

Gulf of Mexico OCS Proposed Geological and Geophysical Activities

Western, Central, and Eastern Planning Areas

Final Programmatic Environmental Impact Statement

Volume IV: Appendices M and N



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Author

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Gulf of Mexico OCS Region

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APPENDIX M

RESPONSES TO PUBLIC COMMENTS ON THE DRAFT GULF OF MEXICO G&G PROGRAMMATIC EIS

M RESPONSES TO PUBLIC COMMENTS ON THE DRAFT GULF OF MEXICO G&G PROGRAMMATIC EIS

M.1 OVERVIEW

To initiate the public review and comment period of the Draft Programmatic Environmental Impact Statement (EIS), the Bureau of Ocean Energy Management (BOEM) took the following actions: (1) published a Notice of Availability in the *Federal Register* (2016) on September 30, 2016, announcing a 60-day comment period that ended on November 29, 2016; (2) mailed a special public notice that reported the availability of the Draft Programmatic EIS and how to comment to the groups and agencies identified in **Chapters 6.3 and 6.4** of the Draft Programmatic EIS; (3) emailed a group notification that reported the availability of the Draft Programmatic EIS and how to comment to people who had given BOEM their email address during scoping or who had requested to be on such a mailing list; (4) placed multiple notices announcing the availability of the Draft Programmatic EIS, all public meeting locations and times, and how to comment on the document on Facebook and Twitter and in the newspapers that served local media markets, i.e., *The Gambit*, and *Times-Picayune* (New Orleans, Louisiana), *Lagniappe* and *Press-Register* (Mobile, Alabama), *The Sun Herald* (Gulfport/Biloxi, Mississippi), *The Business Journal* (Houston, Texas), *The Northwest Florida Daily News* (Fort Walton Beach, Florida; and (5) posted the Draft Programmatic EIS on BOEM's Gulf of Mexico OCS Region's website at <http://www.boem.gov/Gulf-of-Mexico-Geological-and-Geophysical-Activities-Programmatic-EIS/#Draft>.

All comments received during the public comment period for the Draft Programmatic EIS were considered during preparation of this Final Programmatic EIS. Public comments on the Draft Programmatic EIS were received via www.regulations.gov, by mail, by email via gomggeis@boem.gov, and in oral and written form at the five public meetings conducted by BOEM at five locations along the Gulf Coast adjacent to the Area of Interest. The review and response process is intended to ensure that improvements are made to the Final Programmatic EIS for its use as a decisionmaking document through the inclusion of new or substantive information or to explain the rationale for how the evaluation was carried out.

M.1.1 Comment Review and Response Protocol

Regardless of stakeholder type or mode of transmittal, all comments received were reviewed in the same manner. Upon receipt by BOEM, each individual comment document (submission) submitted during the public comment period was entered into a comment database as a unique submission. A document identification number (the "Submission ID") was assigned to each comment document; the documents were consecutively numbered with a Submission ID based on the order of submittal/processing. Within each comment document unique comments were then consecutively numbered as a suffix to the Submission ID (e.g., 1130-0001 and 1130-0002). If a comment was resubmitted by different commenters, and/or if there were multiple signatories, the original occurrence of the letter was considered unique, and the others were classified as a duplicate form letter. The duplicate form letters were reviewed to determine if they were identical duplicates or

if they contained additional and unique comments. Unique form letters were handled in the same manner as the other unique submissions.

A total of 1,128 unique comment submissions were received during the public comment period, including 10 unique form letters. A total of 60,232 duplicate form letters were received; of these, 3,574 contained additional comments that were further reviewed to determine if a detailed response would be required. Therefore, a total of 4,702 unique comment submissions and 56,658 duplicate form letters were received.

Following review and identification that unique comments were included within the letters, each unique comment submission was then reviewed to determine if it contained general and similar concerns or if it contained specific comments requiring detailed technical responses and/or changes to the Final Programmatic EIS. The 1,128 unique comment letters identified to require either general or technical responses were divided into categories (**Table M-1**), and BOEM developed responses to the public comments, modifying text and analyses in the Final Programmatic EIS, as necessary.

M.1.1.1 General Comments

If the comment expressed a general concern that was similar in content to other submissions, it was assigned a General Comment Code to categorize the general topic/concern. Similar concerns were addressed with an appropriate common response to avoid repeating the same response numerous times. A comment code was also assigned to comments that were general in nature but did not require a technical or detailed response.

General comment codes and topics are provided in **Table M-1**. **Section 3** summarizes the general comments, including those that are unique and those that BOEM grouped together, and it provides responses to those concerns.

Table M-1. General Comment Code Categories

Comment Code	Comment Code Topic
A. Accidental Fuel Spills	
A-1	Accidental fuel spills
B. Alternatives	
B-1	Supports Alternative A/Supports seismic exploration as it has always been carried out
B-2	Supports Alternatives B through G
B-3	Alternatives presented are too cautionary/Support for lesser restrictions/ Alternative A
B-4	Support for seismic exploration if done responsibly/Based on sound science and agency participation
B-5	Seismic exploration is critical for the country's energy needs/Oil and gas development and should therefore not be hindered
B-6	No need for additional exploration/End seismic exploration/Supports a different alternative

Comment Code	Comment Code Topic
B-7	Rejects Alternatives B through G
B-8	Supports a different alternative
C. Archaeological Resources	
C-1	Archaeological resources
D. Environmental Setting	
D-1	Climate change
D-2	Need for appropriate data
E. Natural/Biological Resources	
E-1	Potential negative impacts to oceans and marine life
E-2	Potential harm from seismic surveys to marine mammals
E-3	Seismic exploration techniques and impacts to the environment
E-4	Impacts from airgun use
E-5	Chronic negative impacts to marine life
F. Regulatory	
F-1	No further regulations needed
F-2	Increased regulations would not increase safety factors for marine life
F-3	Increased regulations would impact the economy negatively
F-4	Comment extension/Public availability
F-5	Agency consultation
G. Socioeconomic Resources	
G-1	Employment
G-2	Seismic exploration is vital for the economy/Benefits the economy
G-3	U.S. energy independence and security
G-4	Impacts on ports
G-5	Impacts on military missions in the Gulf of Mexico
H. Multiple/Other¹	

¹ Submissions categorized as "Multiple/Other" include comments that did not fall under the above subcategories but were general in nature and did not require a technical response. These submissions are summarized and responded to in **Table M-3**. Category H also includes concerns that may not have been submitted multiple times but which were general in nature.

M.1.1.2 Comments Requiring Detailed Technical Responses

If the comment submission contained specific comments or recommendations requiring detailed technical responses and/or changes to this Programmatic EIS, subject-matter experts reviewed it and provided a response specifically addressing the comment. Changes, if required, were incorporated into this Final Programmatic EIS (refer to **Section 4** for the comments requiring detailed technical responses).

M.2 REVIEWING COMMENT RESPONSES

Table M-2, the Comment Index, was developed to provide accessibility, a full understanding of who provided comments, and how comments received during the public comment period were addressed. All commenters are listed under their stakeholder type (i.e., Federal Government, State government, local government, industry, non-governmental organization, academia, Tribe, or private

citizen) and are then organized alphabetically by last name. **Table M-2** also provides the comment's unique Submission ID and notes if the comment was a duplicate form letter.

To review a response provided for a specific comment, readers should refer to the Comment Index and look for the stakeholder type or commenter's name. The last column of the table provides a comment code assigned to each unique comment. Readers can refer to the appropriate table to locate a response to their concern; responses to general comments are provided in **Table M-3**, and comments that required a detailed technical response are provided in **Tables M-4 through M-21**.

Table M-2. Comment Index

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
Federal Government					
1063	Epperson	Deborah	Bureau of Safety and Environmental Enforcement	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1130	Harrison	Jolie	National Oceanic and Atmospheric Administration	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0343	Lent	Rebecca	Marine Mammal Commission	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1080	Tomiak	Robert	U.S. Environmental Protection Agency	No	Refer to Tables M-4 through M-21 for detailed technical responses.
State Government					
1072	Grider	Galen	Alabama Department of Conservation and Natural Resources	No	Refer to Table M-3 , Comment Code F-5.
0001	Haydel	Don	Louisiana Department of Natural Resources	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1071	Kinsey-Carlsen	Shana	Florida Department of Environmental Protection	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0044	McBride	Amanda	Alabama Historical Commission, State Historic Preservation Office	No	Refer to Table M-3 , Comment Code F-5.
Local Government					
0680	Russell	Stephen	Mobile Area Chamber of Commerce	No	Refer to Table M-3 , Comment Code H-11.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
Industry					
1055	Austin-Ramsaran	Joy	BP Exploration & Production Inc.	No	Refer to Table M-3 , Comment Codes B-1, B-3, E-2, F-3, H-1.
0998	Bradshaw	John	IMCA	No	Refer to Table M-3 , Comment Codes B-3, B-1, F-1, H-2.
1093	Chalenski	David	Shell International Exploration and Production Inc.	No	Refer to Table M-3 , Comment Codes E-2, E-4.
0052	Chiasson	Chett	Greater Lafourche Port Commission	No	Refer to Table M-3 , Comment Codes G-2, E-3, G-4, H-3.
0670	Fayard	Cecil	Ship to Shore	No	Refer to Table M-3 , Comment Code E-2.
1127	Form Multiple	Form Multiple	N/A	Master of 462 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
0037	Graham	Barry	Barry Graham Oil Service	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0676	Greenfield	Brent	Consumer Energy Alliance	No	Refer to Table M-3 , Comment Codes B-1, B-5.
1070	Greenfield	Brent	Consumer Energy Alliance	Master of 437 duplicates	Refer to Table M-3 , Comment Codes B-1, E-2, H-9.
1068	Holt	David	Consumer Energy Alliance	No	Refer to Table M-3 , Comment Code B-1.
0053	LeBlanc	Lori	Gulf Economic Survival Team	No	Refer to Table M-3 , Comment Code B-1.
0614	LeBlanc	Lori	Louisiana Mid-Continent Oil and Gas Association	No	Refer to Table M-3 , Comment Codes B-1, G-2, E-3.
1073	Orgeron	Joseph	Montco, Inc.	Yes, with additional comment	Refer to Tables M-4 through M-21 for detailed technical responses.
1069	Perry	Ruth	Shell Offshore Inc.	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0051	Rolland	Gabriel	TGS	No	Refer to Table M-3 , Comment Code H-5.
0678	Ross	Kim	Rethink Energy Florida	No	Refer to Table M-3 , Comment Codes D-1, H-10.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
0999	Sales	Mark	Tidewater Inc.	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0049	Seidel	Peter	TGS	No	Refer to Table M-3 , Comment Codes B-1, E-2.
0673	Snowman	Leo	Geokinetics	No	Refer to Table M-3 , Comment Codes A-1, B-1.
1076	Steen	Ryan	IAGC, API, NOIA, OOC	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1077	Tsoflias	Sarah	IAGC	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0038	Veal	Stephen	ARC Controls	No	Refer to Table M-3 , Comment Code F-1.
1088	Wilson	Frank	Geokinetics	No	Refer to Tables M-4 through M-21 for detailed technical responses.
Non-governmental Organization					
0031	Gutierrez	Mary	Earth Action, Inc.	No	Refer to Table M-3 , Comment Code B-8.
0677	Gutierrez	Mary	Earth Action	No	Refer to Table M-3 , Comment Code B-6.
1074	Jasny	Michael	NRDC	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1001	Knowles	Cybele	Center for Biological Diversity	Master of 6,541 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
1067	Patriana	Zarah	Earthjustice	Master of 40,062 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
1062	Sakashita	Miyoko	N/A	Master of 27 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
0899	Slaughter	Scott	Center for Regulatory Effectiveness	No	Refer to Tables M-4 through M-21 for detailed technical responses.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
Academia					
1091	Nowacek	Douglas	Duke University	No	Refer to Tables M-4 through M-21 for detailed technical responses.
Tribe					
1126	Bilyeu	Lindsey	Choctaw Nation of Oklahoma	No	Refer to Table M-3 , Comment Code C-1.
Private Citizen					
0008	Abruzzese	Rick	N/A	No	Refer to Table M-3 , Comment Code B-1.
0674	Akers	Carol	N/A	No	Refer to Table M-3 , Comment Codes E-2, B-1
0050	Ali	Asif	N/A	No	Refer to Table M-3 , Comment Code B-1.
0040	Anonymous	Anonymous	N/A	No	Refer to Table M-3 , Comment Code E-3.
0055	Anonymous	Anonymous	N/A	No	Refer to Table M-3 , Comment Codes E-1, E-4.
0002	Anonymous	Sandi	N/A	No	Refer to Table M-3 , Comment Code E-1.
0682	Antalan	Jackie	Operation Home Care	No	Refer to Table M-3 , Comment Code F-4.
0691	Archer	John	N/A	No	Refer to Table M-3 , Comment Code E-2.
0047	Auten	Barbara	N/A	No	Refer to Table M-3 , Comment Codes A-1, G-2.
0007	Baker-Fox	Charmaine	Israelite B.C.	No	Refer to Table M-3 , Comment Code G-1.
0672	Barron	Eliot	Gardner Realtors	No	Refer to Table M-3 , Comment Code F-4.
0010	Bass	Shelia	N/A	No	Refer to Table M-3 , Comment Code G-1.
0011	Baumbach	John	N/A	No	Refer to Table M-3 , Comment Code G-1.
0012	Beduze	Graham	CFACT	No	Refer to Table M-3 , Comment Code F-3.
0036	Bingert	Jack	Cummins Mid-South, L.L.C.	No	Refer to Table M-3 , Comment Code B-1
1120	Bolen	DK	N/A	Duplicate	Refer to Tables M-4 through M-21 for detailed technical responses.
0014	Boyer	Brian	BT Gap, LLC	No	Refer to Table M-3 , Comment Code E-3.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
1083	Briley	Arlin	N/A	Duplicate	Refer to Tables M-4 through M-21 for detailed technical responses.
0598	Brooks	Scott	N/A	No	Refer to Table M-3 , Comment Code B-5.
0015	Brumfield	Brittany	N/A	No	Refer to Table M-3 , Comment Code G-1.
0045	Calhoon	Melidy	N/A	No	Refer to Table M-3 , Comment Code G-2.
0046	Carnes	Billy	N/A	No	Refer to Table M-3 , Comment Code G-2.
0275	Carrell	Richard	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code B-1.
0016	Cotton	Lewis	N/A	No	Refer to Table M-3 , Comment Code G-1.
1105	Cournayer	Noreen	N/A	No	Refer to Table M-3 , Comment Code B-6.
0349	Day	Marie	N/A	No	Refer to Table M-3 , Comment Codes B-1, G-3.
1109	Engelman	Stewart	N/A	No	Refer to Table M-3 , Comment Code B-1.
1121	Eustis	Scott	N/A	Form letter with additional comment	Refer to Tables M-4 through M-21 for detailed technical responses.
0056	Fahey	Melanie	N/A	Master of 963 duplicates	Refer to Table M-3 , Comment Codes B-1, B-3, B-5, E-2, F-2.
0035	Favre	Thomas	N/A	No	Refer to Table M-3 , Comment Codes G-1, G-3.
1108	Form Multiple	Form Multiple	N/A	Master of 723 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
1116	Form Multiple	Form Multiple	N/A	Master of 1,178 duplicates	Refer to Table M-3 , Comment Codes B-6, E-1 E-5.
1128	Form Multiple	Form Multiple	N/A	Master of 907 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.
1129	Form Multiple	Form Multiple	N/A	Master of 5,358 duplicates	Refer to Tables M-4 through M-21 for detailed technical responses.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
0032	Fornell	Gordon	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0473	Fosdick	Jason	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code D-2.
0613	Gandy	Murry	Defense Support Initiatives	No	Refer to Table M-3 , Comment Code H-4.
0668	Hackney	Robin	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0612	Heald	James	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0043	Heffron	Joshua	N/A	No	Refer to Table M-3 , Comment Code E-4.
0017	Herbert	Jason	TPF	No	Refer to Table M-3 , Comment Code F-3.
0018	Hetrick	Teresa	N/A	No	Refer to Table M-3 , Comment Code F-3.
0019	Hobbs	Scott	N/A	No	Refer to Table M-3 , Comment Code H-6.
0006	Hudiburg	Peter	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0973	Jones	Jack	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code G-2.
0020	Keefe	Patrick	N/A	No	Refer to Table M-3 , Comment Code B-1.
0487	Klug	Chris	N/A	No	Refer to Table M-3 , Comment Code B-2.
1075	Landry	Christopher	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
1064	Lish	Christopher	N/A	No	Refer to Table M-3 , Comment Codes B-6, E-1, E-5, H-7.
1110	Lowrey	Shane	N/A	No	Refer to Table M-3 , Comment Code H-8.
0005	Mabry	Kate	N/A	No	Refer to Table M-3 , Comment Code E-1.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
0042	Mathis	Pheobe	N/A	No	Refer to Table M-3 , Comment Codes G-2, G-3.
0592	Meeks	Kurt	N/A	No	Refer to Table M-3 , Comment Code G-5.
0021	Melancon	Mike	Offshore Technical Compliance, LLC	No	Refer to Table M-3 , Comment Codes E-3, G-2.
0022	Melillo	Allan	New Orleans Geological Society	No	Refer to Table M-3 , Comment Codes F-2, G-2, G-3.
0023	Meyers	De'Cartia	N/A	No	Refer to Table M-3 , Comment Code G-1.
0048	Morris	John	N/A	No	Refer to Table M-3 , Comment Codes B-4, G-2.
0024	Name	No	N/A	No	Refer to Table M-3 , Comment Code F-3.
0602	Op de Weegh	Kelly	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code B-4.
0675	Orange	Dan	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0882	Orange	Daniel	N/A	No	Refer to Table M-3 , Comment Code B-1.
0033	Prater	Mitzi	N/A	No	Refer to Table M-3 , Comment Codes E-3, G-2, G-3.
0030	Rasmussen	Kay	Economic Development Council	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0025	Reinhard	Greg	N/A	No	Refer to Table M-3 , Comment Code F-1.
1066	Roberts	Jason	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0671	Rushing	Randall	N/A	No	Refer to Table M-3 , Comment Code B-1.
0026	Ryder	Korey	N/A	No	Refer to Table M-3 , Comment Code G-2.
1113	Schmalz	Steve & Robyn	N/A	Form letter with additional comments	Refer to Tables M-4 to M-21 for detailed technical responses.

Submission ID	Last Name	First Name	Organization	Form Letter	Comment Codes
0027	Schneider	Paul	Primerica	No	Refer to Table M-3 , Comment Codes F-1, G-2.
0028	Settoon	Deborah	Energynation	No	Refer to Table M-3 , Comment Code B-1.
0029	Shamp	Joseph	CFACT	No	Refer to Table M-3 , Comment Code F-3.
0336	Sheddrick	Da	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code B-1.
0233	Sheen	Mark	N/A	Form letter with additional comment	Refer to Table M-3 , Comment Code B-7.
1111	Sherfick	Debbie	N/A	Form letter with additional comment	Refer to Tables M-4 through M-21 for detailed technical responses.
0681	Spriggs	Kevin	Spriggs Enterprise	No	Refer to Table M-3 , Comment Code F-4.
1095	Steitz	Jim	N/A	No	Refer to Tables M-4 through M-21 for detailed technical responses.
0693	Stieglitz	Ted	N/A	No	Refer to Table M-3 , Comment Code B-4.
0440	Sullivan	David	N/A	No	Refer to Table M-3 , Comment Code E-4.
1123	Taylor	Ben	N/A	No	Refer to Table M-3 , Comment Code B-4.
0701	Thomson	James	N/A	No	Refer to Table M-3 , Comment Code B-1.

N/A = not applicable.

M.3 COMMENT SUMMARY AND RESPONSES

Each unique general comment was reviewed, summarized, and grouped with similar concerns (**Table M-1**). A summary of the comments and a concise response to each general concern is provided in **Table M-3**. **Table M-3** also includes responses to concerns that may not have been submitted multiple times but were general in nature and did not require a technical response.

Table M-3. General Comment Summary and Responses

Comment Code	Comment Code Name	Comment Summary	Response
Accidental Fuel Spills			
A-1	Accidental Fuel Spills	The Bureau of Ocean Energy Management (BOEM) received comments noting the oil and gas industry's safety record and sensitivity to the environment in which they operate, despite the <i>Deepwater Horizon</i> oil spill.	Thank you for your comments. BOEM is committed to managing the development of U.S. Outer Continental Shelf (OCS) energy and mineral resources in an environmentally and economically responsible way. The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve resources offshore through vigorous regulatory oversight and enforcement; nevertheless, some accidental spills are reasonably foreseeable and therefore analyzed in this Programmatic Environmental Impact Statement (EIS) in Chapter 4 under each resource. Reasonably foreseeable accidental spills and adverse effects also are analyzed in the <i>Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261—Final Multisale Environmental Impact Statement (2017-2022 GOM Multisale EIS)</i> , which is hereby incorporated by reference (USDOl, BOEM, 2017a). Large-scale catastrophic oil spills are not considered reasonably foreseeable and therefore are not considered in this Programmatic EIS. An analysis of a large-scale catastrophic oil spill can be found in the <i>Catastrophic Spill Event Analysis</i> white paper (USDOl, BOEM, 2017b).
Alternatives			
B-1	Supports Alternative A/ Supports seismic exploration as it has always been carried out	BOEM received comments expressing overall support for geological and geophysical (G&G) surveys in the Gulf of Mexico (GOM); these comments were presented as a vote. Support for the proposed action was generally associated with support for oil and gas production.	Thank you for your comment. This Programmatic EIS is not the decision document under the National Environmental Policy Act (NEPA). The decision of which alternative would be implemented will be provided in the Record of Decision (ROD) following publication of this Final Programmatic EIS. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the Area of Interest (AOI) for BOEM's three Program Areas: Oil and Gas; Renewable Energy; and Marine Minerals. The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. The procedures under the Outer Continental Shelf Lands Act (OCSLA) to set up a lease sale

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
B-2	Supports Alternatives B through G	BOEM received comments expressing support for Alternatives B through G, citing a need for additional regulations and safeguards in order to conduct G&G surveys safely and responsibly.	<p>include a specific NEPA evaluation for the proposed action.</p> <p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. Alternative selection will be provided in the ROD following publication of this Final Programmatic EIS. Potential impacts to resources from the implementation of Alternatives A through G are analyzed in Chapter 4. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
B-3	Alternatives presented are too cautionary/ Support for lesser restrictions/ Alternative A	BOEM received several comments in support of Alternative A, stating that the other alternatives presented in the Draft Programmatic EIS are too cautionary. Commenters stated that Alternatives E through G, in particular, should be eliminated because evidence and best available data show seismic surveying has little to no impact on marine life.	<p>Thank you for your comment. In accordance with the Council on Environmental Quality's (CEQ) regulations implementing NEPA (40 CFR part 1502) and U.S. Department of the Interior (USDOI or DOI) implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated, and a decisionmaker must not consider alternatives beyond the range of alternatives evaluated in this Programmatic EIS but must consider all of the alternatives evaluated in this Programmatic EIS.</p> <p>BOEM has determined that a reasonable range of alternatives includes conditions prior to (Alternative A) and including the Settlement Agreement (Alternative B) since on February 10, 2016, the parties formally agreed to extend the stay until final action by the agencies or September 25, 2017, whichever occurs first. Thus, the conditions of the Settlement Agreement currently are being implemented in the GOM and are evaluated in this Programmatic EIS. Inclusion of the Settlement Agreement's conditions will enable decisionmakers to compare the magnitude of the environmental effects of the action alternatives.</p> <p>Alternatives C through F contain mitigation measures designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys, and they contain elements that are continually evolving but represent current standards. Moreover, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
			<p>individual surveys based on the best available information at that time.</p> <p>Regarding Alternative G, CEQ regulation 40 CFR § 1502.14(d) specifies that NEPA analyses require the alternatives analysis in an EIS to "include the alternative of no action."</p> <p>Finally, this Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. Potential impacts to resources from the implementation of Alternatives A through G are analyzed in Chapter 4. The analyses were developed using the best available data by the subject-matter experts, All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
B-4	Support for seismic exploration if done responsibly/Based on sound science and agency participation	BOEM received several comments in support of seismic exploration if done in a responsible manner, with appropriate oversight/regulations to protect marine life. Commenters also supported an alternative based on solid science and agency participation. Specifically, commenters noted the need to continue seismic exploration across industries, agencies, and interested parties to enhance understanding, to better guide surveys, and to make prudent energy decisions. Commenters also stated that solid science must guide the selection of an alternative, and science does not show that seismic surveys harm marine life.	Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. Each alternative presented in this Programmatic EIS includes implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources from the implementation of Alternatives A through G are analyzed in Chapter 4 . The analyses were developed using the best available data by the subject-matter experts. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
B-5	Seismic exploration is critical for the country's energy needs/Oil and gas development and therefore should not be hindered	BOEM received several comments stating that seismic exploration is critical to the country's energy needs and oil/gas development. Commenters stated that seismic exploration is key to understanding our resources; developing the oil and gas industry; and supporting renewable resources, sand, and gravel.	This Programmatic EIS was developed to analyze the potential impacts of G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI. This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation's broader energy policy. The potential beneficial and adverse impacts to resources from Alternatives A through G are analyzed in Chapter 4 . These analyses were developed by the subject-matter experts using the best available data. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
B-6	No need for additional exploration/End seismic exploration/ Supports a different alternative	BOEM received several comments opposing what the commenters referred to as "seismic blasting", specifically requesting an alternative that limits surveys to only what is necessary to support development of existing leases and offshore renewable resources; includes area closures to protect marine mammals, closure of the Eastern Planning Area (EPA), overall reduction in seismic surveys, and requirements for industry to achieve noise reduction targets. Commenters also stated that existing leases will provide oil and gas for up to 70 years. Commenters urged BOEM to restrict oil and gas leases in Federal waters.	<p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. BOEM developed a reasonable range of proposed alternatives, including a suite of proposed mitigations to analyze the potential impacts from G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI. BOEM developed the proposed mitigations and alternatives in close coordination with the National Marine Fisheries Service (NMFS) using the best available data by the subject-matter experts. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation's broader energy policy. The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. The procedures under the OCSLA to set up a lease sale include a specific NEPA evaluation for the proposed action. The Nation's energy policy is determined at the national level and is analyzed in the 2017-2022 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
			(Five-Year Program) and the associated Five-Year Program EIS (USDOJ, BOEM, 2017).
B-7	Rejects Alternatives B through G	BOEM received a comment opposing Alternatives B through G, citing a lack of scientific data to support them.	<p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. BOEM developed a reasonable range of proposed alternatives, including a suite of proposed mitigations to analyze the potential impacts from G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI. BOEM's subject-matter experts developed the proposed mitigations and alternatives in close coordination with NMFS, using the best available data. Chapter 2 outlines the alternatives and mitigation measures to the proposed action. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
B-8	Supports a different alternative	BOEM received a comment in support of Alternative G, stating current leases will produce enough oil for up to 70 years, and additional surveys are not needed.	<p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. This Programmatic EIS was developed to analyze the potential impacts from G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2) such as the Nation's broader energy policy. The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. The procedures under the OCSLA to set up a lease sale include a specific NEPA evaluation for the proposed action. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
Archaeological Resources			
C-1	Archaeological resources	BOEM received a comment requesting work be stopped immediately and that the Choctaw Nation of Oklahoma be contacted if artifacts or human remains are encountered.	Thank you for your comment. The potential effects of each alternative on archaeological resources are analyzed in Chapter 4.11 . If archeological resources or human remains are encountered, BOEM will adhere to the applicable rules and regulations of the National Historic Preservation Act, 30 CFR § 250.194(c), 30 CFR § 250.1010(c), 30 CFR § 250.194(c), 30 CFR § 250.1010(c), and the Native American Graves Protection and Repatriation Act, as appropriate.
Environmental Setting			
D-1	Climate change	BOEM received a few comments stating climate change was not addressed in the Draft Programmatic EIS.	Thank you for your comment. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). However, many comments noted that downstream emissions from oil and gas leasing on the OCS should be included in this Programmatic EIS. Oil and gas leasing in the AOI is not part of the proposed action, and this NEPA document does not analyze or authorize an OCS lease sale. Oil and gas leasing activities and the impacts that may result from them are outside of the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need (Chapter 1.1.2), and reasonable range of alternatives (Chapter 2). Nevertheless, as part of its mission, BOEM does consider these activities and issues in other NEPA documents. BOEM directs these commenters to the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of greenhouse gas (GHG) emissions. Chapter 3.3 of the Five-Year Program EIS considers climate change and the baseline environment in the areas proposed for oil and gas leasing. In addition, the GOM lease sale-stage NEPA analyses will further specify impacts of GHG emissions related to a single proposed lease sale (e.g., the 2017-2022 GOM Multisale EIS).
D-2	Need for appropriate data	BOEM received a comment noting that seismic data are needed and	Thank you for your comment. BOEM recognizes the benefits of and need for G&G activities (as described in Chapter 1.1.2).

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
		that a lack of appropriate data could lead to incidents that may harm the environment.	Information obtained and developed as a result of G&G activities are used to make informed business, management, design, stewardship, and environmental protection decisions for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Additionally, the information presented in the comment was considered by BOEM in determining the Preferred Alternative.
Natural/Biological Resources			
E-1	Seismic exploration negatively impacts oceans and marine life	BOEM received numerous comments stating seismic exploration harms marine life. Commenters specifically stated the following: research shows the oil and gas industry, including seismic blasting and associated noise, adversely affects the health of oceans, including habitats, wildlife, and endangered marine mammals. Commenters were generally opposed to seismic exploration.	<p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will be provided in the ROD following publication of this Final Programmatic EIS. BOEM's subject-matter experts developed the proposed mitigations and alternatives in close coordination with NMFS using the best available data. Chapter 2 outlines the alternatives and mitigation measures to the proposed action. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM and the National Oceanic and Atmospheric Administration (NOAA) are working together to meet statutory obligations (e.g., NEPA, Marine Mammal Protection Act, and Endangered Species Act) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM.</p>
E-2	Science shows no evidence that seismic surveys harm marine mammals	BOEM received several comments stating that science and years of industry experience show no evidence that seismic surveys, including associated sound produced, harm marine mammals, impact commercial fishing, or affect coastal communities. Comments further state that seismic surveys are safe and compatible with GOM uses and that the proposed restrictions in the Draft	<p>Thank you for your comment. The potential beneficial and adverse impacts resulting from the proposed action are analyzed in detail throughout Chapter 4; specifically, marine mammals are addressed in Chapter 4.2; commercial fishing is addressed in Chapter 4.9; coastal communities are addressed in Chapters 4.4, 4.5, and 4.8; and economic factors are addressed in Chapter 4.13.9. According to this Programmatic EIS, potential impacts range from nominal to moderate in these resource areas.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate potential</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
		<p>Programmatic EIS would directly impact the ability to explore GOM energy resources without any overall benefits. Commenters generally expressed support for seismic exploration.</p>	<p>impacts.</p> <p>All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
E-3	<p>Experience shows current seismic exploration is done in an environmentally responsible way</p>	<p>BOEM received several comments citing that years of industry experience proves seismic exploration is done in an environmentally responsible manner. Commenters support oil and gas exploration in the GOM and state that seismic exploration methods have not been demonstrated to harm or result in long-term impacts to marine life. Commenters also stated that seismic exploration has occurred without negative impacts to marine life, commercial fishing, and seafood production.</p>	<p>Thank you for your comment. The potential beneficial and adverse impacts resulting from the proposed action are analyzed in detail throughout Chapter 4; specifically, marine mammals are addressed in Chapter 4.2; commercial fishing is addressed in Chapter 4.9; coastal communities are addressed in Chapters 4.4, 4.5, and 4.8; and economic factors are addressed in Chapter 4.13.9. According to this Programmatic EIS, potential impacts range from nominal to moderate in these resource areas.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate potential impacts.</p> <p>All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
E-4	<p>Impacts from airgun use</p>	<p>BOEM received several comments stating that airgun use disrupts vital behavior in marine mammals (comments cite 37 species in the GOM) in areas larger than 100,000 square nautical miles (132,429 square miles). Commenters stated that the sound produced from airguns can impact marine life thousands of miles from the source, negatively affecting the ability to find prey, navigate, reproduce, and communicate.</p>	<p>Thank you for your comment. BOEM's subject-matter experts, in close coordination with NMFS' subject-matter experts, note 21 species of marine mammals likely to occur within the AOI (refer to Table 4.2-1 and Appendix E). As stated in Chapter 4.2, BOEM's analysis concludes that effects of G&G deep-penetration airgun seismic survey activity noise would be moderate because the potential impacts on marine mammals could be extensive but are not expected to be severe or lethal. Additional details can be found in Chapter 4.2.</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
E-5	Chronic negative impacts to marine life	BOEM received a comment regarding the chronic negative effects of seismic exploration on marine life. The commenter cited inadequate regulations, violation of environmental law, the <i>Deepwater Horizon</i> oil spill, and seismic blasting as negatively impacting marine life cumulatively, over time.	<p>Thank you for your comment. Chapter 4.2.2.1.2 and Appendix K discuss the chronic and cumulative effects of noise produced by seismic activities in the GOM.</p> <p>As discussed in Chapter 4.2.2.1.2, modeling results included in Appendix K indicate significant losses in the listening area and communication space from G&G survey activities. BOEM, in coordination with NMFS, presents the best available data at this time regarding chronic noise and potential exposure and effects to marine mammals. The science on chronic noise in the ocean will continue to progress and be used as appropriate when available. BOEM acknowledges that there is incomplete or unavailable information regarding chronic noise and potential effects to marine mammals, discussing what is used in lieu of having more detailed information in Chapter 4.2.2.1.2.</p> <p>Regarding the <i>Deepwater Horizon</i> oil spill, BOEM considered the potential changes to the environmental baseline conditions of the physical, biological, and economic resources resulting from the oil spill.</p>
Regulatory			
F-1	No further regulations needed	BOEM received several comments opposing further regulations on seismic exploration, stating that G&G surveys already are carried out in a safe manner, minimizing environmental impacts. Commenters also stated the lack of facts and proven negative impacts of G&G surveys negate the need for further restrictions.	<p>Thank you for your comment. The potential beneficial and adverse impacts resulting from the proposed action are analyzed in detail throughout Chapter 4; specifically, marine mammals are addressed in Chapter 4.2; commercial fishing is addressed in Chapter 4.9; coastal communities are addressed in Chapters 4.4, 4.5, and 4.8; and economic factors are addressed in Chapter 4.13.9. According to this Programmatic EIS, potential impacts range from nominal to moderate in these resource areas.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate potential impacts.</p> <p>All of this information will be considered by the decisionmaker in</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
F-2	Increased regulations would not increase safety factors for marine life	BOEM received a comment stating that additional restrictions on seismic exploration would not materially increase the safety factors for marine mammals but would make exploration more difficult and costly.	determining which alternative is selected in the ROD. Thank you for your comment. Alternatives B through F include continued G&G activities with a suite of proposed mitigation measures. Each alternative includes additional mitigation measures that afford protection to specific marine species. Table 2.13-2 illustrates the species afforded protection under each alternative. In addition, Alternative E would require a reduction in activity. Alternative F would result in reduced impacts to marine mammals from seismic sound, reducing the potential impacts of deep-penetration airgun survey noise from moderate to minor. Additional detail is included in Chapter 4.2 . All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
F-3	Increased regulations would negatively impact the economy	BOEM received several comments opposing increased regulations, citing negative impacts to the economy. Specifically, commenters state that increased regulations would hinder oil and gas production, decrease the number of jobs and job growth, increase energy costs, impact our ability to identify new oil and gas resources essential for the country, and threaten the economic and operational feasibility of the oil and gas industry in the GOM.	Thank you for your comment. BOEM has considered beneficial and adverse potential effects associated with each alternative. Chapter 4 analyzes each alternative's potential effects on environmental and human resources. Chapter 4.13 specifically focuses on human resources, including land use and economic factors.
F-4	Comment extension/Public availability	BOEM received several comments related to public outreach, public participation, and the public comment period. One commenter expressed appreciation for public outreach efforts undertaken by BOEM. Another commenter expressed concern over the limited time that was provided to the public to review and comment on the	Thank you for your comment. As stated in the Notice of Availability (NOA) for this Programmatic EIS, which was published on September 30, 2016, the comment period was to be 45 days with an automatic 15-day extension, and no further extensions would be granted. The extended 60-day comment period was from September 30 to November 29, 2016. The Draft Programmatic EIS was publicly available on BOEM's Gulf of Mexico OCS Region's Internet website at http://www.boem.gov/Gulf-of-Mexico-Geological-and-Geophysical-Activities-Programmatic-EIS/#Draft . Compact discs containing this

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
		Draft Programmatic EIS, as well as the availability of supplemental documents/information pertaining to the Draft Programmatic EIS; requested a comment extension period of 90 days; and requested publicly available supplemental documents/information at public meeting locations.	<p>Programmatic EIS were mailed to BOEM's mailing lists. Paper copies were mailed out upon request. The length of the comment period was consistent with CEQ's guidelines implementing NEPA (40 CFR § 1501.7). In addition, BOEM conducted public meetings in each of the Gulf Coast States. The meetings were advertised in local magazines and newspapers, and were 4-hour open house format meetings that spanned work and evening hours to accommodate various schedules and to ensure that attendees could take full advantage of the meeting material and availability of the subject-matter experts.</p> <p>BOEM believes that the information provided in the Draft Programmatic EIS was sufficient under NEPA to allow interested stakeholders to provide informed comments on the analysis and conclusions.</p>
F-5	Agency consultation	Several commenters requested that BOEM correspond with the Alabama State Historic Preservation Office, Alabama Department of Conservation and Natural Resources, and other affected/applicable Alabama State agencies throughout the Programmatic EIS process.	Thank you for your comment. BOEM performed public outreach and consultation with stakeholders throughout the development of this Programmatic EIS. BOEM will comply with all application rules and regulations pertaining to activities covered in this Programmatic EIS and will have additional consultations during site-specific evaluations, as needed.
Socioeconomic Resources			
G-1	Employment	BOEM received several comments in general support of the oil and gas industry, noting that it brings much needed employment to the region.	Thank you for your comment. BOEM addressed the potential adverse and beneficial impacts on employment within the economic factors analysis in Chapter 4.13 .
G-2	Seismic exploration is vital and beneficial to the economy	BOEM received several comments stating that seismic exploration is vital for the economy. Specifically, commenters state that seismic exploration and production provides thousands of jobs,	Thank you for your comment. BOEM addressed the potential adverse and beneficial effects within the economic factors analysis in Chapter 4.13 .

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
		creates economic opportunity, increases revenue and the local tax base, reduces foreign dependence, and reduces the cost of energy. Some commenters also pointed out how the oil and gas industry supports a vibrant economy in combination with other uses of the GOM, including commercial fishing, hunting, and recreation.	
G-3	U.S. energy independence and security	BOEM received several comments stating seismic exploration in the GOM is vital for U.S. energy independence as well as national and economic security.	<p>Thank you for your comment. This Programmatic EIS was developed to analyze the potential impacts from G&G activities associated with BOEM’s three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation’s broader energy policy. The Nation’s energy policy is determined at the national level and was analyzed in the Five-Year Program and Five-Year Program EIS.</p>
G-4	Impacts on ports	BOEM received one comment stating that the Nation’s coastal ports and port channel deepening projects across the GOM will rely on G&G surveys to advance ports and port projects, thereby affecting a multitude of industries, not just oil and gas.	Thank you for your comment. BOEM conducted a robust cumulative effects analysis, including the potential effects on deepwater ports. Deepwater ports are discussed in Chapter 3.4.3.1 and Appendix E, Section 12.6 . Additionally, impacts on ports and port facilities resulting from the proposed action are evaluated in Chapter 4.13 .
G-5	Impacts on military missions in the GOM	BOEM received one comment supporting seismic exploration as long as the environment and military testing/training in the GOM are protected. The commenter stated that seismic exploration must be coordinated in advance	Thank you for your comment. BOEM will continue to require military coordination within specific areas. Chapter 3.4.3.6 and Appendix E, Section 12.2 discuss military areas and other military uses.

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
		with the Gulf Military Test Range to protect the missions of BOEM and the military.	
Multiple/Other			
H-1	Subcategories were not assigned to general comments categorized as multiple.	BOEM received one comment supporting comments submitted by the International Association of Geophysical Contractors (IAGC), American Petroleum Institute (API), National Ocean Industries Association (NOIA), and Offshore Operators Committee (OOC).	Thank you for your comment. Refer to the technical responses in Tables M-3 through M-18 .
H-2	Subcategories were not assigned to general comments categorized as multiple.	BOEM received one comment supporting survey activity, stating that the OCS is capable of supporting survey activity, as well as fishing, tourism, and the marine ecosystem.	Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered.
H-3	Subcategories were not assigned to general comments categorized as multiple.	BOEM received one comment supporting seismic exploration stating that continued surveying provides the Nation with economic and environmental sustainability benefits.	Thank you for your comment. Chapter 4.13 provides an analysis of the potential impacts to human resources, including economic factors and land use. This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2) such as the Nation's broader energy policy. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.
H-4	Subcategories were not assigned to general comments categorized as multiple.	BOEM received one comment supporting seismic exploration when carried out in an environmentally responsible way that protects the environment, fishing, tourism, and military training in the GOM.	Thank you for your comment. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail. Potential impacts to resources from proposed G&G activities are analyzed in Chapter 4 . Additionally, Chapter 3.4.3.6 and Appendix E, Section 12.2 discuss military areas and other military uses. BOEM will continue to require military coordination within specific areas.

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
H-5	Subcategories were not assigned to general comments categorized as multiple.	BOEM received comments supporting seismic exploration stating that not only does exploration help us understand the extent and location of our offshore resources but exploration is also critical to meeting the energy needs throughout the country.	<p>Thank you for your comment. This Programmatic EIS was developed to analyze the potential beneficial and adverse impacts that could result from G&G activities within the AOI. The G&G activities are associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Chapter 4 presents the potential effects analysis and conclusions for all of the resources considered.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation's broader energy policy. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.</p>
H-6	Subcategories were not assigned to general comments categorized as multiple.	BOEM received one comment stating that constant public education regarding seismic exploration is needed to ensure that the environment is protected.	<p>Thank you for your comment. Educational opportunities were provided by BOEM staff members who were available at the public meetings. In addition, public information and educational material relating to this Programmatic EIS are available on BOEM's website at https://www.boem.gov/Gulf-of-Mexico-Geological-and-Geophysical-Activities-Programmatic-EIS/#Draft. As this Programmatic EIS is finalized, the website will be updated with additional information.</p>
H-7	Subcategories were not assigned to general comments categorized as multiple.	BOEM received a comment opposing seismic exploration as exploration harms marine wildlife. The commenter stated that there is no need for additional exploration as the country's demand for fossil fuel decreases and climate change already negatively impacts oceans.	<p>Thank you for your comment. This Programmatic EIS was developed to analyze the potential beneficial and adverse impacts that could result from G&G activities within the AOI. The G&G activities are associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Chapter 4 presents the effects analyses and conclusions for all of the resources considered.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation's broader energy policy. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.</p>

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
H-8	Subcategories were not assigned to general comments categorized as multiple.	BOEM received a comment opposing seismic exploration as there is no way to assure the safety of deepwater drilling. Until exploration can occur safely, drilling should be restricted.	Thank you for your comment. This Programmatic EIS describes and evaluates the potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale or associated drilling activity.
H-9	Sub-categories were not assigned to general comments categorized as multiple.	BOEM received a comment supporting Alternative A, stating that experience shows seismic operations can occur without harm to marine life or fisheries. Furthermore, the commenter stated that marine seismic exploration is an effective method to locate oil and natural gas and that exploration reinforces national energy security and independence.	Thank you for your comment. This Programmatic EIS was developed to analyze the potential beneficial and adverse impacts that could result from G&G activities within the AOI, including BOEM's Oil and Gas, Renewable Energy, and Marine Minerals Programs. This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2), such as the Nation's broader energy policy. Chapter 2 describes in detail the proposed alternatives and a suite of mitigation measures. Potential impacts to resources resulting from proposed G&G activities are evaluated in Chapter 4 .
H-10	Subcategories were not assigned to general comments categorized as multiple.	BOEM received a comment stating that the Draft Programmatic EIS does not consider the long-term infrastructure and economic impacts to the United States resulting from climate change and how seismic, as a precursor to additional oil and gas exploration, contributes to climate change. Also, that the Draft Programmatic EIS did not acknowledge additional exploration and ocean acidification.	The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. It does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1. and 2), such as the Nation's energy policy. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of GHG emissions. Chapter 3.3 of the Five-Year Program EIS considers climate change and the baseline environment in areas proposed for oil and gas leasing. In addition, the 2017-2022 GOM Multisale EIS (USDOJ, BOEM, 2017a) considers the effects of climate change on infrastructure.
H-11	Subcategories were not assigned to general comments	BOEM received a comment supporting seismic exploration, specifically Alternative A, as exploration is critical for the	Thank you for your comment. Chapter 4.13 provides an analysis of the potential impacts to human resources, including the economy and employment as well as land use, resulting from implementation of the alternatives. BOEM recognizes the

Table M-3. General Comment Summary and Responses (continued)

Comment Code	Comment Code Name	Comment Summary	Response
	categorized as multiple.	economy, energy environment, and national security. In addition, exploration has occurred for decades without evidence of negative impacts to marine life, fishing, or coastal communities. The commenter states that seismic exploration helps us better understand the location and extent of offshore energy resources.	benefits of and need for G&G activities (as described in Chapter 1.1.2). Information obtained and developed as a result of G&G activities is used to make informed business, management, design, stewardship, and environmental protection decisions for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Additionally, the information presented in the comment was considered by BOEM in determining the Preferred Alternative.

M.4 COMMENTS REQUIRING A DETAILED TECHNICAL RESPONSE

As described in **Section M.1.1**, if a comment was technical in nature or required changes to this Programmatic EIS, subject-matter experts reviewed it and provided a response; changes, if required, were incorporated into this Final Programmatic EIS.

Tables M-4 through M-21 present a tabular listing of specific comments provided in detailed submissions, organized by Programmatic EIS chapter/topic; provide the subject-matter expert's response; and identify changes made in this Final Programmatic EIS, if any. The comments were reproduced verbatim as they were received. Refer to **Table M-2** for the Comment Index developed to provide a full understanding of who provided which comments. **Sections M.4.1 through M.4.8** summarize the types of technical comments received by Programmatic EIS chapter.

M.4.1 Purpose and Need/Regulatory Overview

Several comments questioned the compatibility of the proposed action with the Outer Continental Shelf Lands Act (OCSLA) and the Marine Mammal Protection Act (MMPA), and the compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) requirements. The basis of these comments either promoted using G&G surveys to continue safe and effective energy development or disputed the need for additional G&G data collection and future development. Some comments expressed that exclusion of a cost-benefit analysis resulted in an analysis that was arbitrary and capricious. In regards to the MMPA, some comments noted that the level of takes presented in this Programmatic EIS may pose population-level impacts; conversely, other comments stated that the presented takes were not reasonable because the benefits of mitigation measures were not taken into account. Comments indicated that the Monitoring Plan should be completed to increase the understanding of impacts to marine mammals and to analyze the efficacy of mitigation measures prior to finalizing this Programmatic EIS. Comments asserted that the summary presented in **Chapter 1** describing the marine mammal impact analysis as worst-case and conservative was contrary to NEPA and CEQ. **Section M.4.16** more thoroughly describes technical comments related to the modeling inputs, their limitations, and the model outputs. Detailed responses to specific comments are provided in **Table M-4**.

Several comments noted that the scope of this Programmatic EIS omitted adequate analysis of greenhouse gas emissions and climate change impacts resulting from G&G activities over the time period of the analysis. Many comments outlined deficiencies in the cumulative scenario relative to coastal resources, as well as reasonably foreseeable offshore commercial aquaculture activities. Detailed responses to specific comments are provided in **Table M-4**.

Many comments on the Draft Programmatic EIS indicated a preference on which alternative should be selected. Several comments proposed additional mitigation measures, altering mitigation measures, changes to the way that BOEM handles mitigation, or that alternative G&G technologies should be preferentially used. Many of the suggested mitigations are addressed in other chapters.

Many comments asserted that existing mitigation measures (e.g., Federal laws and regulations, lease stipulations) provide sufficient protection for this stage of the OCLSA process, and suggested strengthening this conclusion in this Final Programmatic EIS. Conversely, some comments asserted that existing regulatory restrictions already are overly burdensome and hindering industry, while other comments stressed that newly introduced mitigation measures would be too economically burdensome and would hinder industry. Additional comments expressed that mitigation measures were inadequate to afford protection to natural resources. Other comments stated that mitigation measures were not supported by best available science or that adequate rationale was not provided for their inclusion in this Programmatic EIS. Some comments questioned why mitigation measures were geared toward marine mammals and why measures for other marine species were lacking.

Various comments indicated that the purpose of each alternative was vague and that certain alternatives lacked detail with respect to how BOEM would implement related mitigation measures. Some comments stated that assumptions made relative to mitigation measures under the alternatives were flawed or that certain alternatives lacked a legal basis for their implementation. Finally, comments contended that shutdown requirements as part of various alternatives were not clearly explained and that newly introduced mitigation measures were difficult to discern from measures carried forward from other alternatives. Detailed responses to specific comments are provided in **Table M-4**.

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses

Submission ID	Comment	Response
Purpose and Need/Regulatory Overview		
0001-0002	Louisiana continues to suffer losses to its coastal resources as a result of offshore energy development, as it has throughout the history of BOEM's lease sale program. When past, present and future lease sales are considered, cumulative impacts to coastal resources are considerable. OCM firmly believes that BOEM must provide leadership to minimize these losses and mitigate for impacts in subsequent National Environmental Policy Act evaluations.	<p>The proposed activities in this Programmatic EIS are geological and geophysical activities on Federal OCS waters of the Gulf of Mexico. Oil and gas leasing is outside the scope of this Programmatic EIS. Nevertheless, in our leasing EISs, we acknowledge that Louisiana has experienced coastal land loss in the cumulative impacts analyses and will continue to consider potential mitigations in future OCS leasing environmental analyses.</p> <p>BOEM included in this Programmatic EIS information relevant to its cumulative effects analysis, including the proposed action and all OCS activities in its consideration, as described in Chapter 3.4.</p>
0006-0007	Stop coddling the oil and gas industry and start protecting our sea life and environment.	This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.
0668-0001	It is critically important if any Alternative that is enacted includes any limitations on seismic ship array for pre-drilling exploration, is absolutely imperative that operational drilling sensors such as telemetry or logging while drilling (LWD) be allowed to continue such as they do today. There is no way to conduct oil and gas operations safely without earth sensors including seismic.	This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Operational monitoring is not included in this Programmatic EIS because those monitoring technologies are not authorized by BOEM under the OCSLA; they are safety related and would be addressed by a NEPA review of the company-submitted Plan of Development.
0899-0001	The PEIS violates OMB' Peer Review Bulletin because it is "Influential Scientific Information" that must be peer reviewed under OMB's Bulletin. ¹ In fact, the PEIS is a "Highly Influential Scientific Assessment," which is a subset of Influential Scientific Information that is subject to rigorous requirements under OMB's Bulletin. ²	BOEM, as the lead agency with BSEE and NOAA as cooperating agencies, prepared this Programmatic EIS in accordance with CEQ regulations implementing NEPA (40 CFR part 1502), USDOl implementing procedures for NEPA (43 CFR part 46), and NOAA procedures for implementing NEPA (USDOC, NOAA, 2017). The NEPA documents are not identified in the OMB

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Yet the PEIS has never been peer reviewed. Given this violation of the OMB Peer Review Bulletin requirements, BOEM should withdraw the PEIS; subject it to public peer review in accordance with OMB's Peer Review Bulletin; and make any appropriate changes in the PEIS based on the peer review.</p> <p>OMB's Peer Review Bulletin defines "Influential Scientific Information" as "scientific information the agency reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions. In the term 'influential scientific information,' the term 'influential' should be interpreted consistently with OMB's government-wide information quality guidelines and the information quality guidelines of the agency. Information dissemination can have a significant economic impact even if it is not part of a rulemaking. For instance, the economic viability of a technology can be influenced by the government's characterization of its attributes. Alternatively, the federal government's assessment of risk can directly or indirectly influence the response actions of state and local agencies or international bodies."³</p> <p>The PEIS will be used to determine whether oil and gas exploration is allowed to occur in the Gulf of Mexico and, if so, then under what conditions and where it can occur. Consequently, in the words of OMB's Peer Review Bulletin, the PEIS "will have or does have a clear and substantial impact on important public policies or private sector decisions." Yet the PEIS has never been peer reviewed, in clear violation of OMB's Peer Review Bulletin.</p> <p>OMB's Peer Review Bulletin defines "Highly Influential Scientific Assessment" in two parts. First, the term "Scientific Assessment" is defined as "an evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or</p>	<p>Bulletin and have not been routinely subjected to the peer review contemplated by the bulletin. The underlying scientific information on which this Programmatic EIS relies and analyzes for impact conclusions may be subject to the OMB Peer Review Bulletin. While it is always BOEM's preference that the science on which it relies and uses to inform decisions is peer reviewed, NEPA neither expressly requires such review nor does it allow an agency to limit its review to such information. NEPA goes further and requires an agency to consider and evaluate "incomplete and unavailable information" (refer to 40 CFR § 1502.22) and to evaluate how relevant incomplete or unavailable information may affect agency analyses and decisions. For these reasons, while BOEM's preference is to rely on peer-reviewed scientific information, BOEM acknowledges in process studies, modeling efforts not peer reviewed, and other relevant information in this Programmatic EIS. This is consistent with the statutory obligations and intent of NEPA. The OMB Bulletin does not supersede this broader statutory obligation under NEPA.</p> <p>Nevertheless, BOEM provided ample opportunity for public input and review (including by scientists, peer experts at other agencies, and nongovernmental organizations) of this Programmatic EIS and the underlying scientific information and modeling efforts contained herein. BOEM published the availability of the Draft Programmatic EIS on September 30, 2016, to initiate the 60-day public comment period, during which time informational public meetings were held in the states adjacent to the AOI. All public comments received were considered during preparation of this Final Programmatic EIS.</p> <p>BOEM conducted early coordination with appropriate Federal and State agencies and other concerned parties to develop the proposed action in this Programmatic EIS. Key agencies and organizations were contacted, including FWS, NOAA, U.S. Army Corps of Engineers, U.S. Department of Defense, and the National Aeronautics and Space Administration. The analyses in this Programmatic EIS are based on the best available scientific knowledge, acknowledging where there is incomplete or</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>applies best professional judgment to bridge uncertainties in the available information. These assessments include, but are not limited to, state-of-science reports; technology assessments; weight-of-evidence analyses; meta-analyses; health, safety, or ecological risk assessments; toxicological characterizations of substances; integrated assessment models; hazard determinations; or exposure assessment.”⁴ The PEIS is “health, safety or ecological risk assessments...hazard determinations, or exposure assessment” that obviously fits the first part of OMB’s definition.</p> <p>Second, the PEIS also fits OMB’s definition of “highly influential,” which is “scientific information that the agency or the [OMB] Administrator determines to be a scientific assessment that: (i) could have a potential impact of more than \$500 million in any year, or (ii) is novel, controversial, or precedent-setting or has significant interagency interest.”⁵</p> <p>Alternative G under consideration by BOEM in the PEIS is the prohibition of any new G&G activity in the Gulf of Mexico, and the phasing out of all already approved G&G activity.⁶ This PEIS Alternative “could have a potential impact of more than 500 million in any year.” The PEIS explains that many individuals and companies depend on G&G in the Gulf: “In addition to the oil and gas industry, G&G services and activities in the GOM are utilized by a wide variety of scientific, research, educational, governmental, and commercial enterprises. Studies into geomorphology, cartology and climate change; cultural resource surveys; fisheries research; military and USCG activities; and BOEM’s Marine Minerals Program all require G&G services. As a result, G&G services support the multimillion dollar industries that employ thousands of workers throughout the Gulf Coast.”⁷</p> <p>By contrast, the PEIS does not identify a single marine mammal that has actually been injured by oil and gas G&G in the GOM after over 50 years of G&G operations there.</p>	<p>unavailable information, in compliance with NEPA.</p> <p>In addition, please note that this Programmatic EIS will be used to inform decisions by BOEM on seismic survey permit applications and potentially by NOAA for MMPA authorizations for those same activities. This Programmatic EIS does not extend to oil and gas exploration generally in the Gulf of Mexico.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>The PEIS has “significant interagency interest.” BOEM, NMFS and BSEE are all involved in preparation of the PEIS. The Marine Mammal Commission will be commenting on the PEIS. The Department of Energy is interested in the energy impacts of the PEIS. The PEIS was prepared in violation of the OMB Peer Review Bulletin and in violation of other Government-wide Data Quality and regulatory review requirements that are supervised by OMB.</p> <p>There has never before been a Programmatic Environmental Impact Statement devoted solely to G & G in the Gulf of Mexico. Consequently, the PEIS is “novel...or precedent setting.” Finally, the PEIS is in large part BOEM’s attempt to satisfy an ill-advised settlement agreement in federal court litigation.⁸ The PEIS is obviously “controversial.” It was born in litigation.</p> <p>For these and other reasons, the PEIS is a “High Influential Scientific Assessment” subject to the most rigorous requirements of OMB’s Peer Review Bulletin. We will not discuss those requirements in detail at this point. However, we do stress that they require that BOEM ensure adequate public participation in the peer review process when BOEM withdraws the PEIS and provides for peer review of it, as required by OMB’s Peer Review Bulletin.</p> <p>CONCLUSION AND RECOMMENDED ACTION: BOEM’s proposed use of the PEIS violates OMB’ Peer Review Bulletin because the PEIS has not been peer reviewed. If BOEM still hopes to use the PEIS, then BOEM should schedule peer review of it in accordance with the Peer Review Bulletin requirements. These requirements include but are not limited to public participation in the peer review. In addition, the Peer Review Bulletin requires that “Reviewers shall be informed of applicable access, objectivity, reproducibility and other quality standards under federal information quality laws.”⁹</p>	

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
0999-0002	<p>The parameters of Geological and Geophysical (G&G) activities are described in general terms. While Tidewater recognizes that the main direction being addressed suggests interest in sound energy being imparted to the seawater medium; the inclusion of 'bottom-disturbing' activities brings in a much wider scope. Current generation workboat activities include not only supply support to offshore oil & gas facilities, but also anchor-handling, subsea lifting projects and remote operated vehicles (ROV) work. OCS energy projects, both hydrocarbon and renewable, require construction of foundations on the seafloor, which may fall under this description. ROV work can use subsea transducers and other energy-radiating equipment. For these reasons, we would submit that, detailed as the draft PEIS is, it is not yet mature enough for complete, cogent comment or action at this time.</p>	<p>For the purpose of the proposed action and scope of this Programmatic EIS, BOEM evaluated G&G activities and the associated seafloor-disturbing activities used in all three of BOEM's Program Areas (e.g., core samples to truth survey data) to assess the suitability of seafloor sediments for supporting structures such as platforms, pipelines, cables, and renewable energy facilities (e.g., wind turbines) or to evaluate the quantity and quality of sand for beach nourishment and coastal restoration projects, as described in Appendix F, Section 2. This Programmatic EIS does not include all seafloor-disturbing activities associated with all types of OCS energy projects. Many OCS energy-related, seafloor-disturbing activities are associated specifically with oil and gas activities (e.g., anchoring, pipeline installation and trenching, and site clearance trawling) and are outside the scope of this Programmatic EIS. This Programmatic EIS is being prepared to serve as the programmatic NEPA analysis from which BOEM will tier its site-specific NEPA analyses for BOEM to permit or authorize G&G activities under the OCSLA. BOEM prepares separate NEPA evaluations for lease sales and site-specific activities (refer to the 2017-2022 GOM Multisale EIS).</p>
1001-0003	<p>Seismic oil exploration not only harms the Gulf's sensitive wildlife, but also destroys the acoustic environment and paves the path for more oil drilling. There are already thousands of offshore oil and gas platforms in the Gulf of Mexico and most of the area has already been surveyed for oil exploration. The expansion of oil and gas development in the Gulf is a step in the wrong direction, especially when this activity is unrestrained.</p>	<p>Under the OCSLA, the Secretary of the Interior is responsible for the administration of mineral exploration and development of the OCS. Within DOI, BOEM is responsible for managing and regulating the development of OCS resources in accordance with the provisions of the OCSLA. Therefore, BOEM promotes environmental protection and economic development through responsible, science-based management of offshore conventional and renewable energy resources. The purpose of this Programmatic EIS is to evaluate potential significant environmental effects of G&G activities on the Gulf of Mexico OCS. Chapter 2 outlines the alternatives to the proposed action, which contain various mitigation measures offering protection to biological resources. The scope of this Programmatic EIS does not include a NEPA analysis that evaluates a specific proposal for oil and gas leasing in the AOI and does not authorize an OCS lease sale. BOEM prepares separate NEPA evaluations for lease sales and site-specific</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1063-0008	Chapter 1 Pages 1-19-20: The last paragraph begins on Page 1-19 seems to be largely a repeat of the paragraph from Section 1.2.5 (Page 1-15) and from other sections before. Suggest deleting.	activities (refer to the 2017-2022 GOM Multisale EIS). Chapter 1.2.6 has been revised to incorporate NMFS' new acoustic criteria.
1067-0004	Vast areas of the Gulf are already producing oil and gas, with millions of additional areas already leased. This development, combined with declining future demand for fossil fuels, undercuts the need to engage in a speculative search for additional and risky deposits. At a time when climate change is already impacting our oceans, it simply doesn't make sense to harm the Gulf's marine wildlife merely to identify oil deposits that must stay where they are if we are to prevent the worst impacts of climate change.	This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Oil and gas leasing in the AOI is not part of the proposed action, and this NEPA document does not analyze or authorize an OCS lease sale. Those activities, and the impacts that may result from them, are outside of the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need, and reasonable range of alternatives (Chapters 1.1.2 and 2). Nevertheless, as part of its mission, BOEM does consider these activities and issues in other NEPA documents such as the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considered the effects of GHG emissions. Chapter 4.2 of the Five-Year Program EIS considers climate change and the baseline environment in the areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assess the potential lifecycle GHG emissions and social cost of carbon under the Five-Year Program. In addition, the GOM lease sale-stage NEPA analyses will further specify impacts of GHG emissions related to a single proposed lease sale. To supplement the Five-Year Program and Five-Year Program EIS, BOEM prepared a document to explain the analytic approaches used for the economic analyses in the decision document, including comprehensive tables and references to original studies (https://www.boem.gov/Economic-Analysis-Methodology/). BOEM completed the 2017-2022 GOM Multisale EIS for oil and gas lease decisions in the GOM; it can be found on BOEM's website at https://www.boem.gov/nepaprocess/ .
1069-0008	Alternatives B through G conflict with the law and mission underpinning the OCS program. The DPEIS must not function	The purpose of the proposed action, described in Chapter 1.1.2 , is to gather state-of-the-practice data about the ocean bottom

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>to administratively repeal or contravene entire provisions of the Outer Continental Shelf Lands Act (OCSLA). For the statutory ramifications alone, Alternatives B through G are not feasible and must be dismissed. Shell notes for the record that the OCSLA requires the expeditious and orderly development of OCS resources for the benefit of the nation: The outer Continental Shelf is a vital national resource reserve held in trust by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs;¹⁴</p> <p>This statute requires that the government (1) “make resources available to meet the nation’s energy needs”, (2) “insure the extent of OCS resources is assessed at the earliest practicable time”, (3) “balance orderly energy resource development with protection of the human, marine, and coastal environments.”¹⁵ Seismic and other G&G data acquisition is in many ways the most advanced and least impactful means to both assess and advance the availability of the resources as directed here. To effectively prohibit that data acquisition would run contrary to the requirement to balance development with the enumerated protections.</p> <p>The previously cited examples, wherein Shell has utilized G&G data to optimize and achieve better production results and fulfill the policy goal of maximizing benefits to the U.S. Treasury and taxpayer, link back to these provisions of law.</p> <p>It is incumbent upon operators to take measures to ensure that resource recovery is conducted safely and diligently in a manner lending itself towards greatest ultimate recovery. Section 1337(d) requires that “No bid for a lease may be submitted if the Secretary finds, after notice and hearing, that the bidder is not meeting due diligence requirements on other leases.” Because G&G technology, particularly seismic, is demonstrably safe with the current standard mitigations, and</p>	<p>and subsurface. Data collected through G&G surveys provide information about the location and extent of oil and gas reserves, other marine mineral reserves, seafloor topography, and geological hazards for the installation of structures. The information obtained through surveys is used to (1) make informed decisions regarding development of OCS minerals; (2) protect existing biological and human resources; and (3) provide a knowledge base for economic purposes to allow BOEM to best benefit the public in the management of offshore resources and minerals to provide the best return and for industry to identify the best and safest development options.</p> <p>Section 11(g) of the OCSLA specifies that permits for geological explorations shall be issued only if the Secretary of the Interior determines that “such exploration will not be unduly harmful to aquatic life in the area....” BOEM’s regulations at 30 CFR § 551.6 state that permit holders for G&G activities must not “cause harm or damage to life (including fish and other aquatic life), property, or to the marine, coastal, or human environment.” This Programmatic EIS analyzes impacts with respect to context and intensity as required by NEPA regulations at 40 CFR § 1508.27.</p> <p>As part of the Settlement Agreement (Chapter 1.2.3.4), BOEM is required to analyze certain mitigation measures as potential COAs for permit applications for deep-penetration seismic surveys in this Programmatic EIS (Chapter 2.4). Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM’s Environmental Studies Program develops, conducts, and oversees world-class scientific research specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>is well documented as an effective tool in responsible and efficient exploration and production, it is unacceptable and illogical to ignore its benefits to lease maintenance and development. In this sense, an unnecessary restriction on seismic and other G&G data acquisition would oddly force agencies to choose between enforcing unnecessary seismic restrictions versus enforcing statutory due diligence requirements. This conflict of authority would create waste, inefficiency, and uncertainty in a period when it is least affordable and least excusable.</p> <p>Elsewhere in the OCSLA, clear language similarly favors policies to promote development or increased production on producing or non-producing leases and to encourage production of marginal resources.¹⁶ These efforts toward improved ultimate recovery for the benefit of the U.S. Treasury would be needlessly and seriously frustrated by significant restrictions on G&G activities, particularly seismic surveys.</p> <p>Perhaps most relevant is the clear language of the OCSLA expressly authorizing seismic and other G&G activities as an expected and normal element in the course of OCS operations and fulfillment of the law's mission: Any agency of the United States and any person authorized by the Secretary may conduct geological and geophysical explorations in the outer Continental Shelf, which do not interfere with or endanger actual operations under any lease maintained or granted pursuant to this subchapter, and which are not unduly harmful to aquatic life in such area." 43 U.S.C. 1340(a).</p>	<p>leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment. A listing of the currently active studies addressing this broad range of topics can be found on BOEM's website at http://www.boem.gov/GMStudies/.</p> <p>Nonetheless, this Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of this Final Programmatic EIS. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources from the implementation of Alternatives A through G are analyzed in Chapter 4. These analyses were developed by the subject-matter experts using the highest quality and best available information. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1071-0001	<p>Florida supports G&G activities on the Gulf of Mexico OCS as they will play a significant role in helping to locate offshore sand deposits important to beach and shoreline restoration and supporting the siting of renewable energy projects. However, care must be taken to ensure that marine and coastal resources, especially protected species and ecosystems are provided maximum protection. Florida recommends that final requirements be the most protective without imposing unnecessary regulation or restrictions that</p>	<p>Thank you for your comment. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources (e.g., marine mammals, sea turtles, and economics) from Alternatives A through G are analyzed in</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	increase costs unless those regulations provide significant benefits to environmental resources. We defer to NOAA Fisheries for final recommendations of protected resources under their jurisdiction.	Chapter 4. These analyses were developed by the subject-matter experts using the best available data. In addition, NOAA and BSEE are cooperating agencies for this Programmatic EIS and BOEM worked closely with both agencies to include their input into this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
1071-0008	FWC staff appreciates the opportunity to provide comments on the BOEM DPEIS for Proposed Geological and Geophysical Activities in the Gulf of Mexico and we find this action consistent with FWC enforceable policies included in the Florida Coastal Management Program.	Thank you for your comment. BOEM will continue to ensure that the Florida Coastal Management Program receives consistency reviews for G&G permitted activities in the GOM when the proposed activity is in the designated offshore administrative boundary. These activities will be consistent with the enforceable policies of the State's coastal management plan.
1074-0006	In all, the DEIS estimates as many as 31 million instances of “take” of Gulf marine mammals over the next ten years, representing chronic disruption of vital behaviors such as feeding and nursing and on top of tens of thousands of cases of injury. Given the sheer extent of disruption, the substantial scientific concern about both seismic surveys and cumulative acoustic stressors, and the acute vulnerability of Gulf populations, particularly in the wake of the <i>Deepwater Horizon</i> disaster, it is vitally important that NMFS approach this EIS, and its associated rulemaking under the Marine Mammal Protection Act (“MMPA”), carefully and conservatively.	<p>Thank you for your comment. There has been some confusion in this Programmatic EIS regarding terminology, specifically “exposure” versus “take.” BOEM has clarified language in this Programmatic EIS to be more consistent in terminology. Refer to Chapter 1.2.5.</p> <p>Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts.</p> <p>Potential impacts to resources from Alternatives A through G are analyzed in Chapter 4. Appendix D presents the modeling conducted to estimate the number of marine mammal exposures. These analyses were developed by the subject-matter experts using the best available data. In addition, NOAA is a cooperating agency for this Programmatic EIS and BOEM worked closely with NOAA to include their input into this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1074-0007	...current levels of seismic exploration in the northern Gulf of Mexico are not compatible with the MMPA or OCSLA, the underlying statutes for which the DEIS was prepared. Neither	As stated in Chapter 1 , BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. Each

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>BOEM nor NMFS can ensure against significant adverse population-level impacts on Gulf marine mammals, or bring themselves into compliance with federal environmental law, without making a focused effort to reduce the environmental footprint of these activities.</p>	<p>alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources (e.g., marine mammals, sea turtles, and economics) from Alternatives A through G are analyzed in Chapter 4. These analyses were developed by the subject-matter experts using the best available data. In addition, NOAA and BSEE are cooperating agencies for this Programmatic EIS and BOEM worked closely with both agencies to include their input into this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>To comply with NEPA, this Programmatic EIS will help ensure the necessary documentation and analyses to support informed decisions regarding future OCSLA permit and MMPA authorization actions related to G&G activities on the OCS. This Programmatic EIS provides information that can be used when complying with other applicable laws, including the ESA, Magnuson-Stevens Fishery Conservation and Management Act, National Marine Sanctuaries Act, National Historic Preservation Act, and Coastal Zone Management Act.</p> <p>In addition, site-specific analyses will be performed for each survey activity.</p>
1074-0019	<p>The agencies should carefully consider the recommendations we made in previous comments in developing its long-term monitoring plan (which is not included in the DEIS). We recommend, inter alia, that the monitoring program be hypothesis-driven to the greatest extent possible; that it provide focused research effort for populations of special concern, especially Bryde’s whales, sperm whales, and near-coastal bottlenose dolphins; and that it provide meaningful public participation, transparency, and data accessibility regardless of what funding structure is employed.</p>	<p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p>
1074-0048	<p>As the monitoring plan is still in agency development, with comment apparently deferred to the MMPA process (id.), we are unable to respond now to an agency proposal. We will</p>	<p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>therefore reiterate, and incorporate into these comments, the points we made in our response to BOEM's 2013 request for information, namely</p> <p>(1) The monitoring program should be hypothesis-driven to the greatest extent possible;</p> <p>(2) The program should provide focused research effort for populations of special concern, especially Bryde's whales, sperm whales, and near-coastal bottlenose dolphins;</p> <p>(3) The program should include regular distribution and abundance surveys;</p> <p>(4) The program should include research on the most pertinent topics related to the industry's noise impacts on Gulf marine mammals, including research on masking and impacts on acoustic habitat, research on chronic stress, analysis of the population consequences of cumulative impacts, and data acquisition on the potential impacts of new seismic technology; and</p> <p>(5) The program should provide meaningful public participation, transparency, and data accessibility regardless of what funding structure is employed.</p>	<p>developed by industry (Chapter 1.2.3.4).</p>
<p>1074-0071</p>	<p>We recommend that BOEM consult the Advisory Group's 2011 report, which we have attached to these comments;² and we urge the agency to ensure that work conducted under its monitoring program, with the exception of real-time monitoring for mitigation purposes, meets scientific objectives.</p> <p>...It is essential that the monitoring program focus resources on these populations...Near-coastal bottlenose dolphins... Bryde's whales...Sperm whales...</p> <p>...The program [Long-Term Monitoring Program] should include regular distribution and abundance surveys.</p> <p>...The program should include research on the most pertinent topics related to the industry's noise impacts on Gulf marine mammals.</p>	<p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>...The program [Long-Term Monitoring Plan] should provide meaningful public participation, transparency, and data accessibility regardless of what funding structure is employed.</p>	
<p>1074-0076</p>	<p>C. NEPA compliance in the Gulf of Mexico Despite considerable evidence of harm to marine mammals, fish, and other marine species, BOEM initially declined to prepare an EIS for Gulf of Mexico seismic surveys, releasing instead, in 2004, a programmatic environmental assessment that found the activity would have “no significant impact.”²⁰ Four months later, NMFS took the extraordinary step of noticing, in the <i>Federal Register</i>, its own intent to prepare an EIS, an implicit rebuke of BOEM’s decision. 69 Fed. Reg. 67535, 67536 (Nov. 18, 2004). Yet neither agency produced an EIS or, for that matter, issued or received an MMPA authorization for the numerous annual seismic surveys taking place in the Gulf during the next six years. Finally, in 2010, in the wake of the <i>Macondo</i> disaster, a Plaintiff group that included most of our organizations brought suit against BOEM for violating NEPA. The resulting settlement agreement requires, inter alia, that the agency undertake programmatic compliance under NEPA and other statutes for seismic surveys in the Gulf of Mexico. Settlement Agreement, NRDC v. Jewell, Case No. 2:10-cv-01882 (E.D. La.) (Ordered June 24, 2013).</p>	<p>The background, including the history of G&G environmental review, MMPA petition, litigation, and <i>Deepwater Horizon</i> baseline changes are described in Chapters 1.2.1 through 1.2.4. This Programmatic EIS was prepared to (1) serve as the programmatic NEPA analysis from which BOEM will tier its site-specific NEPA analyses to permit or authorize G&G activities under the OCSLA; (2) provide necessary information and assessment under NEPA to support NMFS’ decision regarding MMPA authorizations for G&G activities on the OCS; and (3) support additional coordination and consultation requirements under other statutes, including the ESA, Magnuson-Stevens Fishery Conservation and Management Act, Coastal Zone Management Act, National Marine Sanctuaries Act, and National Historic Preservation Act.</p>
<p>1076-0012</p>	<p>We also wish to clarify at the outset the relevance of the settlement agreement and subsequent stipulation that were entered into by the parties in NRDC et al. v. Jewell et al., No. 2:10-cv-01882 (E.D. La.) (“NRDC v. Jewell”). See <i>id.</i> at Dkt. 118-2 (“Settlement Agreement”); <i>id.</i> at Dkt. 127-2 (“Stipulation to Amend”). The Settlement Agreement and the Stipulation to Amend were expressly agreed to for the sole purpose of settling litigation. The mitigation measures currently implemented through the terms of those agreements are not representative of measures that have been traditionally employed in the GOM. Moreover, the parties to the Settlement Agreement and the Stipulation to Amend did not agree, and there has otherwise been no subsequent</p>	<p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and USDOl implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated. Additionally, the decisionmaker must not consider alternatives beyond the range of alternatives analyzed in this Programmatic EIS but must consider all the alternatives evaluated in this Programmatic EIS.</p> <p>BOEM has determined that a reasonable range of alternatives includes conditions prior to (Alternative A) and including the Settlement Agreement (Alternative B) since on February 10, 2016, the parties formally agreed to extend the stay until final action by the agencies or September 25, 2017, whichever occurs</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	demonstration, that the mitigation measures imposed through those documents are feasible, appropriate, or supported by the best available science.	<p>first. Thus, the conditions of the Settlement Agreement are being implemented in the GOM and are evaluated in this Programmatic EIS. Inclusion of the Settlement Agreement's conditions will enable decisionmakers to compare the magnitude of the environmental effects of the alternatives.</p> <p>Alternatives C through F contain mitigation measures designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys, and they contain elements that are continually evolving but represent current standards. Moreover, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available data at that time.</p> <p>Regarding Alternative G, CEQ regulation 1502.14(d) specifies that NEPA analyses require the alternatives' analysis in an EIS to "include the alternative of no action."</p> <p>Finally, as stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources (e.g., marine mammals, sea turtles, and economics) from Alternatives A through G are analyzed in Chapter 4. These analyses were developed by the subject-matter experts using the best available data. In addition, NOAA and BSEE are cooperating agencies for this Programmatic EIS, and BOEM worked closely with both agencies to include their input in this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1076-0015	We encourage BOEM to issue the final PEIS on a schedule that is compliant with court-ordered deadlines; it must do so in a manner that produces a final PEIS that does not contain the	Thank you for your comment.

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0016	<p>inadequacies described in the following comments.</p> <p>...the DPEIS provides no meaningful discussion of OCSLA's mandates and specifically fails to show how each of the proposed alternatives is consistent with those mandates.</p>	<p>This Programmatic EIS analyzes the potential impacts of BOEM authorizing G&G survey activities in the GOM. The statutory authority for BOEM to issue such permits or authorizations is provided by the OCSLA. This Programmatic EIS does not address elements beyond those required by NEPA (e.g., the stated proposed action, purpose, and need as described in Chapter 1.1.2).</p>
1076-0018	<p>...the DPEIS does not meaningfully address the environmental benefits of G&G activities and, accordingly, fails to "adequately set forth sufficient information to allow the decision maker to consider alternatives and make a reasoned decision after balancing the risks of harm to the environment against the benefits of the proposed action."⁸ In sum, well-established NEPA law requires BOEM to fully consider the statutory authority for the proposed action as well as all of the environmental benefits of the proposed action.</p>	<p>This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI. BOEM recognizes the benefits and need for G&G activities to occur (as described in Chapters 1.1.2 and 2.9.1). Information obtained and developed as a result of G&G activities are used to make informed business, management, design, stewardship, and environmental protection decisions for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p>
1076-0021	<p>"Biological significance" is not further evaluated or considered in the DPEIS even though, as addressed below, relevant information is available. This is a particularly arbitrary error because it results in a DPEIS that does not evaluate the actual effects that are anticipated to be "caused by the action" or that are "reasonably foreseeable." 40 C.F.R. § 1508.8 (definitions for "direct" and "indirect" effects).</p>	<p>The biological significance of impacts was left to interpretation by the subject-matter experts and incorporated into the impact determination for each alternative.</p> <p>The NEPA requires consideration of the context and intensity in determining impact significance (40 CFR § 1508.27). However, there is no quantitative, qualitative, consistent, or agreed-upon measure of adequacy for NEPA with respect to characterizing impacts. Although NEPA does not require it, BOEM chose an approach (described in Chapter 4.1.2) and defined significance criteria. Significance criteria are judgmental in nature and are defined by qualitative descriptors. Where they were applied, there is an explanation regarding how each determination was made. Criteria reflect consideration of the context and intensity of the impact (40 CFR § 1508.27) based on four parameters: detectability (i.e., measurable or detectable impact); duration (i.e., short term, long term); spatial extent (i.e., localized, extensive); and severity (i.e., severe, less than severe). The evaluation process to determine significance considered the potential impacts by context (e.g., short term versus long term) and intensity (e.g., severity), following NEPA regulations as</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		guidance. An assessment of environmental impacts within a context of where they occur and by their intensity and duration have been provided.
1076-0023	Moreover, by performing an effects analysis that is “purposely developed to be conservative,” based on the highest sound levels and erroneously high marine mammal densities, and purposely intended to overestimate adverse effects, BOEM has performed precisely the type of “worst case analysis” that was rejected by both CEQ and the U.S. Supreme Court many years ago. By its terms, and as expressly stated in the DPEIS, the analysis of marine mammal impacts is intentionally designed to be inaccurate and to evaluate the worst possible consequences that could hypothetically result from unmitigated seismic surveying.	<p>At this stage, the modeling used the best available data to support assumptions and inputs. For this Programmatic EIS, the existing modeling outputs fully inform the potential range of exposures, with a reasonable margin of conservatism over the 10-year timeframe of this analysis. Appendix C of Appendix D explains how densities were derived for each modeling region.</p> <p>There were some erroneous occurrences of “worst case” in Appendix D, and they have been removed and/or clarified. Chapter 1.2.5 has been revised to provide clarity on the modeling effort. While the modeling results may be conservative, they are the most credible, science-based information available at this time.</p>
1076-0024	In sum, the DPEIS’s analysis of marine mammal effects is plainly not credible; it evaluates effects that, by BOEM’s admission, will not occur, and, therefore, it is “unworthy of belief.” 40 C.F.R. § 1502.22(b)(1); 51 Fed. Reg. at 15,622-23. The DPEIS violates NEPA because it relies exclusively on a “worst case” analysis of seismic impacts on marine mammals, contrary to well-established law.	<p>The impact analysis considered the modeling results in conjunction with subject-matter expert review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record.</p> <p>There were some erroneous occurrences of “worst case” in Appendix D, and they have been removed and/or clarified. Chapter 1.2.5 has been revised to provide clarity on the modeling effort. While the modeling results may be conservative, they are the most credible, science-based information available at this time.</p>
1076-0028	BOEM’s refusal to incorporate the known benefits of mitigation measures, many of which are standard best practices that the seismic industry already implements, is arbitrary, unsupported, and contrary to well-established NEPA principles. ¹¹ An agency cannot simply ignore certain effects of an action because they “cannot be quantified with statistical confidence” (DPEIS at 1-19), particularly when it chooses not	<p>Throughout this Programmatic EIS, BOEM has clarified the assumptions and scenarios used in the modeling as well as limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>to ignore admittedly incorrect assumptions that inaccurately estimate impact levels. This is the very definition of “arbitrary and capricious” agency action. Rather, BOEM must evaluate all reasonably foreseeable effects that will be caused by the proposed action, including the offsetting effects of mitigation measures, perform a high quality and accurate assessment of those effects, and reach reasoned conclusions regarding the effects that are likely to occur.</p>	<p>considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate potential impacts. BOEM is involved in several ongoing programs to acquire new data and improve existing knowledge on marine mammals and underwater noise, and future analyses will use the best available data at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM’s Environmental Studies Program develops, conducts, and oversees world-class scientific research specifically to inform policy decisions regarding development of OCS energy and mineral resources. The currently active studies addressing this broad range of topics can be found on BOEM’s website at http://www.boem.gov/GMStudies/.</p> <p>BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0050	<p>G&G exploration activities authorized by BOEM may be denied or conditioned if they “would probably cause serious harm or damage to life (including fish and other aquatic life).” See 43 U.S.C. § 1340(c)(1); see also id. § 1340(a)(1) (“any person authorized by the Secretary may conduct geological and geophysical explorations in the outer Continental Shelf ... which are not unduly harmful to aquatic life in such area”). BOEM may also temporarily stop off-lease exploration or scientific research activities under a permit when the Regional Director determines that the “[a]ctivities pose a threat of serious, irreparable, or immediate harm. This includes damage to life (including fish and other aquatic life) ... [and] to the marine, coastal, or human environment.” 30 C.F.R. § 551.9(a)(1); see also 30 C.F.R. § 551.6(a)(2) (prohibiting a permittee from causing harm to marine life). None of these requirements are satisfied based upon the information provided in the DPEIS. Even the unrealistic and overly conservative effects analysis does not conclude that there will be any “serious harm or damage” or “serious, irreparable, or immediate harm” to marine life. Moreover, such arbitrary reductions in activity levels directly contradict OCSLA’s primary mandates, particularly because no adverse effects from the original activity levels have been demonstrated.</p>	<p>based on the best available data at that time.</p> <p>The impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. The impact analysis considered the modeling results, in conjunction with subject-matter experts’ review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record.</p> <p>Refer to Chapter 4 for specific information on potential impacts to the analyzed resources. Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or by altering their vocalizations. This Programmatic EIS acknowledges that acute physical injury other than auditory, or death of marine mammals is not likely to be a direct result of seismic noise. It does, however, acknowledge that disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. BOEM, however, does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p> <p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		obligations and provide the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions.
1076-0085	<p>Respectfully, the DPEIS is poorly organized and presented. For some sections and appendices, it is almost impossible to clearly review and understand many of the underlying technical analyses. The body of the DPEIS contains a substantial amount of both conflicting and redundant material, which is repeated in appendices, and in appendices to appendices. For example, Appendix D itself has six appendices, many details of which conflict with portions of the body of the DPEIS or with Appendix D itself. As another example, sections addressing threshold criteria in the body of the DPEIS (pages 4-12; 4-33; 4-45) and in Appendix D (D-50; D-25; D-56; Table 6) conflict with Appendix H. Assumptions and conclusions are buried in the details of Appendix D, but the other documents (i.e., the DPEIS and Appendix H) present no conclusions that clearly correspond to those presented in Appendix D's Phase II model. The three sections on threshold criteria in these three separate documents appear to have been written by three different people who did not view each other's work.⁴⁴ There appears to be hundreds of referential and typographical errors in the DPEIS and its appendices. In short, the overall quality and clarity of the analyses presented in the DPEIS and its appendices is poor and inhibits meaningful review and input, particularly in light of the relatively short period that was provided for review and comment on the DPEIS.⁴⁵</p>	<p>Edits were made throughout this Final Programmatic EIS to ensure consistency across all chapters and appendices, and to ensure that pertinent details and assumptions from the appendices were made evident in their application in the main text of this Programmatic EIS.</p> <p>BOEM believes that the information provided in the Draft Programmatic EIS was sufficient under NEPA to allow interested stakeholders to provide informed comments on the analysis and conclusions included in the Draft Programmatic EIS.</p>
1076-0086	<p>The flaws in the DPEIS (as described above), to the extent they are not cured in the final PEIS, may have unintended and undesired negative consequences for any agency that relies on the final PEIS for the authorization of future federal actions and, specifically, for the issuance of MMPA ITAs in the GOM. For example, the DPEIS makes unrealistic, incorrect effects findings that will almost certainly contradict findings made in reviews of future federal actions (assuming those reviews are performed correctly). Additionally, the DPEIS's failure to address the effects of mitigation measures will very likely</p>	<p>The impact conclusions are a synthesis of available qualitative and quantitative scientific information. The impact analysis considered the modeling results, in conjunction with the subject-matter experts' review of scientifically credible information using accepted approaches and research methods. However, species and the evaluation of the effects of an action on ESA-listed species and critical habitat and on marine mammals are ultimately under the purview of the appropriate agencies (i.e., NMFS and/or FWS) charged with implementation of those statutes, which is discussed in Chapter 1.2.5.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>contradict subsequent MMPA Section 101(a)(5) evaluations, which require the permitting agency to consider the effects of mitigation measures in making a determination that the authorized take will have a “negligible impact” on marine mammal species or stocks. 16 U.S.C. § 1371(a)(5)(A), (D). By failing to evaluate the actual anticipated effects of G&G activities in the GOM, and by failing to consider the effects of mitigation measures, BOEM has created a scenario in which the final PEIS will likely (if not corrected) present significant contradictions and inconsistencies with subsequent action-specific regulatory processes. For this additional reason, the serious flaws in the DPEIS must be corrected before a final PEIS is issued.</p>	<p>Throughout this Programmatic EIS, BOEM has clarified the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p>
1076-0091	<p>This indicates that site-specific EA’s will be required for G&G activities. The industry would appreciate greater clarity on what the future permit application and supporting NEPA process will look like for individual applicants.</p>	<p>Approval processes currently in place will continue, and they include BOEM’s commitment to comply with NEPA for G&G activities. As described below, this can take a number of forms, from this Programmatic EIS to tiered environmental assessments, categorical exclusions, or determinations of NEPA adequacy.</p> <p>During site-specific analyses for a variety of G&G survey activities, including geological sampling and geophysical surveys, BOEM may need to prepare additional NEPA analyses in the form of an EA or EIS to support authorization for the proposed activity. When a request to conduct G&G activities is received, BOEM evaluates whether an EIS, EA, or categorical exclusion is appropriate. BOEM typically prepares site-specific EAs for proposed G&G activities that include airguns, such as 2D and 3D seismic surveys, some ocean bottom nodes, and ocean bottom cables and any non-airgun activities that could include high-resolution surveys or that could impact benthic or archaeological resources such as geologic cores and grab samples. BOEM expects future site-specific NEPA reviews to tier from this Programmatic EIS.</p>
1076-0093	<p>Using the Atlantic G&G PEIS as a reference for showing that significant strides have been made in quantifying the effects of</p>	<p>The nature of modeling always requires some assumptions and forecasts by subject-matter experts, and each model has its</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>noise on marine mammals is not useful or appropriate. That document used a similar approach to estimated exposures as used in this DPEIS for the GOM, but there are no data to indicate how accurate these methods are in representing actual exposures or impacts from the modeled activities.</p>	<p>limitations. Throughout this Programmatic EIS, BOEM has clarified the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p>
<p>1076-0094</p>	<p>Text in the Adaptive Monitoring Plan section of Chapter 1.2.3 does not include any materials that address the efficacy of proposed mitigation measures.</p>	<p>The Monitoring Plan would focus on monitoring marine mammal populations and behavior, as well as the effectiveness of mitigation measures. The implemented mitigation measures would be evaluated and, through an adaptive management process, may be altered depending on effectiveness. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM.</p> <p>The data collected from implementing the Monitoring Plan will provide additional information regarding the efficacy of the implemented mitigation measures. BOEM will continue to coordinate with industry and external stakeholders to understand how a marine mammal monitoring plan in the GOM for G&G activities may fit into other efforts in order to prevent duplication and to address monitoring needs in the context of the larger</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1077-0003	<p>First, BOEM’s failure to conduct a cost-benefit analysis or even to consider beneficial effects of existing mitigation measures is arbitrary and capricious. E.g., <i>Friends of the Boundary Waters Wilderness v. Dombeck</i>, 164 F.3d 1115, 1128 (8th Cir. 1999) (EIS must allow a balancing of costs and benefits). Second, NEPA regulations prohibit BOEM’s use of admittedly “unrealistic” data; they require BOEM to rely on “high quality” information and “accurate scientific analysis.” 40 C.F.R. § 1500.1(b) (“Accurate scientific analysis [is] essential to implementing NEPA.”); see also <i>id.</i> § 1502.22 (evaluation must be based upon “credible scientific evidence”). Third, the Council on Environmental Quality concluded long ago that the type of “worst case analysis” BOEM used in the DPEIS is “an unproductive and ineffective method of achieving [NEPA’s] goals; one which can breed endless hypothesis and speculation.” 51 Fed. Reg. 15,618 (Apr. 25, 1986). The Supreme Court has agreed. <i>Robertson v. Methow Valley Citizens Council</i>, 490 U.S. 332, 354-56 (1989) (confirming that worst case analysis is no longer applicable).</p>	<p>GOM ecosystem.</p> <p>A cost-benefit analysis is not required to satisfy NEPA analysis requirements, particularly if there are important qualitative considerations (40 CFR § 1502.23). However, an EIS should indicate considerations, including factors not related to environmental quality, that are likely to be relevant and important to a decision (40 CFR § 1502.23). Therefore, a cost-benefit analysis for inclusion of the proposed mitigation measures was performed. Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F. BOEM considered many factors, including the cost of implementing mitigation measures, in selecting the Preferred Alternative. If NOAA moves forward with their proposed action (i.e., issuance of MMPA incidental take regulations), then an Regulatory Impact Analysis would accompany the MMPA rule.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating impacts. BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of subject-matter experts. BOEM developed this in-depth Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.</p> <p>There were some erroneous occurrences of “worst-case” in Appendix D, and they were removed. Throughout this Programmatic EIS, BOEM clarified the assumptions and scenarios used in the modeling, as well as limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1077-0008	Chevron urges BOEM to correct the errors identified above and in the Associations' comments and recognize G&G activities as imperative for safe, effective, and environmentally responsible resource development.	<p>Comment noted. BOEM has reviewed and taken into consideration all comments received on the Draft Programmatic EIS in the development of this Final Programmatic EIS.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating impacts. BOEM is committed to complying with the requirements and intent of NEPA, in preparing a sound Programmatic EIS based on the best-available scientific information and professional judgment of its subject-matter experts. BOEM has developed this Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.</p>
1085-0002	Of course, we know that marine mammal populations in the Gulf already have suffered from inadequate regulation of offshore oil and gas activities from loss of habitat and the disastrous <i>Deepwater Horizon</i> oil spill.	As stated in Chapter 1 , BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts. Potential impacts to resources (e.g., marine mammals, sea turtles, and economics) from Alternatives A through G are analyzed in Chapter 4 . These analyses were developed using the best available data by subject-matter experts and include analysis of baseline trends for each resource. In addition, NOAA and BSEE are cooperating agencies for this Programmatic EIS, and BOEM worked closely with both agencies to include their input in this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
1088-0009	Continuing to conduct geophysical surveys in the GOM will produce known discoveries safely and more efficiently and will help uncover new sources of oil and natural gas. This data will allow people to make informed decisions about the potential for continued job creation and economic growth from offshore energy production in the Gulf.	Thank you for your comment. BOEM analyzed the potential effects of each alternative, including the potential benefits of G&G activities and acquiring G&G data. This information is located in Chapter 4.13 . All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>The geophysical industry remains committed to improving the scientific understanding of the potential impacts of our operations on marine life. Seismic and other geophysical surveys in the GOM are a critical part of the safe offshore energy development that is necessary to harness our nation's energy potential for the benefit of American energy consumers.</p>	<p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS using the best available science, along with consideration of technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provide the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions.</p>
1091-0026	<p>BOEM mentions it is developing a G&G Marine Mammal Monitoring Plan collaboratively with NMFS, which would allow for increased monitoring and understanding of impacts to marine mammals from G&G activities (Volume I, Chapter 1.2.3.2). It would be wise to have this plan in place before a new Alternative action is adopted for G&G activity in the Gulf of Mexico.</p>	<p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p>
1091-0027	<p>As BOEM states in Section 1.2.6 of the PEIS (2016), BOEM has used NMFS' traditional acoustic guidance for assessing Level A and Level B Harassment to marine mammals throughout the PEIS. BOEM also acknowledges that it has referenced and used NMFS' July 2016 final "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing" throughout the EIS, though BOEM acknowledges that this is based on BOEM's "initial review" and that it "intends to further review these new guidelines and work with NMFS for further clarification and guidance" (Chapter 1.2.6). Notwithstanding that the guidelines came out just shortly before this PEIS was published, it is critical that BOEM has a full understanding and achieves full implementation of these guidelines before</p>	<p>Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. This represents the best available scientific information and criteria issued by NOAA.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1091-0028	<p>projecting acoustic impacts and standards moving forward.</p> <p>BOEM states in Volume I, Chapter 1.2.7 that it is in the process of developing a new Risk Assessment Framework (RAF) on marine mammal hearing and sound, which presumably fully integrates the new NMFS Technical Guidance. It is true that agencies often have to evaluate potential acoustic impacts to marine mammals under the Marine Mammal Protection Act using Level A or Level B exposures based on a more qualitative assessment, and that this assessment is not foolproof and leaves room for error. Therefore, it would be in BOEM's best interest to finish developing this RAF before authorizing new G&G activity in order to use the best available science and methods for projecting impacts to marine mammals in the Gulf of Mexico.</p>	<p>Thank you for your comment. BOEM acknowledges that it would be useful to have the Risk Assessment Framework (RAF) final report prior to finalizing this Final Programmatic EIS, but it is not possible within the timeframe of this NEPA document or the other activities under consideration, including the ESA consultation and MMPA petition. Ideally, a Federal agency would have complete information when undertaking a NEPA analysis or agency action. However, with the rapid pace of scientific study, the ongoing and overlapping timelines for completion of studies, and the constant evaluation and refinement of existing data and modeling, such perfect information is not always possible. At some point, the agency must move forward and complete its analyses and move forward with agency's mission. The CEQ regulations specifically acknowledge this and, instead of mandating that Federal agencies cannot move forward with scientific uncertainty, direct agencies to evaluate where there is incomplete or unavailable information when preparing NEPA documents and implementing agency decisions (40 CFR § 1502.22).</p> <p>BOEM has tried to apply this directive in this Programmatic EIS whenever there was relevant incomplete or unavailable information, including acknowledging that the RAF study is in process but not available yet. However, this information is not essential to a reasoned choice among alternatives (refer to Chapter 1.2.6). The RAF study results will help fill in and refine certain exposures estimates, but they are not expected to significantly deviate from the existing exposure estimates from the JASCO modeling since the estimates rely on the same underlying density data. When the RAF study results become available, BOEM will evaluate them, consistent with CEQ regulations, to determine whether supplementation of this Programmatic EIS is necessary or if additional analysis in future site-specific NEPA documents for G&G survey requests is appropriate. The NOAA expects to incorporate the results of the RAF into its MMPA rulemaking or authorization decisions, through the rulemaking itself, or individual decisions on Letters of Authorization and</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1095-0004	<p>This proposal clearly does not seek an appropriate or rational balance between energy production and the existence rights of marine mammals, and its serious entertainment by the BOEM is an affront to the moral decency that we owe these precious and profoundly intelligent creatures.</p> <p>Such a horrifying acoustic assault upon the liquid medium that defines and envelops the conscious life of cetaceans, plainly violates the Endangered Species Act and the Marine Mammal Protection Act.</p>	<p>Incidental Harassment Authorizations.</p> <p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS using the best available science, along with consideration of technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provide the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions.</p>
1095-0006	<p>Moreover, our atmosphere cannot safely absorb any more carbon dioxide, and this liability to human welfare and survival negates the net economic value of the oil to be extracted. At this moment, when vast areas of the Gulf have already been leased to oil and gas production, to the detriment of our national security and our ecological wealth, to cut further into the Gulf for the last hydrocarbons, is unbecoming a government agency in ostensible service to the public interest. The carbon content of the oil that may result from the exploration is a material threat to America's national security. This Administration, across agencies and audiences, has articulated the need to curb global warming as an urgent matter of national security and human health. For the BOEM to commit to production of a new long-term supply of fossil fuels from a new block of the Gulf of Mexico would cripple this important national goal. The decision to extract oil and gas does not occur in a policy vacuum, triggered by industry interest, but in the context of an urgent national need to shift from carbon-based fuels. Unmolested marine ecosystems are becoming scarcer over time, while excess carbon dioxide is becoming a lethal liability. Therefore, any sane and rational</p>	<p>This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Although downstream emissions from oil and gas leasing on the OCS should be included in this Programmatic EIS, oil and gas leasing in the AOI is not part of the proposed action and this NEPA document does not analyze or authorize an OCS lease sale. Those activities, and impacts that may result from them, are outside the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need, and reasonable range of alternatives (Chapters 1.1.2 and 2). Nevertheless, as part of its mission, BOEM considers these activities and issues in other NEPA documents. BOEM directs these commenters to the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considered the effects of GHG emissions. Chapter 4.2 of the Five-Year Program EIS considers climate change and the baseline environment in the areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assess the potential lifecycle greenhouse gas emissions and social cost of</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	balance of values to occur in BOEM offices must reach toward preservation of the former and discouraging the latter.	carbon under the Five-Year Program. In addition, the 2017-2022 GOM Multisale EIS' NEPA analyses further specify the impacts of GHG emissions related to a single proposed lease sale.
1095-0008	I urge the Bureau of Ocean Energy Management to withdraw your proposed acoustic exploration assault on the Gulf of Mexico in search of fossil fuels that our country does not need, and in fact cannot tolerate.	Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of the Final Programmatic EIS. BOEM developed a reasonable range of proposed alternatives, which includes a reasonable suite of proposed mitigations to analyze the potential impacts from G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI. BOEM developed the proposed mitigations and alternatives in close coordination with NOAA's National Marine Fisheries Service using the highest quality and best available information. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD. This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1.2 and 2). The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI, and it does not authorize an OCS lease sale. The procedures under the OCSLA to set up a lease sale include a specific NEPA evaluation for that proposed action. The Nation's energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.
1108-0003	Seismic surveying makes oil and gas development safer and reduces damage caused by test drilling and other, more invasive, exploratory methods.	BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS using the best available science, along with consideration of technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provide the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions.
1108-0004	Advances in seismic imaging technology over the last few years have made this proven way to locate oil and gas deposits even more effective. We must not do anything that would take this valuable tool out of the hands of the men and women who work to deliver Gulf of Mexico energy resources to U.S. consumers.	<p>Thank you for your comment. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts while allowing development of OCS oil and gas, renewable, and mineral resources.</p> <p>This Programmatic EIS describes and evaluates potential environmental impacts (adverse and beneficial) to all resources (e.g., marine mammals, sea turtles, economics, etc.) related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals [Chapter 4]). These analyses were developed using the highest quality and best available information. All of the information in this Final Programmatic EIS will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1108-0005	Certain proposed mitigation rules in the Draft PEIS would dramatically curtail seismic testing in the Gulf, by some estimates reducing the overall number of seismic surveys performed as much as 25 percent. This could have an enormous negative impact on domestic oil and gas production, U.S. energy security, and employment opportunities for American workers. Please make sure the final EIS protects seismic surveying, and safeguards this crucial support for U.S. energy development.	Comment noted. BOEM developed the alternatives and associated mitigations in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and considers them a reasonable range of alternatives for NEPA analysis. A proposed alternative is reasonable only if it will fulfill this Programmatic EIS's purpose and need. This Programmatic EIS will enable BOEM and NMFS to fulfill statutory responsibilities associated with permitting or authorizing G&G activities/the take of marine mammals in connection with activities conducted in support of BOEM's Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. In addition, only one alternative, Alternative E,

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>includes a reduction in the activity levels; all of the other alternatives evaluated in this Programmatic EIS reflect the same projected level of activity, which is based on input from industry and historical survey permit data.</p> <p>Chapter 4 describes and evaluates potential environmental impacts (adverse and beneficial) to all resources (including economic factors) related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). All of the information in this Final Programmatic EIS will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>The scope of this Programmatic EIS does not include a NEPA analysis for nor does it address topics beyond the stated proposed action, purpose, and need (Chapter 1.1.2), such as the Nation's energy policy. The national energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS. Consultations were also conducted with NMFS regarding the ESA and MMPA, and information regarding those consultations is included in Chapter 6.7.</p>
1111-0002	<p>We need an "all of the above" solution for energy independence and energy independence is what we need to secure our country right now. Again, please make sure the final EIS protects seismic surveying, and safeguards this crucial support for U.S. energy development.</p>	<p>As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS was developed to analyze the potential impacts from G&G activities within the AOI from BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Chapter 4 describes and evaluates potential environmental impacts (adverse and beneficial) to all resources (including economic factors) related to reasonably foreseeable G&G survey activities. All of the information in this Final Programmatic EIS will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>(Chapters 1.1 and 2), such as the Nation’s broader energy policy. The Nation’s energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.</p>
<p>1127-0003</p>	<p>Why, then, in the Draft PEIS, is BOEM proposing high-cost, unwieldy regulations to address a problem that does not exist? I accept that the energy industry will be attacked by activists without scientific basis. It is inappropriate, however, for the federal government to bend to these attacks and create regulatory policies that are unwarranted by scientific evidence. As a scientist, you must understand my frustration.</p> <p>I urge your Office to review the scientific literature and revise the PEIS accordingly. Rules concerning seismic surveying should not be molded by ideology and politics.</p>	<p>BOEM prepared this Programmatic EIS using the best available data. BOEM promotes environmental protection and economic development through responsible, science-based management of offshore conventional and renewable energy resources. The purpose of this Programmatic EIS is to evaluate potential environmental effects of multiple G&G activities on the Gulf of Mexico OCS by utilizing the most current scientific research in analyzing the proposed action and alternatives to the proposed action.</p> <p>In addition, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning), BOEM is funding and is planning to fund additional studies and workshops to examine impacts to marine mammals, as well as the effectiveness and feasibility of mitigation measures in the GOM.</p>
<p>1129-0001</p>	<p>I am writing to show my support for the continued use of seismic surveys in the Gulf of Mexico. Seismic surveys help make offshore energy development safer and more efficient and are essential to locating potential new sources of energy.</p>	<p>Thank you for your comment. As stated in Chapter 1, BOEM’s mission is to manage development of the Nation’s OCS energy and mineral resources in an environmentally and economically responsible way. Each alternative presented in this Programmatic EIS includes the implementation of standard mitigation measures, monitoring, reporting, survey protocols, and guidance designed to minimize environmental impacts while allowing development of OCS oil and gas, renewable, and mineral resources.</p> <p>This Programmatic EIS describes and evaluates potential environmental impacts (adverse and beneficial) to all resources (e.g., marine mammals, sea turtles, economics, etc.) related to reasonably foreseeable G&G survey activities in the AOI for BOEM’s three Program Areas (i.e., Oil and Gas, Renewable</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		Energy, and Marine Minerals [Chapter 4]). These analyses were developed using the highest quality and best available information. All of the information in this Final Programmatic EIS will be considered by the decisionmaker in determining which alternative is selected in the ROD.
1130-0004	<p>Revise the proposed action description in Section 1.1.1, last paragraph (as provided below) for accuracy and consistency regarding the purpose and intent of including a proposed action description for NMFS. Although NOAA's previous comments concerning this topic were partially addressed during pre-draft versions, the description in the Draft PEIS for public review requires additional changes. Reference: Chapter 1, Section 1.1.1, Page 1-4. "NOAA's National Marine Fisheries Service (NMFS) proposed action will be a direct outcome of responding to BOEM's petition for incidental take regulations and subsequent applicants' requests for incidental take authorizations per the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 <i>et seq.</i>). U.S. citizens seeking to obtain authorization for the incidental take of marine mammals must submit requests (in the form of an application). Once NMFS determines an application is complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in an application. NMFS's responsibilities under Sections 101(a)(5)(A) and (D) of the MMPA and its implementing regulations (50 CFR 216, Subpart I) establish and frame NMFS's proposed action. To authorize the incidental take of small numbers of marine mammals, NMFS evaluates the best available scientific information to determine whether the total taking would have a negligible impact on the affected marine mammals or stocks and whether the activity would have an unmitigable adverse impact on the their availability for subsistence use, as well as prescribing the means of effecting the least practicable adverse impact. NMFS cannot issue an incidental take authorization if it cannot make those findings in the affirmative."</p>	<p>In response to this comment, and based on discussions between BOEM and NOAA, text has been revised in Chapter 1.1.1 to include clarifying language.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0005	<p>NMFS's action to authorize the take of marine mammals under the MMPA incidental to geological and geophysical survey (G&G) activities under the MMPA is not substantially the same as BOEM's action to permit or authorize G&G activities. Therefore, delete "NMFS" and "/the take of marine mammals" from the first sentence in the fourth paragraph of Section 1.1.2 because NMFS's purpose and need is also not the same as BOEM's and requires some degree of separation from BOEM's purpose and need. Although NOAA's previous comments concerning this topic were partially addressed during pre-draft versions, the description in the Draft PEIS for public review is inconsistent. Reference: Chapter 1, Page 1-5, Section 1.1.2.</p>	<p>Text has been edited in Chapter 1.1 to differentiate between BOEM's and NMFS' proposed actions.</p>
1130-0006	<p>Remove duplicate and inconsistent explanations why NMFS is relying on BOEM's PEIS and replace with the explanation (as provided below). It is important to note there is a difference between NOAA adopting BOEM's Programmatic EIS for NMFS's proposed action (which is the potential authorization of incidental take of marine mammals) and relying on the analysis within this Programmatic EIS to support consultation efforts. These are two distinct efforts with different purposes, in particular, under NEPA. The beginning of Chapters 1 and 6 indicate that Chapter 6, Section 6.3.3 provides the details of cooperating agency status, process and roles. Therefore, NOAA's preference is to provide the following explanation as the second paragraph in section 6.3.3.2 and move the MOA explanation as the last paragraph. We do not believe it is necessary to duplicate this statement throughout the document. However, if BOEM does repeat this information, it needs to be consistent throughout. Reference: Some examples of inconsistent explanations concerning this topic can be found in Chapter 1, Section 1.1.1, 1.2 and 1.2.2, and Appendix B, Page B-29, B-34, B48-B49. "Since the issuance of an incidental take authorization would allow for the taking of marine mammals, consistent with the provisions under the MMPA and incidental to the G&G activities, NOAA considers this issuance to be a major federal action subject to NEPA. Therefore, NOAA's NMFS intends to adopt this Programmatic</p>	<p>Clarifying language has been added to address this concern. BOEM acknowledges that NOAA intends to adopt this NEPA document to support its own proposed action (i.e., issuance of MMPA take authorizations through ITRs or IHAs). However, NOAA is correct that while the analyses in this document may be useful and relevant to NOAA in engaging in consultations under the ESA or other related statutes, those consultations are not "proposed actions" for the purposes of NEPA or this Programmatic EIS. BOEM has attempted to clarify this in this Final Programmatic EIS.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>EIS as the NEPA documentation associated with authorizing incidental take of marine mammals. In addition, NMFS and ONMS may rely on the analysis within this Programmatic EIS to support consultation efforts under the ESA, MSA and NMSA.”</p>	
<p>1130-0013</p>	<p>Summary of impacts to non-marine mammal Impact-Producing Factors (IPF) under Alternative 4: FGB is the only closure designed for resources other than marine mammals; however, in assessing potential effects associated with Alternative F vs. status quo, assessment is made either over individual resources or over all offshore MPAs in the Gulf. This dilutes any assessment of whether this closure is projected to lead to reduced impacts to the resources of the only designated NMS in the AOI. Reference: Executive Summary, beginning Page xxiii.</p>	<p>The additional mitigation measures in Alternative F will reduce potential direct impacts to resources within Marine Protected Areas that may occur in the four closure areas (i.e., the CPA Closure Area, the EPA Closure Area, the Dry Tortugas Closure Area, and the Flower Gardens Closure Area), as well as secondary impacts to resources near the closure areas. However, at the programmatic level, impact ratings were designed to address impact probability, severity, and duration to resource categories as a whole, rather than to individual components of a resource. The definitions of each impact level were purposely broad to avoid exceptions to a single impact rating due to the complexities of program-related IPFs to resources that occur within the AOI and over the 10-year period of this Programmatic EIS. This level of detail is expected to accompany analyses of impacts for future site-specific EAs and permit application evaluations.</p>
<p>1130-0022</p>	<p>Statements concerning whether “every exposure to sound results in a ‘take’” must be revised. NOAA concurs that not every exposure to sound results in a take, as marine mammals may be exposed to sound at levels above that of ambient but below those at which take is assumed to occur. However, the referenced exposure estimates are in fact definitively equated with “take” (as defined by the MMPA) because the estimates are for exposures to sound exceeding the levels at which “take” is assumed to occur. Therefore, NOAA disagrees with the evident intent of this statement. Reference to injury should be eliminated, as it confuses the statement. Under the MMPA, “injury” is a type of “take.” Under the ESA, injury may be the result of “harm” (a type of taking), whereas harassment (another form of taking under the ESA) is an act that creates the likelihood of injury (pursuant to NMFS’ Interim Guidance on the ESA Term “Harass”). Reference to injury should be clarified or removed.</p>	<p>BOEM thanks NOAA for its comment. Because other comments noted some confusion between exposures and takes, and because the term “take” has a specific legal significance under the ESA and MMPA, BOEM has opted for clarity to refer to “exposures” throughout this Programmatic EIS. The estimation of takes of listed species and evaluating the effects of an action on ESA-listed species, critical habitat, and marine mammals are under the purview of the services charged with implementation of those statutes (namely, NOAA and FWS). The focus of NEPA, however, is broader. Prior to undertaking a major action, NEPA mandates that Federal agencies identify and analyze potentially significant impacts to the environment from the proposed action and alternatives, direct and indirect effects, and incremental contributions to cumulative effects. The NEPA analysis is to be made available to the public and to inform the decisionmaker in reaching a decision.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Reference: Chapter 1, Section 1.2.5, pg 1-15, Section 1.2.6, pg 1-19; Chapter 2, pg 2-6; Chapter 4, pgs 4-14, 4-46, 4-48.</p> <p>We note for the record that, despite NOAA having previously expressed to BOEM its disagreement with this statement, BOEM did not clarify or remove it from the PEIS. Rather, BOEM edited the document to state that BOEM and NMFS (vs. BOEM alone) “does not believe that every exposure to sound results in a ‘take’” and “exposure estimates used in this Programmatic EIS are not the same as a ‘take’...”, without notifying NOAA of the change prior to publication. This is unacceptable.</p>	<p>However, modeling done to estimate potential exposures at certain decibel thresholds was limited in several ways. Mitigation could not be included in the model predictions, but some or all of the mitigation measures, as evaluated under the various alternatives, will be implemented during actual surveys. While mitigation effectiveness is difficult to predict, BOEM believes it will have some value in avoiding certain animal exposures and/or reducing certain exposures to below NMFS’ decibel thresholds. In addition, the Level of Effort (i.e., the number of surveys based on industry input and historical data) is a reasonable forecast, but the actual number of surveys for the next 10 years may differ from the estimated and modeled level of effort. Given recent oil and gas prices and leasing interest, the actual number of surveys may be lower, at least over the short term. Finally, airgun exposure predictions are based on a single nominal 8,000-in³ airgun array, which may over-represent many of the arrays that actually would be used, but this array size was used as a realistic representative proxy to ensure that potential impacts were not underestimated after discussions with several industry companies.</p>
1130-0023	<p>Following the trend of calling the modeling results into question in vague and unsupported fashion, BOEM adds what appears to be a vague criticism of the density models used to provide information regarding marine mammal occurrence to the exposure modeling effort. BOEM states that density information may not be an accurate representation of the population “due to the model’s assumptions.” It is unclear which model assumptions BOEM is referring to or in what way BOEM believes that these assumptions impact the ultimate results of the exposure modeling effort. BOEM must remove or further develop this statement. Reference: Chapter 1, Section 1.2.6, pg 1-20.</p>	<p>The text in Chapter 1.2.5 has been clarified to address the use of density data in the modeling efforts for this Programmatic EIS.</p>
1130-0024	<p>BOEM states that “Without a rigorous methodology to [interpret biological significance]...must move forward with an overly conservative scenario equating the numbers of exposures to the number of ‘takes’...” This is not correct. The “Risk Assessment Framework” is not about some new way of equating exposures with takes, but rather is about</p>	<p>Chapter 1.2.7 has been revised to clarify the role and goals of the Risk Assessment Framework.</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>assessing the significance of the assumed takes, and does not influence the methodology of estimating exposures (and therefore takes). Reference: Chapter 1, Section 1.2.7, p 1-21; Chapter 4, Section 4.1.4.4, pg 4-16.</p>	
<p>1130-0045</p>	<p>Remove all references to NOAA's 1999 Administrative Order in Chapter 1, Section 1.4 and elsewhere.</p>	<p>Changes have been made in Chapter 1.4 and throughout this Programmatic EIS where necessary.</p>
<p>1130-0047</p>	<p>Text edit as follows: The National Marine Fisheries Service's (NMFS) proposed action will be a direct outcome of responding to BOEM's (or another applicant's) request for authorization under the Marine Mammal Protection Act of 1972....Reference: Chapter 1, pg 1-4.</p>	<p>Text has been revised in Chapter 1.1.1 in accordance with NOAA Comment 1130-0004, which supersedes this comment.</p>
<p>1130-0048</p>	<p>Text edit as follows: The NMFS intends to use this Programmatic EIS as the NEPA documentation associated with the issuance of incidental "take" authorizations and rule-making process under the MMPA and the Section 7 Consultation process under the ESA for the incidental taking of marine mammals and ESA-listed species during G&G survey activities.</p>	<p>Text has been revised in Chapter 1.2.</p>
<p>1130-0050</p>	<p>Historical harassment thresholds were never put forward in formal guidance; therefore this statement is incorrect and must be revised. Reference: Chapter 1, Section 1.2.6, pg 1-17, 1st paragraph, 2nd sentence; Chapter 4, Section 4.1.4.3, 2nd paragraph.</p>	<p>Text in Chapters 1.2.6 and 4.1.4.3 have been revised accordingly.</p>
<p>1130-0051</p>	<p>The figure displaying differences between frequency weighting curves displays both sets of curves as being from 2012 and therefore does not adequately show the differences between the two sets of curves. Reference: Chapter 1, Section 1.2.6, pg 1-18; Chapter 4, Section 4.1.4.3, pg 4-13.</p>	<p>Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. Appendix N replaces the material referenced in this comment, and Chapter 1.2.6 has been revised to reflect this.</p>
<p>1130-0052</p>	<p>Historical injury criteria did not require summation of energy, as the thresholds were based on the root mean square metric rather than cumulative sound exposure level. Therefore, the table footnote does not make sense and should be revised. Reference: Chapter 1, Section 1.2.6, pg 1-19; Chapter 4, Section 4.1.4.3, pg 4-14.</p>	<p>Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. Appendix N replaces the material referenced in this comment. Chapter 1.2.6 has been revised to reflect this.</p>
<p>1130-0060</p>	<p>The description in Vol. I, Chapter 5, Section 5.3 does not address the concept the section implies it does.</p>	<p>Thank you for your comment. While Chapter 5.3 addresses a specific regulatory requirement under NEPA and provides</p>

Table M-4. Purpose and Need/Regulatory Overview Detailed Comment Responses (continued)

Submission ID	Comment	Response
		examples of the short-term and long-term impacts analyses, it mostly refers back to the fuller impact analyses for individual resources in Chapter 4 . However, for clarification, BOEM has made additional edits to Chapter 5.3 .
1130-0069	How would "future" source levels be expected to differ substantively from present source levels, which we have a reasonable understanding of? Reference: Chapter 1, Section 1.2.5, pg 1-16.	Chapter 1.2.5 has been revised.
1130-0070	Variability associated with the number and exact description of the surveys to be conducted does not make the modeling results "difficult to interpret." One performs a modeling exercise on the basis of a defined scenario. If in fact a lesser amount of activity occurs or the activity in fact shifts in time or space to an area where less impact on a resource might be expected, then we can reasonably conclude in hindsight that the modeling scenario resulted in an inflation of likely actual exposures. Description of this modeling limitation should be revised for accuracy. Reference: Chapter 1, Section 1.2.5, pg 1-16.	Thank you for your comment. The text was revised in Chapter 1.2.5 .

M.4.2 Scope of Programmatic EIS

Several comments noted that the scope of this Programmatic EIS omitted adequate analysis of GHG emissions and climate change impacts resulting from G&G activities over the time period of the analysis. Several comments outlined deficiencies in the cumulative scenario relative to coastal resources, as well as reasonably foreseeable offshore commercial aquaculture activities. Detailed responses to specific comments are provided in **Table M-5**.

Table M-5. Scope of This Programmatic EIS's Detailed Comment Responses

Submission ID	Comment	Response
Scope of This Programmatic EIS		
0006-0006	<p>"Flooding the ocean with noise from seismic surveys is a devastating one-two punch for the ocean," said Steve Mashuda, an attorney with Earthjustice. "At a time when our oceans are already showing the stress of climate change, it just doesn't make sense to harm whales, dolphins, and other ocean wildlife in service of drilling for more oil we can't afford to burn."</p>	<p>Potential impacts from the proposed action are evaluated in Chapter 4 for all resources. In addition, this Programmatic EIS includes climate change as part of the cumulative impact scenario in Chapter 3.4.3.11, and climate change is evaluated for each resource in Chapter 4. The relevant effects from climate change are identified and evaluated, including that physical and biological systems will be subject to rising water temperatures, changes in ice cover, ocean acidification, and habitat loss. BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, MMPA, and ESA) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM. Chapter 2 outlines the alternatives and mitigation measures to the proposed action.</p>
1069-0012	<p>Shell reiterates to BOEM that, globally, nations are competing for private investment as they seek to develop their resources and realize the benefits of energy security, government revenues, employment, and economic growth. Decisions that limit exploration and production of U.S. OCS oil and gas resources put the nation behind competing countries that are at present making progress in developing their offshore resources. When companies, like Shell, make decisions about where to invest and explore, each opportunity is weighed against others. Government policies that needlessly devalue existing leases, impose burdensome restrictions, and remove areas from exploration may therefore have impacts that reverberate across geopolitical boundaries.</p>	<p>As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way.</p> <p>The need for the proposed action is to have access to and use of the best available information obtained from G&G activities in order to make informed business, management, design, stewardship, and environmental protection decisions. Such decisions are an integral part of several OCS programs, including oil and gas (e.g., location, extent, fair market value of resources, and orderly development of hydrocarbon reserves), renewable energy (e.g., engineering decisions regarding the construction of renewable energy projects), and marine minerals (e.g., informed estimates regarding the composition and volume of marine mineral resources). This Programmatic EIS has been developed to analyze the impacts that may result from G&G activities within the AOI for BOEM's three program areas (i.e., oil and gas, renewable energy, and marine minerals). The impacts from the proposed action are evaluated in Chapter 4 for all resources, including economic</p>

Table M-5. Scope of This Programmatic EIS’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>factors.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2). Therefore, this Programmatic EIS does not address out-of-scope topics, such as the Nation’s broader energy policy. The Nation’s energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.</p>
1069-0001	<p>It is important that the DPEIS promote flexibility, transparency, and robust decisionmaking, and that the scientific analysis should adequately inform DPEIS impact determinations for the Gulf of Mexico (GOM) environment, marine life, resources and communities.</p>	<p>BOEM is responsible for stewardship of OCS energy and mineral resources as well as protecting the environment that may be impacted by development of those resources. As stated in Chapter 1, BOEM’s mission is to manage development of the Nation’s OCS energy and mineral resources in an environmentally and economically responsible way.</p> <p>The National Environmental Policy Act of 1969 (42 U.S.C. §§ 4321-4347) is the foundation of environmental policymaking in the U.S. The intent of the NEPA process is to help public officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. BOEM produces NEPA documents, such as this Programmatic EIS, for each of the major stages of energy development planning. The NEPA process provides for public input and transparency as part of the decisionmaking process through numerous public meetings, emails, and mail outs at the scoping and public review stages during EIS development. BOEM prepared this Programmatic EIS using the best available science and highest quality data available.</p> <p>In addition, the Monitoring Plan developed through the MMPA process would focus on monitoring marine mammal populations and behavior, as well as the effectiveness of mitigation measures. The implemented mitigation measures would be evaluated and, through an adaptive management process, may be altered depending on effectiveness. BOEM</p>

Table M-5. Scope of This Programmatic EIS's Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM.</p> <p>The data collected from implementing the Monitoring Plan will provide additional information regarding the efficacy of the implemented mitigation measures. BOEM will continue to coordinate with industry and external stakeholders to understand how a marine mammal monitoring plan in the GOM for G&G activities may fit into other efforts in order to prevent duplication and to address monitoring needs in the context of the larger GOM ecosystem.</p>
1071-0005	<p>Both Volume 1, Section 3.4.3, and Volume 3, Appendix E, Section 12, of the DPEIS identify and discuss cumulative effects and uses of the marine waters of the AOI, but do not address offshore aquaculture activities. Offshore aquaculture is only mentioned amongst a suite of potential alternate uses for existing platforms in the Outer Continental Shelf (Section 3.2.2.1), but is dismissed because alternate use of these platforms is not foreseeable within the next 10 years.</p> <p>We would like to note that while offshore aquaculture is a developing industry and does not have much of a presence in the AOI at this time, it is a foreseeable activity that will likely occur within the next 10 years and should be considered within the scope of the DPEIS. FWC staff recommends that the DPEIS fully include consideration of offshore aquaculture activities specifically within these sections and any other section of the DPEIS as appropriate.</p>	<p>Thank you for your comment. Text has been added in Chapter 4.9 and Appendix E, Section 9 to include aquaculture activities.</p>
1074-0049	<p>The approach that BOEM has taken in its impacts analysis is arbitrary and capricious in significant ways.</p>	<p>BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of its subject-matter experts. BOEM has developed</p>

Table M-5. Scope of This Programmatic EIS’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and the alternatives to ensure that any decision regarding G&G activities is fully supported.</p>
1074-0062	<p>As the DEIS recognizes, impacts from G&G activities can in their aggregate cause adverse effects on a population or species level. These several impacts can include relatively short-term behavioral responses to noise, such as alterations in vocalization, behavioral state, dive pattern, location, and other factors, that can adversely affect foraging and other vital behavior and affect vital rates over time. They can also include loss of communication space and listening area, which can have a highly detrimental impact on vital behaviors in acoustic species; chronic stress, which can affect health outcomes over time; and indirect effects through, for example, the loss of prey availability. Aside from Appendix K, however, the DEIS does little to address these effects or to evaluate how the various alternatives might mitigate them.</p>	<p>An assessment of the potential for fitness level consequences at both the individual and population level was included in the Draft Programmatic EIS, beginning on page 4-54. This chapter has been expanded in this Final Programmatic EIS to include quantitative analysis results from Appendix D and an expanded integrated discussion of the chronic impacts analysis of Appendix K.</p>
1074-0070	<p>Unfortunately, while BOEM, in its “proposed action scenario,” briefly considers the contributory effects of global warming on the Gulf environment (DEIS at 3-49 to 3-50), it fails to evaluate the converse: the upstream effects of seismic exploration on the U.S. carbon footprint. The Gulf of Mexico is one of the most prospected bodies of water on the planet, and the leading source in the United States for offshore oil and gas. Limiting seismic exploration in the Gulf, as, at minimum, the agency’s Alternatives E and G call for, is likely to reduce oil and gas production there, which in turn will have favorable consequences for our greenhouse gas emissions.</p>	<p>This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM’s three Program Areas (i.e. Oil and Gas, Renewable Energy, and Marine Minerals). A discussion of how G&G activities support existing and future oil and gas exploration, development, and production can be found in Chapter 3.2.1. The scenario evaluated in this Programmatic EIS includes G&G activities for all existing leases as well as future leases.</p> <p>The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. This Programmatic EIS does not address topics beyond the stated proposed action and purpose and need (Chapter 1.1.2), such as the Nation’s energy policy.</p>
1074-0070 (continued)	<p>Contrarily, allowing seismic exploration to continue at projected rates will result in a larger carbon footprint and a greater contribution to global warming, making it more difficult for the United States to achieve our Paris obligations. The EIS</p>	<p>The Nation’s energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of GHG emissions. Chapter 4.2 of the Five-Year</p>

Table M-5. Scope of This Programmatic EIS's Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>produced this year, by BOEM, for the 2017-2022 OCS Lease Sale Program does not obviate the need to analyze climate change contributions in the present impact statement since the underlying actions are independent of one another and since the G&G EIS covers a substantially longer time period.</p> <p>The EIS should analyze the relative climate impacts of each considered alternative consistent with CEQ's recent memorandum.</p>	<p>Program EIS considers climate change and the baseline environment in areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assessed the potential lifecycle of GHG emissions and the social cost of carbon under the Five-Year Program. The Five-Year Program EIS and the Multisale EIS considered the potential impacts to downstream GHG emissions should OCS oil and gas leasing in the GOM cease. Please refer to those documents for that discussion.</p> <p>In addition, the GOM lease sale-stage NEPA analyses will further specify impacts of GHG emissions related to a single proposed lease sale.</p>
1076-0013	<p>The economic analysis included in the DPEIS is inadequate, particularly regarding the assumptions made about activity levels in the face of overly restrictive mitigation measures. The analysis appears to completely ignore the potential of reduced future drilling and production resulting from the generation of less G&G data. ...although the DPEIS describes the potential economic impacts of the various alternatives, it provides no cost estimates for direct, indirect, and induced economic impacts over the 10-year time period covered by the DPEIS. Nor does it adequately account for the variability inherent in offshore oil and natural gas exploration and development. In short, BOEM has failed to provide an economic impact analysis that allows stakeholders to meaningfully assess the practicability or feasibility of the proposed alternatives.</p>	<p>BOEM has provided adequate information to disclose potential effects of the alternatives analyzed within this Programmatic EIS. Specifically with regard to potential economic effects, Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F. The industry cost analysis for this Programmatic EIS focused only on additional expenditures for operating costs from the proposed mitigations for Alternatives A through F; therefore, this cost analysis represents only one part of the whole economic analysis. Therefore, the economic analyses consider the additional operating costs to be incurred as well as the larger ranging effects to industry, local economy, and supply chains from a reduction in activity and closure areas. The analysis for each alternative and the associated impact conclusion were developed using the best available, scientifically credible information and generally accepted scientific methodologies. Additional text has been added to Chapter 4.13.1.5.</p> <p>BOEM has developed this in-depth Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G</p>

Table M-5. Scope of This Programmatic EIS’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>activities is fully supported. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. The procedures under the OCSLA to set up a lease sale include a specific NEPA evaluation for the proposed action.</p> <p>Nevertheless, Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities.</p> <p>In addition, if NOAA moves forward with their proposed action (i.e., issuance of MMPA incidental take regulations), then a Regulatory Impact Analysis would accompany the rule.</p> <p>The impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record.</p>

Table M-5. Scope of This Programmatic EIS's Detailed Comment Responses (continued)

Submission ID	Comment	Response
1080-0001	<p>We strongly encourage BOEM to consider including an assessment of the potential range of GHG emissions and climate change impacts associated with the planned or foreseeably anticipated future actions that would prompt tiered documents for this PEIS. EPA has rated the draft PEIS as LO - "Lack of Objections." A summary of EPA's rating is enclosed. The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal.</p> <p>The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.</p>	<p>This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). Chapter 4.1.1.2 describes resources that were screened out, including air quality.</p> <p>Oil and gas leasing in the AOI is not part of the proposed action, and this NEPA document does not analyze or authorize an OCS lease sale. Oil and gas leasing activities and the impacts that may result from them are outside the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need, and reasonable range of alternatives (Chapters 1.1.2 and 2). Nevertheless, as part of its mission, BOEM considers these activities and issues in other NEPA documents. BOEM directs these commenters to the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of GHG emissions. Chapter 4.2 of the Five-Year Program EIS considers climate change and the baseline environment in areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assessed the potential lifecycle of GHG emissions and the social cost of carbon under the Five-Year Program. For example, refer to the 2017-2022 GOM Multisale EIS.</p>
1121-0006	<p>BOEM must assess the climate impact of this plan under the climate executive order and CEQ guidance. The Gulf of Mexico is hotter than ever, and BOEM must quantitatively assess to what degree these leases contribute to this heat, which is fueling mega-rains in Louisiana, Texas, and other states in the Mississippi River and Ohio valleys.</p>	<p>BOEM is committed to following CEQ regulations and guidance related to GHGs. Oil and gas leasing in the AOI is not part of the proposed action, and this NEPA document does not analyze or authorize an OCS lease sale. Oil and gas leasing activities and the impacts that may result from them are outside the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need, and reasonable range of alternatives (Chapters 1.1.2 and 2). Nevertheless, as part of its mission, BOEM considers these activities and issues in other NEPA documents. BOEM directs these commenters to the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of GHG emissions.</p>

Table M-5. Scope of This Programmatic EIS’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
		Chapter 4.2 of the Five-Year Program EIS considers climate change and the baseline environment in areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assessed the potential lifecycle of GHG emissions and social cost of carbon under the Five-Year Program. For example, refer to the 2017-2022 GOM Multisale EIS.

M.4.3 Alternatives and Mitigation Measures

Many comments on the Draft Programmatic EIS indicated a preference for which alternative should be selected. Several comments proposed additional mitigation measures, altering mitigation measures, changing the way BOEM handles mitigation, or alternative G&G technologies that should be preferentially used. Many of these suggested mitigations are addressed in **Chapters 2**.

Many comments asserted that existing mitigation measures (e.g., other Federal laws and regulations and lease stipulations) provide sufficient protection for this stage of the OCSLA process and suggested strengthening this conclusion in this Final Programmatic EIS. Conversely, some comments asserted that existing regulatory restrictions are burdensome and hindering industry. Other comments stressed that newly introduced mitigation measures would be too burdensome economically and would hinder industry. Additional comments expressed that mitigation measures were inadequate to protect natural resources. Other comments stated that mitigation measures were not supported by best available science or that adequate rationale was not provided for their inclusion in this Programmatic EIS. Some comments questioned why mitigation measures were geared to marine mammals and why measures for other species were lacking.

Various comments indicated that the purpose of each alternative was vague and that certain alternatives lacked detail regarding how BOEM would implement related mitigation measures. Some comments stated that assumptions made relative to mitigation measures under alternatives were flawed or that certain alternatives lacked a legal basis for implementation.

Finally, comments contended that shutdown requirements as part of various alternatives were not clearly explained and that newly introduced mitigation measures were difficult to discern from measures carried forward from other alternatives. Detailed responses to specific comments are provided in **Table M-6**.

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses

Submission ID	Comment	Response
Alternatives and Mitigation Measures		
0032-0002	The proposed mitigation to sea life and the environment are not adequate. They are a self-imposed best practice that does not have adequate testing and analysis.	<p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of the BOEM’s three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p>
0037-0002	I most strongly recommend the BOEM select Alternative A in the final EIS. I also urge BOEM to reject adoption of the other overly burdensome alternatives as harmful to the US economy, detrimental to US Energy Security, and as unsupported by sound science.	<p>Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. Alternative selection will be provided in the ROD following publication of this Final Programmatic EIS. Potential impacts to resources (including economic factors) from the implementation of Alternatives A through G are analyzed in Chapter 4. These analyses were developed using the highest quality and best available information. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1.2 and 2), such as the Nation’s broader energy policy. The scope of this Programmatic EIS does not include a NEPA analysis for oil and gas leasing in the AOI and does not authorize an OCS lease sale. The procedures under the OCSLA to set up a lease sale include a specific NEPA</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		evaluation for that proposed action. The national energy policy is determined at the national level and is analyzed in the Five-Year Program and Five-Year Program EIS.
0343-0011	<p>Given that neither the Commission nor the public can review meaningfully the impact assessment, judge the appropriateness of the various alternatives, or decipher how BOEM intends to interpret takes, suggesting a Preferred Alternative is completely impractical. The range of alternatives appears to be suitable and includes various measures to reduce impacts on marine mammals including implementing shut-down procedures, using both visual and passive acoustic monitoring, implementing time-area closures, and reducing the overall level of activity. However, it appears that no single alternative currently includes all of those measures, which the Commission believes would be a more appropriate approach for BOEM to take.</p>	<p>BOEM has made revisions within this Programmatic EIS to make the comparison of alternatives easier, and BOEM has objectively compared the alternatives to determine the preferred alternative.</p> <p>BOEM has identified Alternative C as the preferred alternative in this Final Programmatic EIS. The identification of Alternative C as the preferred alternative does not constitute a commitment or decision in principle, and there is no requirement to select Alternative C as the preferred alternative in the ROD.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting or authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>BOEM notes your preference. This information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
0343-0012	<p>BOEM should evaluate all such factors when determining its Preferred Alternative. Accordingly, the Commission recommends that BOEM incorporate marine mammal shut-down procedures, visual and passive acoustic monitoring, overall activity reduction (rather than redistribution), and appropriate time-area closures in its Preferred Alternative to maximize the mitigation value for those species that are</p>	<p>Thank you for your comment. BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS focuses on potential environmental impacts of BOEM's Oil and Gas, Renewable Energy, and Marine Minerals Programs. The impact assessment in Chapter 4, as well as all of the comments and</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>believed to warrant the greatest protection, including sperm whales, Bryde's whales, and bay, sound, and estuarine stocks of bottlenose dolphins.</p>	<p>responses received on the Draft Programmatic EIS that are in this appendix, will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
<p>0612-0002</p>	<p>WRT to the protection of marine mammals and other species, I do not believe that using only Protected Species Observers is adequate. A single observer on duty for a lengthy period of time could not adequately monitor all 360 degrees around the towed arrays.</p> <p>Requiring more observers would be marginally better, but still inadequate. The use of a PAM operator to acoustically monitor for vocalizations of marine mammals should be required at all times. Twelve hour shifts for PAM operators are too long to maintain adequate attention. A maximum shift should be no longer than 6 hours with at least 12 hours between shifts and 8 hours of uninterrupted rest.</p>	<p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and DOI implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated. BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting or authorizing G&G activities connected with activities conducted in support of BOEM's Oil and Gas, Renewable Energy, and Marine Minerals Program on the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) represent current standards. The elements of these measures are continually evolving, and through adaptive management, BOEM may require additional mitigation measures at the site-specific level as mitigation measures evolve. NTL 2016-BOEM-G02 describes the implementation of the PSO Program and use of PAM, and it states that no observer will be allowed more than 4 consecutive hours on watch as a visual observer, a "break" time of no less than 2 hours must be allowed before an observer begins another visual monitoring watch rotation (break time means no assigned observational duties), and no person (crew or third party) on watch as a visual observer will be assigned a combined watch schedule of more than 12 hours in a 24-hour period.</p> <p>Both PSOs and PAM are components of alternatives analyzed within this Programmatic EIS. The use of PAM at all times is included in specific areas in Alternatives C through F and is</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		evaluated in this Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
0675-0001	<p>I am not in favor of Alternative B because I don't believe there is a scientific basis for a minimum separation distance. Although I understand that it seems reasonable that there is a calving season for dolphins, I don't believe there is any science that specifies what that season is and where. I am strongly opposed to the closures for all deep-penetration seismic airgun surveys in the EPA.</p>	<p>BOEM developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, including Settlement Agreement requirements (Chapter 1.2.3 and Appendix C) and considers them to be a reasonable range of alternatives for this NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting or authorizing G&G activities in connection with activities conducted in support of BOEM's Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these same activities.</p>
0675-0002	<p>Regarding Alternative C, I don't see any need for the use of PAM, Passive Acoustic Monitoring, for all deep-penetration seismic at all times in Mississippi Canyon and De Soto Canyon. The PAM protocols in Alternative A should suffice. Regarding non-airgun HRG survey protocols, there's no distinction between narrow-beam, high-frequency, low-power systems and omnidirectional systems. I don't believe there's any science to support a requirement for a PSO for high-resolution surveys. I have personally conducted high-resolution surveys for 30 years; and we frequently have dolphins playing around the vessel, swimming in the bow wave apparently unperturbed by our survey activities.</p> <p>Regarding the seasonal restrictions, same comment as B. It seems reasonable, but there's no science to support when and where.</p>	<p>The PAM has been used effectively as a mitigation tool in the GOM since 2012. Inclusion of the use of PAM in the Mississippi Canyon and De Soto Canyon lease blocks provides additional protection for marine mammals, targeting vocalizing Bryde's, sperm, and other deep-diving odontocetes, to reduce the potential for Level A exposures. Additionally, seasonal restrictions for coastal waters were expanded for additional protection of reproducing dolphins. BOEM will consider the value of these and other mitigation measures during future NEPA analyses, along with any new information available at that time.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>BOEM recognized the need to identify, quantify, and analyze all active acoustic source operations that might occur during G&G activities and created a Screening Out Team (ScOT) to examine the issue and make recommendations (Appendix G). The ScOT indicated which sources and activities, based on their potential to affect the environment, required thorough analysis in this Programmatic EIS and which sources and activities did not. The results of the screening indicated that acoustic sources operating at frequencies above 200 kHz do not require detailed analysis because these frequencies are outside of the hearing range for marine mammals. However, the analysis should focus on the impacts of specific equipment types that have operational frequencies below 200 kHz and airguns. Therefore, only non-airgun HRG surveys with equipment that operate at frequencies below 200 kHz are required to implement the Non-Airgun HRG Survey Protocol that requires PSOs.</p>
0675-0003	Alternative D, same comments regarding C.	<p>PAM has been used effectively as a mitigation tool in the GOM since 2012. The purpose of the mitigation measures included in Alternative D is to further minimize the potential for injury to marine mammals and sea turtles, to avoid most Level A harassment of marine mammals, and to provide additional protection for marine mammals. This alternative was developed based on the Alternative C mitigation measures, but it includes additional protection for all marine mammals species – including manatees but not bow-riding dolphins (i.e., bottlenose, Fraser’s, Clymene’s, rough-toothed, striped, spinner, Atlantic spotted, pantropical, and Risso’s) – with inclusion of an expanded PSO Program to avoid most potential Level A exposures to marine mammals in all water depths. BOEM will consider the value of these mitigation measures when selecting an alternative in the ROD. In addition, during future, site-specific NEPA analyses, BOEM will use adaptive management and consider any new information available regarding mitigation measure effectiveness at that time.</p>
0675-0004	Alternative E, there's no science to support that the level of sound we are creating now is causing significant harm. So,	<p>BOEM, through consultation with industry representatives, has tried to base the reductions on an attempt to balance</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>there's no science to support a reduction in harm due to a reduction in activity.</p>	<p>environmental impacts with economic impacts to achieve the proposed action's purpose and need. Using expert opinion and best professional judgement, BOEM determined that 10 percent and 25 percent reductions offer a reasonable range of reduced activity levels while still allowing BOEM to fulfill the purpose and need of this Programmatic EIS.</p> <p>The purpose of the mitigation measures included in Alternative E is to minimize the potential for injury to marine mammals and sea turtles, to provide additional measures to avoid opportunities for Level A harassment of marine mammals, and to provide additional protective measures for marine mammals.</p> <p>The implementation of this alternative would be essentially first come first serve for permit applicants on an annual basis; therefore, this alternative is essentially like additional time area closures in a calendar year whereby reducing the total amount of sound being permitted annually.</p> <p>BOEM analyzed the potential effects, both beneficial and adverse, of the 10 percent and 25 percent reduction in line miles. Chapter 4 describes and evaluates potential environmental impacts (adverse and beneficial) to all resources (including economic factors) related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p> <p>Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or by altering their vocalizations. This Programmatic EIS acknowledges that acute physical injury other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. It does, however, acknowledge that disruption of behavioral patterns or auditory injury are possible, which may reduce fitness for individual animals. Population-level impacts</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>related to energetic effects or other impacts of noise are difficult to determine. Refer to Chapter 4.2 for further detail on the potential impacts to marine mammals.</p> <p>All of the information in this Final Programmatic EIS will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
0675-0005	<p>Regarding Alternative F, I view this alternative as extreme with significant aerial closures to all new seismic activity and all non-airgun high-resolution geophysical surveys in that it would effectively shut down exploration and activity that has significance for America's energy needs when there's no science to support this. I'd also like to point out that shutting down non-airgun high-resolution geophysical surveys would have the unintended consequence of shutting down all drilling activity because nobody's going to drill a well if they can't show that it's safe to do so.</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. A proposed alternative is reasonable only if it will fulfill this Programmatic EIS's purpose and need as described in Chapter 1.1.2. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting or authorizing G&G activities in connection with activities conducted in support of Oil and Gas, Renewable Energy, and Marine Minerals Programs areas for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Chapter 4.13 provides an analysis of the potential economic effects of Alternatives A through G. Direct mitigation costs are quantified in tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F. Indirect effects of the alternatives are also considered in Chapter 4.13, including potential impacts to the programs that rely on the G&G data, e.g., oil and gas activities such as exploration and development operation.</p>
0675-0006	<p>I am strongly opposed to Alternative G as the complete shutdown of activity in the Gulf of Mexico would have significant negative consequences for the USA and our citizens. And similar to all of the above, there is no science to support a shutdown of all activity.</p>	<p>We note your opposition to Alternative G. This Programmatic EIS is not a decision document; however, this Programmatic EIS will help inform BOEM's decision, and a final decision on whether or how to proceed with processing G&G survey applications will be announced in the ROD. The CEQ regulation at 40 CFR § 1502.14(d) specifies that NEPA</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>analyses require the alternatives analysis in the EIS to "include the alternative of no action." This analysis provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives and provides an analysis for each resources of the potential effects of not selecting one of the action alternatives.</p>
0899-0004	<p>The OMB also made BOEM submit a new ICR Supporting Statement that responded to CRE's comments on the LTMP. BOEM's new Supporting Statement states as follows:</p> <p>"CRE stated that it was making these comments to inform OMB/OIRA that BOEM is planning an information collection that would significantly increase the burden of BOEM's monitoring requirements for G&G activities, including seismic, in the Gulf of Mexico. CRE opposed the long-term management plan (LTMP), stated that BOEM would need OMB approval for LTMP, and stated that the public would need an opportunity to comment. CRE made the following recommendations:</p> <ul style="list-style-type: none"> - BOEM and NMFS should not proceed with the LTMP. Current monitoring requirements are less burdensome and all that's necessary to protect marine mammals. - If BOEM and NMFS do proceed with the LTMP, then they should request new ICRs that cover the LTMP. Those new ICRs should be subject to public comment. BOEM and NMFS should not try to implement the LTMP until and unless the new ICRs have been reviewed and approved by OMB/OIRA. - If BOEM and NMFS do proceed with the LTMP, then they should perform predissemination review of compliance with the IQA Guidelines and the PRA's practical utility requirements. The public should be allowed to comment on this predissemination review before it is final. - If BOEM and NMFS do proceed with the LTMP, then they 	<p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p> <p>The agencies will comply with the Paperwork Reduction Act (PRA) and ensure that any new information collection requirements are appropriately documented and approved by OMB. We thank you for your comment, but it is premature at this point to determine the outcome of the PRA process which is ongoing and separate from this NEPA analysis.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>should perform a cost benefit analysis, as required by Executive Order 13563, to determine whether the benefits of the LTMP, if any, justify its costs.</p> <p>BOEM is in the early planning stages for LTMP and no decisions have been made. We issued a <i>Federal Register</i> notice on November 7, 2014 (79 FR 66402) requesting information to aid in the development of LTMP for the Gulf of Mexico. Comments were due on December 8. BOEM will seek OMB approval for all information collected by either revising a currently approved collection or requesting approval for a new collection. At a minimum, the public will have opportunities to comment through the Paperwork Reduction Act process.</p> <p>In addition, BOEM will arrange a meeting with CRE and appropriate BOEM offices to discuss the upcoming monitoring requirements for G&G activities in the Gulf.³⁶</p> <p>CRE will not repeat its prior extensive comments on the LTMP, which are incorporated by reference as if fully set forth herein. We will, however, emphasize a few points that are discussed in detail in our prior comments.</p> <p>First, neither BOEM nor NMFS have ICRs authorizing an LTMP, and they cannot enforce LTMPs without OMB approving ICRs that authorize them.</p> <p>Second, OMB should not approve ICRs for an LTMP for many reasons, as set forth above and in our incorporated prior comments.</p> <p>Third, neither BOEM nor NMFS have legal authority to require a LTMP.</p> <p>Fourth, the NOLA litigation settlement agreement does not and cannot dictate that BOEM and NMFS require LTMPs.</p>	

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	CONCLUSION AND RECOMMENDATIONS: Neither BOEM nor NMFS should require an LTMP.	
0999-0001	Tidewater is extremely concerned about the vague nature of the reasons for and uses projected for the alternatives currently described in the Draft PEIS.	<p>The rationale behind each alternative is provided in Chapter 2. BOEM will further consider the value of all mitigation measures during future site-specific NEPA analyses, along with any new information available at that time.</p> <p>Appendix G describes the process by which BOEM identified, quantified, and analyzed the active acoustic sources that might occur during G&G activities in order to identify sources and survey types that could affect environmental resources and to dismiss those that did not rise to this level of potential impact for this Programmatic EIS.</p>
0999-0003	Originally quite crude, the seismic industry has developed best-practices and procedures designed to minimize and mitigate any environmental impact on marine life. It should be noted that portions of the Draft PEIS may originate from periods prior to the 2013 Notice of Intent (NOI), and as a result may not accurately reflect current industry practice. We believe IAGC data substantiates the sustainability of their methods; there is no evidence of other than temporary changes in marine life patterns, restricted to the areas of seismic surveys.	Although the preparation of this Programmatic EIS began in 2013, BOEM prepared this Programmatic EIS in compliance with the requirements and intent of NEPA, preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of the subject-matter experts. BOEM developed this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully informed. BOEM is involved in several ongoing programs to improve existing data for marine mammals and underwater noise, and future analyses will use the best data available at that time.
0999-0006	Tidewater urges BOEM that if action beyond regulator-integration in industry best practice discussions is found to be necessary; that Alternative A be selected as the alternative adopted.	Thank you for your comment. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of this Final Programmatic EIS. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy; and Marine Minerals). All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1001-0004	<p>I strongly urge the Bureau to reject widespread unchecked seismic blasting in the Gulf. Rather, it should thoroughly consider and adopt an alternative that (1) limits any seismic oil and gas surveys to only what is necessary for existing operations; (2) includes area closures that protect important habitat for sperm whales, Bryde's whales and coastal bottlenose dolphins; (3) closes the Eastern Gulf of Mexico that is under a leasing moratorium; (4) reduces the overall amount of seismic survey activity; and (5) includes a requirement that industry reduce noise levels of oil exploration.</p>	<p>As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p> <p>BOEM developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors and considers them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting or authorizing G&G activities in connection with activities conducted in support of the oil and gas, renewable energy, and marine minerals programs on the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these same activities.</p> <p>Your preference is noted. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1062-0001	<p>On behalf of the undersigned groups and our millions of supporters, we write to express our concern about unfettered exploration for oil and gas in the Gulf of Mexico and the harmful impact of seismic surveys on whales and other wildlife. We urge the Bureau to put sensitive habitats in the Gulf off-limits and to put a cap on seismic activities that harm marine mammals.</p>	<p>Thank you for your comment. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p> <p>Chapter 2 outlines the alternatives and mitigation measures to</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>the proposed action.</p> <p>Your preference is noted. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1062-0003	<p>The Bureau should immediately reduce the amount of seismic surveys that may occur each year; close important habitat areas for Bryde's whales, sperm whales and coastal bottlenose dolphins; close the eastern Gulf of Mexico that is under a leasing moratorium; and set reasonable targets to quiet the airgun arrays that are now bombarding the Gulf's habitat.</p>	<p>Thank you for your comment. Thank you for your comment. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p> <p>Chapter 2 outlines the alternatives and mitigation measures to the proposed action.</p> <p>Your preference is noted. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD following publication of this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1063-0009	<p>Chapter 2 Page 2-6 Paragraph 2 notes that mitigations are required of "all seismic airgun surveys" however, please note that there are a number of survey activities considered ancillary activities that do not require BOEM notification (see NTL 2009-G34) and as such have no NEPA analyses or mitigations required. Also, activities in less than 200m of water in the CPA and WPA also do not require the mitigations described in NTL BOEM 2016-G02 (though the settlement (Alt B) currently requires it).</p>	<p>Text has been edited in Chapter 2.2 to reflect information provided in this comment regarding ancillary activities and activities in less than 200 m (656 ft) of water in the CPA and WPA.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1063-0010	Page 2-9 The last bullet discussing the PAM requirement should read: "the required use of PAM during times of reduced visibility for all...add in italics language. The way it reads now implies PAM is required at all times.	Text has been edited in Chapter 2.4.2 to reflect this comment regarding the use of PAM.
1063-0011	Page 2-10 Under Rationale section - 2nd paragraph, last sentence. Remove "including manatees" as PAM does not detect them so does not provide additional protection.	Text has been edited in Chapter 2.4.2 to reflect this comment regarding the use of PAM for manatees.
1063-0012	Page 2-12 Same comment as above - for clarity the first bullet should include "during times of reduced visibility" to make it clear that PAM is not required at all times, as it is in the next bullet.	Text has been edited in Chapter 2.5.2 to reflect this comment regarding use of PAM.
1063-0013	Page 2-13 Last bullet - same comment as above.	Text has been edited in Chapter 2.6.2 to reflect this comment regarding the use of PAM.
1063-0014	Page 2-15 - same comment; should consider a global change for this mitigation "implementation of expanded PAM requirement: the required use of PAM for all deep-penetration seismic airgun surveys in water depths >100m.	Text has been edited in Chapter 2.7.2 to reflect this comment regarding the use of PAM.
1063-0015	Page 2-39 2.14.3 The last paragraph talks about the panels and how the analyses was not available...aren't the reports provided as Appendix L? And earlier in the document (Ch 1) it talked about the outcomes of the panels.	Text has been edited in Chapter 2.14.3 to reflect this comment regarding the conclusions of the Panel Reports.
1063-0026	Page 4-90 - The season restriction is stated somewhat incorrectly. Amended settlement agreement matches this but with some geographic limits as per the UME. See Appendix C-53. Please check throughout the document for Alt B (Page 4-97, etc.)	Text has been edited in Chapters 4.2.3.1.1, 4.2.3.1.4, and 4.2.3.1.6 to reflect this comment regarding the seasonal restriction. The remaining chapters and appendices were reviewed and changes were made where necessary.
1063-0028	Page 4-155 - Alt B seasonal restriction is stated somewhat incorrectly - See Appendix C, Page C-53.	Text has been edited throughout Chapter 4 in reference to the seasonal restriction in Alternative B. The remaining chapters and appendices were reviewed and changes were made where necessary.
1063-0034	Appendix B Page B-8 - 1.2.1.1 - Update NTL Page B-14 - Note that the last sentence should include that no notification is required if airguns are used in water depths less	Revisions have been made in Appendix B in response to the comments.

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>than 200m in the CPA and WPA as per NTL 2009-G34.</p> <p>Page B-14 - 1.2.4 - 2nd paragraph - States that "all of the mysticetes" misleading since there is only one resident species (Bryde's whale).</p> <p>Page B-15 - Update NTL on this page and throughout this section.</p> <p>Page B-16 - 1.2.4.3 - This statement is incorrect. "Operators may only engage trained third party PSOs."</p> <p>From the current NTL: Operators may engage trained third party observers, may utilize crew members who have been trained as observers, or may use a combination of both third party and trained crew observers.</p> <p>Last paragraph: The write up about the Visual PSOs is not accurate. A 3rd observer is not on duty with the other two. Nor does the PAM operator coordinate typically with visuals since they work at separate times, with the exception of a short overlap at dawn/dusk.</p> <p>Page B-17 - 1.2.4.4 Shutdowns are not required for all marine mammals and sea turtles.</p> <p>1.2.4.5 - PAM is not used to "supplement" visual observations in the GOM...they are using PAM at times when visual observations are not used (times of reduced visibility).</p> <p>PAM write-up overall suggests that towed PAM is pretty new and not ready for use. This is largely untrue and it has been used effectively as a mitigation tool in the GOM for some time (required since 2013). Suggest rewording much of this to make that point also suggest referencing the ANSI PAM standards project at Scripps which BOEM/NAVY/BSEE/NMFS/JNCC (BSEE, NAVY, JNCC funded) has been actively engaged in.</p>	

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>http://scripps.ucsd.edu/labs/athode/american-national-standard-on-towed-passive-acoustic-monitoring-and-mitigation-systems/</p> <p>Page b-19 - 1.2.4.6 - Again, 3rd party PSOs are not currently required in the GOM. See earlier comment. Make changes in Table B-3.</p> <p>Page B-26. 1.3.6 Check coastal restriction for Alt B. See earlier comments. See Page C-53.</p> <p>Page B-48 - 2.2.2. The section on BSEE seems very brief and does not note our environmental compliance role for BOEM on G&G activities nor does it mention our cooperating agency status on the document.</p>	
1067-0005	<p>I strongly urge BOEM to reject widespread and unchecked seismic blasting in the Gulf. Rather, it should thoroughly consider and adopt an alternative that (1) limits any seismic oil and gas surveys to only what is necessary for active development of existing leases; (2) limits other seismic surveys to those necessary to support development of offshore renewables; (3) includes area closures that protect important habitat for sperm whales, Bryde's whales, and coastal bottlenose dolphins; (4) sets limits on the overall amount of seismic survey activity and; (5) includes a requirement that industry achieve a noise reduction target from individual surveys within five years.</p>	<p>Thank you for your comment. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. This Programmatic EIS describes and evaluates potential environmental impacts related to reasonably foreseeable G&G survey activities in the AOI for BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals).</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Program Areas for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Your preference is noted. This Programmatic EIS is not the decision document under NEPA. The decision will be</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>provided in the ROD following publication of this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1069-0001	<p>Alternatives B through G would not result in any meaningful environmental, species, or communities benefit; rather, the Alternatives create new risks to humans and the marine environment.</p> <p>As this letter and the Joint Trades' comments reiterate, no credible scientific evidence exists that establishes the causation of the harm in which Alternatives B-G purport to guard against. In fact, any potential risk is already lowered under the current mitigation measures already imposed on the industry. Safety and protection of people and the environment are top priorities for Shell. For decades, the industry has operated G&G technology in a safe and responsible manner. Approximately 65,000 wells have been drilled successfully in the federal and state waters of the U.S. GOM since World War II. All the while, our industry has co-existed with marine life, commercial and recreational fishing, military restricted zones, tourism, recreational activities, and even in the proximity of important and sensitive environments, including the Flower Garden Banks National Marine Sanctuary and in the Mississippi and De Soto Canyons. Shell has established a long record of support for environmental mitigation and monitoring efforts, as well as scientific studies, to improve the understanding of potential impacts to the GOM environment, marine life, and communities. We continue to support appropriate and reasonable mitigation measures and robust environmental monitoring to understand potential impacts and to create appropriate environmental baselines. Sound environmental science, along with improved technologies and new G&G data, especially seismic, helps drive informed decision making, which can ultimately lead to smaller operational footprints, safer management of projects, and correspondingly lower risks and potential impacts.</p> <p>It is with this base of knowledge, interest, and experience that</p>	<p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate impacts. BOEM is involved in several ongoing programs to improve existing data for marine mammals and underwater noise, and future analyses will use the best data available at that time.</p> <p>Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p> <p>Safety and environmental integrity of OCS operations is of the utmost importance to BOEM, and they are considered in all of the proposed mitigation measures. All of this information will be considered by the decisionmaker in determining which</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Shell cautions against new restrictions on G&G activities. Safety and environmental integrity of OCS operations could be compromised at demonstrable and serious levels by the inability to conduct G&G activities as needed. Optimal safety performance can best be achieved through comprehensive planning and project risk assessment programs managed by operators, and G&G data plays a key role in both. A prime example, particularly in high density reservoirs, is the manner in which good quality velocity-model seismic data can and frequently does reduce the risk of kicks and/or loss of well control. A virtuous circle currently exists between continuous evolution of geophysical technology and safe operations. The latest seismic data form the cornerstone of pore-pressure prediction models that are necessary to meet Bureau of Safety and Environmental Enforcement (BSEE) regulations. Alternatives B through G would, by way of increased burden to the industry, slow the advancement of technology and therefore needlessly limit the ability of operators to plan and execute the safest and most effective exploratory wells. Seismic information thereby proves an effective component of continuous improvement in safe operations.</p> <p>Likewise, processing of the latest seismic data with the application of algorithms demonstrated better illumination of updip targets at several fields in the GOM. For example, at Shell's Cardamom and Deimos fields, new seismic data enhanced the subsalt image, enabling the development team to more safely plan recent wells around salt complexities and higher pressures, which further reduces potential risks to human safety and the environment. Additional examples abound and the government must consider and reconcile any potential additive risk it could create by constraining access to G&G data.</p> <p>It is also concerning that proposed Alternatives would create time or area restrictions or closures, as well as blanket prohibitions, which would limit the amount and quality of the sort of imagery available to continuously improve the safety in</p>	<p>alternative is selected in the ROD.</p> <p>BOEM is responsible for stewardship of OCS energy and mineral resources, as well as protecting the environment that may be impacted by development of those resources. As stated in Chapter 1, BOEM's mission is to manage development of the Nation's OCS energy and mineral resources in an environmentally and economically responsible way. The NEPA (42 U.S.C. §§ 4321-4347) is the foundation of environmental policymaking in the U.S. The intent of the NEPA process is to help public officials make decisions based on an understanding of environmental consequences and to take actions that protect, restore, and enhance the environment. BOEM produces NEPA documents, such as this Programmatic EIS, for each of the major stages of energy development planning. The NEPA process provides for public input and transparency as part of the decisionmaking process through numerous public meetings, emails, and mail outs at the scoping and public review stages during EIS development. BOEM prepared this Programmatic EIS using the best available science and highest quality data available. In addition, the Monitoring Plan developed through the MMPA process would focus on monitoring marine mammal populations and behavior, as well as the effectiveness of mitigation measures. The implemented mitigation measures would be evaluated and, through an adaptive management process, may be altered depending on effectiveness. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM.</p> <p>The data collected from implementing the Monitoring Plan will provide additional information regarding the efficacy of the</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>well planning efforts similar to those described above. It would be irresponsible for the government to deliberately risk such a situation. Shell requests that BOEM formally consult with the BSEE on this critical factor, as BSEE recently finalized the Well Control Rule and has been working to ensure that all technologies with the capacity to yield safer operations are encouraged rather than restricted.</p>	<p>implemented mitigation measures. BOEM will continue to coordinate with industry and external stakeholders to understand how a marine mammal monitoring plan in the GOM for G&G activities may fit into other efforts in order to prevent duplication and to address monitoring needs in the context of the larger GOM ecosystem.</p>
1069-0006	<p>With this context in mind, Shell opposes Alternatives B through G. These proposed scenarios for regulating G&G activities are untenable and must be rejected due to their severe costs and overly restrictive nature, their conflict with the law and mission underpinning the U.S. OCS program, and the lack of scientific evidence that they would result in any meaningful additional safety or environmental benefits to GOM communities and marine life. Shell strongly supports Alternative A as the preferred course of action. In addition to the comments in this letter, Shell incorporates by reference with the comments submitted by the American Petroleum Institute (API), National Ocean Industries Association (NOIA), International Association of Geophysical Contractors (IAGC), and the Offshore Operators Committee (OOC) (herein 'the Joint Trades').</p> <p>Also of great importance, the restrictive Alternatives B through G further fail on the substantive merits related to the protection of marine life. The considerable body of evidence, including BOEM's own findings and those of the expert agency, NMFS, demonstrates that the sound produced by exploring for oil and gas with seismic surveys under long-standing industry mitigations have not resulted in any known physical or auditory injury to a marine mammal or negatively impacted marine life populations (See I. pg. 3). Also, the evidence reveals that any behavioral disturbance that individual animals may experience is short-term and temporary and has not resulted in adverse consequences to marine life populations.¹⁷</p> <p>Given the weight of evidence, including the fact that existing law permits G&G operators to incidentally "take" marine species as long as certain standards are not exceeded, BOEM's</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>Please see the comment responses to letter number 1076 (IAGC comment letter) for additional details.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>proposed mitigation measures must be based on the best available science and should logically reflect what the evidence does support and suggest. Alternative A includes a commensurate scale of mitigation measures, which align with industry best practices, including protected species observing and shutdown protocols in the event of certain marine mammal sightings. These mitigations require appropriate measures to ensure that the marine environment and its species are being safeguarded from potential impacts. These current and near-term scientific monitoring and research efforts¹⁸ will always be an important supporting element for regulatory policy, and Shell is proud of such collaborative work to date with interested government and academic stakeholders.</p>	
1069-0007a	<p>Alternatives B through G are overly restrictive and will cause unnecessary negative economic impacts.</p> <p>We find that Alternative A mitigation measures⁷ in the DPEIS – including protected species observing and seismic airgun survey protocol, as well as recommended use of passive acoustic monitoring – put forth reasonable monitoring mitigation measures without imposing duplicative, unnecessary, and/or cost-prohibitive restrictions. In contrast, Alternatives B through G are needlessly restrictive and drastic in their reach. Specifically, BOEM’s analysis of these Alternatives demonstrates that with each scenario of additional restrictions, there are few, limited, or highly uncertain additional protective benefits for marine life, particularly marine mammals and sea turtles. More so, for over 60 years, the Department of the Interior⁸, the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS)⁹, and academic scientists have examined the potential impacts of G&G activities and concluded they are insignificant.</p>	<p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. Mitigation measures are discussed in more detail in Appendix B.</p> <p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provides decisionmakers with information necessary to evaluate and implement prospective actions, including the relative need and costs of mitigations.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1069-0007b	<p>The BOEM Chief Scientist, Dr. Bill Brown, has made many statements¹⁰ reiterating ‘there has been no documented scientific evidence of noise from airguns used in G&G seismic activities adversely affecting marine mammals populations or coastal communities’ and ‘[G&G technology has] no known detrimental impact to marine animal populations or to commercial fishing.’ BOEM’s DPEIS fails to demonstrate any evidence to modify this long-standing conclusion and includes contradictory statements between lack of observed effects on marine life and the impact determination factors for proposed Alternatives and associated mitigations.¹¹ It is only by application of wildly ambitious and “overly conservative”¹² activity level estimates wherein the agency is now alleging that G&G seismic impacts could be “moderate” to marine mammals.</p> <p>Given the lack of conservation benefit, additional regulations that would constrain, delay, and/or increase costs of seismic acquisition or performing other G&G activities are untenable. Shell therefore disagrees with the "moderate" impacts conclusion and opposes any significant new and costly mitigation that would only tend to make domestic OCS production less viable and force substitution of foreign products. Alternatives B through G would substantially deprive the U.S. and its leaseholders of much, and in some cases all, of the economic value of the GOM OCS oil and gas resources, without the added benefit of greater protection for marine species.</p>	<p>This Programmatic EIS analyzes projected scenarios for activity levels that are expected to occur over the next 10 years. While BOEM acknowledges the reduced level of exploration G&G activity and the corresponding decrease in permit applications in the 2016 calendar year, BOEM assumes that future levels will return to previous levels within the next 10 years. Therefore, BOEM must be prudent and conservatively consider the full range of potential impacts. For this reason, the scenarios contain projections based on analysis of past activity levels and trends made by BOEM’s subject-matter experts who also considered industry-projected activity levels in their estimates.</p> <p>While it has been demonstrated that these measures offer protection to marine mammals and sea turtles (Appendix B, Section 1.2.4), it is not possible to quantify the degree of protection. However, Chapter 4.2.2 states that individual and small groups of animals may experience some permanent hearing loss, and larger numbers of animals may experience temporary hearing impairment, some multiple times over the course of the 10-year timeframe covered by this Programmatic EIS. Impacts are rated as moderate, though not significant to populations of individual species.</p> <p>Overall, the impact analysis considered the modeling results, in conjunction with subject-matter expert review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions are credible in light of the available scientific record.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities. The range of alternatives was developed based on the underlying purpose and need (Chapter 1.1.2), and alternatives that did not meet the purpose and need were not carried forward for further analysis (Chapter 2.11).</p>
1069-0007c	<p>The regular and continuing use of G&G technologies is a modern pillar of viable OCS development, fulfilling the policy goal of maximizing benefits to the U.S. Treasury and taxpayer. Examples wherein Shell has utilized G&G technologies and data to optimize and achieve better production results are many, highlighting the seriousness of the decisions at stake.</p> <p>Shell has planned and is relying upon the deployment of G&G technologies in coming years. This type of G&G surveys, together with their projected activity levels as published in the DPEIS demonstrate the extremely disruptive and costly effects, on the order of several billions of dollars¹³, which Alternatives B through G would cause. These forms of G&G acquisition and processing are commercially necessary. G&G surveys afford a unique value in virtually all stages of field life, and they tend to continuously identify additional resources, and pathways to their safe recovery, in both exploratory areas and existing mature fields.</p>	<p>A cost-benefit analysis is not required to satisfy NEPA analysis requirements, particularly if there are important qualitative considerations (40 CFR § 1502.23). However, an EIS should indicate considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision (40 CFR § 1502.23). Therefore, a cost analysis for inclusion of the proposed mitigation measures has been performed and included in Chapter 4.13. Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B-F. BOEM considers many factors, including the cost of implementing mitigation measures, in selecting the Preferred Alternative. If NOAA moves forward with their proposed action (i.e., issuance of MMPA incidental take regulations), then a Regulatory Impact Analysis would accompany the rule. BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating impacts. BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of its subject-matter experts. BOEM has developed this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully informed. In addition, additional information regarding forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		activities is referenced in Chapter 4.13 of the 2017-2022 GOM Multisale EIS.
1069-0007d	<p>Any loss of the ability to obtain G&G data, particularly seismic data in the way it is currently employed and with no viable alternative technologies commercially in use, would therefore immediately and irreversibly impact the economics of GOM exploration and production. New fields would be explored and developed in less efficient and less productive ways, many currently producing fields would be less optimized, and certain prospects would simply be passed over or relinquished for lack of data supporting further exploration and development. Furthermore, few if any options exist for companies to return to sub-optimally developed fields and execute improved recovery, which is why maintaining seismic throughout the life-of-lease is necessary. Implementing Alternatives B through G would cause immediate revenue impacts to the U.S. Treasury, taxpayers, and private sector investments of GOM operators, which would be serious, as lower royalties and rents would directly result from poorer volumetric recovery and unwanted acreage relinquished to the government for lack of productivity or promise. Specifically, it is Shell's broad estimate that less than half of the bids in a given OCS lease sale, and correspondingly less than half of new OCS developments, would go forward without new seismic data to supplement the old and support further investment. Simply put, older seismic data loses its value over time as technology advances and reinterpretation grows redundant. The government should consider, given the \$64 billion in value added from the OCS program in FY 2014, that this figure would certainly be much smaller absent seismic technology. This is a major economic value, which would not otherwise be achievable under Alternatives B through G, and this is an unacceptable price for no meaningful environmental or socioeconomic offset.</p> <p>Critically, the government must also consider economic impacts to its own lease sale program. There is a direct relationship between bid levels and the certainty and confidence over the target of a given bid. Absent the availability of new and</p>	<p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>BOEM acknowledges the cost to industry of implementing the mitigation measures and includes this analysis in Chapter 4.13 and its associated tables. In addition, Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>improving G&G data, the attractiveness of available lease acreage would necessarily be reduced and likely stagnant at best, with potential bidders, and the government itself, having no option but to base massive investment decisions and resource potential estimates on years - or decades-old data. Moreover, lease sale bids made in spite of the substandard data would probably be less competitive, resulting to less revenue, due to the circumstances described in the previous paragraph. The inability to safely optimize recovery would make any acreage, no matter how otherwise promising, less attractive from an investment standpoint.</p>	
<p>1069-0007e (continued)</p>	<p>A certain outcome would be that lease sales in competing and perhaps neighboring regimes, e.g. Mexico, Caribbean and other Latin American countries, would draw substantially more competitive interest than the U.S. acreage. Since there is no evidence that seismic activity, under standard industry protocols, would cause physical harm to marine mammals or harm to marine species populations or the environment, firms with responsibilities to investors may have few reservations about shifting investment to those theatres that continue to widely permit G&G in a reasonable manner.</p> <p>These economic impacts are substantial, certain, and completely avoidable. They must be factored into a meaningful cost-benefit analysis in this NEPA document and the forthcoming marine mammal incidental take regulations stemming from this analysis, with an accounting for not only the major revenue shortfalls to the federal government, but for the negative impacts on direct and indirect employment and legitimate, investment-backed expectations. Indeed, it is foreseeable that the government could be obligated to refund bonus bids and other lease payments to operators whose acreage might be so badly devalued under the restrictive alternatives.</p>	<p>A cost analysis for inclusion of the proposed mitigation measures has been performed and included in Chapter 4.13.</p> <p>The impact assessment in Chapter 4, as well as all of the comments and responses received on the Draft Programmatic EIS that are in this appendix, will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
<p>1071-0002</p>	<p>...the description of Florida Coastal Management Program (FCMP) in Appendix B should be corrected since the Department of Community Affairs no longer exists and has been replaced by the Department of Economic Opportunity.</p>	<p>Text in this Programmatic EIS has been edited in response to the comment regarding the Florida Coastal Management Program.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	Please refer to http://www.dep.stateRusicmp/partners/stateagencies.htm for corrections. In addition, the 2015, not the 2014, Florida Statutes are the most recent approved by NOAA for inclusion in the FCMP.	
1073-0008	BOEM's environmental analysis should accurately reflect the best available science and research and consider the industry's operational experience, which indicates that seismic surveys have little-to-no impact on marine mammal and wildlife populations. I personally attended the New Orleans information session on this topic and spoke directly with subject matter experts on hand. From these conversations, I have learned that the no "Class-A" infractions (actual death or near-mortal casualties) have been documented, and that the primary purpose of the adopting alternatives beyond Alternative A is to add data to the potential 'changes in eating, reproductive and socializing patterns' that occur due to G/G activities.	<p>BOEM is committed to complying with the requirements and intent of NEPA, preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of its subject-matter experts. BOEM developed this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully informed.</p> <p>Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM, does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p>
1073-0013	...we urge BOEM not to impose new and unnecessary restrictions on such activities and to instead adopt Alternative A of the DPEIS.	Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
1073-0014	Montco Offshore fully supports Alternative A as the preferred course of action.	Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD
1073-0015	The various measures included in Alternatives B-G threaten the operational and economic viability of G/G activities in the GOM, which will cause additional costs and lead to fewer wells being drilled, diminish future production and cause negative economic impacts throughout the Gulf region, which are ALL additional negative factors that our industry cannot currently take on.	Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. In addition, Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>While the DPEIS describes the potential economic impacts of the various alternatives (e.g., increased cost leading to decreased profits; supply chain impacts; lost production), it does not provide cost estimates for direct, indirect and induced economic impacts over the 10-year time period, nor does it adequately account for the variability inherent in offshore oil and natural gas exploration and development. As such, stakeholders cannot evaluate the full economic impacts of the alternatives. BOEM has failed to provide an adequate accounting of potential economic impacts for stakeholders to make an adequate assessment of the practicability or feasibility of the proposed alternatives. Perhaps the absence of a trained economist listed as one of the preparers/reviewers for chapter four of the DPEIS caused the inadequate accounting. Montco Offshore respectfully urges BOEM to conduct the required quantitative analyses and provide the findings for appropriate consideration going forward. ...Alternative A is the only alternative that may be consistent with the best available science, operational feasibility, and applicable law. Montco Offshore strongly objects to any of the other Alternatives presented in the DPEIS for all of the reasons stated above and particularly because BOEM reaches the same effects conclusions for Alternative A as it does for all of the other Alternatives except Alternative G). Before the DPEIS is issued as a final PEIS, many flaws must be addressed and corrected.</p>	<p>economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>The impact conclusions are a synthesis of a variety of available qualitative and quantitative scientific information. BOEM is committed to complying with the requirements and intent of NEPA, preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of its subject-matter experts. BOEM developed this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully informed.</p> <p>BOEM notes your preference for Alternative A. This Programmatic EIS is not the decision document under NEPA. The decision of which alternative would be implemented will</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>be provided in the ROD following publication of this Final Programmatic EIS. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD. In addition to the economists included in the list of contract preparers, economists at BOEM assisted in the preparation of Chapter 4.13, but they were inadvertently left off the draft list of preparers. This has been corrected.</p>
<p>1074-0010</p>	<p>Our organizations support a variant of Alternative G, the “no-action” alternative, that would allow G&G activity for oil and gas development on presently leased blocks and for development of offshore renewables. Short of this, however, we urge the agencies to consider and adopt an alternative that includes the complementary safety zone, area closure, activity reduction, and other measures set forth in Alternatives D through F, which is by far the most appropriate approach among the options BOEM has identified.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
<p>1074-0011</p>	<p>The agencies should consider an alternative that excludes seismic oil and gas surveys from all portions of the Eastern Planning Area subject to the current Congressional moratorium. Additionally, given the potential for increased leasing in the Eastern Planning Area over the next ten years, they should identify what areas are most likely to propagate low-frequency sound into the Bryde’s whales’ extremely limited habitat and consider establishing area closures in those areas, with the aim of protecting this vitally important habitat from chronic noise.</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>The Congressional moratorium is in effect until 2022; therefore, the restrictions will remain in place until then. Alternative F includes closure areas where Bryde’s whales are known to occur, namely the EPA Closure Area. BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation. The development of a Monitoring Plan has been evaluated within this Programmatic EIS (Chapter 1.2.3.4). This plan would allow for adaptive management of mitigation measures and</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1074-0012	<p>The agencies should consider other reasonable variants, described at § II.A below, of the alternatives it has identified, such as including the month of January in the seasonal coastal area closure and expanding the Flower Gardens Closure Area to improve acoustic habitat within the National Marine Sanctuary. If the agency demurs from barring G&G activities within the CPA Closure Area, it must thoroughly consider, as part of a range of reasonable alternatives, less proscriptive protections for the area, including but not limited to a variant that would allow continued exploration of presently leased blocks.</p>	<p>would be implemented for the life of the MMPA rule.</p> <p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and DOI implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated, and a decisionmaker must not consider alternatives beyond the range of alternatives evaluated in this Programmatic EIS but must consider all the alternatives evaluated in this Programmatic EIS.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. BOEM believes that it has followed the regulatory standards for developing NEPA alternatives, which included to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" (Section 102 [42 U.S.C. § 4332]). The construction of alternatives followed the simple premise that, in order to be a valid alternative, it must fulfill the purpose of and need for the proposed action and must be economically feasible and technically viable. The range of alternatives was developed based on the underlying purpose and need. Alternatives that did not meet the purpose and need were not carried forward for further analysis</p> <p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of the three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) for which</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>BOEM has oversight. BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM's Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment.</p>
1074-0013	<p>The agencies must identify and evaluate alternatives and mitigation measures in light of NMFS' purpose and need under the Marine Mammal Protection Act, and not simply BOEM's purpose and need under OCSLA. For example, the need to meet the "small numbers" and "negligible impact" standards might necessitate a greater reduction in seismic airgun activity beyond the 10 or 25 percent that BOEM has contemplated; or it might alter the DEIS' evaluation of the time-area closures it has identified for sperm whales, Bryde's whales, and coastal bottlenose dolphins—all small populations with high projected take numbers.</p>	<p>The NOAA's purpose and need is included in Chapter 1.1.2, and NOAA is a cooperating agency for this Programmatic EIS. BOEM continues to work closely with NOAA to include its input into this Final Programmatic EIS.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>BOEM believes that it has followed the regulatory standards for developing NEPA alternatives, which included to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>available resources” (Section 102 [42 U.S.C. § 4332]). The construction of alternatives followed the simple premise that in order to be a valid alternative, it must fulfill the purpose of and need for the proposed action and be economically feasible and technically viable. The range of alternatives was developed based on the underlying purpose and need. Alternatives that did not meet the purpose and need were not carried forward for further analysis.</p>
1074-0014	<p>The agencies must consider a technology-based alternative that motivates research, development, and adoption of noise-quieting technology, some of which is already available for deep-penetration seismic surveys. Options include establishing a future noise output standard throughout the northern Gulf or in areas with higher habitat value for protected species; deferring the permitting of surveys in particular areas where effective mitigative technologies could reasonably be expected to become available within the life of the EIS; and strongly incentivizing the use of alternative technologies.</p>	<p>Appendix F, Section 3, evaluates emerging technologies, and Chapter 2.11.2 discusses alternatives considered but not carried forward with respect to alternative technology. BOEM determined that alternative technologies are in various stages of development and that none of the systems with the potential to replace airguns as a seismic source are currently commercially available for use on a scale of activity considered in the proposed action scenario described in Chapter 3. Although some alternative technologies are available now or will be in the next several years for select uses, none are, or will be, in the next 10 years at a stage where they can replace airgun arrays outright; however, some may be used in select environments when commercially available. The alternative proposed in this comment would not provide the oil and gas industry or the government with sufficiently accurate data on the location, extent, and properties of hydrocarbon resources or the character of formation fluids or gases, or information on shallow geologic hazards and seafloor geotechnical properties, in order to explore, develop, produce, and transport hydrocarbons safely and economically. As this alternative does not meet the stated purpose and need, and cannot be analyzed on a programmatic scale at this stage, it has not been carried forward for detailed environmental impact analysis in this Programmatic EIS. Should these technologies become commercially available, BOEM can evaluate them in the future as a standalone, site-specific request or in a supplemental programmatic document. BOEM will consider future data on new technologies to adjust mitigation requirements for individual surveys based on the best available information at</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1074-0017	<p>The agencies should consider additional mitigation for powerful, lower-frequency multibeam echosounders, such as the system implicated in the Madagascar mass strandings, such as area closures and required employment of less powerful systems except in areas where water depth or other factors necessitate their use.</p>	<p>that time (Chapter 1.2.3.5).</p> <p>Mitigation measures for powerful lower-frequency MBESs are included in Alternatives C through F, depending on the operating frequencies of the non-airgun HRG surveys Appendix B, Section 1.3.1).</p> <p>Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM's Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment. Currently active studies addressing this broad range of topics can be found at http://www.boem.gov/GMStudies/. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1074-0018	<p>The agencies should consider alternatives and mitigation measures for G&G activities that were not addressed, or sufficiently addressed, in the DEIS, such as establishing additional ship-strike avoidance measures in Bryde's whale habitat, mitigating impacts on non-marine mammal taxa, and requiring MMPA authorization as a condition of OCSLA permit.</p>	<p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and DOI implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated, and a decisionmaker must not consider alternatives beyond the range of alternatives evaluated in this Programmatic EIS, but must consider all the alternatives evaluated in this Programmatic EIS.</p> <p>The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. BOEM believes that it has followed the regulatory standards for developing NEPA alternatives, which included to "study, develop, and</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources” (Section 102 [42 U.S.C. § 4332]). The construction of alternatives followed the simple premise that, in order to be a valid alternative, it would have to fulfill the purpose of and need for the proposed action and be economically feasible and technically viable. The range of alternatives was developed based on the underlying purpose and need. Alternatives that did not meet the purpose and need were not carried forward for further analysis. Additionally, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p> <p>Overall, these comments have been noted and considered by BOEM when determining the Preferred Alternative.</p> <p>NOAA is a cooperating agency for this Programmatic EIS, and BOEM will continue to work closely with NOAA to include its input into this Final Programmatic EIS. This Programmatic EIS will be used as the NEPA documentation associated with the issuance of ITAs and the rule-making process under the MMPA for the incidental taking of marine mammals in connection with all G&G survey activities in the GOM.</p> <p>In addition, BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1074-0021	Under the settlement agreement in NRDC v. Jewell, BOEM is required analyze a number of alternatives and mitigation measures, including, but not limited to the interim mitigation measures adopted under the agreement, which comprise area closures, seasonal closures, vessel separation distances, expanded safety zone protocols, and other requirements; additional mechanisms “to reduce cumulative or chronic	BOEM respectfully disagrees. Alternative B includes the mitigation measures from the Settlement Agreement and the amendment to the Settlement Agreement, as described in Chapter 2.4. Chapter 4 provides the impact analysis for Alternative B for all resources. This Final Programmatic EIS has been modified to include the revised mitigation measures from the amendment to the Settlement Agreement. In

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>exposure of marine mammal populations to noise (e.g., limiting concurrent surveying, limiting the total amount of survey activity in portions of the Gulf of Mexico); and “[r]equirements or incentives to develop and use emergent alternative technologies for Deep Penetration Seismic surveying.” Settlement Agreement § IX.A. The agency is also required to analyze the development of a “long-term adaptive monitoring plan” to address chronic impacts of seismic surveys on Gulf marine mammals. Id. § IX.B. Finally, it has had to determine the feasibility of developing two potentially important mitigation standards, one limiting seismic airgun surveys to the “lowest practicable source level” and the other denying permission to surveys that are “unnecessarily duplicative” in whole or in part. Id. § VIII. While an improvement on the analysis offered in many of BOEM’s previous environmental compliance documents, BOEM’s alternatives and mitigation analyses miss the mark in several significant respects. We urge the agencies to correct these problems in its Final EIS.</p>	<p>addition, some of the mitigation measures included in Alternative B are also included in some form in other alternatives evaluated.</p> <p>As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p> <p>Appendix L provides the evaluation by an expert panel of the lowest practicable source levels and duplicative surveys.</p>
<p>1074-0021 (continued)</p>	<p>BOEM’s alternatives and mitigation analyses miss the mark in several significant respects. We urge the agencies to correct these problems in its Final EIS.</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS.</p>
<p>1074-0024</p>	<p>The DEIS presently treats Alternatives D, E, and F as independent and mutually exclusive options. Yet these alternatives are not contradictory and, indeed, may improve outcomes in combination.</p> <p>...the DEIS’ cumulative acoustic exposure modeling, at Appendix K, indicates that some area closures (which are needed to protect the most vulnerable species) could potentially increase chronic noise levels in some areas by redistributing rather than reducing activity—a problem that can be addressed by combining area closures with activity reduction (see DEIS at</p>	<p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and DOI implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated, and a decisionmaker must not consider alternatives beyond the range of alternatives evaluated in this Programmatic EIS but must consider all the alternatives evaluated in this Programmatic EIS.</p> <p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility,</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>K-31, Table 27). For this and other reasons, the Marine Mammal Commission recommends as “more appropriate” an alternative that includes the broader set of measures, including expanded “shut-down procedures, visual and passive acoustic monitoring, overall activity reduction (rather than redistribution), and appropriate time-area closures in its Preferred Alternative to maximize the mitigation value for those species that are believed to warrant the greatest protection, including sperm whales, Bryde’s whales, and bay, sound, and estuarine stocks of bottlenose dolphins. The agencies should include these several mitigation measures in a single proposed alternative.</p>	<p>economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provides the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions. Additionally, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p> <p>Overall, these comments have been noted and considered.</p>
1074-0025	<p>Alternative C, which is incorporated into Alternatives D through F, would primarily establish a seasonal exclusion in waters from the 20 meter isobaths shoreward, as a means of protecting near-coastal bottlenose dolphin populations. This aspect of the alternative is a variant on the seasonal coastal exclusion required by the NRDC v. Jewell settlement agreement. More protective variants on the concept are also reasonable and should be considered.</p> <p>First, BOEM should consider at least a temporary, adaptive restriction on all oil-and-gas exploration activity in the coastal exclusion area, to afford near-coastal bottlenose dolphins opportunity for recovery. (As a variant, the agency could apply the interim year-round restriction only to non-lease activities.) The need to reduce stressors on <i>Deepwater Horizon</i> spill-zone populations is clear: NMFS estimates that 38% of coastal bottlenose dolphins were killed in the recent Unusual Mortality Event (“UME”), that 37% of their pregnancies were lost, and</p>	<p>Thank you; your suggestions regarding additional alternatives have been noted. This information was considered by BOEM when determining the Preferred Alternative.</p> <p>This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD. The Assistant Secretary for Land and Minerals Management can select all of the closure areas or a subset of the closures areas as part of the decision provided in the ROD. BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>that 30% of them are suffering from adverse health effects. Animals that are in poor health or are limited in range, such as the Gulf's coastal bottlenose dolphins, are more likely to remain in a disturbed area despite the biological costs.²³ Such a restriction is certainly reasonable given the exigent circumstances, and may in fact be required in much of the Gulf to meet the negligible impact and small numbers provisions of the MMPA. It should be considered.</p> <p>Second, BOEM should consider a variant on its seasonal exclusion that adds January to the exclusion period. Our proposal focuses on January and February in part because these months, together with March and April, correspond with periods of higher neonate mortality and of peak calving and late gestation for bottlenose dolphins in the central Gulf.</p>	<p>authorization of the incidental take of marine mammals under the MMPA for these activities. In addition, BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p> <p>In accordance with CEQ regulations implementing NEPA (40 CFR part 1502) and DOI implementing procedures for NEPA (43 CFR part 46), a range of alternatives must be rigorously explored and objectively evaluated, and a decisionmaker must not consider alternatives beyond the range of alternatives evaluated in this Programmatic EIS, but must consider all the alternatives evaluated in this Programmatic EIS.</p>
1074-0025 (continued)	<p>A correspondence between neonate strandings and calving peaks has been observed in other U.S. regions, such as the southeast.²⁴ In the central Gulf, stranding data from various studies show peaks in neonate (<115 cm) mortality in the later winter and spring.²⁵ During the first year of the UME documented by NOAA, an unusual number (n=186) of perinatal (near term to neonatal) bottlenose dolphin mortalities occurred, in waters running from Louisiana to western Florida, between 1 January and 30 April 2011.²⁶ This time period was marked by heightened strandings with three distinct peaks: 29 January-4 February, 19-25 February, and 19-25 March.²⁷ Overall, the greatest number of strandings of premature, stillborn, or neonatal dolphins reported during the five-year UME have occurred in January (range=0-9), February (range=1-35), March (range=7-28), and April (range=2-16).²⁸</p> <p>Similarly, before the recent UME began, the highest incidence of neonate strandings in the Mississippi Sound was recorded during the months of February through April.²⁹ By contrast, neonate strandings generally occur year-round in Sarasota Bay, Florida, in the eastern Gulf, with the highest number (n=3) reported between February and September, and the mean date of strandings occurring on 17 June.³⁰ A stressor can adversely</p>	<p>Subject-matter experts made a best judgment as to a reasonable range that encompasses important reproductive periods for bottlenose dolphins in coastal waters. Expert interpretation of the long-term data for "neonate" strandings is that February through April are the primary months that animals are born in the northern GOM and that fewer but similar numbers are born in January and May. This refers to long-term averages and, in any particular year, the peak reproductive period can shift earlier or later. While pregnant mothers may be susceptible to the impacts of noise, we believe that neonates and/or calves are likely most susceptible because behavioral disruption could have more severe energetic effects for lactating mothers and/or lead disruption of mother-calf bonding and ultimate effects on rates of neonate and/or calf survivorship. Therefore, we believe that February through May represents a reasonable best estimate of the time period of most sensitivity for bottlenose dolphins.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>affect reproductive success at any time during gestation; however, in the central Gulf, inclusion of January would cover the remainder of the dolphins' peak calving and late gestation periods as well as the beginning of the period of highest reproductive failure.</p> <p>Additionally, seasonal changes in the distribution of some bottlenose dolphin populations make them more vulnerable to seismic activity during the winter months. Gulf bottlenose dolphins show varying degrees of residency, with certain populations demonstrating strong site fidelity to feeding areas³² and others exhibiting seasonal movements between the coastal waters of the Gulf and inshore bay, sound, and estuary habitat.³³ Notably, some near-coastal bottlenose dolphin populations have been observed leaving the Mississippi Sound during the winter to temporarily reside outside of the barrier islands.³⁴ Populations that seasonally inhabit the Gulf's coastal waters in the winter months, including January, are more likely to be at risk of exposure to federally permitted seismic survey activity during that time. A winter restriction would substantially reduce exposure of these populations.</p> <p>Third, BOEM should clarify certain elements of this measure. In particular, it should clarify that the seasonal exclusion does indeed cover activities occurring in state waters, via NMFS' involvement (DEIS at ix). It should also clarify that the exclusion includes HRG surveys, as does the analogous requirement in the NRDC v. Jewell Settlement Agreement. See Settlement Agreement § V.A (referencing archeological resources surveys and other preparatory work for deep penetration seismic surveys that employ sub-bottom profilers).</p>	
1074-0026	<p>Alternative D, as presently described, would extend the shut-down requirement to delphinid species with the exception of bowriding dolphins. DEIS at 2-13. This exception is based on a simple cost-benefit analysis, that while shutting down in the presence of bowriding dolphins would increase shutdowns by an estimated 35 to 41 percent, resulting in an additional 44-46 shutdowns per year across the seismic fleet, protected species</p>	<p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>observers have “report[ed] no observable impacts” to these individuals. DEIS at 2-24. But it is not known why dolphins bowride; researchers have cautioned, for example, against making longitudinal assumptions about population health based on seemingly benign behavioral responses of dolphins around vessels;³⁵ and it is not evident how a visual observer would detect temporary or permanent hearing loss in a non-captive marine mammal. On the contrary, the best available science indicates that dolphins are at risk of auditory and other injury at relatively close distances to the seismic source. Without further analysis of the acoustic field near the sea surface and in the immediate vicinity of the vessel, the agency cannot assume away this risk; indeed, it is possible that a dolphin’s tendency to bowride increases its risk of injury. More analysis is therefore needed of the potential costs and benefits of excluding bowriding dolphins from this alternative.</p> <p>Additionally, we recommend that the agencies consider a narrower formulation of this measure, requiring shutdown for delphinids or, alternatively, for bottlenose dolphins and delphinids of unidentified species, within the coastal area presently identified for seasonal exclusion. As noted above at II.A.3 and elsewhere in these comments, the Gulf’s small near-coastal bottlenose dolphin populations are suffering severely from the consequences of the <i>Deepwater Horizon</i> disaster, with precipitous declines. Any cost-benefit analysis under NEPA or application of the MMPA’s negligible impact standard must take the conservation status of these populations into account.</p>	<p>may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p> <p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provides the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and implement prospective actions.</p> <p>Through the adaptive management of the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1074-0027	<p>Under Alternative E, BOEM would cap the amount of deep-penetration, multi-client activity it permits each calendar year, with permitting stopped once a specified amount of activity has been permitted. DEIS at 2-24 to 2-25. Such a reduction is likely to be environmentally beneficial, reducing marine mammal take numbers and, as suggested by Appendix K, improving acoustic habitat. BOEM does not indicate, however, why the particular caps considered in the DEIS, representing a 10 percent (Alternative E1) or 25 percent (Alternative E2) reduction in the number of line miles permitted annually, were</p>	<p>BOEM, through consultation with industry representatives, has tried to base the reductions on an attempt to balance environmental impacts with economic impacts to achieve the proposed action’s purpose and need. Using expert opinion and best professional judgement, BOEM determined that 10 percent and 25 percent reductions offer a reasonable range of reduced activity levels while still allowing BOEM to fulfill the purpose of and need for this Programmatic EIS.</p> <p>BOEM and NOAA developed the alternatives in this</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>chosen. The agencies should consider other reduction levels that meet the purpose and need of BOEM and, separately, NMFS. See § II.B below.</p> <p>Time and place restrictions designed to protect important habitat are one of the most effective available means to reduce the potential impacts of noise and disturbance on marine mammals and is frequently recommended as core mitigation for disruptive acoustic activities, including seismic exploration.³⁶ It is also a cornerstone of NOAA’s new Ocean Noise Strategy, which takes habitat management as one of its priorities.³⁷</p> <p>Alternative F would establish area closures at four sites in the northern Gulf: a Central Planning Area (“CPA”) unit, largely corresponding to the Mississippi Canyon, to protect sperm whales and beaked whale species; an Eastern Planning Area unit, corresponding to the upper northern slope of the De Soto Canyon, to protect Gulf Bryde’s whales; a unit near the Dry Tortugas in the far eastern Gulf, primarily for the protection of sperm whales; and a Flower Gardens unit, to protect the National Marine Sanctuary there. The DEIS concurs that the areas it has identified, encompassing both the coastal habitat in Alternative C and the four habitat areas in Alternative F, are important to these target species. DEIS at 2-17 to 2-18. BOEM should consider additional reasonable measures to minimize effects on these areas.</p>	<p>Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>BOEM believes that it has followed the regulatory standards for developing NEPA alternatives, which included to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources” (Section 102 [42 U.S.C. § 4332]). The construction of alternatives followed the simple premise that, in order to be a valid alternative, it must fulfill the purpose of and need for the proposed action and be economically feasible and technically viable. The range of alternatives was developed based on the underlying purpose and need. Alternatives that did not meet the purpose and need were not carried forward for further analysis.</p> <p>Thank you; your suggestions regarding additional alternatives have been noted. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD. As indicated in Chapter 2.8.1, all the closure areas or a subset of the closures areas could be selected as part of Alternative F, or as part of the decision provided in the ROD.</p>
1074-0028	<p>First, BOEM should consider extending the “buffer zone,” currently set at 160 dB (broadband SPL), around the areas it has proposed for closure, including the coastal exclusion area proposed in Alternative C, which presently lacks a buffer zone entirely. The best available evidence indicates that behavioral impacts on sperm whales, baleen whales, and other species</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, environmental impacts, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>can occur at received levels well below the 160 dB that NMFS takes as its current standard. (See § III.A below.) The agency should consider the benefits of enlarging the buffer zone.</p> <p>Second, BOEM should consider how reductions in deep-penetration seismic surveys outside the closure areas could reduce chronic noise levels within them. The complex bathymetry found in some parts of the northern Gulf makes for an apparently complex propagation regime, particularly for low-frequency sound. For example, the relatively shallow water in the EPA Closure Area important to Bryde’s whales, and the lack of substantial airgun surveys in the activity zones to the area’s north and south, afford it some protection from chronic noise produced elsewhere in the Gulf. BOEM should consider an alternative that excludes seismic oil and gas surveys from all portions of the EPA subject to the current Congressional moratorium. But given the potential for increased leasing in the Eastern Planning Area over the next ten years, particularly after expiration of the existing moratorium in 2022 (see § III.D.1 below), BOEM should at least identify what areas are most likely to propagate low-frequency sound into the Bryde’s whales’ extremely limited habitat and consider establishing area closures in those areas as well—protecting, as it were, the acoustic watershed of this vitally important, and as yet relatively unspoiled, habitat. The agency should also consider how chronic noise might be reduced within the Flower Gardens Closure Area, given that the area closure, apparently, did not appreciably improve the listening area available to mid- and high-frequency cetaceans. See DEIS at K-42.</p>	<p>authorizing G&G activities connected with activities conducted in support of Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>In addition, BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p> <p>The current available science was used to determine the closure areas to afford the most protection to protected species; this includes the EPA. Those closure areas were analyzed as part of the programmatic NEPA process.</p> <p>The BOEM has incorporated Appendix K into the cumulative impacts analysis of marine mammals. The best available science was used to analyze impacts to marine mammals from the proposed activity.</p>
1074-0028 (continued)	<p>Third, BOEM should put considerable weight in its analysis on protecting the “CPA Closure Area.” As the agency recognizes (see DEIS at 2-18), it is well established, on the basis of historic whaling records, mark-recapture data, and extensive surveys including by GulfCet II and the Sperm Whale Seismic Study, that this area constitutes important habitat for the Gulf’s small, biologically distinct population of sperm whales,³⁸ most likely due to the input of a nutrient-rich, freshwater plume from the Mississippi Delta.³⁹ Nearly all sightings of females and mother-</p>	<p>BOEM and NOAA developed the alternatives (including those with closure areas) for this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. Further, BOEM’s subject-matter experts developed the alternatives in close coordination with NMFS using the best available data.</p> <p>The attempt in the modeling exercise in Appendix K was to</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>calf groups have occurred in the Mississippi Canyon area, strongly suggesting it functions as a nursery ground.⁴⁰</p> <p>Yet this habitat is easily compromised. A controlled exposure experiment conducted in the Mississippi Canyon under the Sperm Whale Seismic Study (“SWSS”) found that sperm whales did not abandon that habitat; but their buzz rates, a measure of foraging success, declined substantially, by an average of 19 percent, on exposure to even moderate levels of airgun noise.⁴¹ Moreover, deeper parts of the canyon, where deep-diving sperm whales are likely to spend considerable time foraging, are particularly susceptible to high levels of chronic noise. See DEIS at K-28, K-33. The area was also, of course, at the epicenter of the Deepwater Horizon spill, presenting a serious long-term risk to sperm whale health. It is worth noting that sperm whales sampled in the area during a post-spill biopsy study showed levels of nickel and chromium, two genotoxic metals found in Macondo oil, that were several times higher than the global mean for the species.⁴² Finally, as the DEIS states, deeper waters in the CPA Closure Area also constitute relatively high-density habitat for beaked whales (DEIS at 2-18), a family of species whose acute sensitivity to anthropogenic noise is well known.⁴³</p>	<p>bring a tool that could help evaluate loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. Potential masking realized by individual calling and receiving animals due to noise at relatively close proximity to a single intermittent source is an important but limited evaluation of the real-world contexts within which populations of marine mammals and other animals are exposed to noise from multiple seismic surveys in a region like the Gulf of Mexico.</p>
<p>1074-0028 (continued)</p>	<p>Our organizations fully support the proposed CPA Area Closure and believe it is appropriate under OCSLA and, indeed, required to satisfy the “negligible impact” standard of the MMPA. Given the amount of activity taking place in this area, however, we are concerned that BOEM ultimately will demur from including it within its Preferred Alternative. If that is BOEM’s intent, the agency must thoroughly consider, as part of a range of reasonable alternatives, less proscriptive protections for the area, including but not limited to a variant that would allow continued exploration only of presently leased blocks.</p> <p>Fourth, and relatedly, BOEM should consider reducing noise in areas that may support Bryde’s whale recovery. As noted below at III.C.1, whaling logbooks and other evidence suggest that the Gulf Bryde’s whale population may have ranged farther</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities. The full consideration of alternatives and mitigations assists both agencies in meeting their NEPA obligations and provides the decisionmakers with the necessary information, including the relative need and costs of mitigations, to evaluate and</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>west than its present, seemingly constricted habitat in the De Soto Canyon. The greatest number of whaleship sighting and capture records are contained in a cluster south and west of the Mississippi River Delta, corresponding to the western portion of the CPA Area Closure.⁴⁴ Given the suggestion made by Rosel and Wilcox (2014), that industrial activity may have caused or contributed to a contraction of the whales' range, and given the deeply imperiled status of the population, BOEM should consider measures to restore acoustic habitat quality in these areas, including the CPA Area Closure proposed in this alternative.</p>	<p>implement prospective actions.</p> <p>The current available science was used to determine the closure areas to afford the most protection to protected species; this includes the CPA and EPA. Closure areas are part of different alternatives analyzed.</p>
<p>1074-0029</p>	<p>Alternative G, the "no-action" alternative, is rejected by BOEM for failing to meet its purpose and need. DEIS at 2-19. But in summarily rejecting the alternative, the agency fails to consider reasonable variants. For example, in lieu of barring all new G&G permits for oil and gas, the agency could instead proscribe only surveys that target unleased blocks, alleviating the agency's safety concerns about support for ongoing production in leased areas. Id. Additionally, the agency could allow G&G activities, including HRG surveys with mitigation, related to the development of offshore renewable energy projects, alleviating another well-founded concern. Id. The agency must consider these alternative formulations rather than simply set up and reject a binary formulation.</p>	<p>The CEQ regulation at 40 CFR § 1502.14(d) specifies that NEPA analyses require the alternatives analysis in the EIS to "include the alternative of no action." This analysis provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives. It is also an example of a reasonable alternative outside the jurisdiction of the agency, which must be analyzed (CEQ regulation at 40 CFR § 1502.14(c). Inclusion of such an analysis in this Programmatic EIS is necessary to inform Congress, the public, and the President as intended by NEPA (CEQ regulation at 40 CFR § 1500.1(a).</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>This Programmatic EIS is not the decision document under NEPA. The decision regarding which alternative or combination of mitigation measures analyzed will be provided</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1074-0030	<p>The DEIS makes clear that NMFS intends to use the document for its own NEPA compliance (DEIS at 1-4), and yet, with the arguable exception of the “no-action alternative” (DEIS at 2-19 to 2-20), its alternatives and mitigation analyses do not appear to take NMFS’ responsibilities into account in any way. The “significance” standard the agencies apply (see section II.C below) bears no relation to the MMPA’s standards for incidental take authorization; and what summary conclusions are made in the document, e.g., that Alternative E would “noticeably reduce impacts” (DEIS at 2-14) make no reference to those standards. Applying the MMPA is crucial to the agencies’ alternatives analysis. For example, the need to meet the “small numbers” and “negligible impact” standards might necessitate a greater reduction in seismic airgun activity beyond the 10 or 25 percent that BOEM has contemplated; or it might alter the DEIS’ evaluation of the time-area closures it has identified for sperm whales, Bryde’s whales, and coastal bottlenose dolphins—all small populations with high projected take numbers. The DEIS, in formulating its alternatives, must not “avoid the task actually facing NMFS.” Conservation Council, 97 F. Supp. 3d at 1236.</p>	<p>in the ROD.</p> <p>Comment noted. NOAA is a cooperating agency for this Programmatic EIS, and BOEM worked closely with NOAA to include its input to this Final Programmatic EIS. In addition, text has been added in Chapter 1 to more accurately capture NOAA’s responsibilities and authorities. BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, MMPA, and ESA) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM.</p> <p>BOEM intends to use this Programmatic EIS’s analyses to support an application for rulemaking under the MMPA and intends to apply for rulemaking under the MMPA on behalf of the G&G industry. The rulemaking would cover G&G survey activities supporting the Oil and Gas, Renewable Energy, and Marine Minerals program areas. Industry then would be allowed to apply for individual (company) permits under the rulemaking. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p>
1074-0033	<p>The Marine Mammal Commission has expressed concern about the DEIS’ lack of accuracy and transparency, and the difficulty that poses for alternatives analysis: “Given that neither the Commission nor the public can review meaningfully the impact assessment, judge the appropriateness of the various alternatives, or decipher how BOEM intends to interpret takes, suggesting a Preferred Alternative is completely impractical. “For this reason among others, the Commission recommends that BOEM adopt all of the DEIS’ mitigation alternatives, including area closures, activity reduction, and shut-down provisions, as “a more appropriate approach for BOEM to take.” Regardless, BOEM should improve its analysis.</p>	<p>BOEM has made revisions within this Programmatic EIS to make the comparison of impacts from each alternatives easier.</p> <p>This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS will also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>Thank you for your recommendation; however, this Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD.</p>
1074-0034	<p>BOEM dismisses a technology-based alternative from consideration on the grounds that noise-quieting technologies, at least at their current rate of development, will not completely supplant existing airgun technology within the ten-year scope of the DEIS (DEIS at 2-26). But this is a strawman rationale that ignores both the state of noise-quieting in the industry and the availability of reasonable alternatives that motivate development.</p> <p>Quieting technologies are among the most promising means of mitigating ocean noise, with potentially significant long-term reductions in cumulative exposures and impacts on marine species. Industry experts and biologists participating in a September 2009 workshop reached the following conclusions: that airguns produce a great deal of “waste” sound and generate peak levels substantially higher than needed for offshore exploration; that a number of quieting technologies were technically feasible and could be made available for commercial use within a few years; and that governments should accelerate development and use of these technologies through both research and development funding and regulatory engagement.⁵⁰ A 2007 report by Noise Control Engineering reached similar conclusions,⁵¹ and, in 2013, BOEM hosted an international workshop focused in substantial part on seismic as a target for mitigation.</p>	<p>Appendix F, Section 3 evaluates emerging technologies, and Chapter 2.11.2 discusses alternatives considered but not carried forward with respect to alternative technology. BOEM has determined that alternative technologies are in various stages of development and that none of the systems with the potential to replace airguns as a seismic source are currently commercially available for use on a scale of activity considered in the proposed action scenario described in Chapter 3. Although some alternative technologies are available now or will be in the next several years for select uses, none are, or are anticipated to be in the next 10 years, at a stage where they can replace airgun arrays outright; however, some may be used in select environments when commercially available. This alternative would not provide the oil and gas industry or the government with sufficiently accurate data on the location, extent, and properties of hydrocarbon resources or the character of formation fluids or gases, as well as information on shallow geologic hazards and seafloor geotechnical properties, in order to explore, develop, produce, and transport hydrocarbons safely and economically. As this alternative does not meet the stated purpose and need, and cannot be analyzed on a programmatic scale at this stage, it has not been carried forward for detailed environmental impact analysis in this Programmatic EIS. Should these technologies become commercially available, BOEM can evaluate them in the future as a standalone, site-specific request or in a supplemental programmatic document. BOEM will consider future data on new technologies to adjust mitigation requirements for individual surveys based on the best available information at that time (Chapter 1.2.3.5).</p>
1074-0035	<p>As BOEM is well aware, a number of new technologies are now commercially available or on the horizon of commercial availability—well within the ten-year timeframe encompassed by the DEIS. Most immediately, a new type of modified airgun,</p>	<p>Appendix F, Section 3 evaluates emerging technologies, and Chapter 2.11.2 discusses alternatives considered but not carried forward with respect to alternative technology. BOEM has determined that alternative technologies are in various</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>known as the eSource (the “e” standing for “environment”), is now part of Teledyne Bolt’s product line and is commercially available to the seismic industry.⁵³ According to the company, the eSource reduces noise output by 15 dB (SPL) or more in frequencies above 80–120 Hz.⁵⁴ Given that the vast majority of Gulf marine mammal populations are odontocetes, this reduction in source level above the useful energy band would be likely to significantly reduce the area in which auditory and behavioral impacts would occur, substantially reducing BOEM’s take estimates for any survey that uses the eSource.</p> <p>Perhaps the best known quieting alternative to airguns is marine vibroseis, a vibratory source that could, by spreading the acoustic energy embedded in a short airgun pulse over several seconds, significantly reduce effective source levels and all but eliminate acoustic output above 100 Hz, which, again, is waste energy for geophysical exploration. A Geo-Kinetics system known as AquaVib was field-tested in the Gulf of Mexico last year for shallow-water application, with the intention of making it available for commercial deployment in 2016.⁵⁵ Three other vibroseis systems are in Joint Industry Program development under the terms of the NRDC v. Jewell settlement agreement, with field tests to be conducted on at least one device and final results submitted for publication by mid-2017.⁵⁶ The environmental superiority of such systems is indicated in a forthcoming technical paper from Curtin University modelers, funded by the International Fund for Animal Welfare: it reports general reductions in both SPL and SEL exposures from an experimental vibroseis system, as compared with a similarly sized airgun array, across several operational scenarios. Other quieting technology in some stage of development includes BP’s “staggered-fire” (or “popcorn”) method of seismic acquisition, which is theoretically compatible with both conventional and modified airguns and could reduce amplitudes by as much as 20 dB.⁵⁷</p> <p>It is not at all self-evident, as BOEM seems to believe (DEIS at 2-26), that none of these technologies are “currently, or will be</p>	<p>stages of development and that none of the systems with the potential to replace airguns as a seismic source are currently financially viable for use on a scale of activity considered in the proposed action scenario described in Chapter 3 without imposing a significant financial burden on industry. Although some alternative technologies are available now or will be in the next several years for select uses, from a practical perspective, none are, at a stage where they can replace airgun arrays outright. Should these technologies become commercially viable, BOEM can evaluate them in the future as a standalone, site-specific request or in a supplemental programmatic document. BOEM will consider future data on new technologies to adjust mitigation requirements for individual surveys based on the best available information at that time (Chapter 1.2.3.5).</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>in the next 10 years, at a stage where they can replace airgun arrays outright.” Indeed, the eSource airgun already appears to be at a stage where it can replace conventional airguns, potentially across all or most of the northern Gulf, and the DEIS provides no analysis to the contrary.</p>	
1074-0036	<p>BOEM’s consideration of a technology-based alternative amounts to conceiving the most extreme variant of such an alternative—the immediate proscription of conventional airguns in all parts of the northern Gulf—and then rejecting it. This approach fails to meet NEPA’s mandate to consider “[r]igorously explore and objectively evaluate all reasonable alternatives.” 40 C.F.R. § 1502.14(a).</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA authorization of the incidental of marine mammals under the MMPA for these activities.</p> <p>BOEM is engaged in the development of new technologies through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/). BOEM determined that alternative technologies currently are not commercially available for use on a scale of activity considered in the proposed action scenario described in Chapter 3. Should these technologies become commercially available, BOEM can evaluate them in the future as a standalone, site-specific request or in a supplemental programmatic document. BOEM will consider future data on new technologies to adjust mitigation requirements for individual surveys based on the best available information at that time (Chapter 1.2.3.5).</p>
1074-0037	<p>Other approaches include establishing a future noise output standard only in portions of the northern Gulf, such as those with high habitat value for protected species; deferring the permitting of surveys in particular areas where effective mitigative technologies could reasonably be expected to become available within the life of the EIS; and strongly incentivizing the use of alternative technologies. Our organizations and others have repeatedly called for careful</p>	<p>BOEM is engaged in the development of new technologies through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/). BOEM determined that alternative technologies currently are not commercially available for use on a scale of activity considered in the proposed action scenario described in Chapter 3. Should these technologies become commercially available, BOEM can evaluate them in the future as a</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>consideration of these and other approaches to noise-quieting.⁶² None are considered in the DEIS.</p> <p>Quieting alternatives have the potential to significantly reduce impacts on acoustic habitat and marine wildlife populations. That is true not only of large-scale chronic effects, which is why their development is considered a priority within NOAA’s new Ocean Noise Strategy, but even of near-source auditory injury, with a recent study concluding that a seismic source-level reduction of 3 dB (broadband RMS) would be more effective under most operating conditions at mitigating such harm than would a monitoring-based safety zone requirement.⁶³ BOEM’s abdication in this DEIS from any serious consideration of a noise-quieting alternative is beyond disappointing. It is also arbitrary and capricious and must be reconsidered.</p>	<p>standalone, site-specific request or in a supplemental programmatic document. BOEM will consider future data on new technologies to adjust mitigation requirements for individual surveys based on the best available information at that time (Chapter 1.2.3.5).</p>
1074-0039	<p>The DEIS states that authorizations “would include guidance for implementing... best management practices” where nodes and cables are used, including, for example, “shortening the acoustic buoy line and tethered acoustic pinger line to the shortest length practical using only a single line rather than a loop,” and “replacing the line with wire, clasps, or shackles to connect directly to the OBN [ocean bottom nodes]” (DEIS at 4-74). We appreciate these efforts to prevent entanglement and ask BOEM to consider the following issues:</p> <p>(1) BOEM’s characterization of its intended action, to provide “guidance [in relevant authorizations] for implementing... best management practices” on entanglement risk (DEIS at 4-74), leaves some question about the regulatory status of the measures it has proposed. The DEIS does not include entanglement-prevention measures among its mitigation alternatives. See DEIS at 2-1 et seq. Will permittees be required to achieve “best practice” in this area as a condition of operation? Which agency, BOEM, NMFS, or both, will require implementation as part of its “authorizations” (DEIS at 4-74)?</p> <p>(2) Relatedly, the DEIS does not indicate who will evaluate whether companies are indeed implementing best management</p>	<p>The G&G permit applicants are required to list equipment and methods to be used during surveys. Each permit application is evaluated by BOEM and NMFS, and considerations are made for best practices and for minimizing entanglement risk. This evaluation will continue to be conducted by BOEM during the G&G permit review process. This Programmatic EIS does not include general entanglement prevention measures because of the extremely low risk and because the measures will be project-specific and therefore evaluated on a case-by-case basis so that BOEM can require specific entanglement-reduction measures appropriate for the survey to be issued within the permit. By doing so, BSEE’s enforcement process would be the same for entanglement reduction measures as it would be for any other permit requirement. BOEM will consider the addition of less flexible cable for the list of best practices measures.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>practices in this area. BOEM's use of the term "guidance" (id.) suggests that the agencies may be non-prescriptive with respect to at least some of these practices, even if achieving best practice is mandatory. Will the Bureau of Safety and Environmental Enforcement monitor what actions companies take under this requirement? How will it evaluate whether companies are indeed achieving best practice, and how will it respond to companies that do not comply?</p> <p>(3) As noted, the DEIS lists a number of useful measures among its "best management practices" (id.); however, those practices do not include the use of thicker, less flexible cable in nodal surveys. Why is that measure, which might have prevented the Fairfield Nodal mortality, not included?</p>	
1074-0041	<p>The DEIS rejects requiring seismic applicants to obtain MMPA authorization from NMFS before receiving a BOEM permit, apparently on the grounds (1) that BOEM cannot require activities it doesn't permit to obtain MMPA authorization; and (2), with respect to the activities it does permit, that the EIS will already provide the requisite environmental analysis and already includes the mitigation measures "likely to be considered and applied through... MMPA authorizations." DEIS at 2-26 to 2-27. We do not quarrel with (1). With respect to activities that fall under BOEM's jurisdiction, however—activities that make up the vast majority of those covered under the EIS—BOEM's analysis is mistaken.</p> <p>First, as noted above at § II.B, the alternatives and mitigation measures presented in the DEIS do not reflect the MMPA's authorization standards; nor, relatedly, does the DEIS' impact assessment reflect those standards. Without substantial modification then, the EIS will not represent NMFS' analysis under the MMPA, or the analysis it must complete under NEPA pursuant to authorizing take under the MMPA, and therefore cannot be adopted by NMFS in fulfillment of either responsibility. Even if those modifications are made, a programmatic EIS cannot stand in for the project specific analysis required of NMFS in the MMPA authorization process.</p>	<p>Chapter 1 explains how this Programmatic EIS will be used to tier subsequent NEPA analysis under the OCSLA and how it will support NOAA regarding MMPA authorizations (Chapters 1.2.2 and 1.4).</p> <p>This Programmatic EIS establishes a framework for subsequent NEPA analyses of site-specific actions and also identifies and analyzes potential mitigation measures for use in future G&G activities on the Gulf of Mexico OCS involving BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>In conjunction with this Programmatic EIS, the MMPA petition was submitted to NOAA, requesting the issuance of regulations governing the authorization of incidental take of marine mammals in the GOM under Section 101(a)(5) of the MMPA on behalf of oil and gas and geophysical companies for geophysical-permitted (authorized) and ancillary activities. The G&G surveys conducted in support of marine mineral beach nourishment or coastal restoration projects under a non-competitive lease and renewable energy projects would</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Second, requiring MMPA authorization as a condition of permit is a valuable safeguard for ensuring industry compliance with the law. This is particularly true since NMFS itself does not preventively enforce the MMPA’s prohibition on take, and the Act’s post hoc penalties cannot be said to have any deterrence factor since the industry has operated for years in the Gulf without obtaining any authorizations under that statute. Third, MMPA authorization process has long been used by NMFS for adaptive management, which would not be possible if companies do not seek authorization under the Act. And fourth, we believe that BOEM’s decision not to require MMPA authorization as a condition of permit represents an abandonment of agency practice as it has proceeded in other planning regions, including the Beaufort and Chukchi Seas and the Atlantic.</p> <p>We certainly do not suggest that requiring MMPA approval can substitute for BOEM’s independent environmental responsibilities under OCSLA and NEPA. But, as explained above, maintaining such an elementary requirement has value, and BOEM has offered no viable argument to the contrary, at least for deep-penetration seismic surveys falling within its jurisdiction. The requirement should be part of any alternative considered in this EIS.</p>	<p>separately comply with the ESA, MMPA, and other relevant laws, regulations, and EOs as deemed appropriate by all agencies on a project-by-project basis.</p> <p>The NOAA intends to use this Programmatic EIS as the NEPA documentation associated with the issuance of ITAs and the rule-making process under the MMPA, as well as the Section 7 Consultation process under the ESA for the incidental taking of marine mammals and ESA-listed species during G&G survey activities. Additional information regarding these agencies, roles, and regulations is provided in Chapter 6 and Appendix B.</p> <p>The NOAA is a cooperating agency for this Programmatic EIS, and BOEM will continue to work closely with NOAA to include its input to this Final Programmatic EIS to ensure that this document meets NOAA’s needs.</p>
1074-0042	<p>Given the multiple potential benefits of employing thermal detection as a mitigation tool, the agencies should analyze its application as a supplement to visual monitoring.</p>	<p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p> <p>BOEM is engaged in the development of emerging technologies through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/).</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM's Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment. Currently active studies addressing this broad range of topics can be found at http://www.boem.gov/GMStudies/. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1074-0043	<p>To further reduce undersea noise, BOEM should consider requiring that all vessels used in oil and gas G&G activities undergo regular maintenance to minimize propeller cavitation, which is the primary contributor to underwater ship noise; and that all new industry vessels be required to employ the best ship-quieting designs and technologies available for their class of ship.⁷¹ The agency should also consider requiring those vessels to undergo measurement for their underwater noise output, optimally though not necessarily per American National Standards Institute/Acoustical Society of America standards (S12.64), sufficient to identify the loudest vessels for quieting purposes.</p>	<p>BOEM appreciates the comment, but the suggested requirements are outside of BOEM's jurisdiction.</p>
1074-0044	<p>The agencies should therefore consider requiring that all vessels associated with G&G activities, including support vessels, avoid known Bryde's whale habitat, as defined by the Eastern Planning Area Closure Area, to the greatest extent possible; to otherwise plan their crossings of the area to minimize transit distance; and to adhere to a 10-knot speed limit when transiting the area. This measure is easily practicable for seismic vessels, which proceed at a nominal 4.5 knots when operating and at generally slow speeds (below</p>	<p>BOEM appreciates the comment, but the suggested requirements are outside of BOEM's jurisdiction.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>13-14 knots) when transiting, and should be practicable for most support vessel transits given the relatively narrow strip (roughly 30 to 45 nm) encompassed by the area.</p>	
<p>1074-0045</p>	<p>The DEIS does not, apparently, consider protective measures for non-marine mammal taxa, such as sea turtles and fish. Certainly some of the mitigation measures set forth in the Alternatives would have ancillary benefits for these other taxa, as, for example, any overall reduction in permitted survey effort (Alternative F) will benefit all marine species in the Gulf. But the DEIS does not explicitly consider any measures specifically designed for sea turtles, fish, or invertebrates, nor does it analyze the effects, if any, on these species of the alternatives it has identified. Given the importance of Gulf habitat for several endangered sea turtle and fish species, it should have done so as part of setting forth a full range of reasonable alternatives.</p>	<p>Thank you for your comment. BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, MMPA, and ESA) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM. Chapter 2 outlines the alternatives and mitigation measures to the proposed action. Mitigation measures common to all alternatives considered in this Programmatic EIS (Chapter 2.2) that afford protective measures for non-marine mammal taxa include the following:</p> <ul style="list-style-type: none"> • “Guidance for Vessel Strike Avoidance and Injured/Dead Protected Species Reporting” (NTL 2016-BOEM-G01), which requires vigilant watch for marine mammals and sea turtles, specifies vessel speeds and required distance for vessels to keep away from marine mammals and sea turtles, and reporting requirements; • “Guidance for Marine Trash and Debris Awareness And Elimination” (NTL 2015-BSEE-G03), which provides information on the marine trash and debris awareness training video and slideshow, as well as reporting requirements (expires on November 30, 2018); • “Guidance for Avoidance of Biologically Sensitive Underwater Features and Areas” (NTL 2009-G39), which establishes protection zones around the core of the Pinnacle Trend feature and prohibits any contact with the seafloor; • “Guidance for Avoidance of Deepwater Benthic Communities” (NTL 2009-G40), which provides protective measures for protecting high-density

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>deepwater benthic communities by requiring set-back distance for seafloor-disturbing activities;</p> <ul style="list-style-type: none"> • “Guidance for Archaeological Resource Surveys and Reports” (NTL 2005-G07), which provides archaeological survey and reporting requirements; • “Guidance for Shallow Hazards Program” (Section VI.B of NTL 2008-G05), which provides requirements for shallow hazards surveys and reporting for seafloor-disturbing activities; • “Guidance for Activities in or Near National Marine Sanctuaries” (NMSs) (15 CFR part 922), which provides a listing of prohibited or otherwise regulated activities for NMSs; and • “Guidance for Activities in or Near Military Warning and Water Test Areas” (NTL 2014-BOEM-G04), which provides contact information for required coordination for activities within military warning areas. <p>The measures listed above provide protection for marine mammals and sea turtles; all marine species; biologically sensitive underwater features such as corals, pinnacles, and topographic features; deepwater benthic communities such as corals and chemosynthetic communities; archaeological resources; seafloor habitats; national marine sanctuaries and the resources contained within them; and other marine use areas; respectively. Additional mitigation measures are listed in Chapter 2.2 and Appendix B, Section 1. Mitigation measures specific to each alternative are provided in Chapters 2.3 through 2.9. New mitigation measures outlined in the alternatives were designed to further minimize the potential for injury to marine mammals and sea turtles, to avoid most potential for Level A harassment of marine mammals, and to provide additional protection for marine</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>mammals (as a whole or targeted groups or species).</p> <p>The elements of these measures are continually evolving, and those included in this Programmatic EIS represent current standards. Through the Adaptive Management process, mitigation requirements could be revised or new protocols developed if new information indicates that the proposed mitigation measures are infeasible or could be made more effective or if measures are identified for additional species (Chapter 1.2.3.4) of this Programmatic EIS. Additionally, BOEM will consult with other agencies such as NOAA and FWS on EFH and ESA, respectively, to determine if additional mitigation measures are warranted.</p> <p>Chapters 4.2 through 4.13 of this Programmatic EIS provides an impact analysis by resource for each alternative considered and that analysis considers the effect of mitigation measures in determining the impact rating.</p>
1074-0046	<p>Under all the alternatives the DEIS has set forth, the proposed activities would still result in millions of instances of marine mammal take, and would still degrade acoustic habitat through much of the northern Gulf of Mexico. Yet the DEIS does not propose mitigation to compensate for the harm that remains. Compensatory mitigation is a concept that is routinely employed in implementation of the Endangered Species Act, Clean Water Act, and other environmental statutes; it is also included, along with avoidance and minimization, as one of three “federal principles for mitigation” that agencies are directed to apply, in the 2015 Presidential Memorandum on Mitigating Impacts on Natural Resources from Development.⁷⁶ The EIS should consider mitigation—e.g., a restoration of the Gulf’s acoustic habitat—to compensate for the harm the agencies cannot prevent.</p>	<p>As summarized in Appendix B, the mitigation in the proposed action is extensive and includes avoidance (e.g., time-area closures, guidance for vessel strike avoidance, and avoidance of sensitive seafloor resources) and impact minimization (e.g., Seismic Airgun Survey Protocol and HRG Survey Protocol). Compensatory mitigation typically is the lowest priority in the mitigation hierarchy. This Programmatic EIS does not include any compensatory (offset) mitigation measures, and there is no NEPA requirement to do so. However, each individual survey will be subject to a NEPA analysis that evaluates impacts on a site- and project-specific basis, which would be the appropriate place to consider the full hierarchy of mitigation actions avoidance, minimization, and possibly compensatory mitigation, as necessary.</p>
1074-0047	<p>In setting its mitigation protocol for non-airgun high-resolution geophysical (“HRG”) surveys (DEIS at 2-12, B-21 to B-23), the DEIS does not consider any alternatives, other than, implicitly, whether or not such a protocol should be required at all....But this approach ignores recent developments in both impact</p>	<p>Mitigation measures for powerful lower-frequency MBESs are included in Alternatives C through F, depending on the operating frequencies of the non-airgun HRG surveys (refer to Appendix B, Section 1.3.1).</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>analysis and mitigation of HRG surveys and thus fails to analyze a reasonable range of mitigative alternatives.</p> <p>First, the DEIS fails to consider additional mitigation aimed at mitigating impacts from nonairgun sources, including but not necessarily limited to certain specialized multibeam echosounders, that the best available science indicates may cause large-scale behavioral disruption in some marine mammal species. As described further below at § III.G.1, the Kongsberg Simrad EM120 multibeam echosounder was determined to be the “most plausible and likely behavioral trigger” for a mass stranding and mortality of melonheaded whales, during an Exxon exploration survey in 2008.⁷⁷</p>	<p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate impacts. BOEM is involved in several ongoing programs to improve existing data for marine mammals and underwater noise, and future analyses will use the best data available at that time. BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis.</p>
<p>1074-0047 (continued)</p>	<p>The acoustic characteristics of that system, which has an output carrier frequency of 12 kHz and a source level of 236-242 dB (RMS), are not dissimilar to those of some naval mid-frequency sonar systems; and, according to an expert report on the strandings, the signals it produces could easily propagate at levels above 120 decibels over a greater than 30 km radius, notwithstanding the system’s downward orientation. BOEM must consider additional mitigation for such devices, including but not limited to area closures and required employment of less powerful systems except in discrete areas where water depth and other factors necessitates their use.</p> <p>Second, the DEIS fails to consider mitigation measures contained within recent private agreements on HRG surveys in the Atlantic. As BOEM is aware, a number of major offshore wind developers entered into agreements with environmental NGOs, including several signatories to the present comment letter, to undertake additional mitigation and monitoring during high-resolution geophysical surveys (and during meteorological tower installation as well) as part of their development of the Rhode Island/ Massachusetts Wind Energy Area and the mid-Atlantic Wind Energy Areas running from New York to Virginia;⁷⁸ and several other developers who are not signatories to these agreements have engaged in mitigation consistent with them. Additional requirements include a time-area closure</p>	<p>BOEM’s Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation’s marine and coastal environment. Currently active studies addressing this broad range of topics can be found at http://www.boem.gov/GMStudies/. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>requirement; a vessel speed restriction for all ships involved in the activity regardless of vessel length, including supply ships transiting to the survey site; and sound source validation and extended safety zone and monitoring requirements for sub-bottom profiling. NMFS' Office of Protected Resources has reviewed the measures for the mid-Atlantic agreement and acknowledged their reasonableness.⁷⁹ In the Atlantic, these terms were primarily intended to reduce risk to endangered right whales by barring activity throughout their peak occurrence periods, reducing co-occurrence with the species, and by setting additional requirements during other months. A similar approach might be taken in the Gulf with Bryde's whales, coastal bottlenose dolphins, and sperm whales—yet, as for now, the only area restriction for HRG surveys (implicitly) considered in the DEIS is the seasonal exclusion for bottlenose dolphins.</p> <p>Third, the DEIS does not consider relevant methods prescribed by the government of California. In 2013, the California State Lands Commission revised its general permit program for “lowenergy” geophysical surveys to substantially increase mitigation and monitoring requirements to protect marine wildlife and to require additional environmental review and, potentially, mitigation for certain sources.⁸⁰ These mitigation measures include a bar on nighttime operations, except in the case of single-beam echosounders under particular circumstances; use of the highest frequency band and fewest pulse rates to the maximum extent practicable; exclusion of activity and other mitigation around pinniped haul-out sites; and soft-start before the commencement of each day's activity and after any mitigative shutdowns. BOEM must consider these measures as well.</p>	
1074-0068	<p>Regardless, it is clear that high-power, lower-frequency echosounders and other sonar systems have the potential to impact marine mammal behavior, especially of odontocetes, over a wide spatial scale—and to a far greater extent than has previously been supposed for this category of sound source.¹²⁴ To address these impacts, BOEM must expand its</p>	<p>Mitigation measures for powerful lower-frequency MBESs are included in Alternatives C through F, depending on the operating frequencies of the non-airgun HRG surveys (Appendix B, Section 1.3.1).</p> <p>BOEM and NOAA developed the alternatives in this</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>consideration of alternatives and mitigation to include, for example, outright restrictions on the use of these systems, particularly in areas close to shore; time-area closures; and improvements in safety zone monitoring. (See § II.I above.)</p>	<p>Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM's Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment. Currently active studies addressing this broad range of topics can be found at http://www.boem.gov/GMStudies/. BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1075-0003	<p>BOEM's environmental analysis should accurately reflect the best available science and research and consider the industry's operational experience, which indicates that seismic surveys have little-to-no impact on marine mammal and wildlife populations. Neither the G/G industry's operational experience nor the best available science justifies the precautionary approach BOEM has proposed in some of the alternatives considered in the EIS.</p>	<p>BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating impacts. BOEM is involved in several ongoing programs to improve existing data for marine mammals and underwater noise, and future site-specific NEPA analyses will use the best data available at that time.</p> <p>Studies have shown that marine mammals react to underwater</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p>
1075-0004	<p>The geophysical industry implements many mitigation measures as standard business practice, including marine mammal observers (MMOs), passive acoustic monitoring (PAM), soft startups, and exclusion zones — all in an effort to avoid any potential impacts on marine mammals. As BOEM moves through the PETS process, including consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), Barry Graham Oil Service, [IC encourages an adherence to scientifically valid mitigation measures, while recognizing the favorable track record of the geophysical industry in the GOM. Mitigation measures for the sake of 'precaution' are based on unsubstantiated claims from anti-energy development interests and have no backing in U.S. statute or regulation.</p>	<p>Through the adaptive management of the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p> <p>Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM's Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation's marine and coastal environment. Currently active studies addressing this broad range of topics are listed at http://www.boem.gov/GMStudies/.</p> <p>Effective September 30, 2016, BOEM implemented NTL 2016-BOEM-G02 to address the implementation of seismic survey mitigation measures and the PSO Program. This NTL outlines the various requirements of operators. While the NTL does</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>not introduce any new types of mitigation measures, it clarifies how seismic survey mitigation measures should be implemented, including ramp-up procedures, the use of a minimum sound source, airgun testing, and protected species observation and reporting. The NTL also updates regulatory citations in addition to addressing and clarifying how measures identified in the NTL will be implemented to assist BOEM, BSEE, and operators in complying with the ESA and MMPA. Mitigation measures associated with seismic survey operations have been implemented via this NTL to reduce the potential for significant impacts to protected species. While these mitigation requirements are considered common-sense measures, with a growing body of supporting scientific evidence (e.g., reductions in marine mammal vocalization for several species during acoustic exposure), the efficacy and scientific merit of these measures is being evaluated and will continue to be evaluated, as noted previously.</p>
1075-0005	<p>The various measures included in Alternatives B-G threaten the operational and economic viability of G/G activities in the GOM, which will lead to fewer wells being drilled, diminish future production and cause negative economic impacts throughout the Gulf region.</p>	<p>Chapter 4.13 provides an analysis of the economic impacts from each alternative and includes tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. BOEM, through consultation with industry representatives, has tried to base the reductions on an attempt to balance environmental impacts with economic impacts to achieve the proposed action's purpose and need. This information was considered by BOEM when determining the Preferred Alternative.</p> <p>The CEQ regulation at 40 CFR § 1502.14(d) specifies that NEPA analyses require the alternatives analysis in the EIS to "include the alternative of no action." This analysis provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives. It is also an example of a reasonable alternative outside the jurisdiction of the agency, which must be analyzed (CEQ regulation at 40 CFR § 1502.14(c)). Inclusion of such an</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>analysis in the EIS is necessary to inform Congress, the public, and the President as intended by NEPA (CEQ regulation at 40 CFR § 1500.1(a).</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p>
1075-0009	<p>Continuing to conduct geophysical surveys in the GOM will produce known discoveries safely and more efficiently and will help uncover new sources of oil and natural gas. This data will allow people to make informed decisions about the potential for continued job creation and economic growth from offshore energy production in the Gulf.</p> <p>A sensible energy policy that helps ensure access to affordable, reliable domestic energy for years to come must include the ability to effectively and efficiently explore the Gulf’s offshore resources. To ensure our long-term energy, economic, and national security, geophysical and seismic exploration must continue</p> <p>For the reasons stated above, Alternative A is the only alternative that may be consistent with the best available science, operational feasibility, and applicable law. Barry Graham Oil Service, LLC strongly objects to any of the other Alternatives presented in the DPEIS for all of the reasons stated above and particularly because BOEM reaches the same effects conclusions for Alternative A as it does for all of the other Alternatives (except Alternative G). Before the DPEIS is issued as a final PEIS, many flaws must be addressed and</p>	<p>Chapter 4.13 provides an analysis of the economic impacts from each alternative and includes tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. This information was considered by BOEM when determining the Preferred Alternative.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	corrected.	
1076-0011	In addition, many of the mitigation measures recommended in certain alternatives presented in the DPEIS are economically and operationally infeasible, will impose serious burdens on industry, and are highly unlikely to result in benefits to protected species.	Chapter 4.13 provides an analysis of the economic impacts from each alternative and includes tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. BOEM, through consultation with industry representatives, has tried to base the reductions on an attempt to balance environmental impacts with economic impacts to achieve the proposed action's purpose and need.
1076-0014	The Associations find Alternative A to be the most reasonable because it presents the option that is most consistent with the best available science, operational feasibility, and applicable law. We strongly object to Alternatives B-G, for the reasons stated below.	All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.
1076-0017	...some of the alternatives undermine OCSLA's mandates by imposing measures that will render important current and future exploration and development activities economically or operationally infeasible	BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. In addition, Chapter 4.13 provides an analysis of the economic impacts from each alternative and includes tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F.
1076-0044	The unwarranted and arbitrary mitigation measures are addressed in detail below. Without question, these measures, if implemented, will have substantial adverse effects on	Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>offshore geophysical operations and substantial economic impacts. These measures will also result in increased survey duration, which, in turn, can increase the potential exposure of marine mammals to sound from seismic surveys and the potential for interference with other users of the GOM.¹⁹</p>	<p>efficiency per survey for Alternatives B through F.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p>
<p>1076-0045</p>	<p>The Settlement Agreement restricts operation of airguns within federal coastal waters shoreward of the²⁰ meter isobath from March 1 to April 30, and the stipulation to extend the Settlement Agreement extended the closure from January 1 to April 30 to a smaller area within the unusual mortality event (“UME”) (Texas/Louisiana border to Franklin County, Florida).²¹ It is unclear to us how BOEM derived the four-month February 1 to May 31 restriction used in Alternatives C-F and why it has proposed to include all nearshore coastal waters. No explanation is provided in the DPEIS.²²</p>	<p>Rationale for each alternative is provided in Chapter 2; specifically, the rationale for the expanded restriction is provided in Chapter 2.13. The seasonal restriction in coastal waters was designed to protect the coastal and estuarine stocks of the common bottlenose dolphin during their peak reproductive activity by reducing active acoustic sound sources from airguns and to provide protection for loggerhead sea turtles during a portion of their mating and nesting/inter-nesting season. Extending the closure period adds protection for dolphins and sea turtles during critical time periods.</p>
<p>1076-0046</p>	<p>...the rationale originally offered by the plaintiff parties to the Settlement Agreement for the nearshore restriction was in response to coastal bottlenose strandings and mortalities (i.e., the Northern GOM UME). However, the UME has since been closed. Moreover, none of the strandings or deaths in the UME have been attributed to deep penetration seismic survey activities. Instead, recent research demonstrates that seismic impulses at even higher thresholds fail to induce even temporary threshold shifts (“TTS”) in dolphin hearing (Finneran., et al. 2015). Accordingly, no relevant scientific evidence supports a further restriction of deep penetration seismic surveys, let alone suggests that such a restriction would result in any meaningful benefit to coastal bottlenose dolphin populations.²³</p>	<p>As part of the Settlement Agreement (Chapter 1.2.3), BOEM is required to analyze these mitigation measures as potential COAs for permit applications for deep-penetration seismic surveys in this Programmatic EIS.</p> <p>While none of the strandings or deaths in the UME have been attributed to deep-penetration seismic survey activities, the event indicates that stocks in the area are stressed, and studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur. This closure provides additional protection to these stocks during their peak reproductive activity.</p>
1076-0047	<p>...another rationale for the nearshore restriction was that seismic activity is an additional stressor to an already stressed bottlenose dolphin population in the UME, and that such additional stress may impact dolphin breeding rates. However, there is no evidence that sound from deep penetration seismic surveys is a stressor to coastal bottlenose dolphin populations or contributes in any way to dolphin late-term pregnancy complications or perinatal and postnatal responses that would lead to increased calf mortality, or UMEs (Litz et al. 2014; Venn-Watson et al. 2015).</p>	<p>As part of the Settlement Agreement (Chapter 1.2.3), BOEM is required to analyze these mitigation measures as potential COAs for permit applications for deep-penetration seismic surveys in this Programmatic EIS.</p> <p>Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur. Captive bottlenose dolphins have shown increased stress hormones in response to seismic water gun noise (Romano et al., 2004).</p>
1076-0048	<p>There are unleased blocks within the area covered by the seasonal restriction stated for Alternatives B-F. Because existing seismic data in these areas is outdated and inadequate to inform decisions regarding future lease sales, such a restriction would significantly impede industry's and BOEM's evaluation of blocks for planned future lease sales. Moreover, given the amount of time required to acquire additional seismic data, any extension of the existing seasonal exclusion period significantly increases the likelihood that an affected deep penetration seismic survey cannot be completed within its one-year permit term, thereby increasing the overall number of surveys that will need to be conducted.²⁴</p>	<p>BOEM understands that some of the alternatives would impact industry's evaluation of lease blocks. This Programmatic EIS evaluates the impacts to industry and the economy in Chapter 4.13. In addition, the 2017-2022 GOM Multisale EIS provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities, which is referenced in Chapter 4.13.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities. BOEM believes that it has followed the regulatory standards for developing NEPA alternatives, which included to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources” (Section 102 [42 U.S.C. § 4332]). The construction of alternatives followed the simple premise that, in order to be a valid alternative, it must fulfill the purpose and need for the proposed action and be economically feasible and technically viable. The range of alternatives was developed based on the underlying purpose and need. Alternatives that did not meet the purpose and need were not carried forward for further analysis.</p> <p>Thank you for your comments. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1076-0049	<p>In Alternative E, BOEM proposes to reduce levels of deep-penetration, multi-client seismic activities by either 10% or 25%. This measure would be a “Gulfwide strategy designed to reduce overall exposures and sound levels,” the stated purpose of which is to “reduc[e] protected species cumulative sound exposures because a reduced number of surveys would be performed.” DPEIS at 2-47. The Associations object to these proposed reductions because there is no legal basis for imposing them and they are arbitrary.</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. Using expert opinion and best professional judgement, BOEM determined that 10 percent and 25 percent reductions offer a reasonable range of reduced activity levels while still allowing BOEM to fulfill the purpose of and need for this Programmatic EIS.</p> <p>This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. A proposed alternative is reasonable only if it fulfills the Programmatic EIS's purpose and need as described in Chapter 1.1.2. This Programmatic EIS will enable BOEM and NMFS to fulfill statutory responsibilities associated with permitting and authorizing G&G activities/the take of marine mammals in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS.</p> <p>All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1076-0051	<p>To the extent the proposed reductions are premised on the MMPA, they are also without any legal basis. Under the MMPA, NMFS has the authority to grant or deny, or to reasonably condition, marine mammal incidental take authorizations ("ITAs"). See <i>Ctr. for Biological Diversity v. Salazar</i>, 695 F.3d 893, 916 (9th Cir. 2012) (MMPA ITAs only authorize incidental take, not the underlying activity). Accordingly, any mitigation measures premised upon NMFS's MMPA authority may only address the proposed MMPA action i.e., authorization of incidental take, not the actual exploration activities.</p>	<p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. Federal actions informed by this Programmatic EIS will be made by each Federal agency with jurisdiction and legal authority for that action, including the potential imposition of any COAs or mitigations. Based on the analyses in this Programmatic EIS, BOEM and NOAA will separately announce their respective decisions and implement them as appropriate.</p>
1076-0052	<p>...the proposed reductions also present practical implementation problems. For example, one could perform a 3D survey with a 4,000 cubic inch array or a 2D survey with 10 km track spacing and have half or fewer the number of takes in the same number of track miles. In this example, would 50,000 track miles at half the exposure levels be translated into 25,000 track miles for purposes of calculating the remaining allocations</p>	<p>Additional text has been added to Chapter 2.7 to provide information about how BOEM could implement Alternative E.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>available? How will the reductions be fairly apportioned among the various applicants over the course of a year? Such questions are not addressed at all in the DPEIS, further highlighting the impracticability of the proposed measure.</p>	
<p>1076-0053</p>	<p>In Alternative B, BOEM recommends an expanded 40 km buffer zone between concurrent seismic surveys within the area of concern (“AOC”) and a 30 km buffer zone between concurrent seismic surveys outside of the AOC. No scientific evidence, published studies, or other rationales are provided for this proposed measure. Indeed, to our knowledge, no buffer zones even approaching this size have ever been required as a condition of offshore seismic authorizations.²⁵</p> <p>Moreover, buffer zones have little or no value in the GOM where directional migrations have not been documented and animals are likely to be moving in a variety of directions as they track dynamic features. Additionally, unless the vessels are moving parallel to each other at the same speed and direction, the static concept of a corridor is not applicable, with the space between vessels opening and closing depending on the relative speed of the vessels and their direction. Marine mammals are unlikely to perceive anything like a corridor when the two sound sources are moving dynamically. All that vessel separations achieve are to expose the animals to a more prolonged period of sound exposure than would otherwise be the case and expand the zone that animals might avoid.</p> <p>We therefore agree with BOEM’s statement that “it is doubtful that separation distances would provide the necessary benefits to offset potential impacts from sound exposure.” DPEIS at 2-39. Because there is no support for this proposed measure, it should be eliminated entirely from the DPEIS.</p>	<p>BOEM believes that the spatial separation between simultaneously operating surveys may be a feasible approach to limiting the exposure of animals to the highest sound levels from multiple seismic surveys.</p> <p>As part of the Settlement Agreement (Chapter 1.2.3), BOEM is required to analyze these mitigation measures as potential COAs for permit applications for deep-penetration seismic surveys in this Programmatic EIS, and, therefore, cannot eliminate this mitigation measure from evaluation.</p>
<p>1076-0054</p>	<p>All of the alternatives “use a standard exclusion zone radius of 500 m (1,640 ft) around a sound source.” DPEIS at 2-40. The DPEIS explains that exclusion zones “will be dependent upon the source levels, array configuration, operational parameters, and environmental and oceanographic conditions” and that the “actual extent of the acoustic isopleths around the sound</p>	<p>Seismic mitigation measures in the GOM for protected species first appeared in NTL 2002-G07 as a result of an ESA Biological Opinion from NMFS on Lease Sale 184 in 2002. The NTL modeled seismic mitigations after those implemented by the United Kingdom’s statutory conservation agency, the JNCC, which identified 500 m (1,640 ft) around an airgun array</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>source will depend on the source level, source configuration, water depth, bottom properties, and sound propagation through the immediate environment.” Id. BOEM’s suggested approach for exclusion zones will require a substantial modeling effort and will result in exclusion zones that are many times greater than those that have typically been implemented (with success) in the GOM. The expanded exclusion zones are especially concerning because they will ultimately be dictated by the marine mammal hearing group with the largest modeled radii once new group specific acoustic criteria are implemented.²⁶</p> <p>In addition, exclusion zones should be based on the best available information, and if that information demonstrates that exclusions zones of less than 500 meters are warranted, then there is no basis for arbitrarily requiring a minimum exclusion zone of 500 m (if the DPEIS intends for 500 m to be a minimum). If a minimum 500 m exclusion zone requirement is not applied, the Associations would support the incorporation of power-down procedures to mitigate any potential effects. Power-down procedures acceptable to the Associations are a modified version of the procedures described at 79 Fed. Reg. 14,780, 14,797 (Mar. 17, 2014) (“Langseth IHA”).²⁷</p>	<p>as the exclusion or mitigation zone. BOEM implemented this industry standard in lieu of requiring each operator to provide modeling and/or sound source verification for each source vessel. The IAGC has supported this 500-m (1,640-ft) industry standard exclusion zone in its 2015 “Recommended Mitigation Measures for Cetaceans during Geophysical Operations” (http://www.iagc.org/uploads/4/5/0/7/45074397/2015-02_iagc-mitigation_measures_for_cetaceans.pdf).</p> <p>All seismic airgun surveys in the GOM addressed in this Programmatic EIS require implementation of the Seismic Airgun Survey Protocol per NTL 2016-BOEM-G02 (Appendix B, Section 1.2.4 and Attachment 1), which specifies the use of a 500-m (1,640-ft) exclusion zone. An edit was made in Appendix B for clarification.</p>
1076-0055	<p>The DPEIS does not clearly explain whether shutdowns for dolphins are required and, if so, under what scenarios. In Chapter 2, the DPEIS appears to state that the “Expanded PSO Program” applicable to Alternatives B-F includes shutdown requirements for whales and manatees and that these requirements are further expanded in Alternative D to apply to all “marine mammals” except for bow-riding dolphins. However, Appendix B suggests that the Expanded PSO Program requires shutdowns for all “marine mammals” except that bow-riding dolphins are excluded from this requirement only for Alternative D. DPEIS Appx. B at B-23, B-24. We assume that Chapter 2 correctly describes BOEM’s intent and that none of the alternatives require shutdowns for dolphins.²⁸ However, to the extent BOEM does contemplate the application of shutdown requirements to dolphins, or to the extent commenters advocate for dolphin shutdown requirements, such measures</p>	<p>For Alternative D, shutdown is required for all marine mammals in the exclusion zone except bow-riding dolphins (i.e., bottlenose, Fraser’s, Clymene’s, rough-toothed, striped, spinner, Atlantic spotted, pantropical, and Risso’s dolphins).</p> <p>Clarifying text has been added to the Executive Summary, Chapters 2 and 4, and Appendix B to ensure consistency regarding when shutdowns are required.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0056	<p>have no support for the following reasons.</p> <p>...to the extent the DPEIS contemplates shutdowns for all marine mammals except dolphins approaching the vessel to bow-ride, implementation of such a measure is impractical. We are aware of no mitigation measures applicable to offshore exploration activities in which an observer is required to subjectively determine the intent of a marine mammal (i.e., the intent to bow-ride or to approach a vessel). Determining marine mammal intent from great distances is very difficult for experienced marine mammal biologists in controlled scientific experiments, let alone for observers who will be attempting to determine dolphin intent over vast distances in the ocean environment. Based on observation reports, PSOs will be unable to confidently assess animal behavior or “intentions” because they cannot accurately determine species within the expanded exclusion zone.³³ The result is that observers will likely, out of caution, call for shutdowns in almost all instances where dolphins are observed within the exclusion zone.</p> <p>In sum, any shutdown requirement applicable to dolphins in the GOM would broadly and substantially impact seismic operations without any corresponding environmental benefit and without any scientific support. The Associations respectfully request that BOEM clarify in its final PEIS that no such requirement is included in any of the alternatives.</p>	<p>BOEM agrees that the subjectivity of determining dolphin intent has great potential for error and likely depends on the PSO’s experience, educational background, and compliance training. BOEM also understands that acoustic detections have no way of determining behavior. However, BOEM believes that highly skilled, professional PSOs that meet the standards outlined in NOAA’s Technical Memorandum NMFS-OPR-49 (USDOC, NMFS, 2013), combined with PSO training on standardized behavior parameters, will adequately address the subjectivity of such assessments. BOEM believes that allowing professional PSOs some latitude in the assessment of dolphin behavior will reduce, not increase, the number of shutdowns due to dolphins.</p> <p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those included in this Programmatic EIS represent best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4.</p> <p>In addition, through the adaptive management of the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time.</p>
1076-0057	<p>Under Alternatives B-F, BOEM would require the use of Passive Acoustic Monitoring (“PAM”) as part of the Seismic Airgun Survey Protocol in certain circumstances. See DPEIS at 2-43. PAM is one of several monitoring techniques that offers a monitoring capability during periods of poor visibility or night conditions. PAM complements (rather than replaces) traditional visual monitoring. However, towed commercially available PAM systems can be highly variable and less robust than other</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>However, PAM has been used effectively as a mitigation tool in the GOM since 2012. BOEM will consider the value of PAM as a mitigation measure during future site-specific NEPA</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>in-sea integrated PAM capabilities/equipment. In addition, overall performance and capabilities of PAM are dependent on factors such as technical specification of equipment, operational setting, availability of experienced and trained personnel, and the species of marine mammals present in a given area. Mandatory use of PAM may substantially increase survey cost, require the placement of more personnel on vessels (i.e., four dedicated PAM observers onboard), and potentially increase entanglement risk due to more gear being towed in the water. The Associations therefore urge BOEM to make the use of PAM optional in all alternatives, as recommended in Alternative A.</p>	<p>analyses, along with any new information available at that time.</p> <p>Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F.</p> <p>The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. A proposed alternative is reasonable only if it will fulfill this Programmatic EIS's purpose and need as described in Chapter 1.1.2.</p>
1076-0058	<p>The DPEIS states that observer qualifications addressed in NOAA Technical Memorandum NMFS-OPR-49, National Standards for a Protected Species Observer and Data Management Program: A Model Using Geological and Geophysical Surveys (Nov. 2013) ("Observer Standards") "may be required for future activities." DPEIS, Appx. B at B-16. Although we appreciate the agencies' attempt to clarify and standardize observer guidelines and requirements, the Observer Standards are flawed in a number of respects. It is imperative that the agencies consider public input on the Observer Standards and make the revisions necessary to ensure that the standards are workable, accurate, and appropriate before they are required. The standards should encourage adaptive technology, remote monitoring, reduction of health, safety, and environmental risks, and use of an updated reporting form that provides substantive data from observations to inform the need (if any) for additional or revised mitigation measures. The letter by IAGC, API, and NOIA, dated May 2, 2014, addressing the Observer Standards more specifically states our concerns with the Observer Standards and offers constructive solutions. See Attachment D.</p>	<p>The NOAA issued the Observer Standards in 2013, and they remain the best available information to be utilized. Incorporation of public comments to these standards is outside of the scope of this Programmatic EIS.</p> <p>As part of the Settlement Agreement (Chapter 1.2.3), BOEM is required to analyze in any NEPA document (i.e., EIS or EA) for BOEM's petition for rulemaking under the MMPA, the development of a Monitoring Plan to address potential chronic and cumulative impacts from seismic surveys on marine mammal populations in the GOM. An adaptive monitoring plan ("Monitoring Plan") is currently under development as part of the petition to NOAA for ITRs for operators' G&G activities in the GOM (Chapter 1.2.3.4). This plan would allow for adaptive management of mitigation measures and would be implemented for the life of the MMPA rule.</p>
1076-0059	<p>With respect to potential measures regarding non-duplicative surveys and use of the lowest practicable source, the DPEIS states:</p>	<p>Thank you for your comment. Text in Chapter 2 has been updated to reflect the panel's findings, and the full reports can be found in Appendix L.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>The goal of these measures is to reduce the overall sound source levels in the AOI, which could be effective in achieving this goal. Overall reduction in sound input may have wide-scale benefits. As noted in Chapter 1, under the terms of the Settlement Agreement, BOEM convened two panels to determine the feasibility of including refined standards for these two requirements; however, the panels' work on these matters is still in process and was not available at the time the analysis for this Programmatic EIS was completed.</p> <p>DPEIS at 2-39. However, this characterization is incorrect because the panels' work on these two issues has concluded and this description is not consistent with the panels' findings. The DPEIS should be updated to reflect the panels' findings. Consistent with those findings, the Associations' position is that these measures would have no meaningful beneficial impact.</p>	
1076-0061	<p>"Where the action subject to NEPA review is triggered by a proposal or application from a private party, it is appropriate to give substantial weight to the goals and objectives of that private actor." Citizens' Committee to Save Our Canyons, 297 F.3d 1012, 1030 (10th Cir. 2002); see also, e.g., Sylvester v. U.S. Army Corps of Eng'rs, 882 F.2d 407, 409 (9th Cir. 1989) (explaining that agency has a duty to take into account objectives of applicant's project). An alternative considered in an EIS is not reasonable when it renders the applicant's proposed project "impractical," or not "technologically or economically feasible." Citizens' Committee to Save Our Canyons, 297 F.3d at 1031-32; see also Sylvester, 882 F.2d at 409 (explaining that the agency must consider whether alternative is "economically advantageous" to applicant's objective); Cape May Greene, Inc. v. Warren, 698 F.2d 179, 187 (3d Cir. 1993) (noting NEPA "requires a balancing between environmental costs and economic and technical benefits"). As demonstrated below, the various measures included in Alternatives B-G threaten the operational and economic viability of G&G activities in the GOM, which will lead to fewer wells being drilled and diminish future production.</p>	<p>Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F.</p> <p>The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. A proposed alternative is reasonable only if it will fulfill this Programmatic EIS's purpose and need as described in Chapter 1.1.2.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0063	<p>In Alternatives B-F, BOEM notes in multiple places³⁵ that any seismic survey not conducted because of operational inefficiencies, seasonal shutdown, survey restrictions, or area closures could be conducted at a later time or else the vessels would move to another area of the GOM. BOEM uses these assumptions as partial justification that economic impacts of the alternatives will be either minor (Alternative C) or minor to moderate (Alternatives B, D, E, F), yet these assumptions are flawed. The potential to have surveys done in future time periods, as stated in the analysis, does not reduce the negative socioeconomic impact of an alternative. With restrictions continually in place, surveys originally planned for Year 1 would just replace surveys that would have occurred in Year 2, while even more Year 2 planned surveys would be pushed to Year 3, and so on. Over time, the ripple effect of delayed or forgone surveys will reduce overall seismic data collection, adversely impacting the industry's ability to drill new wells and curtailing future production. Timing delays large enough to affect drilling schedules are more important to potential economic impacts than seismic cost increases. BOEM does not provide estimates for the number of wells that will not be drilled and how reduced drilling will have significant negative impacts on production, government revenue, gross domestic product ("GDP"), and employment.</p>	<p>In Chapter 4.13, BOEM has considered the potential economic impacts from delayed or foregone G&G activity resulting from Alternatives B through F and has updated the analysis to provide additional information on these potential effects. The impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record.</p>
1076-0082	<p>The DPEIS states that BOEM and NMFS are presently developing an "adaptive monitoring program" that will be implemented for the life of the anticipated MMPA incidental take regulations and "will outline high-level monitoring objectives focused on understanding how and to what extent G&G activities may affect marine mammals in the Gulf of Mexico." DPEIS at 1-13. However, the DPEIS includes very little information about the adaptive monitoring plan because, according to the DPEIS, "an opportunity for public input on the monitoring plan would occur through the process that NMFS undertakes in response to BOEM's petition for rulemaking under the MMPA." DPEIS at 1-14.</p> <p>The Associations have a strong interest in environmental</p>	<p>Thank you for your comment. As agreed upon in the revised Settlement Agreement in 2015, BOEM has analyzed the development of the monitoring plan developed by industry (Chapter 1.2.3.4).</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>monitoring--both to better understand the environment in which our members work, but also to mitigate potential risks of activities to living marine resources. The Associations support efforts that improve the quantity and quality of information related to determining the nature and magnitude of the potential effects of offshore G&G activities on marine mammals. Such information assists with developing reasonable and workable incidental take MMPA authorizations, including appropriate mitigation measures to minimize incidental take, and correctly assessing the type and amount of incidental take that occurs in the course of G&G operations. In this light, the Associations support both ongoing and future research endeavors by industry and its partners that help to inform the understanding and mitigation of potential effects of G&G activities on marine life in the GOM. We also support agency efforts to improve the collection and use of the best available science consistent with the requirements and limits of the MMPA.</p> <p>Nonetheless, the Associations have expressed concern on multiple occasions that the agencies' envisioned monitoring requirements for the forthcoming MMPA regulations for geophysical surveys in the GOM will exceed the authority granted to NMFS. We have explained in detail that the MMPA does not authorize NMFS to require as a condition of an ITA the preparation or development of a large-scale, expansive monitoring plan that reaches beyond the time and area in which site-specific activities are undertaken or the performance of actions related to such a plan. The comments detailing these concerns are attached as Attachment F so that they may be included in the administrative record supporting the final PEIS. The Associations look forward to working collaboratively with BOEM and NMFS to complete the preparation of a legally compliant and operationally effective monitoring program.</p>	
1076-0115	<p>Alternative A is the only alternative that may be consistent with the best available science, operational feasibility, and applicable law. The Associations strongly object to all of the other Alternatives presented in the DPEIS for all of the reasons stated above and particularly because BOEM reaches the</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>same effects conclusions for Alternative A as it does for all of the other Alternatives (except Alternative G). Before the DPEIS is issued as a final PEIS, all of the flaws detailed in this comment letter and the associated attachments must be addressed and corrected.</p>	
<p>1077-0002</p>	<p>Chevron joins the Associations in supporting Alternative A described in the DPEIS because it presents the option that is most supported by available scientific studies and observations, and applicable law....We too urge BOEM to issue a final PEIS within court-ordered deadlines, but one that accounts for the law and facts, and does not rely on methods that produce admittedly “unrealistic” data.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
<p>1077-0007</p>	<p>BOEM also improperly ignores the environmental and safety benefits of modern geophysical technology, which has led to dramatic improvements in the placement of wells and reduction in the numbers of wells that need to be drilled. A reduction in the availability of seismic data threatened by many of the DPEIS alternatives could increase – not decrease – potential environmental and safety risks. Thanks to modern geophysical data, Chevron has reduced the number of wells that need to be drilled on exploration and development projects and has drilled fewer wells in the Gulf as a direct result of improved seismic data.</p> <p>Improvements in 3D and newer 4D seismic technology, for example, allow Chevron geoscientists to visualize the sub-surface without drilling and to optimize exploration well locations and evaluate the prospectivity of lease blocks with minimal drilling activity. For development drilling, modern seismic imaging enables geoscientists to identify potentially hazardous and over-pressurized zones in subsurface reservoirs. As a result, Chevron can better position wells to avoid hazards, and design the wells for improved safety and increased productivity. G&G data allows Chevron to reduce substantially the number of wells drilled, install facilities with smaller footprints, identify risks, mitigate potential consequences and decrease the overall impact on the environment. BOEM must acknowledge and evaluate such</p>	<p>BOEM recognizes the benefits of modern geophysical technology and the associated environmental and safety benefits in Chapter 2.9.1. Chapter 4.13 provides an analysis of the economic impacts from each alternative and includes tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. These factors and others were considered by BOEM's decisionmaker when selecting the Preferred Alternative. However, this Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	crucial benefits from the availability of geophysical data before analyzing alternatives in the DPEIS that would reduce its obtainability, either directly or by increasing its cost. BOEM's failure to do so is arbitrary and capricious.	
1088-0001	<p>The geophysical industry has successfully coexisted with multiple industries, including tourism, and within a thriving ecosystem under mitigation measures and practices similar to those included in the DPEIS Alternative A for many years. As a member of the geophysical industry I generally support Alternative A as the preferred course of action. Data acquisition through seismic surveys is a proven, environmentally sound technology with a track record around the globe that extends for decades. Seismic surveys and geophysical activities help make offshore energy development safer and more efficient. They are essential in the U.S. and around the world to locate potential new sources of energy. In addition to the oil and natural gas industry, seismic surveys are commonly used by the U.S. Geological Survey, the National Science Foundation, and the offshore wind industry.</p> <p>BOEM's environmental analysis should accurately reflect the best available science and research and consider the industry's operational experience, which indicates that seismic surveys have little-to-no impact on marine mammal and wildlife populations. Neither industry's operational experience nor the best available science justifies the precautionary approach BOEM has proposed in some of the alternatives considered in the EIS.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate impacts. BOEM is involved in several ongoing programs to improve data for marine mammals and underwater noise, and future analyses will use the best data available at that time. Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p>
1088-0006	The restrictive and arbitrary nature of some of the proposed mitigations outlined in the DPEIS alternatives would threaten the economic and operational feasibility of performing geophysical surveys in the GOM. Specifically, near-shore seasonal restrictions included throughout the EIS alternatives have no basis in science and should be precluded from the final preferred alternative. Further, arbitrary reductions in seismic survey activities of 10 – 25% (Alternative E) are a nonstarter, without environmental merit and should be removed from any final preferred course of action.	<p>Chapter 2 provides rationale supporting each alternative. Chapter 4.13 provides an analysis and tabular data that outline the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. Using expert opinion</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>and best professional judgement, BOEM determined that 10 percent and 25 percent reductions offer a reasonable range of reduced activity levels while still allowing BOEM to fulfill the purpose of and need for this Programmatic EIS.</p> <p>This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities connected with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS would also support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities. A proposed alternative is reasonable only if it will fulfill the Programmatic EIS's purpose and need as described in Chapter 1.1.2.</p> <p>A 10 percent or 25 percent reduction in the level of seismic airgun survey activities would minimize the potential for injury to marine mammals and sea turtles, reduce the potential for Level A harassment of marine mammals, and provide additional protection for marine mammals. Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering vocalizations. Acute physical injury, other than auditory injury, or death of marine mammals is not likely to be a direct result of seismic noise. However, disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. However, BOEM does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur. Captive bottlenose dolphins have shown increased stress hormones in response to seismic water gun noise (Romano et al., 2004).</p>
1088-0007	The geophysical industry implements many mitigation measures as standard business practice, including marine mammal observers (MMOs), passive acoustic monitoring	Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is funding and is planning to fund additional studies

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>(PAM), and exclusion zones – all in an effort to avoid any potential impacts on marine mammals. The energy industry has invested over \$60 million in research on the impacts of sound and marine life, including advances in technology that may lead to more efficient data acquisition in the future.</p> <p>As BOEM moves through the PEIS process, including consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), the IAGC encourages an adherence to scientifically valid mitigation measures, while recognizing the proven track record of the geophysical industry in the GOM. Mitigation measures for the sake of ‘precaution’ are based on unsubstantiated claims from anti-energy development interests and have no backing in U.S. statute or regulation.</p>	<p>and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM. BOEM’s Environmental Studies Program develops, conducts, and oversees world-class scientific research, specifically to inform policy decisions regarding development of OCS energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and environmental fates and effects. BOEM is a leading contributor to the growing body of scientific knowledge about the Nation’s marine and coastal environment. Currently active studies addressing this broad range of topics can be found at http://www.boem.gov/GMStudies/.</p> <p>Effective September 30, 2016, BOEM implemented NTL 2016-BOEM-G02 to address the implementation of seismic survey mitigation measures and the PSO Program. This NTL outlines the various requirements of operators. While the NTL does not introduce any new types of mitigation measures, it clarifies how seismic survey mitigation measures should be implemented, including ramp-up procedures, the use of a minimum sound source, airgun testing and protected species observation and reporting. The NTL also updates regulatory citations and addresses and provides clarification on how measures identified in the NTL will be implemented to assist BOEM, BSEE, and operators in complying with the ESA and MMPA. Mitigation measures associated with seismic survey operations have been implemented via this NTL to reduce the potential for significant impact to protected species. While these mitigation requirements are considered common-sense measures with a growing body of supporting scientific evidence (e.g., reductions in marine mammal vocalization for several species during acoustic exposure), the efficacy and scientific merit of these measures is being evaluated and will continue to be evaluated, as noted previously.</p>
1091-0011	<p>Alternative A is one of the weakest alternatives for protecting marine mammals in the Gulf of Mexico, as it includes only minimum mitigation standards for marine mammals. While it</p>	<p>Alternative A reflects the mitigation measures that were in place prior to the Settlement Agreement and is being analyzed with other alternatives that include additional mitigation</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>includes ramp-up procedures and exclusion zones, visual monitoring by PSOs, and various shutdown requirements, many of these commonly employed mitigation measures—particularly exclusion zones and ramp-up procedures—remain untested in their efficacy for marine mammals (Barlow and Gisiner, 2006). Because passive acoustic monitoring is not required and only strongly encouraged, as well as there not being expanded observer coverage, this alternative affords minimal protection to marine mammals. Furthermore, this Alternative is one of two Alternatives that does not require, but only strongly encourages, some level of PAM.</p>	<p>measures.</p> <p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1091-0012	<p>Alternative B offers strong protection for marine mammals in the survey zone, particularly through its expanded PSO program, PAM requirements, seasonal closures for bottlenose dolphins, and new reporting requirements. Like Alternative A, however, this alternative does not require PAM monitoring in the De Soto Canyon lease block (Appendix B, Table 2-2), which is critical for Bryde’s whales, since they are only known to occupy the De Soto canyon (Maze-Foley and Mullin, 2006).</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA’s authorization of the incidental take of marine mammals under the MMPA for these activities.</p>
1091-0013	<p>Alternative C builds off mitigation measures proposed in Alternative A, and is therefore stronger than Alternative A by including expanding PSO and PAM requirements. It is also stronger than A since this alternative includes PAM in all deep penetration surveys in the Mississippi Canyon and De Soto Canyon, as the latter will likely be helpful at detecting Bryde’s whales. It remains unclear, however, what the overall PAM protocol is, and what operators will do once an animal is detected. Furthermore, Alternative C adjusts Alternative B’s area closures from February 1 to May 31, but it is unclear throughout the Draft Programmatic Environmental Impact Statement as to whether this closure is also intended for</p>	<p>The NTL 2016-BOEM-G02 provides basic guidelines regarding actions when a marine mammal or sea turtle is detected within the exclusion zone. The PAM operators would implement the same actions as PSOs when an animal is detected, and PAM allows for the start-up of activities during times of reduced visibility. The rationale for Alternative C is provided in Chapter 2.5.3 and states that "Although there is no fixed reproductive season for bottlenose dolphins in the GOM, there does appear to be a peak in calf and neonate strandings falling within the boundaries of the UME in the northern Gulf of Mexico from February to May (now closed and determined by NMFS to be largely unrelated to seismic</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	bottlenose dolphins as in Alternative B, or if it's intended for other protected species.	activities); therefore, the restriction was extended to incorporate this timeframe."
1091-0014	<p>Like Alternatives B and C, Alternative D calls for an expanded PSO program and shut-downs for detected marine mammals, but excludes shut downs for bow-riding dolphins (i.e., bottlenose, Fraser's, Clymene's, rough-toothed, striped, spinner, Atlantic spotted, pantropical, and Risso's dolphins). Bow riding is a behavioral strategy by dolphins to reduce energetic costs to conserve energy (Williams et al. 1992), though there is variation between species regarding which species bow-ride more often than others (Griffin and Griffin, 2003). Therefore, there are two primary problems with excluding bow-riding dolphins: (1) This exception assumes that if bow-riding, the dolphin is likely undisturbed from the seismic vessel; and (2) That all species bow-ride and respond to seismic surveys uniformly. These assumptions are highly problematic, as dolphins may bow-ride even if disturbed, if the energetic gains from bow-riding outweigh the costs from noise exposure. Furthermore, there is no baseline reporting for how many and how frequently dolphins bow-ride in the Gulf of Mexico, and a certain subset of dolphins observed bow-riding during a survey may be less than how many would normally bow-ride in a situation with less sound exposure. One study did indeed find that common dolphins bow-ride less frequently during seismic testing (Goold, et al. 1996). Therefore, should Alternative D be chosen for the Gulf of Mexico, PSO coverage and shut-downs should be expanded to include bow-riding dolphins to avoid prolonged exposure to surveys. Additionally, Alternative D does not carry forward restrictions for deep penetration surveys in Areas of Concern in the Eastern Planning Area; this leaves many deep-diving marine mammals highly exposed to harassment, and should be addressed should Alternative D be carried forward.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1091-0015	<p>Alternative E carries forward all mitigation standards proposed in Alternative C, as well as two scenarios for a reduction in deep-penetration seismic surveys in line miles. These two options, E1 and E2, would elicit less acoustic impact to marine mammals and harassment to all species, including sea turtles,</p>	<p>Additional text has been added to Chapter 2.7 to provide information about how BOEM could implement Alternative E.</p> <p>BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>in the survey zone. We applaud BOEM for exploring ways to reduce the amount of energy put into the water; it is unclear, however, where the reduction in survey activity would occur and how that will be managed. Furthermore, it is unclear as to why BOEM chose 10% and 25% reductions in deep-penetration seismic surveys in line miles, and they seem like arbitrary numbers without considering what the actual minimum survey levels would be for G&G companies to collect necessary data. A more comprehensive plan specific to E1 and E2 should be developed before implementation. Questions remain on the mitigation standards carried forward from Alternative C as to what the adjusted seasonal area closure is intended to protect, as well as a general monitoring and reporting plan for the PAM requirements.</p>	<p>viability, and other factors, and consider them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, total annual survey incremental cost, and percent reduction in efficiency per survey for Alternatives B through F. The alternatives identified in this Programmatic EIS are based on technical feasibility and economic viability. BOEM, through consultation with industry representatives, has tried to base the reductions on an attempt to balance environmental impacts with economic impacts to achieve the proposed action's purpose and need.</p>
1091-0016	<p>Alternative F also carries forward mitigation standards in Alternative C, plus closure areas and minimum separation from the closure areas to ensure sound does not exceed Level B harassment thresholds. The closures under this Alternative do offer extended protections for marine mammals and other protected species, particularly for sperm whales and Bryde's whales. Should BOEM carry forward Alternative F, however, a clearer plan as to how it intends to implement and enforce the separation distances from the closure areas is needed.</p>	<p>Chapter 2.8.2 states that, "airgun surveys conducted outside of the closure areas would be required to remain at a distance such that received sound levels at the closed area boundaries would not exceed the threshold for Level B harassment (currently 160 dB [relative to 1 micropascal [dB re 1 µPa)], as determined by field verification of sound levels or sound field modeling." If the mitigation measures included in Alternative F were adopted, any new G&G activities permitted and/or authorized by BOEM would be required to comply with all applicable conditions and mitigation measures, including adequately demonstrating they are operating within sound level limits. Additional implementation and enforcement measures can be included, as necessary, to ensure the operations comply with the limitations. BOEM expects that through the development of the ITRs, there may be a mechanism to implement standardized exclusion zones such that received sound levels at the closed-area boundaries</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>would not exceed the threshold for Level B harassment. Regarding implementation, BOEM has the ability to enforce the distance from the closure areas through the site-specific permit review process and appropriate COAs.</p>
1091-0017	<p>Alternative G would allow previously authorized activity to continue with new mitigation standards applied, but would forbid new leasing and permitting. While this option provides the least possible acoustic impact to marine mammals in the Gulf of Mexico, it is unclear how exactly the phase-out would be managed. Furthermore, as stated in the PEIS, existing G&G surveys would only be required to comply with Alternative A standards, which afford minimum protection to marine mammals on the scale of proposed Alternatives.</p>	<p>As stated in Chapter 2.9.1, under Alternative G (no new activity), BOEM would cease issuing permits for new G&G surveys and would not approve G&G surveys proposed under exploration or development plans. Any G&G activities previously authorized under an existing permit or lease would proceed but would not be renewed or reauthorized and, thus, eventually would be phased out. Overall, existing approvals for deep seismic exploration would drop off quickly and other G&G activities would trickle off as permits expire. Alternative G would not meet the purpose and need of the proposed action, and it would not implement the natural resource development provisions of the OCSLA. However, the CEQ regulation at 40 CFR § 1502.14(d) specifies that NEPA analyses require the alternatives analysis in the EIS to "include the alternative of no action." This analysis provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives. It is also an example of a reasonable alternative outside the jurisdiction of the agency, which must be analyzed (CEQ regulation at 40 CFR § 1502.14(c)). Inclusion of such an analysis in this Programmatic EIS is necessary to inform Congress, the public, and the President as intended by NEPA (40 CFR § 1500.1(a)).</p>
1091-0018	<p>The approach of offering an apparent a la carte menu for these alternatives seems unnecessary. Instead, we recommend the consolidation of Alternatives D, E, and F, with some notable additions.</p>	<p>This information was considered by BOEM when determining the Preferred Alternative. This Programmatic EIS is not the decision document under NEPA. The decision will be provided in the ROD. BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of Oil and Gas, Renewable Energy, and Marine</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA's authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>A proposed alternative is reasonable only if it will fulfill this Programmatic EIS's purpose and need as described in Chapter 1.1.2.</p>
1091-0019	<p>Despite what is contained in Appendix L and the results of the deliberations by the panel convened by BOEM, we believe the conclusions regarding: i) lowest practicable source (LPS); and ii) duplicative survey standard (DSS) must be revised and included as a preferred option.</p>	<p>At present, (i) lowest practicable source (LPS) and (ii) duplicative survey standard (DSS) are part of Alternative B. The panel of experts that convened to examine these two issues stand by the conclusions reached and documented in Appendix L.</p> <p>Comments noted. This information was considered by BOEM when determining the Preferred Alternative.</p>
1091-0022	<p>Advanced and adaptive mitigation measures should be put forth for the De Soto Canyon. The De Soto Canyon is an erosional canyon located in pelagic waters off Florida's panhandle (Harbison, 1968). Bryde's whales in the Gulf of Mexico almost exclusively occupy the De Soto Canyon, particularly in the northern areas of the canyon (Maze-Foley and Mullin, 2006; Ocean Biogeographic Information System (OBIS-SEAMAP) Bryde's Whale Species Profile). All sightings from NOAA's most recent SAR occurred in the De Soto Canyon (NOAA SAR 2015a), and calls for Bryde's whales have only been recorded in the De Soto Canyon (Sirovic et al. 2013).</p> <p>BOEM, however, has called for continuous passive acoustic monitoring in the De Soto Canyon lease block as a mitigation standard only in Alternatives C-F. Given fidelity from Bryde's whales to this location and their small population size, BOEM should consider PAM for all alternatives, including adopting a general plan for PAM monitoring and reporting as well as adaptive management for shut-down procedures when Bryde's whales are detected.</p>	<p>Comments noted. This information was considered by BOEM when determining the Preferred Alternative. BOEM and NOAA developed the alternatives in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. This Programmatic EIS will enable BOEM to fulfill statutory responsibilities associated with permitting and authorizing G&G activities in connection with activities conducted in support of the Oil and Gas, Renewable Energy, and Marine Minerals Programs for the Gulf of Mexico OCS. This Programmatic EIS also would support NOAA authorization of the incidental take of marine mammals under the MMPA for these activities.</p> <p>Recently, BOEM, the U.S. Navy, and NOAA contributed to the formation of a PAM standards working group under the Acoustical Society of America. The working group is establishing ANSI standards for PAM hardware, software, and operators for seismic mitigation. One of the specific tasks for the working group is to establish the PAM plan standards.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>The development of a Monitoring Plan has been evaluated within this Programmatic EIS (Chapter 1.2.3.4). This plan would allow for adaptive management of mitigation measures and would be implemented for the life of the MMPA rule.</p>
1091-0023	<p>A plan for PAM implementation, monitoring, and reporting needs to be articulated. The use of PAM is encouraged or required depending on the Alternative. However, at no point in the PEIS is there discussion of how the PAM is to be implemented and used. PAM is clearly an important tool, but further description of how it is to be implemented is required. For example, there is no protocol for how long a survey is required to listen for animal activity before a survey can begin nor what should be done if an animal is detected. A prescriptive protocol is an absolute necessity for several reasons: i) cetacean species demonstrate differential responses to disturbing acoustic stimuli (e.g., compare Parks et al. (2011) with Cerchio et al. (2014) or Miller et al. (2009); ii) a given species may demonstrate differential acoustic responses depending on the received level (RL), as shown in Blackwell et al. (2015). Given the lack of data on some species, e.g., Bryde's whales, it may be difficult to complete a full prescriptive protocol, but even with this species we know the frequency range to monitor (Sirovic et al., 2014), so at least part of a protocol could be applied.</p>	<p>The use of PAM is described in Appendix B, Section 1.3.5.</p> <p>Recently, BOEM, the U.S. Navy, and NOAA contributed to the formation of a PAM standards working group under the Acoustical Society of America. The working group is establishing ANSI standards for PAM hardware, software, and operators for seismic mitigation. One of the specific tasks for the working group is to establish the PAM plan standards.</p> <p>The development of a Monitoring Plan has been evaluated within this Programmatic EIS (Chapter 1.2.3.4). This plan would allow for adaptive management of mitigation measures and would be implemented for the life of the MMPA rule.</p> <p>Additionally, through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is collecting and synthesizing information about PAM to be used in future site-specific NEPA evaluations.</p> <p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities for which BOEM has oversight. BOEM will address specifics for PAM implementation, monitoring, and reporting for future site-specific actions in subsequent NEPA evaluations and COAs.</p>
1091-0024	<p>There is no development of ideas around what is to be done with the PAM data. These data could be extremely valuable, not only for understanding what transpired during an individual survey but also, perhaps more importantly, as monitoring data to inform future surveys (Nowacek et al., 2013). In summary, just merely requiring PAM is not enough; a plan for how to implement this tool to protect vulnerable species must be developed for this monitoring and mitigation tool.</p>	<p>Recently, BOEM, the U.S. Navy, and NOAA contributed to the formation of a PAM standards working group under the Acoustical Society of America. The working group is establishing ANSI standards for PAM hardware, software, and operators for seismic mitigation. One of the specific tasks for the working group is to establish the PAM plan standards.</p> <p>The development of a Monitoring Plan has been evaluated within this Programmatic EIS (Chapter 1.2.3.4). This plan</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>would allow for adaptive management of mitigation measures and would be implemented for the life of the MMPA rule.</p> <p>Additionally, through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is collecting and synthesizing information about PAM to be used in future site-specific NEPA evaluations.</p>
1091-0025	<p>Clearly articulate what the purpose of the seasonal restrictions are, and why BOEM chose a different window of seasonal closures than offered in Alternative B. Seasonal restrictions are proposed in some form for Alternatives B-F. It remains largely unclear, however, to which species the seasonal restrictions apply (except for as stated in Alternative B), and what benefits arise from moving the seasonal closures offered in Alternative B (January 1 to April 30) to different dates in Alternatives C-F (February 1 to May 31). This should be made clear moving forward.</p>	<p>Rational behind each alternative is provided in Chapter 2.</p> <p>Overall, Chapter 2.13 states that the seasonal restriction in coastal waters falling within the boundaries of the UME for operation of airguns from January 1 to April 30 in Alternative B is a result of the amendment to the Settlement Agreement. In Alternatives C through F, the restriction is from February 1 to May 31 and was designed to protect the coastal and estuarine stocks of the common bottlenose dolphin during their peak reproductive activity by reducing active acoustic sound sources from airguns. The seasonal restriction in coastal waters would also provide protection for loggerhead sea turtles during a portion of their mating and nesting/inter-nesting season. Other resources, including endangered fish and coastal fish species, coastal birds, coastal MPAs, <i>Sargassum</i>, commercial and recreational fisheries, archaeological resources, and other marine uses would receive the associated protection in that area during the restriction period.</p>
1108-0001	<p>The Gulf of Mexico is one of the most energy-rich regions in America and an essential support for U.S. energy security, employment, and economic output. I urge the BOEM to reject any measures in the Draft PEIS on Geological and Geophysical activities in the Gulf that would hinder oil and natural gas exploration and production in this vital area, especially in regard to seismic surveying.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1129-0003	<p>I support Alternative A and request that BOEM reject any regulations that would threaten the continued viability of seismic survey use for energy exploration in the Gulf of Mexico.</p>	<p>Thank you for your comment. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
1130-0007	<p>Revise the NMFS No Action description in Chapter 2, Section 2.9.1 as follows for accuracy and consistency. As we stated in</p>	<p>Thank you for your comment and continuing discussions on this language. BOEM believes this issue was addressed</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>communication on September 2, 2016, following NOAA’s review of the pre-final draft PEIS, we request that the No Action description be restored to language provided to BOEM for inclusion on March 16, 2016. If there is a need for changes to this language, we request that BOEM provide justification and that any change be coordinated between BOEM’s and NOAA’s legal counsel. Reference: Chapter 2, Section 2.9.1, Page 2-20.</p> <p>“The No Action Alternative for NMFS is slightly different. For NMFS, denial of MMPA authorizations constitutes the NMFS No Action Alternative, which is consistent with NMFS’s statutory obligation under the MMPA to grant or deny permit applications and to prescribe mitigation, monitoring and reporting with any authorizations. Under the NMFS No Action Alternative, there are two potential outcome scenarios. One is that the G&G activities occur in the absence of an MMPA authorization. In this case, (1) the entity conducting the activity would be in violation of the MMPA if take of marine mammals occurs (2) mitigation, monitoring and reporting would not be prescribed by NMFS and/or (3) additional mitigation may not be performed voluntarily by the operators. If the G&G activity were conducted under a lease or permit issued by BOEM, the operators must conform with the mitigation and monitoring measures specified in lease stipulations, COAs on permits and plans, NTLs, and any other best management practices prescribed for all G&G activities. The impacts to the environment associated with this scenario would be the same as those analyzed in BOEM Alternatives A through F. The second potential outcome of NMFS’s No Action Alternative is to assume that G&G activities cease or phase out with existing G&G permits. The impacts to the environment associated with this scenario are consistent with those analyzed in BOEM’s No New Activity Alternative.”</p>	<p>through counsel, and the appropriate considerations were included in the Draft Programmatic EIS. However, BOEM is including the additional edits requested in this comment in this Final Programmatic EIS.</p>
1130-0012	<p>Summary of impacts of Alternative F on closure needs editing. The overall finding summarized here is that Alternative F reduces impacts to sanctuaries from moderate to minor, which we agree with. This text here, however, still incorrectly summarizes the large literature on the protective roles that can</p>	<p>Text was added in Chapter 2.13 to emphasize additional benefit to non-resident species in closure areas to provide sites for biologically important activities.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>be played by area-based management: yes, it can protect resident species from potential stressors, but protection for more mobile species can also be incredibly important if species are using the sites for biologically important activities that would otherwise have some potential to be impacted (this is correctly discussed on 4-57 and several other places in Chapter 4). Reference: Chapter 2, Section 2.13, Pages 2-31 to 2-32.</p>	
1130-0029	<p>Footnote coding that relates alternative-specific mitigation measures to expected benefits to marine mammals and, therefore, partially justified the alternative-specific impact conclusions is vague and difficult to interpret. These should be revised for clarity. Reference: Table 2.10-1.</p>	<p>BOEM understands that the footnotes associated with Table 2.10-1 (now Table 2.13-1) are complex; however, BOEM disagrees that they are vague. Nevertheless, to try to explain the nuance of species afforded protection from the mitigation measures for marine mammals, Table 2.13-2 has been added.</p>
1130-0030	<p>The section on Federal Agencies could be deleted entirely (Vol. 2, Appendix B, Section 2.2). However, if BOEM retains this section, NOAA requests the following: delete descriptions concerning NOAA in Appendix B, Section 2.2.3, including the subsections 2.2.3.1 and 2.2.3.2, Page B-48 through B-51 and replace with the description (as provided below). This edit is provided to remove inconsistencies, inaccuracies and duplication regarding NOAA as an organization, NOAA's role and the statutes NOAA implements and enforces.</p> <p>"NOAA executes its mission and statutory mandates through multiple offices; the National Environmental Satellite, Data, and Information Service, National Marine Fisheries Service, National Ocean Service, National Weather Service, Office of Marine & Aviation Operations, and the Office of Oceanic & Atmospheric Research. Each of these offices represent the operating branches of NOAA and are responsible for managing the delivery of products and services to meet the needs of the public, various federal and state agencies, and other stakeholders. NMFS and NOS's ONMS are the primary offices within NOAA that participated in the development of this Programmatic EIS because of their expertise and their statutory responsibilities to protect, conserve and recover marine mammals and threatened and endangered species and to conserve and manage fisheries and national marine</p>	<p>Text in Appendix B, Section 2.2.3 was revised as per the comment in relation to descriptions of NOAA.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>sanctuaries. Subsequently, the early participation of these NOAA offices during the preparation of this Programmatic EIS aided BOEM's analysis of potential impacts to various protected resources within the GOM, including EFH and NMS."</p>	
1130-0039	<p>Revise the description under the NMSA to better reflect that No Activity Zones are regulated by BOEM and not FGBNMS/ONMS. Reference: Appendix B, Pages B-40 to B-41.</p> <p>"Pursuant to a Presidential directive, national marine sanctuaries designated as of July 14, 2008, are withdrawn from new oil/gas leases. The FGBNMS regulations prohibit exploration for developing or production of oil and gas in the sanctuary except outside "no-activity zones". FGBNMS allows exploration for developing and production of oil and gas outside of BOEM's "no-activity zones." The Florida Keys National Marine Sanctuary (FKNMS) regulations prohibit the exploration for hydrocarbons within the sanctuary. In addition, if G&G activities include the potential for discharges or bottom disturbance within the sites, permits from the sanctuary may be required."</p>	<p>Changes have been made to Appendix B, Section 2.1.12 to reflect this information.</p>
1130-0040	<p>Replace the following: "The NMFS consults with ONMS when proposed G&G activities require an MMPA authorization when takes of marine mammals would occur within a sanctuary. As appropriate, the NMFS will forward a copy of the MMPA incidental take application to ONMS and will inform applicants of BOEM's responsibility to consult and the applicant's responsibility to obtain any necessary permits from ONMS."</p> <p>"The NMFS consults with ONMS when their authorization of take of marine mammals, such as associated with G&G survey activity, would include takes of marine mammals within the boundaries of a national marine sanctuary. NMFS determines its need to consult with ONMS upon receipt of MMPA authorization applications. Although the determination and responsibility to consult under NMSA 304(d) resides with the federal permitting/authorizing agencies (NOAA and BOEM), applicants may also be required to acquire permits directly from</p>	<p>Changes have been made in Appendix B, Section 2.1.12 as requested.</p>

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
	ONMS for activities that are prohibited within the sanctuary (see description above)." Reference: Appendix B, Page B-41.	
1130-0041	<p>Revise the description under the NMSA to better reflect the Section 304(d) consultation differences with BOEM and NMFS.</p> <p>"BOEM and/or BSEE will consult with ONMS under Section 304(d) when they receive an application that indicates a G&G activity may occur within or near the Flower Garden Banks of Florida Keys sanctuaries. In addition, NMFS consults with ONMS when an authorization would include takes of marine mammals within the boundaries of a National Marine Sanctuary. NMFS determines its need to consult with ONMS upon receipt of incidental take authorization applications. Although the determination and responsibility to consult under Section 304(d) resides with the federal agencies (i.e., NOAA and BOEM), applicants may also be required to acquire permits directly from ONMS for activities that are prohibited within the sanctuary (see description above)." Reference: Appendix B, Page B-41.</p>	BOEM and BSEE are committed to ensuring that their activities and authorizations comply with applicable law, including any consultation requirements. BOEM has included your proffered language (with minor modification) in this Final Programmatic EIS.
1130-0043	Alternative F: Swap out the area for FGB used to design the FGB area-based closure in Alternative F to represent EITHER the current boundaries of the site identified by NOAA's preferred alternative under expansion proposals (buffered by the extent of the assumed 160-dB rms isopleth). The current closure (e.g., Figure 6.2.1) is based on one of the Alternatives in the FGBNMS DEIS (Alternative 2), but not the Preferred Alternative (Alternative 3) that NOAA moved forward with.	Figure 2.8-1 has been revised to reflect the existing FGB boundaries.
1130-0046	Remove references to "directed take" in Appendix B, Section 2.1.1, Page B-29 and elsewhere	Changes have been made in several locations in Appendix B , including Section 2.1.1 .
1130-0058	Ensure the summary description of the alternatives in the Executive Summary is consistent with the descriptions in Vol. 1, Chapter 2.	Thank you for the comment. Edits have been made in the Executive Summary, Chapters 2 and 4, and Appendix B for consistency in the description of the alternatives.
1130-0059	It is unclear what the references to 15 CFR 922 in Vol. 1, Chapter 2, Section 2.2, Page 2-4 and Chapter 4, Section 4.7.2.1.1, Page 4-270 are intended as, but it appears to be incorrect as the regulations do not constitute a guidance document.	Text has been revised to correct the terminology from "guidance" to "regulation."

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0064	It is unclear why descriptions of potential benefit of the proposed seasonal coastal restriction on geophysical survey effort using airguns reference coastal stocks of "whale species." There are no coastal stocks of whale species, and whale species would not be expected to benefit from the seasonal coastal restriction. Is this reference intended to refer to the seasonal coastal restriction or more broadly to the suite of mitigation measures contained in Alternative B? Reference: Executive Summary, pg xxi.	Text has been revised in the Executive Summary to clarify that the list of species is not considered coastal and is afforded protection through the suite of mitigation measures in Alternative B.
1130-0065	Alternative descriptions in the Executive Summary are vague and misleading with reference to mitigation measures that are new for a given alternative vs. those that are carried forward from prior alternatives (and would therefore not offer additional benefit when compared with prior alternatives).	The Executive Summary's purpose is to be a high-level summary of this Programmatic EIS and not a detailed recount of what appears within the body of this Programmatic EIS. The various alternatives are complex and contain various nuances and some repetition; diving into such detail in the Executive Summary is counter to its purpose. The Executive Summary provides a basic description of each alternative, connections where alternatives are similar, and a brief sentence indicating the primary differentiation of each alternative. Chapter 2 provides a detailed explanation of each alternative.
1130-0067	In our reading of the alternatives, the non-airgun survey protocol for high-resolution geophysical (HRG) survey activity is introduced with Alternative C. If this is correct, why does the description of Alternative D read as though the HRG survey protocol provides additional protection for all marine mammals? Reference: Executive Summary, pg xxii.	Thank you for the comment. Text within the Executive Summary has been edited to clarify the rationale behind the mitigation measures under Alternative D.
1130-0068	In what way would Alternative D lead to changes in timing for airgun surveys? Reference: Executive Summary, pg xxii	Alternative D contains a coastal waters' seasonal restriction from February 1 to May 31, expanded from Alternative B (Chapter 2, Figure 2.3-1) which could alter the timing for airgun surveys in coastal waters.
1130-0071	BOEM should provide additional discussion explaining how the 500-m exclusion zone relates to sound isopleths or should remove statements implying that this proposed zone is reflective of some quantitative understanding of a notional sound field. Reference: Chapter 2, Section 2.14.4, pg 2-40, 1 st paragraph.	Text has been revised in Chapter 2.14.4 to explain the 500-m (1,640-ft) exclusion zone.

Table M-6. Alternatives and Mitigation Measures Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0072	Shutdown mitigation measures can minimize the degree of TTS or PTS experienced or can minimize the severity of behavioral disruption. However, it is unclear what BOEM means in saying that shutdown can minimize impacts to “negligible levels.” This statement is unclear and unfounded, and should be removed. Reference: Chapter 2, Section 2.14.7, pg 2-46, 2 nd paragraph.	Text has been revised in Chapter 2.14.7 to reflect a reduction in impacts.
1130-0073	Does the analysis of potential lost productivity under Alternative D remove those dolphins that were “bowriding” and would therefore have not triggered the shutdown requirement from the overall number of incidents of dolphins observed within the 500-m exclusion zone? If not, this assessment is invalid. Reference: Chapter 2, Section 2.14.7, pg 2-47.	Edits have been made in Chapters 2.11.1 and 2.14.7 to clarify this analysis. Data from Barkaszi et al. (2012) were analyzed to determine that based on the recorded information within the datasheets, a 25 percent to 30 percent increase in downtime would result for Alternative D. The data were analyzed for dolphin sightings as well as dolphin behavior; however, there are limitations to the data set for the following reasons: (1) while behavior is a required entry for sightings, the data set clearly indicates that behavior was not always recorded (15% of all dolphin records in the data set had no behavior recorded); and (2) consistency in the records is highly variable because standardized behaviors are not a condition for data recording. For example, behaviors such as swimming, porpoising, and jumping often were recorded for dolphin sightings within the 500-m (1,640-ft) exclusion zone and could indicate bow-riding behavior. Therefore, while these data predict an increase in shutdowns, an accurate estimation of the number of additional shutdowns is difficult to determine; however, based on the best available data, it is estimated to be 25 percent to 30 percent for Alternative D.

M.4.4 Accidental Fuel Spills

Comments spoke broadly to the general risk that G&G activities pose for accidental spills. Additional comments expressed concern that accidental spills are unreported or underreported because BOEM does not have direct oversight of spill reporting. Detailed responses to specific comments are provided in **Table M-7**.

Table M-7. Accidental Fuel Spills Detailed Comment Responses

Submission ID	Comment	Response
Accidental Fuel Spills		
1071-0009	<p>A review of the document provided suggests that the data collection operations discussed present the potential to impact the integrity of the natural resources of Florida. The potential direct impacts of data collection operations which are not intended to disturb the seabed would appear to be negligible. Those commonly used methods that do disturb the seabed and approximately the first 20 feet of sub-seabed sediments; bottom sampling (e.g., gravity and piston coring and vibracoring) would in our experience also have negligible impact on those sediments. The drilling of deep stratigraphic test wells for the purposes of data collection preliminary to either oil and gas exploration or carbon sequestration, the drilling of shallow borings preliminary to the placement of seabed supported structures and the placement of foundations into the seabed to facilitate oceanographic and meteorological data collection installations present various risks. The risks associated with those operations consist of, but are not necessarily limited to the uncontrolled release of hydrocarbons from deep accumulations of traditional hydrocarbon resources. Deep stratigraphic tests are typically drilled at sites which have little or no potential of encountering commercial accumulations of oil or gas. Thus the risk of uncontrolled releases of hydrocarbons as a result of such operations is presumed to be negligible.</p>	<p>Thank you for your comment.</p>
1071-0011	<p>It is suggested that the PEIS discuss and quantify, in detail, the potential risk the data collection methods it proposes to be allowed present for the uncontrolled release of hydrocarbons from deep accumulations of traditional hydrocarbon resources.</p>	<p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities. BOEM will address impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation. The site-specific NEPA and environmental analyses will examine impacts from surveying/sampling and the specific equipment planned to be deployed, and they would include mitigation measures to control risks from uncontrolled or accidental releases.</p>

Table M-7. Accidental Fuel Spills Detailed Comment Responses (continued)

Submission ID	Comment	Response
1121-0003	<p>Before more leasing is done, old problems must be rectified. There are roughly over 2000 spills in the Gulf of Mexico every year, from rustbucket rigs run by Texas Petroleum Institute to high-tech hazards like Shell's 'cost-effective' Glider pipeline. Taylor Energy has been leaking for over 12 years, with no end in sight. Many spills are unreported, and only 70% of spill reports have associated areas or volumes. Although this is a minimal volume, the volume is easily over 1 million gallons per year.</p>	<p>This Programmatic EIS was developed to analyze potential impacts from G&G activities within the AOI in BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2). Therefore, this Programmatic EIS does not address out-of-scope topics such as oil spills from other sources. This Programmatic EIS addresses potential accidental fuel spills from G&G survey vessels for each resource (Chapter 4), and all G&G vessels must comply with USCG requirements related to prevention and control of oil spills.</p>
1121-0004	<p>BOEM must record every release spill in the Gulf, and not rely on industry to self report. Self reporting is non reporting and underreporting. BOEM cannot assess the environmental impact of new leasing when it doesn't even know how many millions of gallons of oil is being spilled into the Gulf yearly.</p>	<p>This Programmatic EIS was developed to analyze potential impacts from G&G activities within the AOI within BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). This Programmatic EIS does not address topics beyond the stated proposed action, purpose and need, and alternatives (Chapters 1.1 and 2).</p>

M.4.5 Active Acoustic Sound Sources

Several commenters identified minor edits required for **Chapter 3 and Table 3.4-3**. The comments and responses are provided in **Table M-8**.

Table M-8. Active Acoustic Sound Sources' Detailed Comment Responses

Submission ID	Comment	Response
Active Acoustic Sound Sources		
1063-0016	Chapter 3 Page 3-4 3.2.1. Last sentence of this section states all G&G survey types are subject to the same type of review. This is false for some ancillary activities as per NTL 2009-G34 when some do not require BOEM notice nor review.	The sentence has been removed from this Programmatic EIS.
1063-0017	Page 3-38 3.4.1.2. First paragraph, last sentence. Suggest changing from "Programmatic Environmental Assessment" for decommissioning activities to "programmatic NEPA document".	The text has been revised based on this comment's suggestion.
1063-0031	Vol. II Tables-30 Table 3.4-3. The Rigs-to-Reef row in the table is not accurate. Not able to verify accuracy of the remaining table items. Revised Rigs-to-Reef data: [revise per table in comment letter;]	Changes have been made to the "rigs-to-reefs" row of Table 3.4-3 based on updated data provided on BOEM's website (referenced in the table).

M.4.6 Marine Mammals

Comments on this Programmatic EIS regarding marine mammals focused on several general topics, including acoustic propagation modeling and acoustic exposure modeling; analysis of potential impacts to marine mammals (on the species level and collectively as a resource), including impact mitigation measures and their effectiveness; analysis of project alternatives and their relevant benefits to marine mammals; and failure to integrate impacts from the *Deepwater Horizon* oil spill and cumulative impacts of sound on marine mammals. Many of the topics commented on for marine mammals are addressed in other chapters also.

Many comments raised issues related to acoustic propagation and exposure modeling, including model inputs such as sound source characteristics, spatial and temporal aspects of projected survey activities during the 10-year period of this Programmatic EIS, and species density data used in the exposure modeling. Many comments claimed that modeling represented a worst-case scenario, and marine mammal density estimates were not based on best available science. Comments pointed out that NMFS' Acoustic Guidance (USDOC, NMFS, 2016) was not integrated into this Programmatic EIS, and many comments took issue with the fact that the effects of proposed mitigation measures were not modeled. Lastly, comments indicated that terminology used in connection with various acoustic exposures was confusing and required clarification.

Several comments addressed the analysis of potential impacts to marine mammals, contending that the justification for the impact determinations was inconsistent, arbitrary, or capricious; that the impact determinations were not supported by best available science; that there is no evidence that sound is harmful to marine mammals; and that there have been no seismic-related mortalities to support the inclusion of the mitigation measures proposed in this Programmatic EIS. Comments were received stating that the biological significance of impacts to marine mammals were not adequately assessed in this Programmatic EIS. Additionally, comments asserted that this Programmatic EIS failed to adequately incorporate **Appendices D and K** into the analysis.

Many comments were based on the failure to show benefits of the various alternatives to marine mammals, at the species level and collectively as a resource, or that mitigation measures were overly burdensome to industry. Acoustic exposure estimates were calculated for activities associated with Alternative A only; the same level of quantitative analysis was not performed for other project alternatives. Consequently, the effectiveness of mitigation measures in various alternatives was not clearly communicated. Detailed responses to specific comments are provided in **Table M-9**.

Table M-9. Marine Mammals' Detailed Comment Responses

Submission ID	Comment	Response
Marine Mammals		
0006-0001	<p>The US Government should not be allowing the continued assault of whales and all other sea life with the loss of hearing, concussions and loss of communications and navigational abilities all for the benefit of the oil and gas industry. The US should stop these laissez faire policies of leasing tracts to an industry that is endangering our climate and our very existence. It is past time for the US Government to tune into 21st Century climate reality and change to a policy of no more fossil fuel usage and maximization of energy conservation and renewable energy generation.</p>	<p>BOEM is responsible for stewardship of the Nation's OCS energy and mineral resources, as well as protecting the environment that the development of those resources may impact. These resources include oil and gas, marine minerals, and renewable energy. The OCSLA, as amended, mandates the Secretary of the Interior (Secretary) to manage the exploration of OCS oil, gas, and marine minerals (e.g., sand and gravel) and the siting of renewable energy facilities. The OCSLA directs DOI to ensure that G&G data are obtained in a technically safe and environmentally sound manner.</p> <p>The EPO Act of 2005, Public Law (P.L.) 109 58, added Section 8(p)(1)(C) to the OCSLA, which grants the Secretary the authority to issue leases, easements, or rights-of-way on the OCS for the purpose of renewable energy development (43 U.S.C. § 1337(p)(1)(C)). The Secretary delegated this authority to the former MMS, now BOEM.</p> <p>The NEPA of 1969 (42 U.S.C. §§ 4321-4347) is the foundation of environmental policymaking in the United States. The intent of the NEPA process is to help public officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. BOEM produces NEPA documents, such as this Programmatic EIS, for each of the major stages of energy development planning.</p> <p>Oil and gas leasing in the AOI is not part of the proposed action, and this NEPA document neither analyzes nor authorizes an OCS lease sale. Those activities and the impacts that may result from them are outside of the scope of this Programmatic EIS. This Programmatic EIS is limited in scope to the stated proposed action, purpose and need, and reasonable range of alternatives (Chapters 1.1.2 and 2).</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>Nevertheless, as part of its mission, BOEM does consider these activities and issues in other NEPA documents such as the Five-Year Program and Five-Year Program EIS. As part of that analysis, BOEM considers the effects of GHG emissions in the Five-Year Program and Five-Year Program EIS.</p> <p>Chapter 4.2 of the Five-Year Program EIS considers climate change and the baseline environment in the areas proposed for oil and gas leasing. In addition, Wolvovsky and Anderson (2016) assess the potential lifecycle GHG emissions and social cost of carbon under the Five-Year Program. The GOM lease sale-stage NEPA analyses will further specify impacts of GHG emissions related to a single proposed lease sale. BOEM considers many facets of the potential effects of climate change in its decisionmaking.</p>
0006-0005	<p>"For years we have raised concerns that the sound from oil and gas surveys was injuring the marine mammals of the Gulf," said Cynthia Sarthou, executive director at the Gulf Restoration Network. "Protection of mammals in the Gulf is even more important now, as many are still recovering from exposure to oil and dispersant from the BP disaster."</p>	<p>The authorization of G&G activities under the Preferred Alternative includes the implementation of a suite of impact mitigation measures to ensure that the proposed G&G activities comply with existing laws and regulations (Appendix B). The mitigation measures include protocols to reduce and avoid potential impacts to a variety of biological resources, with an emphasis on reducing potential acoustic impacts to marine mammals. The impact analysis in Chapter 4.2 addresses potential impacts on marine mammals. Estimates of site-specific potential impacts associated with each proposed survey would be evaluated through the subsequent NEPA evaluation process performed for each survey. In every case, G&G survey contractors will be required to abide by all mitigation requirements stated in the Preferred Alternative selected from this Programmatic EIS, in addition to the subsequent NEPA analysis and those included in an issued MMPA Incidental Take Authorization or ESA Incidental Take Statement.</p>
0899-0003	<p>For decades, BOEM, NMFS, academics and NGOs have looked extensively for actual harm caused by G&G in the GOM. They have found none. This extensive and endless study is a waste of time, energy and resources given the absence of any observed harm. The PEIS does not point to a single marine</p>	<p>Thank you for your comment. BOEM's subject-matter experts conducted extensive literature reviews and developed model runs using the best available scientific information in the development of this Programmatic EIS. This necessarily involved subject-matter experts using their best professional</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>mammal that has actually been harmed by Oil and Gas G&G in the GOM.²²</p> <p>BOEM correctly stated with regard to GOM G&G: "NTL 2012-JOINT-G02, 'Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program,' minimizes the potential of harm from seismic operations to marine mammals. These mitigations include onboard observers, airgun shut-downs for whales in the exclusion zone, ramp-up procedures, and the use of a minimum sound source. Therefore, no significant cumulative impacts to marine mammals would be expected as a result of the proposed exploration activities when added to the impacts of past, present, or reasonably foreseeable oil and gas development in the area, as well as other ongoing activities in the area. Within the [GOM] CPA, which is directly adjacent to the EPA, there is a long-standing and well-developed OCS Program (more than 50 years); there are no data to suggest that activities from the preexisting OCS Program are significantly impacting marine mammal populations."²³</p> <p>BOEM also correctly stated: "As of May 2012, there are 4,377 active leases in the CPA. Within the CPA, there is a long-standing and well-developed OCS Program (more than 50 years); there are no data to suggest that routine activities from the preexisting OCS Program are significantly impacting marine mammal populations."²⁴</p> <p>BOEM's Science Officer recently emphasized: "To date, there has been no documented scientific evidence of noise from air guns used in geological and geophysical (G & G) seismic activities adversely affecting marine mammal populations or coastal communities."²⁵</p> <p>NMFS has repeatedly explained that "there is no evidence that serious injury, death, or stranding by marine mammals can occur from exposure to [oil and gas] airgun pulses, even in the case of large airgun arrays."²⁶</p>	<p>judgment to determine the most appropriate and pertinent studies and information that informed the impacts analyses for this Programmatic EIS, including information that is either directly relevant to the Gulf of Mexico or is analogous to the activities, geography, or species of the GOM.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>The PEIS suggests that Oil and Gas G&G sonar may have been an “initial behavioral trigger” to the 2008 stranding of melon-headed whales in Madagascar.²⁷ This suggestion is based on a Report “facilitated” by the International Whaling Commission. This IWC Report is incorrect for the following reasons.</p> <p>The IWC report was published several years after the strandings.²⁸ The Report exonerates nearby use of seismic airguns for oil and gas exploration as a possible cause of these strandings. However, the Report does implicate nearby use of a multi-beam echosounder system (MBES) for oil and gas exploration as a possible contributing cause.</p> <p>The IWC Report’s conclusion about seismic is clearly correct because no seismic airguns were used in the area before the strandings. Moreover, there is no evidence that seismic airguns can cause strandings.</p> <p>The Report’s insinuations about MBES are incorrect for the following and other reasons:</p> <ol style="list-style-type: none"> 1) The Report’s time-line for the strandings has errors and is inconsistent with the best available evidence; 2) The best available evidence (e.g., satellite images of stranded whales on May 20) indicates that the strandings began before MBES began on May 29; 3) The Report’s conclusions are inconsistent with necropsy results, which show no sound-induced damage; 4) The Report’s conclusions are inconsistent with the absence of any other strandings from MBES used in Madagascar or anywhere else; 5) There is no evidence supporting the Report’s speculation as 	

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>to why previous MBES use in the area did not cause strandings; and</p> <p>6) Onshore surface currents that force downwelling conditions in the area have previously been associated with strandings in Madagascar, and are a much more plausible cause of these strandings.</p> <p>These facts are discussed in more detail in an online CRE publication, which is incorporated by reference as if fully set forth herein.²⁹</p> <p>CONCLUSION AND RECOMMENDATION: Oil and gas G&G under current and longstanding regulation does not harm marine mammals or any other organisms in the GOM. BOEM should delete the PEIS' discussion of the Madagascar melon-headed whale stranding. BOEM should include in the PEIS the above-quoted BOEM and NMFS statements about no harm.</p>	
1001-0001	<p>I'm writing to express my concern that the entire Gulf of Mexico now is open for additional oil and gas surveys that can injure and harass marine mammals.</p> <p>According to the agency's Draft Programmatic Environmental Impact Statement, continuing the business-as-usual seismic surveys will expose the Gulf's struggling marine mammal population to harmful levels of noise no less than 31.9 million times over the next decade.</p>	<p>Please note that a significant area of the GOM is closed to all proposed G&G activities during the 10-year time period of this Programmatic EIS. This includes most of the EPA and, depending on the selected program alternative, additional area closures and time-area closures that are specifically designed to protect marine mammal species. Please also note that the proposed G&G activities will implement impact mitigation measures that meet or exceed worldwide industry standards. Exposure estimates presented in this Programmatic EIS do not consider the effects of these mitigation measures and therefore overestimate potential behavioral disturbances or auditory injuries associated with proposed G&G activities.</p>
1062-0002	<p>It is unacceptable for the Bureau to allow seismic surveys to injure and harass marine mammals up to 31.9 million times, as predicted. This includes 80 percent of the Gulf's endangered sperm whale population, estimated at 763 animals. Sperm whales will experience as many as 760,000 harassing exposures to airgun blasting over the next decade. The seismic blasting would also cause as many as 588 injuries to the Gulf's</p>	<p>Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Bryde's whales — of which only 33 individuals remain — or about 17 times for each member of this imperiled population and disrupt their vital behavior thousands of times.</p> <p>Marine mammals have already suffered from inadequate regulation of offshore oil and gas activities in the Gulf of Mexico. For decades, seismic surveys have harmed marine mammals in violation of the Marine Mammal Protection Act and Endangered Species Act. The Gulf's Bryde's whales — one of the most endangered populations of whales on the planet — may already have lost much of their canyon habitat due to seismic blasting. In 2010, the Deepwater Horizon oil spill fouled the Mississippi Canyon, a nursery for sperm whales and the heart of their habitat. And the region is still reeling from the spill. For example, bottlenose dolphins have suffered a five-year die-off, with severe lung damage and numerous stillbirths in the spill zone. These populations cannot survive business as usual. We urge the Bureau to be a good steward of the Gulf of Mexico and to protect marine mammals from unrestrained seismic oil exploration.</p>	<p>Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>BOEM developed the proposed mitigations and alternatives in close coordination with NMFS using the best available data. Chapter 2 outlines the alternatives and mitigation measures to the proposed action. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, Marine Mammal Protection Act, and Endangered Species Act) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM.</p> <p>All of this information will be considered by BOEM in determining which alternative is selected in the ROD.</p>
1063-0001	In some cases <i>Tursiops Truncatus</i> is referred to as "Bottlenose Dolphin" and in other cases the same species is referred to as "Common Bottlenose Dolphin" - suggest using "Common Bottlenose Dolphin" - as per the NMFS Stock Assessment Reports for the GOM.	Thank you for your comment. All references to the common name of <i>Tursiops truncatus</i> in this Programmatic EIS have been modified to "common bottlenose dolphin."
1063-0002	Impact conclusions for marine mammals - it states "there are 21 species of marine mammals"...should be changed to "22" - (21 cetaceans and 1 Sirenian.)	Thank you for your comment. The correction has been made to this Programmatic EIS.
1063-0003	<p>Page XX1 of the Executive Summary.</p> <p>Alternative B - There are no coastal stocks of "whale species" - as mentioned in the first sentence on that page.</p>	Thank you for your comment. Changes have been made to clarify the Executive Summary .
1063-0005	The last paragraph on this page [page XXI] regarding entanglement and sea turtles should also be present in the marine mammal section, particular since there has been a lethal take of an Atlantic spotted dolphin in tethered nodal gear.	Thank you for your comment. This information has been added to page xxi of the Executive Summary and to Chapter 4.2.2.1.9 .
1063-0006	Page XXV - Alternatives C through F - It's unclear why	Thank you for your comment. Changes have been made to

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	discussion of marine mammals is in these Alts since these should be discussing impact conclusions for sea turtles. Suggest removing.	the Executive Summary to include this statement.
1063-0018	Chapter 4 Page 4-23 - First paragraph - Bryde's whales - NMFS is conducting a status review, this should be clearly stated. Suggest citing the 90-day finding document in the Federal register. http://sero.nmfs.noaa.gov/protected_resources/listing_petitions/documents/80fr18343.pdf	Thank you for your comment. Text has been added to this Programmatic EIS to reflect the current status.
1063-0019	Page 4-29 - second paragraph references "draft" NOAA guidance...change to final.	Thank you for your comment. Changes have been made throughout this Programmatic EIS.
1063-0020	Page 4-32/33 - 3rd paragraph - should be updated to reflect final NOAA acoustic thresholds. Throughout the "auditory injuries" section the reference to draft thresholds should be replaced with information from the final.	Thank you for your comment. Updates have been made to reflect the final guidance from NMFS.
1063-0021	Page 4-44 - Update Exposure Acoustic Criteria section - see earlier comments.	Thank you for your comment. Pages 4-44 and 4-45 have been updated to reflect NMFS' final acoustic guidance.
1063-0022	Page 4-51 - Deep Penetration Seismic airgun surveys - Level A - First Paragraph - don't think VSPs are supposed to be included here.	The VSP surveys are included in the 2D seismic scenario for the exposure estimate modeling. Estimates of VSPs in this scenario are provided in Table 3.2-1 .
1063-0023	Page 4-29 - Drilling Noise - there really is not much analyses and substantive mention of noise and DPS vessels. This should likely be expanded. https://www.gpo.fdsys/pkg/FR-2016-10-14/pdf/2016-24850.pdf?utm_campaign=subscription%20mailing%20list&utm_source=federalregister.gov&utm_medium=email	Thank you for your comment. Additional text and references have been added to Chapters 4.2.2.1.4 and 4.2.2.1.5 .
1063-0024	Page 4-79 - Last sentence of second paragraph is repeated twice.	Thank you for your comment. The redundant sentence has been removed from this Programmatic EIS.
1063-0025	Page 4-89 - First paragraph states UME began Feb 1, 2010...NMFS website and previously in the document it is stated as March 1, 2010.	The NOAA website (http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm) states that the UME began in February 2010, as shown below: "Under the Marine Mammal Protection Act of 1972 (as amended), an UME has been declared for dolphins and whales (cetaceans) in the northern Gulf of Mexico (Texas/Louisiana border through Franklin County, FL) from February 2010 through the present."

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>"The temporal and spatial boundaries have been redefined to include the following:</p> <p>All cetaceans stranded in Alabama, Mississippi, and Louisiana from March 2010-July 2014 and all cetaceans other than bottlenose dolphins stranded in the Florida Panhandle (Franklin County through Escambia County) from March 2010-July 2014. These boundaries could be adjusted in the future based upon the availability of new results or analyses."</p> <p>This Programmatic EIS has been checked for consistency with these dates.</p>
1067-0001	<p>After permitting seismic airgun surveys to harass and injure marine wildlife in the Gulf of Mexico for decades without analyzing the impacts, the Bureau of Ocean Energy Management has taken the important first step of finally analyzing the harm caused by these airgun blasts. The results are staggering: According to the agency's Draft Programmatic Environmental Impact Statement issued in September 2016, continuing the business-as usual permitting of this activity will expose the Gulf's struggling marine mammal population to harmful levels of noise 31.9 million times over the next decade. This includes more than 4.3 million exposures loud enough to cause permanent hearing loss or other physical injury, including as many as 588 injuries to the 33 remaining Gulf's Bryde's whales. That's about 17 instances of injury for each member of this imperiled population. The agency's analysis also admits that the Gulf's small, endangered population of fewer than 800 sperm whales will experience 760,000 harassing exposures to airgun blasting in that same time period.</p>	<p>Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>BOEM developed the proposed mitigations and alternatives in close coordination with NMFS using the best available data. Chapter 2 outlines the alternatives and mitigation measures to the proposed action. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, Marine Mammal Protection Act, and Endangered Species Act) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM.</p> <p>All of this information will be considered by the BOEM in determining which alternative is selected in the ROD.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
1074-0001	<p>As you know, our organizations are profoundly concerned about the impact of industry's high-intensity seismic exploration activity on the Gulf's marine mammals. Increasingly, the available science indicates that seismic airguns disrupt whale behavior and impair their communication, often on a vast scale; that they harm a diverse range of other marine mammals in multiple ways; and that they significantly impact fish and fisheries, with unknown but potentially substantial effects on both coastal communities and marine mammal populations.</p>	<p>Thank you for your comment. This Programmatic EIS, as well as previous BOEM/MMS National Environmental Policy Act documents, has been produced using the best available information on the spatial and temporal distributions and densities of GOM resources that may be sensitive to acoustic impacts, as well as methods for the analysis of potential impacts to these resources. This EIS is programmatic and covers a period of 10 years. Subsequent, site-specific impact assessment documents, based on specific survey activities within a discrete area or areas over a specified timeframe, will address potential impacts to these resources.</p>
1074-0020	<p>The DEIS does little to meaningfully assess the biological consequences of G&G activities in the Gulf. The agencies estimate marine mammal exposures at Appendix D and loss of communication and listening space at Appendix K, but say little about what the extensive cumulative, chronic impacts they describe mean for the fitness of marine mammals and marine mammal populations. It makes no sense for the agencies to perform that quantitative analysis and then to simply disregard it, providing instead a set of summary conclusions, purportedly about environmental significance, that do not take into account the degree to which vulnerable species are exposed. There is no dispute that repeated disruptions of behaviors, loss of communication space, and chronic stress can adversely affect vital rates of individuals and wildlife populations over time. For these profoundly vulnerable waters, the agencies must do a better job of assessing the potential environmental cost.</p>	<p>An assessment of the potential for fitness-level consequences at both the individual and population level was included in the Draft Programmatic EIS, beginning on page 4-54. This chapter has been expanded in this Final Programmatic EIS to include quantitative analysis results from Appendix D and an expanded integrated discussion of the chronic impacts analysis of Appendix K.</p> <p>There is extensive interest in forecasting how short-term behavioral responses by individual animals may aggregate and result in population-level consequences. The concept was introduced by the National Research Council (2005) as Population Consequences of Acoustic Disturbance; however, given the lack of data on acoustic responses, research studies have generalized the issue to look at environmental and anthropogenic stressors in general and renamed the concept Population Consequences of Disturbance. New et al. (2014) presented a modified conceptual framework to help forecast long-term impacts. The idea is that a series of transfer functions connect increasingly broader impacts from the initial disturbance to effects on individual health, individual vital rates, and finally population dynamics. The concept has been demonstrated with a few species for which there are extensive data from tagged or photo-identified animals so that effects on individuals can be quantified. Northern elephant seals (Aoki et al., 2011; Adachi et al., 2014) were the first study species where the data from time-depth recorders were able to be</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>linked to an individual animal's body fat condition, which provided insight into foraging success and ultimately individual health and vital rates (Robinson et al., 2010). Rolland et al. (2016) used photographic data of North Atlantic right whales to evaluate individual health and link it to demographic groups and population status. Additional studies exploring population consequences are ongoing, but a common theme is that extensive data documenting individual health and population vital rates is necessary for such analyses. These are the gold standards for future studies, but, at present, studies within the Gulf of Mexico have not occurred in sufficient detail for such analyses.</p>
1074-0031	<p>The significance criteria used by the DEIS to evaluate the relative impacts of each alternative (see DEIS at 2-29, 4-26 to 4-27) are flawed in their conception and inconsistently and arbitrarily applied. For example:</p> <ul style="list-style-type: none"> – The significance standards for marine mammal impacts, articulated at 4-26 to 4-27, are inconsistent with the MMPA's impact standards, as, for example, in including only injury and mortality, and not behavioral disturbance, as factors in determining whether an impact is "severe," even though it is widely understood that behavioral disturbance can induce adverse population-level effects.⁴⁵ This definition is applied by the DEIS to assert, for example, that airgun surveys would have only "moderate" rather than "severe" impacts on marine mammals despite what it admits would be "extensive," repeated exposures. DEIS at 4-59 to 4-60. – The standards incorporate "detectability" as a factor in determining environmental significance (DEIS at 2-29), notwithstanding the difficulty of observing certain impacts, such as chronic stress, subtle but significant disruptions in biologically vital activities, and acoustic masking; and notwithstanding the lack of baseline data on abundance and trends in Gulf marine mammal populations (and the populations of many other taxa). – Aside from Appendices D and K, which it does not incorporate 	<p>Thank you for your response. Please note that each impact level includes the effects of behavioral disturbance (e.g., Attention was given to assigning impact levels for each IPF even when impacts were largely limited to behavioral disturbances and when factoring in the duration and severity of potential impacts to the resource.</p> <p>With respect to detectability of responses and impacts and while it is true that an effect may be occurring that is not immediately detectable or that cannot be directly linked to these proposed activities, a cause-and-effect relationship that included detectable elements was assumed.</p> <p>BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>An assessment of the potential for fitness-level consequences at both the individual and population level was included in the Draft Programmatic EIS, beginning on page 4-54. This chapter has been expanded in this Final Programmatic EIS to</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	into the body of the DEIS (see § III.D.1 below), the agency does not provide any quantitative analysis or, for that matter, any meaningful qualitative analysis, in determining the relative environmental impact of alternatives. As a start, BOEM should incorporate these analyses into the body of the EIS. Nor, as noted at §§ III.B and C below, does the agency use any of the available methods or proxies for determining impacts on vital rates from repeated disturbance (as did Wood et al. (2012), which the DEIS otherwise uses to generate take estimates).	include quantitative analysis results from Appendix D and an expanded integrated discussion of the chronic impacts analysis of Appendix K .
1074-0031 (continued)	– Impacts, including acoustic impacts, from G&G activities are excluded from BOEM's cumulative impacts analysis (e.g., DEIS at 4-77), meaning that the impacts from these activities are not aggregated with those from other actions, contrary to NEPA. 40 C.F.R. § 1508.7 (defining "cumulative impact" as resulting "from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions").	Potential impacts from G&G activities are included in the cumulative analysis; their potential effects are added to other Federal and non-Federal actions within the northern Gulf of Mexico OCS and are analyzed in a revised cumulative analysis sections in this Final Programmatic EIS.
1074-0032	Compounding the problem is the DEIS' use of absurd rationales, in some sections but not others, to deny the existence of any benefit from certain alternatives. For example, BOEM suggests that area closures have no substantial benefit because species that tend to occur within those areas sometimes travel outside them and because, in some cases, such closures benefit certain target species only seasonally (DEIS at 2-32)—hardly justifications for the idea that area closures have no benefit. Indeed, the DEIS frequently seems at odds with itself, reasonably finding environmental benefit in its alternatives in some sections of the document while apparently denying it in others, often on the grounds that they would not alter the DEIS' problematic "impact levels." See, e.g., DEIS at 4-109 to 4-110 (denying any benefit from activity reductions of 10% or 25%, except in mitigating risk of auditory injury).	Benefits of time/area closures to mobile resources such as marine mammals and sea turtles were not ignored in the analysis of potential impacts from proposed activities. The analysis procedure allowed one impact rating (or a reasonable range in some cases) from an IPF for ALL marine mammals in the AOI over a 10-year period. Many animals that may occur within the closure areas would indeed benefit seasonally from these mitigation methods, as stated in Chapters 4.2.3.1.1, 4.2.4.1.1, and 4.2.7.1.1 . In addition, Table 2.13-2 has been added to help illustrate the species groups that are afforded protection for each alternative. The overall Programmatic EIS impact analysis did not include a rating scale for impacts that relied on a percentage of the total number of individuals affected by species or stock. It is expected that this level of detail would accompany analyses of potential impacts for future site-specific EAs and permit application evaluations.
1074-0064	The DEIS, as noted, does not appear to provide any meaningful analysis of the aggregate impact of its proposed activities on marine mammal vital rates. The closest it comes is a brief discussion of energetic cost in relation to increased or intensified vocalization; but there it incorrectly assumes, in contradiction of the best available science, that received levels	BOEM acknowledges that studies have been conducted to evaluate PCoD, such as New et al. (2013), which is a very data-heavy analysis approach for understanding how individual impacts may result in population-level consequences. While it would be ideal to conduct such an analysis for sperm whales or other species in the Gulf of

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>must exceed 160 dB for these effects to occur, and it does not aggregate impacts across exposure events, although it acknowledges that such impacts would accumulate. DEIS at 4-56 to 4-57. BOEM's analysis is plainly insufficient, as a brief consideration of sperm whales indicates.</p> <p>...In short, we already have tools to model the aggregate effects of behavioral disruption on marine mammal populations. Insofar as BOEM may claim, incorrectly, that such tools are not available, the agency has made no effort to provide substitutes, such as expert solicitation. As it stands, the evidence does not by any means support BOEM's summary assertion, in the DEIS, that Gulf marine mammals are not suffering adverse population-level effects from G&G activities.</p>	<p>Mexico, there are no data available to inform the "health" step of the PCoD model and very limited data to support such an analysis. BOEM has used the best available data to infer fitness level consequences in Chapter 4.2.</p>
1074-0069	<p>(2) Potential impacts of sources with peak output greater than 200 kHz</p> <p>Two recent papers document the significant frequency "leakage" that can occur in some geophysical sound sources, particularly sources used in high-resolution surveys, such as echosounders, that combine high source levels with rapid rise times. The leakage is so significant that tested sources with peak frequencies at and above 200 kHz, well beyond the range of marine mammal hearing, produced substantial noise within marine mammal hearing ranges in much lower bands.¹²⁵</p> <p>For example, a BioSonics sonar system produces 165 dB (SPL) in the 1/3-octave band centered at 20 kHz, and comparable levels of sound across much of the frequency spectrum below 100 kHz. While these source levels are appreciably lower, at relevant frequencies, than those generated by sub-bottom profilers and other lower-frequency systems, their amplitude is sufficient to induce behavioral effects and contradicts the assumptions made in the DEIS, in its modeling of representative low-energy sources, particularly of (see DEIS at D-154).</p> <p>Furthermore, the short rise times that these sources exhibit are</p>	<p>BOEM thanks you for this comment and is already aware of and has considered the issue of harmonics and, in this case, sub-harmonics in its analysis. Also, the data that you cite are consistent with previously observed occurrences of sub-harmonics. Essentially, the first sub-harmonic's source level (i.e., if the primary frequency is 200 kHz, the first sub-harmonic is 200/2 or 100 kHz, the second is 200/3 or 66.7 kHz, etc.) is at least 20-30 less than the primary frequencies source level, with each subsequent sub-harmonics' source level decreasing rapidly from there. These sub-harmonics are typically so reduced in source level that, for most side-scan and multi-beam sonar systems, they are not strong enough to produce potential Level A impacts beyond a meter or so from the source, and even potential Level B impacts only occur within tens of meters from the source. Additionally, for the impacts to occur, the animal must be within this range and within the very narrow beams produced by the systems (for these sub-harmonic frequencies). Finally, recent sound source verification testing of these and many other high-resolution survey sonar system conducted by the Naval Undersea Warfare Center for BOEM (refer to Crocker and Fratantonio, 2016) did not observe sub-harmonics in any of the systems tested under controlled conditions under many different modes (of operations). It is known that they can</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>correlated across mammalian species with startle response, raising concerns about sensitization. In a 2011 study, researchers demonstrated that sounds eliciting an acoustic startle response in captive grey seals were associated with “rapid and pronounced” sensitization, taking hold after only about 3 playbacks, whereas sounds that failed to induce a startle response did not sensitize the animals.¹²⁶ The startled seals then displayed sustained spatial avoidance, rapid flight responses, and “clear signs of fear conditioning,” and, once sensitized, even avoided food that was proximate to the sound source. According to the authors, sounds with short rise times thus have “the potential to cause severe effects on long-term behavior, individual fitness and longevity of individuals in wild animal populations.” In one of the more recent studies, the BioSonics sonar system discussed above produced a strong behavioral response in the same species, leading the researchers to conclude that it could produce startle responses, and therefore potentially sensitization, as well. The EIS should consider the effects of short rise time from these (and other) sources [sources with peak output greater than 200 kHz].</p>	<p>occur during actual operations, but this is believed to often be due to either "dirty" power system, actual physical mounting issues or use of an aged/damaged sonar system. Therefore, they do not occur for all systems. The overall result of these considerations is that there is an exceedingly small chance for sub-harmonics to add to the Level A or Level B impacts from typical HRG surveys, where other sonar systems are often operating simultaneously in an animal’s hearing range and with the vessel producing noise also.</p>
<p>1076-0009</p>	<p>A fundamental flaw with the DPEIS is its establishment of an unrealistic scenario in which G&G activities are projected to result in supposed effects to marine mammals that BOEM admits are unrealistic overestimates of impact. The supposed adverse effects of this worst case hypothetical scenario are then addressed in the DPEIS with burdensome and unsupported mitigation measures. This approach is contrary to both the best available scientific information and applicable law.</p>	<p>Thank you for your comment. The scenario presented in this Programmatic EIS was based on the best available information derived from BOEM's consultations with industry, as well as historical permit application information for data on representative equipment specifications and projected survey activities (including expectations for level of effort relative to both location and time).</p> <p>Text was revised in Chapter 1.2.5 to summarize material on the model that is included in more detail in Appendix D. The term “worst case” was erroneously used and was replaced with language that more accurately reflected the work that was done.</p>
<p>1076-0010</p>	<p>For over 40 years, the federal government and academic scientists have studied the potential impacts of G&G activities on marine mammals, and have concluded that any such potential impacts are insignificant. Indeed, this conclusion has been publicly reaffirmed by BOEM (see Section III.B.3 infra) and</p>	<p>Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>the DPEIS fails to present any evidence to counter this well-supported and longstanding conclusion. The DPEIS's suggestion that such impacts are "moderate" (as opposed to insignificant) is not supported by the best available science and is made possible only by application of overly conservative estimates that BOEM admits do not accurately reflect the actual anticipated impacts.</p>	<p>considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating potential impacts. BOEM will also conduct future site-specific NEPA analyses for G&G permits using the best data available at that time.</p>
1076-0019	<p>The DPEIS concludes—for each alternative—that the effects of sound from project related seismic surveys on marine mammals are "expected to be moderate, as potential exposures of marine mammals are expected to be extensive (potentially affecting large numbers of individuals within areas of the AOI)..." DPEIS at 4-60. The Associations strongly disagree with this conclusion because it has no support in fact, science, or law. Specifically, as set forth below, this conclusion is erroneous because it (i) is derived from an unlawful "worst case analysis" that BOEM admits is not realistic; (ii) ignores the effects of mitigation measures; (iii) relies on biased and flawed technical assumptions and modeling; and (iv) does not consider all of the best available information, including a wealth of data demonstrating that seismic activities have had no detectable adverse impacts on marine mammal populations.</p>	<p>The analysis of potential impacts for Alternative A was based on the results generated from a modeling study (Appendices D and N). The models incorporated representative sound source arrays and projected survey scenarios (both based on the best available information obtained from industry and historical permit application data), physical and geological oceanographic parameters at several locations within the AOI (during different seasons) derived from scientific literature, current marine mammal distribution and density data (during different seasons), and information on known behavioral patterns of each species. Additional discussion on the modeling effort was added to Chapters 1.2.5 and 1.2.6. For further details, refer to Appendices D and N.</p> <p>The impact analyses and conclusions, derived in past from these modeling efforts, can be found in Chapter 4.2.2.</p>
1076-0036	<p>...DPEIS's analysis of marine mammal impacts is, at best, "highly speculative" because it is based on scenarios and assumptions that, by BOEM's admission, are not accurate and will not occur. For these additional reasons, the analysis of the effects of seismic activities in the DPEIS is arbitrary and violates NEPA.</p>	<p>Thank you for your comment. Scenarios used in this Programmatic EIS were based on information derived from industry. This included specifications for various sound sources as well as spatial and temporal projections for offshore survey activities during the 10-year period of this Programmatic EIS. BOEM and NOAA consulted and developed the alternatives together, and NOAA added additional alternatives after the completion of the preliminary Draft Programmatic EIS. Acoustic exposure to marine mammals associated with Alternative A was based on an extensive modeling study (Appendix D) that utilized</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>equipment specifications and survey projections provided by industry to BOEM, sound propagation modeling in representative locations within the AOI, and species-specific animat modeling methods utilizing acoustic criteria approved by NOAA at the time that this Programmatic EIS was prepared. The animat modeling and acoustic exposure estimations did not factor effects from mitigation methods and aversions; therefore, as noted by BOEM, exposure estimates presented in the study and this Programmatic EIS are conservative but reasonable.</p> <p>They are based on projected temporal and spatial levels of industry activity, realistic sound source characteristics, survey-based marine mammal density estimates, and state-of-the-art acoustic propagation and exposure modeling. Current scientific knowledge regarding the impacts of acoustic exposure and the recognized data gaps regarding acoustic effects on marine mammals were employed to derive well-founded impact determinations.</p>
1076-0037	<p>...there is a wealth of available information that actually informs the analysis of the reasonably foreseeable effects caused by seismic activities. These data are either minimized or not addressed at all in the DPEIS. BOEM must consider this available information to assess the biological significance of the exposure estimates. Without any assessment of biological significance, the exposure estimates are entirely uninformative and misleading.</p>	<p>BOEM prepared this Programmatic EIS using the best available data and included reasonable assumptions to estimate potential impacts. BOEM is involved in several ongoing programs to improve existing data for marine mammals and underwater noise, and future analyses will use the best data available at that time.</p>
1076-0038	<p>BOEM goes to great lengths to assert, correctly, that exposures are not necessarily incidental takes. See, e.g., DPEIS at 1-15. In the same paragraph, however, BOEM contradicts itself by stating, without support, that it expects that the "majority of exposures" are likely to result in takes. Id. at 1-15, 1-16. BOEM makes no effort to quantify or otherwise qualitatively address the significance of exposures. As a result, exposures become a de facto surrogate for "takes." See DPEIS, Appx. D at D-310-320.</p>	<p>There has been some confusion in this Programmatic EIS regarding terminology using exposure versus take. Refer to the revised text in Chapter 1.2.5.</p>
1076-0039	<p>...The history of formal assessments of offshore seismic activities demonstrates that levels of actual incidental take are far smaller than even the most balanced pre-operation</p>	<p>Studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering their</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>estimates of incidental take.¹² Indeed, more than four decades of worldwide seismic surveying and scientific research indicate that the risk of physical injury to marine life from seismic survey activities is extremely low. Currently, there is no scientific evidence demonstrating any biologically significant negative impacts to marine life from seismic surveying. As stated by BOEM:</p> <p>To date, there has been no documented scientific evidence of noise from air guns used in geological and geophysical (G&G) seismic activities adversely affecting marine animal populations or coastal communities. This technology has been used for more than 30 years around the world. It is still used in U.S. waters off of the Gulf of Mexico with no known detrimental impact to marine animal populations or to commercial fishing.</p>	<p>vocalizations. This Programmatic EIS acknowledges that acute physical injury other than auditory, or death of marine mammals is not likely to be a direct result of seismic noise. It does, however, acknowledge that disruption of behavioral patterns or auditory injury are possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. BOEM, however, does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p>
1076-0040	<p>...the DPEIS fails to evaluate the accumulated observational data collected by Protected Species Observers ("PSOs") on survey vessels in the GOM as part of the DPEIS's effects analysis. This information is relevant to the assessment of marine mammal effects by seismic vessels operating in the GOM. Not surprisingly, the PSO data indicate a negligible level of effects that undermines the results of the exposure modeling presented in Appendix D. For example, the DPEIS implausibly concludes that many thousands of marine mammals will experience incidental take as a result of seismic activities. These estimates would result in tens of thousands of shutdown events per year. However, based on actual monitoring data, as reported in relatively recent environmental assessments, an average of only 55 shutdowns per year occur in the GOM with operations conducted under the Standard Mitigation Measures. See also Barkaszi et al. (2012) (reporting a total of 144 shutdowns from 2002 to 2008, or 24 per year); Attachment B.¹⁴</p>	<p>There has been some confusion in this Programmatic EIS regarding terminology using exposure versus take. Refer to the revised text in Chapter 1.2.5.</p>
1076-0040 (continued)	<p>The PSO data must be fully disclosed and evaluated in the DPEIS and the effects analysis must be substantially revised to account for the available PSO data. See Gas Appliance Mfrs. Ass'n, 998 F.2d 1041, 1045 (D.C. Cir. 1993) ("Since the accuracy of any computer model hinges on whether the</p>	<p>Mitigation measures included in this Programmatic EIS (Appendix B, Section 1.2.4) are designed to minimize disturbance and potential auditory injuries to marine mammals (and sea turtles) during seismic surveys. The elements of these mitigation measures are continually evolving, and those</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>underlying assumptions reflect reality . . . [t]he agency's burden [to demonstrate the reasonableness of a model] becomes heavier when a method of prediction is being relied on to overcome adverse actual test data." (quotations and alteration omitted).</p>	<p>included in this Programmatic EIS represent the best available scientific knowledge. All of the elements have limitations that may reduce their effectiveness, as discussed in Appendix B, Section 1.2.4. For example, PSO data do not include accurate enumerations of all animals that may be within the exclusion zone either before or during surveys. Animals that may enter the exclusion zone may remain submerged or may not be detected due to limiting environmental conditions. Similarly, visual monitoring takes place only during daylight hours. Therefore, numbers of animals sighted and recorded in these reports are likely underestimated.</p> <p>While PSO data were not included in the noise exposure modeling exercise for the reasons noted above, PSO sightings' data were addressed throughout the alternatives analysis (e.g., refer to Chapters 2.11.1 and 2.14.7) and as a component of the summaries of marine mammal sightings and behavioral observations during seismic surveys (e.g., refer to Chapter 4.2.2.1).</p>
1076-0041	<p>Aside from being scientifically and legally indefensible, BOEM's conclusion is not supported by the best available information, which demonstrates that no "long-lasting" or "severe" impacts to marine mammal populations from seismic activities have occurred in the GOM. Indeed, BOEM's conclusion is not even supported by its own statements. See DPEIS at 4-59 ("the best available information, while providing evidence for concern and a basis for continuing research, does not, at this time, provide grounds to conclude that [seismic] surveys would disrupt behavioral patterns with more than negligible population-level impacts" (emphases added)). To make matters worse, the unrealistic scenario presented in the DPEIS is evaluated in a vacuum, with no meaningful consideration of the effectiveness of the mitigation measures that are expressly included in the proposed action. Insofar as we are aware, no seismic activities in the United States OCS have caused impacts amounting to anything more than temporary changes in behavior, without any known injury, mortality, or other biologically significant consequence to any marine mammal species or stocks.¹⁵</p>	<p>The analysis of potential impacts for Alternative A was based on the results generated from a modeling study (Appendices D and N). The models incorporated representative sound source arrays and projected survey scenarios (both based on the best available information obtained from industry and historical permit application data), physical and geological oceanographic parameters at several locations within the AOI (during different seasons) derived from scientific literature, current marine mammal distribution and density data (during different seasons), and information on known behavioral patterns of each species. Additional discussion on the modeling effort was added to Chapters 1.2.5 and 1.2.6. For further details, refer to Appendices D and N.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0042	<p>The DPEIS's finding that seismic activities will cause "moderate" impacts to marine mammals has no factual or scientific support, is contrary to the best available information, and violates NEPA.</p>	<p>Impact ratings used in this Programmatic EIS were designed to address impact probability, severity, and duration to local populations rather than to individual animals. The definitions of each impact level were purposely broad to avoid exceptions to single impact ratings due to the complexities of program-related IPFs to resources that occur within the AOI and over the 10-year period of this Programmatic EIS. Potential impacts to species listed as endangered or threatened by the ESA and marine mammal stocks listed as strategic by the NMFS were given greater "weight" than impacts to non-listed species and non-strategic marine mammal stocks. "Moderate" impacts were defined within this Programmatic EIS as those that are detectable, short-term, extensive, and severe; or impacts that are detectable, short-term or long-lasting, localized, and severe; or impacts that are detectable, long-lasting, extensive or localized, but less than severe.</p> <p>From the analysis of impacts (Chapter 4), estimates of potential injurious and non-injurious auditory exposures to individual species are addressed in Chapter 4.2.2.2 and are based on the results of an extensive modeling study (Appendix D). This modeling effort utilized the best available information and current accepted standards for auditory thresholds for both injurious and non-injurious (behavioral) thresholds as well as the best available information on regional (and seasonal) densities of marine mammal species. From these results, potential impacts to marine mammals from deep-penetration seismic airgun surveys were predicted to result in extensive (i.e., affecting large numbers of individuals), short-term but not severe impacts. These potential impacts would consist of largely behavioral responses and temporary auditory impairment (TTS onset), with limited physical injury expected.</p> <p>In summary, potential impacts to marine mammals from G&G activities have been based on projected temporal and spatial levels of industry activity, realistic sound source characteristics, survey-based marine mammal density</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		estimates, and state-of-the-art acoustic propagation and exposure modeling. Current scientific knowledge regarding the impacts of acoustic exposure and the recognized data gaps regarding acoustic effects on marine mammals were employed to derive well-founded impact determinations.
1076-0043	The record demonstrates that the Standard Mitigation Measures, as applied to offshore operations in the GOM, are already more than adequate to protect marine mammals, sea turtles, and fish species in a manner consistent with federal laws. ¹⁸ Despite this record, the DPEIS recommends certain mitigation measures that have never been required for offshore exploratory operations in the United States, and that are more stringent (and less supported) than the measures that have already been successfully implemented. Many of the unprecedented measures recommended in the DPEIS are a direct result of BOEM's flawed impact assessments. As described above, the DPEIS creates a hypothetical worst case scenario for marine mammal impacts, determines that the projected adverse effects in that scenario will be substantial, and then recommends mitigation measures to address those supposed effects. However, because the adverse effects identified in the DPEIS are inaccurate and unrealistic, some of the mitigation measures intended to address those effects are similarly flawed and without support.	As part of the Settlement Agreement (Chapter 1.2.3), BOEM is required to analyze these mitigation measures as potential COAs for permit applications for deep-penetration seismic surveys in this Programmatic EIS. Through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data on the efficacy of mitigation measures to adjust mitigation requirements for individual surveys based on the best available information at that time. Through the Environmental Studies Program (https://www.boem.gov/Environmental-Studies-Planning/), BOEM is currently funding and is planning to fund additional studies and workshops to examine the effectiveness and feasibility of mitigation measures in the GOM.
1076-0043 (continued)	The record demonstrates that the Standard Mitigation Measures, as applied to offshore operations in the GOM, are already more than adequate to protect marine mammals, sea turtles, and fish species in a manner consistent with federal laws. ¹⁸ Despite this record, the DPEIS recommends certain mitigation measures that have never been required for offshore exploratory operations in the United States, and that are more stringent (and less supported) than the measures that have already been successfully implemented. Many of the unprecedented measures recommended in the DPEIS are a direct result of BOEM's flawed impact assessments. As described above, the DPEIS creates a hypothetical worst case scenario for marine mammal impacts, determines that the projected adverse effects in that scenario will be substantial,	BOEM recognizes the conservative nature of the impact assessment and is fully cognizant of NEPA requirements, particularly in terms of the precautionary principle. For example, potential impacts to marine mammals from G&G activities have been based on projected temporal and spatial levels of industry activity, realistic sound source characteristics, survey-based marine mammal density estimates, and state-of-the-art acoustic propagation and exposure modeling. Current scientific knowledge regarding the impacts of acoustic exposure and recognized data gaps regarding acoustic effects on marine mammals were employed to derive well-founded impact determinations. Impact determinations are necessarily conservative, as they do not account for seismic survey mitigation measures (e.g.,

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	and then recommends mitigation measures to address those supposed effects. However, because the adverse effects identified in the DPEIS are inaccurate and unrealistic, some of the mitigation measures intended to address those effects are similarly flawed and without support.	NTL 2016-G02) or potential aversion behaviors. Despite the growing scientific knowledge regarding the impacts of acoustic exposure to marine mammals and other groups, additional mitigation measures under select circumstances are offered in keeping with the spirit of the precautionary principle.
1076-0092	Saying habitat avoidance is an extreme case and including it alongside "death" is not appropriate and misleading. Neither long-term nor permanent habitat avoidance has been observed in conjunction with seismic surveys. No mortalities have ever been confirmed, despite extensive effort to detect such effects. It is unreasonable and not consistent with best available information to infer these effects are possible just because they are imaginable. Contrast with sonar sound, in which association with strandings and mortalities are well-documented. Just because one sound source might have an effect does not mean that other very different sources, used in very different contexts, might have the same effect, especially when the sources in question have been in widespread use for over 50 years.	The comment has taken the statement out of context. The entire sentence reads as follows: "Noise, either natural or anthropogenic, can adversely affect marine life in various ways—inducing alteration of behavior, reduction of communication ranges or orientation capability, temporary or permanent damage to the auditory or other systems; and/or, in extreme cases, habitat avoidance or even death (e.g., Richardson et al., 1995; NRC, 2003, 2005; Nowacek et al., 2007; Southall et al., 2007)." Therefore, it was not a specific statement about the potential effects from seismic surveys but of the range of effects that have been documented from noise.
1076-0095	The potential for a single mortality from a vessel strike causing a jump from nominal to moderate impact is inconsistent with arguments made on the previous pages that changes in impacts to a single species/stock are insufficient to warrant a change in the significance level when considering all species across 10 years.	At the Programmatic EIS level, a rating jump such as this would pertain to the potential mortality of a listed species (sperm whale) or other species of concern (such as beaked whales and Bryde's whale) with low PBR ratings (e.g., sperm whale PBR = 1.1, Cuvier's and Blainville's beaked whale PBR = 0.8, and Bryde's whale PBR = 0.03). Within this Programmatic EIS, each rating by IPF was an integrated assessment of the effects of the IPF to all species within the AOI over a 10-year period. However, an impact that resulted in a likely mortality of an individual or individuals of an endangered species or species of concern increased the severity of this impact to marine mammals as a whole. Subsequent NEPA evaluations will be done at the site-specific level to determine the potential impacts from each individual survey and the cumulative activities occurring at that time.
1076-0096	Why would impacts reach the level of moderate for Marine Mammals inside MPAs when MPAs represent a pretty small area inside the AOI? Some might argue that MPAs contain unusual densities of species of concern or contain critical	Impact ratings to marine mammals and other highly mobile species addressed within the MPA section mirror those used in Chapter 4.2.2.1 and do not refer to subsets of individuals that may be within the MPAs. As noted, there is no

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	habitat, but neither of these assertions are supported by the best available data (e.g. Duke density maps or what data we have from tags and surveys concerning breeding, foraging and other vital activities).	information that quantifies the densities of marine mammals or sea turtles by species or as a group within MPAs; therefore, a determination of impact was drawn from the overall analysis for the AOI.
1076-0098	The analysis of fitness level consequences in this section involves comparing the number of total animals in a hypothetical 7,000 km ² survey area to the number animals that would be within the acoustic threshold distance at any one time. This seems to have been done to compensate for the fact that exposure modeling was conducted for a 24hr period and discusses the probability of an animal experiencing multiple exposures to Level A acoustic energy, but the logic behind this approach is not at all clear. This should be more fully explained.	Thank you for your comment. Edits have been made to the "Fitness Level Consequences" section of Chapter 4.2.2.1.2 to clarify the discussion and expand the quantitative analyses with results from Appendix D .
1076-0099	The argument made here that seems to be predicated on fitness level consequences coming from multiple exposures of the same individual above Level A criteria is not clear. There is not support for the final sentence and there is not an initial logical argument made for how multiple exposures and not a single exposure would lead to fitness level consequences or why the traditional density x area calculation was used for this assessment rather than the results of exposure modeling.	Clarifying language has been added to the "Fitness Level Consequences" text in Chapter 4.2.2.1.2 . Because BOEM cannot discount the possibility of fitness-level consequences from multiple exposures, we acknowledged the possibility in this Programmatic EIS (Chapter 4.2.2.1.2). However, as discussed in this Programmatic EIS, multiple exposures at that level remain unlikely.
1076-0100	No support for this is provided in the document and, to our knowledge, none exists in the scientific literature.	Change have been made in Chapter 4.2.2.1.2 . Text was added stating that minimum multiple deep-penetration seismic survey spacing requirements will ensure that marine mammals will have areas of refuge from ongoing survey noise and that the prescribed minimum separation distances will ensure that there will be areas for avoidance where sound levels will not meet the threshold of harassment.
1088-0004	The DPEIS relies upon the unilateral adoption of an untested process for generating marine mammal population statistics, early application of the process indicates overestimation of some marine mammal species. I encourage BOEM to calibrate population estimates through comparison to Stock Assessment Reports (SARs) and other peer reviewed scientific sources.	The Duke density model (Roberts et al. [2016]) is peer reviewed and is the latest and best available science. Chapter 1.2.5 was revised to include more information on the density and abundance model inputs used for the modeling effort for this Programmatic EIS.
1088-0005	There is no evidence that sound produced by exploring for oil and gas with seismic sources has resulted in any injury to marine mammals or negatively impacted marine mammal	Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism,

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

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	<p>populations in the GOM. In fact, marine life, commercial fishing and seafood production have thrived in the GOM for decades alongside geophysical surveys</p>	<p>economics, and space use) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>BOEM prepared this Programmatic EIS using the best available data from the subject-matter experts and included conservative assumptions to avoid underestimating potential impacts.</p>
<p>1091-0002</p>	<p>Given both the proposed leasing area for seismic surveys in the Gulf of Mexico and sperm whale's wide-ranging habitat in the Gulf of Mexico, there will be spatial overlap between these odontocetes and seismic surveys. The study most relevant to this subject is the Miller et al. (2009) study in Deep Sea Research I: Oceanographic Research Papers. Here, the authors found that none of eight tagged sperm whales exhibited horizontal avoidance to seismic vessels at distances of 1-13 kilometers and maximum received levels of 152-162 dB peak-peak re 1 μPa. The authors note this could be from the whales not being affected by this sound, having become habituated to this type of sound source in the Gulf of Mexico, or because the benefits of remaining in the area were less costly than swimming away (Miller et al., 2009). Alternately, the authors noted that for seven of the eight tagged whales, they continued with foraging behavior uninterrupted throughout exposure, though at apparently diminishing rates, while the whale closest to the sound source exhibited an unusually long resting period and delayed its foraging dive (Miller et al., 2009). The study sample, however, was small (n=8), and the authors note that more research is needed on the subject (Miller et al., 2009). Thus, this study cannot be interpreted as being fully representative for sperm whales in the Gulf of Mexico.</p>	<p>Thank you for your comment. The referenced manuscript and prior BOEM synthesis report (Jochens et al., 2008) indicate that the Sperm Whale Seismic Study (SWSS) greatly advanced our knowledge of the sperm whale population in the northern Gulf of Mexico, though it stressed the need to better understand their behavioral response to anthropogenic noise in the region and its biological significance to the population. This study does represent the best available data and begins to provide insight into potential effects.</p>
<p>1091-0003</p>	<p>Additionally, given sperm whales' reliance on vocalization (codas) in both their social structure and for their use of clicks and buzzes for foraging, there is potential for seismic surveys to mask sperm whale key behavior. Masking in odontocetes is</p>	<p>The potential for masking to occur is addressed in Chapter 4.2.2.1. To particularly address the potential for masking of sperm whales, frequencies of sperm whale vocalizations are predominantly in the 5- to 25-kHz range,</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

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	<p>less understood than in baleen whales, but there is evidence of temporary masking in beluga whales from exposure to a single seismic airgun source (Finneran et al., 2002).</p>	<p>though some energy is found at frequencies lower than 100 Hz. In contrast, the majority of energy from seismic surveys occurs at less than 1 kHz, resulting in little frequency overlap and limited potential for masking</p>
<p>1091-0008</p>	<p>In addition to risks from masking, the current injury and behavioral impact exposure listed in Table F-11 in Volume II in the Draft Programmatic Environmental Impact Statement estimates that 81238.9 sperm whales will be exposed to Level A Harassment, and 680502.4 will be exposed to Level B harassment over the next decade from all cumulated exposures. Using NOAA's 2015 abundance estimate, this means sperm whales will be exposed to injury producing sound levels 106.47 times each using NOAA's abundance estimate (NOAA, 2015b) or 38.18 times each using CetMap's estimates over the next 10 years.</p> <p>Such levels of exposure carry considerable risk to disrupting social structure, communication, foraging patterns, and other behavior of a species that is particularly slow-growing and at risk of many threats; this cannot be considered negligible impact. Furthermore, the cumulative exposure thresholds in the recently released NOAA exposure guidelines are likely to be violated by such numerous Level A exposures. As in the letter from 75 scientists to President Obama in 2015 regarding seismic testing in the Atlantic (Clark, et al., 2015), this activity as proposed poses long-lasting, widespread and potentially harmful exposure to marine mammals in the Gulf of Mexico.</p>	<p>Thank you for your comment. This Programmatic EIS was developed to analyze the potential impacts of G&G activities associated with BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals) within the AOI. The potential beneficial and adverse impacts to resources from Alternatives A through G are analyzed in Chapter 4. These analyses were developed by the subject-matter experts using the best available data. All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p>
<p>1091-0010</p>	<p>Gulf of Mexico Bryde's whales are of high conservation concern from small population size, little genetic diversity, and life history traits, and the proposed activity puts them at further risk... Bryde's whales show a spatial affinity for the De Soto Canyon off Florida's western panhandle at depths from 100 to 1000 meters (Maze-Foley and Mullin, 2006). While the acoustic modeling included with the PEIS (Appendix K) indicates that this may be a relatively quiet area due to the location of surveys and the bathymetry of this area, it is quite possible that the Bryde's whale distribution historically included areas west of the De Soto Canyon (Rosel and Wilcox, 2014). Therefore, the industrial</p>	<p>Thank you for your comment. BOEM conducted a robust effects analysis that considered resources (e.g., marine mammals, fisheries, fish habitat, recreational fishing, tourism, and economics) within the AOI. Chapter 4 presents the effects analysis and conclusions for all of the resources considered. BOEM analyzed a suite of proposed mitigation measures to reduce the effects of proposed G&G activities. Chapter 2 describes the proposed alternatives and mitigation measures in detail.</p> <p>BOEM developed the proposed mitigations and alternatives in</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>activity of the past 20-plus years may well have driven these animals to inhabit a relatively small portion of their former range. The small population size and low genetic diversity of Bryde's whales in the Gulf of Mexico makes them one of significant conservation concern (Rosel and Wilcox, 2014), and at the time of writing, NMFS is pending review of a petition to list the Gulf of Mexico Bryde's whale as a distinct population segment listed as endangered under the Endangered Species Act (NRDC, 2014). Furthermore, though little information is known on Bryde's whale life history, Bryde's whales are slow growing and slow to reproduce, pregnancy lasts for roughly one year, and they are assumed to reach sexual maturity from 8-13 years of age for females, though this varies by location (Best, 1977)... Given the Sirovic et al. (2014) findings, as well as Bryde's whales extremely low density estimates and narrow geographic range in the De Soto Canyon, any seismic testing in or near the De Soto Canyon carries risk, and extreme precaution, perhaps in the form of additional mitigation measures, should be applied in working with Bryde's whales.</p> <p>Table F-11 in Volume II in the Draft Programmatic Environmental Impact Statement estimates that 588.8 Bryde's whales will be injured over the course of the next decade from all geological and geophysical activities in the Gulf of Mexico under Level A sound exposure levels, and 6,487 will be exposed to Level B harassment. Using population density outlined in the SAR, this means an individual Bryde's whale could be injured 17 times (NOAA, 2015a) or 13.38 times under CetMap estimates. Under Level B exposure, BOEM estimates that Bryde's whales will experience behavioral disruption 6,487 times, or roughly 196.58 times per individual under NOAA abundance estimates and 147.43 times for the CetMap estimates. Such levels of exposure over prolonged periods could simply decimate this extremely small, slow-growing, and late to mature cetacean.</p>	<p>close coordination with NMFS using the best available science (including impacts to Bryde's whale; Chapter 4.2 and Appendices K and N). All of this information will be considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>BOEM and NOAA are working together to meet statutory obligations (e.g., NEPA, Marine Mammal Protection Act, and Endangered Species Act) to manage G&G activities and their potential impacts to marine resources, including marine mammals, in the GOM.</p>
1095-0001	I urge the Bureau of Ocean Energy Management to withdraw your proposal to allow acoustic exploration for oil and gas across yet more of the Gulf of Mexico, this acoustic assault on	Thank you for your comment. This Programmatic EIS, as well as previous Bureau of Ocean Energy Management G&G EISs, uses the NEPA process to identify and assess reasonable

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>the marine environment would have devastating impacts on marine mammals and other inhabitants of the Gulf ecosystems, as well as inflict horrendous and heinous suffering on individual animals.</p>	<p>alternatives to a proposed action that avoids or mitigates adverse effects of a given action upon the quality of the environment. The DOI regulations to implement NEPA can be found in 43 CFR part 46 (<i>Federal Register</i>, 2008). It is recognized and clearly stated in this Programmatic EIS that G&G activities in OCS waters may impact marine animals within discrete areas and over periods of time. This Programmatic EIS documents IPFs associated with proposed activities and, within numerous program alternative scenarios using the best available science, estimates potential effects to resources from these factors over a 10-year period. Protective measures and mitigation designed to minimize or eliminate impacts to resources meet or exceed requirements specified in the OCSLA (Appendix B). These mitigation measures represent standard procedures, worldwide, for G&G activities. BOEM will continue to develop studies to address questions or concerns regarding operational technologies and impact mitigation to reduce or eliminate potential impacts to resources from these activities.</p>
1095-0003	<p>Scientific studies have shown that the airgun devices used by industry produce the loudest aquatic sound waves besides outright explosives, and can cripple the hearing and echolocation organs of marine mammals, even across distant swaths of the ocean. The BOEM itself estimate that this invasive, violent form of "exploration" would cause 31.9 million incidents of injury, harassment, disruption, or outright death. Of these, an estimated 588 would be incurred by the extremely tenuous Gulf population of Bryde's Whales, or an average of 17 incidents of injury for each individual whale. A similarly overwhelming assault of 760,000 assaults upon a mere 800 remaining Sperm Whales would occur, by your agency's own analysis. These are demographically overwhelming losses that the already imperiled populations of marine mammals cannot sustain, in light of all the other threats to the Gulf of Mexico. Such an overwhelming assault breaches all familiar notions of reasonable balance among competing interests, proportionality of sacrifices, or sanity in our moral regard for extremely intelligent fellow mammals whose habitation and</p>	<p>Thank you for your comment. Please understand that the marine mammal auditory exposure estimates presented in this Programmatic EIS do not necessarily represent "incidents of injury, harassment, disruption, or (especially) outright death." The numbers of Level A and Level B exposures presented in these tables have been generated from the results of an extensive modeling study that factored in representative sound source arrays used in numerous surveys projected throughout most of the AOI for a period of 10 years. What is important to note is that the modeling effort did not consider the effects of mitigation measures that are specified in this Programmatic EIS (Appendix B), the latter of which meet or exceed worldwide industry standards. Also, animat modeling did not include aversion effects (i.e., animals may move away from the approaching sound source). Thus, these exposure values are conservative but reasonable estimates. No mortalities of marine mammals from exposure to seismic airgun surveys have been reported, and the direct impact of any actual Level A harassment (Chapter 4.2.2.1.2) to marine mammals</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	rights greatly precede humans in the Earth's chronology.	<p>within the AOI from deep-penetration seismic airgun activities would only include hearing (auditory) injury onset, specifically the onset of PTS impairment to individual or small groups of whales and dolphins over the 10-year period. The PTS onset injury is likely to be measured in a few dB loss in hearing sensitivity, not profound loss, because most predicted incidents of auditory injury would occur at greater distances rather than at closer range to the source. The effects of hearing (auditory) injury to marine mammals could cause some reduction in communication and foraging ability. Level B harassment may include temporary hearing impairment (TTS) and behavioral harassment. Studies have demonstrated disturbance of activities or avoidance or temporary displacement from seismic surveyed areas; estimates of potential exposure suggest that large numbers of individual cetaceans could experience non-injurious impacts from seismic airgun surveys during the project period.</p> <p>Seismic airgun surveys would occur in open ocean areas following standard survey lines where highly mobile whales and dolphins are able to move freely to avoid the acoustic footprint of the relatively slow-moving sound source, thus potentially avoiding exposure to injurious sound levels. Because these surveys will occur within the open GOM, there are no physical features that would restrict the movement of animals and it is not likely that a survey vessel would entrap animals between a sound source and shore.</p>
1095-0007	The BOEM must also heed the cruelty, inhumanity, and barbarism inherent in subjecting marine mammals to these airgun devices. As best science can tell, whales, dolphins, and porpoises are extremely intelligent, sentient beings with a range of sensory faculties exceeding those of humans in the apprehension of their aquatic domain. It is extremely likely that the experience of an airgun detonation in the vicinity of a whale whose echolocation tissues are attuned to very slight waves is horrendously painful and traumatic, as well as crippling to that animal's survival. This makes the exploration deeply immoral with respect to individual animals, as well as biologically	Thank you for your comment.

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	destructive to the species and marine ecosystem. It is not within the set of morally rational or sane policies to unleash this acoustic assault on the inhabitants of the Gulf of Mexico to acquire a substance that our civilization must relinquish for its own survival as well.	
1108-0002	Seismic surveys have been safely used for decades to accurately assess energy reserves in the Gulf of Mexico. BOEM has clearly stated there is no scientific evidence in the past of seismic activities causing damage to marine ecosystems or coastal communities	Thank you for your comment. The statement "BOEM has clearly stated there is no scientific evidence in the past of seismic activities causing damage to marine ecosystems or coastal communities" is not entirely accurate. It has been stated in past BOEM impact assessment documents, as well as this current Programmatic EIS, that these activities can and may impact marine ecosystems, referencing those constituents of these ecosystems that are sensitive to sound (e.g., marine mammals, sea turtles, and fishes). It is important to note that the documents state that sound-related impacts will not result in mortalities or life-threatening injuries; rather, these impacts may range from some injuries (PTS), TTS onset, and behavioral harassment (responses). These potential impacts may affect several individuals over the course of this Programmatic EIS (10 years) or during the course of a site-specific activity, but they are not expected to occur at the population level.
1121-0002	We are seeing the collapse of the Gulf Ecosystem in the wake of the BP disaster. It will take a minimal of 40 years for the bottlenose dolphin population to recover. Just this year, a juvenile sperm whale washed ashore in Louisiana. The loss of these large and dominant predators is a sign that the whole system is in a state of collapse.	Thank you for your comment. Please be advised that the cetacean UME in the northern Gulf of Mexico is now closed (http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulf_of_mexico.htm). Per NOAA, the evidence to date supports the premise that exposure to <i>Deepwater Horizon</i> petroleum products was the most likely explanation for the adrenal and lung disease in dolphins, which has contributed to increased deaths of dolphins living within the oil-spill footprint and increased fetal loss. However, NOAA also notes that other causes, such as infections with <i>Brucella</i> bacteria, may have contributed to these mortalities. The number of dolphin mortalities in the area decreased after the peak from March 2010 to July 2014. The cause of the recent sperm whale stranding has not been determined; it is not warranted at this time to conclude that sperm whale strandings were a result of the spill. No other indicators of large predator loss within the

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		GOM have been published, further suggesting that an ecosystem collapse in the northern GOM has not occurred nor is expected to occur.
1127-0002	We strive to conduct our activities in an environmentally responsible way, and new technologies are continuously improving our ability to efficiently produce oil and natural gas, while minimizing environmental impacts. As you know, seismic surveying is an essential step in locating offshore energy reserves. Improved data analysis enables us to locate and develop oil and gas more efficiently. Seismic surveying has taken place for decades, and as BOEM itself has concluded, there is no evidence that surveying noise harms marine animals or commercial fisheries.	Thank you for your comment. High-energy seismic survey activities generate sound at levels that may injure and disturb some marine organisms, such as marine mammals, sea turtles, and fishes. With respect to marine mammals and sea turtles, operational mitigation measures are used prior to and during surveys to minimize potential injurious impacts to these resources. The actual effectiveness of these measures is not known, and studies suggest or show that the methods may not be 100% effective. Seismic surveys do disturb marine life, and the effects of these disturbances may negatively impact individuals or groups of animals.
1129-0002	According to BOEM's chief environmental officer, Dr. William Brown, seismic surveys are frequently used in the Gulf of Mexico with no known detrimental impact to marine animal populations or to commercial fishing.	It is critically important to understand that BOEM's conclusion in their August 2014 Science Note referenced in your comment refers to impacts on marine mammal and sea turtle population sustainability rather than effects on individual animals. Studies have shown that marine mammals may and do react to sound through physical displacement from or avoidance of the area of ensonification and/or by altering their vocalizations. This Programmatic EIS acknowledges that significant acute physical injury to or death of marine mammals is not likely to be a direct result of seismic noise. It does, however, acknowledge that sublethal injurious effects are possible and may, over time, result in the eventual death of the individual(s) from these physical injuries and/or loss of hearing with (as in the case of marine mammals) the resultant inability to forage and communicate with conspecifics. Another prominent concern is whether anthropogenic sounds such as those generated during seismic survey activities may "mask" communications between some marine mammals. Depressed survival rates related to energetic effects or other impacts of noise are difficult to determine. BOEM, however, does not assume that lack of evidence for adverse population-level effects of seismic surveys means that those effects may not occur.

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0015	<p>Consistency: Chapter 4 states that "closures that are part of some alternatives would reduce potential for masking in these areas (pg 4-36)." This is true, but how does that relate to the finding of little implications for non-marine mammal IPFs associated with the closure in FGB?</p>	<p>Thank you for your comment. Text has been added to Chapter 4.3.7.1.1 (sea turtles) stating that this mitigation measure would provide an ancillary benefit to individual turtles within the closure areas as effects on turtle hearing and behavior (addressed in detail in Appendices E and I) will be reduced following a reduction in active acoustic sound sources (e.g., seismic airgun and electromechanical sounds) and vessel and equipment noise. Text has been added to Chapter 4.5.7.1.1 stating that direct auditory injuries and masking protection from auditory seismic activities would be provided to benthic organisms within closure areas. The Flower Garden Banks National Marine Sanctuary and auditory impact examples were added to Chapters 4.7.7.1.</p>
1130-0018	<p>NOAA reiterates its concern that the effects of the Deepwater Horizon (DWH) oil spill are not adequately integrated into the environmental baseline such that a clear statement is made about the extent to which the damages incurred by living marine resources in the GOM have impacted those resources' resilience to the impacts of the PEIS proposed action. Meaningful discussion of oil spill damages is limited to summary information provided in Appendix E, which BOEM states was "indirectly considered." If BOEM has performed any explicit analysis of this information in its assessment of the environmental baseline, we can find no evidence of it. Reasonably available information regarding the effects of the spill, with particular reference to marine mammals, indicates that marine mammal stocks in the GOM were strongly impacted by the DWH incident. This information must be considered in light of the proposed action, e.g., that this shifted baseline has implications for both the susceptibility of impacted individuals to additional stressors, as well as the degree of impact that said stocks can likely sustain. If DWH caused population declines and/or reduced reproductive success that is likely to lead to future population declines for certain stocks of marine mammals, it seems likely that those stocks are able to sustain a lower level of impacts due to the proposed action while remaining at a given impact severity rating.</p>	<p>Thank you for your comment. Additional text has been added in Chapter 4.2.1 to augment the description of the <i>Deepwater Horizon</i> spill and effects on cetaceans, particularly coastal populations and stocks of common bottlenose dolphins.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>If BOEM believes that the DWH impacts will not be exacerbated by the additional impacts associated with the proposed action, it should explicitly state why this is the case. When the available information, as summarized in Appendix E, states that there are negative population trends, increases in mortality, and decreases in reproductive success, and that there are going to impacts are going to result in even further reductions in survival, reproductive success, and population size.</p> <p>BOEM must make a clear statement about this shifted baseline and the expected degree to which living marine resources (both individuals and stocks) are able to sustain impacts due to the proposed action, as to do otherwise is likely to result in an inaccurate depiction of the likely impacts of the proposed action and alternatives thereof. Reference: Chapter 4; Appendix E.</p>	
1130-0025	<p>Discussion of the Alternative F area closures found in Chapter 2 appears to mistakenly state that the closures do not change the overall level of impacts from deep-penetration seismic airgun surveys from the conclusions for Alternative A. However, Table 2.10-1 and Chapter 4, Section 4.2.7 correctly show that the deep-penetration airgun impacts associated with Alternative F for marine mammals would be reduced from Moderate to Minor. Perhaps this statement relates to IPFs and resources more broadly and is not in error; however the associated discussion relating to marine mammals misses the point with regard to the benefit of the measure to the resource. Although marine mammals do occur outside the closure areas and would be exposed to effects from seismic airguns, the closure areas are delineated specifically to protect areas of greatest importance to marine mammals. Therefore, while the overall exposures may not be significantly reduced due to introduction of the closure areas, the biological significance of those exposures is reasonably expected to be less due to the avoidance of important places for marine mammals. Reference: Chapter 2, Section 2.13, pg 2-31 and 2-32.</p>	<p>Thank you for your comment. The text has been revised in Chapter 2.13 to indicate the change in impact rating to marine mammals associated with Alternative F.</p>
1130-0026	<p>NOAA does not believe that direct acute mortality of marine mammals would be likely to occur due to the proposed action, regardless of mitigation. There is no information to suggest that</p>	<p>Thank you for your comment. The text in Chapters 2.13, 4, and 5 has been revised.</p>

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	direct acute mortality could realistically result from use of the active acoustic sources considered in the PEIS. Therefore, it is inappropriate to suggest that avoidance of mortality is contingent upon implementation of mitigation. Reference: Chapter 2, Section 2.13, pg 2-33; Chapter 4, pg 4-30; Chapter 5, pg 5-3.	
1130-0027	Seismic airgun survey protocols are not designed for reduction of potential Level B exposures; they are designed for reduction of potential exposures at close range to the source vessel. Such exposures could result in Level A or Level B harassment, but avoidance of close-range exposures does not necessarily lead to a reduction in exposures overall. BOEM should remove statements to this effect or better explain how survey protocols might reduce overall exposure levels. Reference: Chapter 4, pg 4-59, 3 rd paragraph.	Thank you for your comment. The text in Chapter 4.2.2 has been revised, removing references to reduced Level B exposures from seismic airgun survey protocols.
1130-0028	BOEM provides overall impact ratings but apparently also sub-ratings. For example, the effects of seismic airgun noise are declared moderate overall for Alternative A, but a separate finding of minor effects is given in the same discussion specific to the "likelihood of fitness effects to individuals." How should these subsidiary conclusions be interpreted? Reference: Chapter 4, pg 4-60.	Thank you for your comment. The text has been revised in Chapter 4.2.2.1.2 to discuss the likelihood of fitness-level effects in such a way as to clarify that a separate impact sub-rating for fitness level effects was not intended.
1130-0044	Biologically Important Areas are referenced in a way that implies they are a regulatory designation enforced by some entity, which is incorrect. This description would be improved and clarified through addition of a sentence such as "Having a BIA means awareness to managers and mariners that the area is important to that species." or a direct quote such as: "The delineation of BIAs does not have direct or immediate regulatory consequences. Rather, the BIA assessment is intended to provide the best available science to help inform regulatory and management decisions under existing authorities about some, though not all, important cetacean areas in order to minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals. In addition, the BIAs and associated information may be used to identify information gaps and prioritize future research and modeling efforts to better understand cetaceans, their habitat, and ecosystems."	Thank you for your comment. Edits have been made to Chapter 4.2.1 to address this comment, including a definition of BIAs and supportive text, along with references.

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	(Reference: VanParijs et al., 2015; Aquatic Mammals 2015, 41(1), 1, DOI 10.1578/AM.41.1.2015.1) Reference: Chapter 4, Section 4.2.1, Page 4-21.	
1130-0053	Tables 4.2-3 and 4.2-4 to be updated per NMFS's August 2016 acoustic guidance.	Thank you for your comment. Tables 4.2-3 and 4.2-4 have been updated to include the 2016 acoustic guidance.
1130-0054	Certain HRG sources such as echosounders and side-scan sonars are not appropriately categorized as impulsive sources. These non-impulsive sources are distinguished as intermittent sources, as compared with the non-impulsive (continuous) sources such as vessel and drilling noise. Discussion should be revised as necessary. Reference: Chapter 4, Section 4.2.2.1.1, pg 4-28.	Thank you for your comment. Text has been revised in Chapter 4.2.2.1.1 to better differentiate sound sources by type.
1130-0055	Reference to historical auditory injury criteria as "current" should be removed. Reference: Chapter 4, pg 4-32, 3 rd paragraph, 4-33, 2 nd paragraph.	Thank you for your comment. Edits have been made in Chapter 4.2 .
1130-0056	Decimal place errors in several square mile conversions. Reference: Chapter 4, pg 4-55, 2 nd paragraph.	Thank you for your comment. The square mile conversions in Chapter 4.2.2.1.2 have been edited.
1130-0057	Errors referencing estuarine bottlenose dolphin stocks and associated BIAs. There are 32 estuarine bottlenose dolphin stocks, but only 11 currently identified BIAs for small and resident populations (although with further study additional BIAs may be identified). Reference: Chapter 4, Section 4.2.3.1.1, 1 st paragraph.	Thank you for your comment. The number of estuarine bottlenose stocks has been corrected in the document.
1130-0066	In our reading of the alternatives, the shutdown requirements in Alternative C are the same as those in Alternative A, with the addition of requiring a shutdown provision for manatees and expansion into shallow waters in the WPA/CPA. If this is correct, please explain how Alternative C offers "additional mitigation protection" to all marine mammals, with particular reference to "additional protection (shutdown)" for whale species. It is unlikely that the depth expansion (to waters <200 m) would offer additional protection for sperm whales, <i>Kogia</i> spp., or beaked whales, as these species are unlikely to be found in shallow waters. In addition, this passage seems to describe the protected species observer airgun survey protocols as though they are new to Alternative C, when in fact they are simply carried forward from Alternative A. Reference: Executive	Thank you for your comment. Alternative B introduces the expansion of PSO procedures into all water depths, along with shut downs for manatees and selected whale species. These measures are also discussed in association with Alternative C. Text in Chapters 4.2.3.1.2 (Alternative B) and 4.2.4.1.2 (Alternative C) was revised to clarify details regarding the effectiveness of expanded PSO procedures based on the procedure limitations and the distributions of these specified resources. Text in the Executive Summary was also revised to address concerns in this comment.

Table M-9. Marine Mammals' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	Summary, pg xxi; Chapter 4, Section 4.2.3.1.2.	
1130-0074	NOAA does not believe that an assumption that predicted effort would remain constant if target areas are closed to survey effort is realistic or reasonable. Therefore, as BOEM acknowledges on page 4-115, the existing analysis likely underestimates the potential benefit of closure areas. Reference: Chapter 4, Section 4.2.4.1.1; Section 4.2.7.1.1, "Quantitative Assessment of Alternative F."	Thank you for your comment. BOEM believes that the assumption that the predicted effort would remain constant is reasonable at the programmatic level and within the 10-year timeframe of this Programmatic EIS. While BOEM acknowledges the recent reduced level of exploration G&G activities and the corresponding decrease in permit applications, BOEM assumes that future levels will return to previous historic levels within the next 10 years. BOEM must, therefore, be prudent and conservatively consider the full range of potential impacts. As such, the scenarios contain projections based on the analysis of recent historic activity levels and trends made by BOEM's subject-matter experts, who also considered Industry-projected activity levels in their estimates.

M.4.7 Sea Turtles

Comments regarding sea turtles identified areas where clarifying text with supporting literature should be included and also provided suggestions for updated literature and regulations. One comment expressed that the impact analysis did not sufficiently assess sea turtle hearing thresholds relative to the proposed action. Detailed responses to specific comments are provided in **Table M-10**.

Table M-10. Sea Turtles' Detailed Comment Responses

Submission ID	Comment	Response
Sea Turtles		
1063-0004	Page XXIV - The paragraph regarding vessel strikes and sea turtles notes "most vessel strikes of sea turtles occur in coastal areas by high speed (recreational) vessel traffic." Is there a citation for this? And how do you distinguish high speed recreational traffic from high speed traffic supporting the offshore industry (e.g. offshore supply vessels)?	Paragraph 5, page xxiv, of the Executive Summary has been modified. Citations for subject matter may be found in Chapter 4.3.2.1.4 .
1063-0027	Page 4-124 - First paragraph, last sentence. NMFS has published the final rule for green turtles. https://federalregister.gov/documents/2016/04/06/2016-07587/endangered-and-threatened-wildlife-and-plants-final-rule-to-list-eleven-distinct-population-segments The last paragraph notes no recent nesting info and is direct conflict with the data presented in previous paragraph.	Thank you for your comment. Changes have been made to this Programmatic EIS updating the status on the final rule for green turtles, and the sentence in the last paragraph was removed.
1076-0080	The DPEIS adequately reviews the literature regarding sea turtle hearing and accurately assesses what is known about the frequency range of turtle hearing based on the best available science. However, the DPEIS's sea turtle effects analysis (Section 4.3) fails to sufficiently address sea turtle hearing thresholds at best sensitivity as reported in the scientific literature. These values, which range from 93 to 117 dB at the most sensitive frequencies, are reported in Appendix E but there is no discussion of the meaning of those values. Although the data on sea turtle hearing "are too limited to be definitive because of the low numbers of individuals tested," the best available science demonstrates that sea turtle hearing is substantially less sensitive than marine mammal and fish hearing. By comparison, peak sensitivity thresholds of approximately 30 or 40 dB are the most sensitive frequencies in some odontocetes, and peak sensitivity thresholds of approximately 50 dB are most sensitive frequencies observed in some fish species. See Popper et al. (2014) at 9 (see audiograms). The DPEIS should include a more detailed assessment of sea turtle hearing thresholds at best sensitivity as part of the effects analysis.	Text has been added to Chapters 4.3.2.1.1 and 4.3.2.1.2 , pointing out hearing thresholds at their most sensitive frequencies and that hearing sensitivities in sea turtles is substantially less than that of marine mammals and fishes. More information can be found in Appendices E and I .
1076-0101	The final rule was published April 6, 2016 (81 FR 20058). The North Atlantic DPS is listed as threatened. Critical habitat is not determinable at this time but will be proposed in a future rulemaking.	Thank you for your comment. Appropriate changes have been made in this Programmatic EIS (page 4-124 and Table 4.3-1) to reflect this updated information.

M.4.8 Fish Resources and Essential Fish Habitat

Several comments disagreed with the impact determinations, including opinions that the determinations were too low or too high for seismic survey impacts on fisheries. One comment stated that there had been a decline in fish catch rates subsequent to seismic survey operations. Another comment recommended including a more thorough characterization of State regulatory authority and jurisdiction throughout this Programmatic EIS.

Other comments requested corrections to this Programmatic EIS, such as changing the listing of the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) from an endangered species to a listed species and expanding the distribution of the smalltooth sawfish (*Pristis pectinata*). One comment expressed concern that this Programmatic EIS lacked sufficient consideration for seismic impacts on fish behavior and fisheries with the support of recent publications. Clarification to this Programmatic EIS was requested regarding whether fish mortality due to decompression injuries was likely in individuals close to the seismic surveying sources. Further discussion regarding impacts to habituation in NMSs was requested by a comment. Detailed responses to specific comments are provided in **Table M-11**.

Table M-11. Fish Resources and Essential Fish Habitat's Detailed Comment Responses

Submission ID	Comment	Response
Fish Resources and Essential Fish Habitat		
1067-0003	And it's not just whales and dolphins that are impacted by these airgun blasts--fish populations are also affected. Catch rates of many species have been reported to decline over wide areas for weeks after seismic surveys are conducted.	Impact from noise on marine mammals, fish, EFH, and commercial fisheries are different. The potential impacts to marine mammals are analyzed and addressed throughout Chapter 4.2 . Refer to Chapters 4.4.2.1.2 and 4.9.2.1 for information regarding potential impacts of seismic surveys on fish and commercial fisheries. While it is possible for fish to experience TTS, masking, and behavioral impacts, the effects are not likely to include mortality or permanent barotrauma. Refer to Appendix J for a thorough review of the physics of underwater sound, mechanics of fish hearing, sources of anthropogenic sound and sound metrics, mechanisms of injury to fish from exposure to anthropogenic sound, and criteria for the protection of fish from exposure to injurious levels of G&G survey sounds. Potential impacts from noise are not expected to have long-term effects of fish (Chapter 4.4.2.1). The potential effects of noise on fish catchability is analyzed and addressed in Chapter 4.9.2.1 . Available studies indicate that these impacts are short term and that catch rates return to normal within several days following sound cessation.
1071-0004	The FWC recommends that State regulatory authority as it pertains to both non-listed and ESA-listed fisheries resources within or without the waters of the State within the AOI, should be appropriately characterized wherever these discussions occur throughout the DPEIS.	At the programmatic level, the Federal authorities managing fish species are listed in this Programmatic EIS. The text related to the affected environment (Chapter 4.4.1 and Appendix E, Section 4) is a broad overview of the regulatory framework and regulating bodies that will be consulted during site-specific NEPA analysis. This Programmatic EIS also provides a broad overview of MPAs in Chapter 4.7 , where fishery activities are prohibited and controlled, including those that are managed by FWC.
1071-0006	Both Volume 1, Section 4.4, and Volume 3, Appendix E, Section 4, of the DPEIS incorrectly identify Gulf sturgeon as an ESA-Endangered species. Gulf sturgeon is an ESA-Threatened species, and we recommend correcting this misidentification wherever it occurs throughout the DPEIS.	The text in Chapter 4.4 and Appendix E, Section 4 has been edited to reflect that the Gulf sturgeon are a threatened species.
1071-0007	Additionally, the DPEIS characterization of smalltooth sawfish distribution in the AOI is much more limited than what is	The text in Chapter 4.4.1 was modified to reflect the smalltooth sawfish distribution. BOEM also added the

Table M-11. Fish Resources and Essential Fish Habitat’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>presently known to exist from current data. Waters et al. (2014) characterizes the distribution of smalltooth sawfish as follows:</p> <p>Early faunal surveys indicated healthy populations of sawfishes across the western Atlantic in areas such as Brazil, Nicaragua, and the USA (Evermann and Bean, 1898; Thorson, 1982; Faria et al., 2013), although most of these populations had declined by the mid-1980s (Faria et al., 2013). In the USA, <i>P. pectinata</i> are the only resident sawfish species currently reported (NMFS, 2009). <i>Pristis pectinata</i> were historically commonly encountered from North Carolina to Texas (Bigelow and Schroeder, 1953), however, more recently they have been observed primarily in south and south-west Florida marine and estuarine waters from Charlotte Harbor to the Dry Tortugas (Seitz and Poulakis, 2002; Poulakis and Seitz, 2004; Wiley and Simpfendorfer, 2010).</p> <p>Enclosed are two maps of smalltooth sawfish encounters; one map covers the Gulf of Mexico (i.e., AOI) and the other map is specific to Florida (International Sawfish Encounter Database [ISED] unpublished data). FWC staff recommends that the DPEIS be amended to appropriately reflect distribution of smalltooth sawfish in the AOI.</p>	<p>references Wiley and Simpfendorfer (2010) and Waters et al. (2014). While smalltooth sawfish have been spotted in U.S. coastal waters in the GOM, most of the species’ distribution is limited to waters of southwest Florida and Florida Bay (Simpfendorfer and Wiley, 2005; USDOC, NMFS, 2009). The text in the “Affected Environment” section (Chapter 4.4.1 and Appendix E, Section 4) is a broad overview of the distribution of smalltooth sawfish in the GOM.</p>
1074-0067	<p>The activities considered in the DEIS have potential to detrimentally affect multiple fish species, harm vital fish habitat, and conflict with multiple fisheries.</p> <p>As an initial matter, the DEIS’s consideration of impacts does not give adequate weight to the effects of repeated seismic testing and other activities on the behavior of fish and invertebrates. For instance, the DEIS dismisses temporary hearing loss in fish as a minor effect without considering whether the hearing loss may be permanent or whether even a temporary loss of hearing renders the fish vulnerable to predation, unable to locate food, or unable to locate a mate. In addition, sublethal disturbance that causes fish to avoid key feeding or spawning areas could have a detrimental effect on the population of the species itself, yet the DEIS gives virtually no consideration to what effect disrupted feeding may have.</p>	<p>BOEM prepared this Programmatic EIS using the best available data from the subject-matter experts and included conservative assumptions to avoid underestimating potential impacts. The most likely injuries and effects on behavior are analyzed and addressed, in detail, in Chapters 4.4.2.1.1 through 4.4.2.1.3.</p> <p>While masking and TTS are possible, the impact on predator-prey or foraging interactions from masking and TTS caused by seismic sound has not been tested. Behavioral responses to noise include startle reactions, changes in water column distribution, lateral movement, avoidance of an ensonified area, changes in schooling behavior, and changes in predator-prey interactions, foraging, reproductive, and intraspecific behaviors (Chapters 4.4.2.1.1 through 4.4.2.1.3). How the observed behavioral changes will impact</p>

Table M-11. Fish Resources and Essential Fish Habitat's Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Nor does the DEIS consider the impacts that masking, silencing of fish vocalizations, and the effects of chronic stress may have on fish breeding success.</p> <p>In the case of coastal pelagic species, also known as forage species, the action's adverse effects could ripple through the food chain. Forage species are often very sensitive to sound and tend to avoid the sort of noise generated by G&G activities. These species comprise an important part of the diets of many predatory fish, including tuna. Changes in aggregation behavior or movements of forage species could reduce the available food for predatory species, reducing their fitness and numbers and potentially causing them to shift their own movement patterns in response. Any such effects on predatory fish species would likely adversely affect the commercial and recreational fisheries that depend on them. Nor does the DEIS adequately assess the impact of G&G activities on invertebrates, such as cephalopods like squid and octopus, even as it acknowledges an increasing number of studies demonstrating that seismic and other low-frequency sound sources can disrupt, injure, and kill these taxa (see DEIS at D-209 to D-211).</p>	<p>life-sustaining functions (e.g., predator avoidance, feeding, spawning, and communication) is not well understood. These impacts would be temporary because fish resume normal behavior upon cessation of sound and are capable of regenerating damaged tissues.</p> <p>This Programmatic EIS acknowledges, to the extent possible with available scientific data, the impact of active acoustic sound sources on invertebrates (Chapter 4.5.2.1.1). However, vessel noise was eliminated from detailed analysis due to limited anticipated impacts associated with G&G activities (Table 4.1-2). Research on these topics has produced inconclusive results and conclusions. The best available information was used for analysis.</p>
1074-0067 (continued)	<p>Indeed, airgun surveys are known to significantly affect the distribution of some fish species, which can impact commercial and recreational fisheries and could also displace or reduce foraging success of marine mammals that rely on them for prey. Indeed, as one study has noted, fishermen in various parts of the world have complained for years about declines in their catch rates during oil and gas airgun surveys, and in some areas have sought industry compensation for their losses.¹²⁰ As noted at § I.B above, airguns have been shown experimentally to depress catch rates of various commercial fish, including cod, haddock, pollock, and rockfish, often over large areas of ocean, and has been reported to reduce catch rates of other commercial and recreational fish, including tuna. Yet the DEIS, while acknowledging that displacement can increase the risk of predation, disrupt fish spawning and reproduction, alter migration routes, and impact feeding, appears to assume without support that effects on both fish and fisheries would be</p>	<p>Predicting the effect of seismic airgun surveys on fishing is not possible because there is a lack of information on the effects of anthropogenic sounds on the distribution of fishes and their capture rates by different fishing gears (Hawkins et al., 2014). BOEM classified the impacts to fish (including commercial species) and EFH from noise as minor because the impacts are not likely to be extensive or severe, but they are measurable. As detailed in Chapter 4.9.2.1, studies indicate there are temporary changes in fish behavior and distribution that could influence commercial landings; however, the impacts may be temporary and undetectable. However, a minor impact to commercial fish species would cause a minor impact to the fishery.</p> <p>BOEM has read and added the relevant scientific literature suggested in the comment (i.e., Nedelec et al., 2015; Simpson et al., 2015, 2016). Addition of new literature did not change</p>

Table M-11. Fish Resources and Essential Fish Habitat’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>nominal or minor. See DEIS at D-171 to D-203.</p> <p>In short, research on the impacts of noise on fish and invertebrates has expanded significantly over the past five years, with numerous papers published and in preparation, and increased attention paid by NMFS to management of acoustic impacts on these non-marine mammal taxa, as reflected in NOAA’s Ocean Noise Strategy Roadmap.¹²¹ The DEIS fails to properly assess potential seismic survey impacts on fish and invertebrates, on the Gulf ecosystem, and on human fisheries in light of these studies, or to consider measures, such as time-area closures in spawning areas, to mitigate these impacts. BOEM must improve its analysis.</p>	<p>the impact level for fish, EFH, and commercial fisheries.</p>
<p>1076-0081</p>	<p>Seismic survey activities do not result in any significant adverse effects to fish populations or to fisheries. Marine seismic surveys have been conducted since the 1950s and experience demonstrates that fisheries and seismic activities can and do coexist. There has been no observation of direct physical injury or death to free-ranging fish caused by seismic survey activity, and there is no conclusive evidence showing long-term or permanent displacement of fish. Any impacts to fish from seismic surveys are short term, localized, and not expected to lead to significant impacts on a population scale.³⁸</p> <p>Seismic source vessels move along a survey tract in the water creating a line of seismic impulses. As the seismic source vessel is in motion, each signal is short in duration, local, and transient. There is no conclusive evidence showing long-term or permanent displacement of fish.³⁹ Similar seismic surveys conducted for research in the Atlantic OCS did not result in any detectable effects on commercial or recreational fish catch, based on a review of NMFS’s data from months surveys were conducted, which noted that “there was absolutely no evidence of harm to marine species” (including fish).⁴⁰ Additionally, in the GOM, where G&G activities have routinely occurred for over 40 years, seafood harvested from the OCS is worth approximately \$980 million annually and the fishing industry directly supports in excess of 120,000 jobs, suggesting that</p>	<p>Chapter 4.4.2.1.1 analyzes the potential effects of noise on fishes and documents research related to this subject. Impacts are not expected to include mortality or permanent displacement of fish. However, effects of noise on fish may include damage to the sensory cells lining the auditory system, alarm and avoidance responses, and barotrauma injuries. These impacts would be temporary because fish resume normal behavior upon cessation of sound and are capable of regenerating damaged tissues.</p> <p>BOEM classified the impacts to fish (including commercial species) and EFH from noise as minor because the impacts are not likely to be extensive or severe, but they are measurable. As detailed in this Programmatic EIS, studies indicate that there are temporary changes in fish behavior and distribution that could influence commercial landings; however, the impacts may be temporary and undetectable. A minor impact to commercial fish species would cause a minor impact to the fishery also. BOEM considered the impacts from stand-off distances and determined these to be minor as well (Chapter 4.9.2.1).</p> <p>Several articles mentioned in the footnotes of this comment are already discussed in this Programmatic EIS (e.g., Saetre and Ona, 1996; Hassel et al., 2004; Peña et al., 2013), and</p>

Table M-11. Fish Resources and Essential Fish Habitat’s Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>G&G activities can occur without negatively impacting commercial fisheries.</p> <p>Finally, seismic and other geophysical surveys also do not result in closing areas to commercial or recreational fishing. During surveys, the survey crews work diligently to maintain a vessel exclusion zone around the survey vessel and its towed streamer arrays to avoid any interruption of fishing operations, including the setting of fishing gear. As with all multiple uses of offshore waters, there must be a certain level of coordination by all parties. At sea, coordination is regulated by the U.S. Coast Guard under the International Regulations for Preventing Collisions at Sea, requiring a Local Notice to Mariners specifying survey dates and locations.</p> <p>For these reasons, the effects of seismic activities on fish and fish resources are most accurately described as “nominal” (to use the DPEIS’s impact categorization values). We therefore object to the mischaracterization of impacts to commercial fisheries as “minor.” See DPEIS at 2-35.</p>	<p>BOEM acknowledges and has read the remaining literature cited in the comment. BOEM’s assessment of potential impacts is based on all available scientific literature, theoretical approaches, and research methods. This Programmatic EIS thoroughly examined the existing credible scientific evidence relevant to evaluating potential impacts of G&G proposed activities on fish, EFH, and commercial fisheries when making final impacts determinations.</p>
1130-0017	<p>NOAA does not agree that impacts to EFH can be considered “nominal” because the “small” area of impact is compared to the “large” overall area of interest. The seafloor disturbance section correctly identifies G&G activities which could cause direct physical damage to hard bottom and coral habitats. However, the conclusion is impacts to EFH are “nominal” because “The projected area of seafloor disturbance from G&G activities is an extremely small percentage of the planning areas”; NOAA considers this type of effect analysis to be arbitrary. Reference: Executive Summary, Page xxviii; Section 4.4.2.1.5 and Table 2.10-1.</p>	<p>Text edits emphasizing the impacts to the overall biological value of the AOI and not just in reference to the AOI and impact areas have been made in Chapter 4.4.2.1.5 and Executive Summary.</p>
1130-0042	<p>Revise language regarding impact assessments to National Marine Sanctuaries:</p> <p>a. Habituation is now discussed much more carefully in Chapter 4, but there are still places (e.g., 4-191) where it is used as synonym for animals being “familiar with” a sound, which is</p>	<p>Text changes that discuss "habituation" have been made in Chapter 4.4.</p>

Table M-11. Fish Resources and Essential Fish Habitat's Detailed Comment Responses (continued)

Submission ID	Comment	Response
	not correct—please incorporate the following reference to improve habituation discussion: Bejder L, Samuels A, Whitehead H, Finn H, Allen S (2009) Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. Mar Ecol Prog Ser 395:177-185.	
1130-0062	Alternative A for fisheries resources and EFH states mortality is not likely but Appendix J states that mortality is possible when close to source by decompression injury, especially for fish with swim bladders. May consider revising the term “not likely” or reconsider impact conclusions.	Text was modified in order to eliminate any conflict between Chapter 4.4 and Appendix J.

M.4.9 Benthic Communities

A comment provided corrections to statements and figures concerning the number of artificial reef sites, including Rigs-to-Reef sites, and the managing authorities. Another comment requested additional language be added to state that closure areas associated with Alternative F that were designed to protect marine mammals also provide protections for specialized habitats that support fish and other managed and listed species. Detailed responses to specific comments are provided in **Table M-12**.

Table M-12. Benthic Communities' Detailed Comment Responses

Submission ID	Comment	Response
Benthic Communities		
1063-0029	<p>Page 4-206 & 4-207 4.5.1.2.5 Artificial Reefs. "As of 2013, there are >500 sites that have been approved by BSEE as artificial reef sites on the OCS (USDOl, BSEE, 2013) (Figure 4.5-3)." - This statement in the document is not accurate and the references figure does not correspond with the statement. Figure 4.5-3 represents artificial reefs and/or artificial reef structures managed by one of the five Gulf States. The figure is appropriate for the first sentence of the paragraph, but not the later statement quoted above.</p> <p>New wording/rationale for change:</p> <p>As of 2013, there were >500 platform structure removals that had been approved by BSEE for Rigs-to-Reef conversion on the OCS. Towing the jacket structures to an established State artificial reef for deployment accounted for sixty-five percent of the approvals. The remaining thirty-five percent were for partial removal or toppling the jacket in place within a newly permitted State artificial reef.</p> <p>As of 2016, there are just over 500 Rigs-to-Reef structures deployed in 142 established artificial reefs. A majority of the Rigs-to-Reef structures have been deployed within artificial reef sites managed by Louisiana and Texas. A total of 19 Rigs-to-Reef structures have been reefed within the Mississippi, Alabama, and Florida artificial reefs.</p>	<p>Thank you for your comment. Suggested text has been inserted and has replaced the existing sentence in Chapter 4.5.1.2.5 ("Artificial Reefs").</p>
1130-0016	<p>Under impacts to fish and benthic communities, the PEIS asserts that closures in Alternative F are designed to protect marine mammals, which FGB was already described as an exception to—need to clarify this here and call out that in evaluating implications of Alternative F on fish resources, this is the one case in which an area specified for closure relates to providing protection for specialized habitats that support fish, including managed species, and turtles, including listed species. Reference: Chapter 4, Section 4.4.7.1.1, Page 4-201; Section 4.5.7.1.1, Page 4-224.</p>	<p>Thank you for your comment. Added text in Chapters 4.4.7.1.1 and 4.5.7.1.1 to clarify the closure protection for the FGBNMS.</p>

M.4.10 Marine Protected Areas

Comments requested clarification and corrections regarding what general protective measures are included in Marine Protection Areas (MPAs) compared to the more restrictive protective measures applied to only select MPAs such as the Flower Garden Banks National Marine Sanctuary (FGBNMS) and Coral Habitat Areas of Particular Concern (HAPCs).

Several comments requested corrections or additions to text such as additional brine seep locations; expanding the list of species that could be present in the FGBNMS, including specific species details of deep coral assemblages; expanding BOEM's permitting procedures within MPAs; and clarifying activity restrictions and limitations within and outside of No Activity Zones.

Clarification was requested for terminology and intent for topics that included deepwater MPAs and restricted MPA activities.

Several comments had specific concerns regarding the FGBNMS, such as cumulative noise impact determinations getting diluted when included with the other MPAs considered in this Programmatic EIS. Additional FGBNMS concerns included species-specific impact evaluations such as consideration of significant biological activities the MPAs may provide for transient species, and providing additional details on activity restrictions, evaluations, and authorization procedures. Detailed responses to specific comments are provided in **Table M-13**.

Table M-13. Marine Protected Areas' Detailed Comment Responses

Submission ID	Comment	Response
Marine Protected Areas		
1063-0030	<p>Page 4-263, top. HAPCs near FGB are described. Only 5 of 10 HAPCs in the area are listed, but not clarifies as a partial list. Not all HAPCs are protected from anchoring by fishing vessels. Only the few that are designated as "Coral HAPCs" have that rule, i.e., EFG, WFG, Stetson, and McGrail.</p>	<p>Chapter 4.7.1.1, "Offshore Marine Protected Areas, National Marine Sanctuaries," has been amended to accurately describe designated HAPC restrictions and limitations, including Coral HAPCs.</p>
1063-0035	<p>Appendix E</p> <p>Page E-114. The brine seep at the EFGB is not the only (one in the northern GOM. FGBNMS ROV work a few years ago found some at the base of at least one other shelf-edge bank, I think it was Rankin. There are many brine seeps in deep water along the base on the Florida Escarpment (off the shelf).</p> <p>Page E-114, bottom. Same list of 5 HAPCs, leaving out many in between. The statement, "All HAPCs have protective measures..." is not correct. Most are just management tools to require special attention to the habitats.</p> <p>Page E-115. Probably should add boundary expansion numbers from the FGB Expansion DEIS. Advisory Council recommendation from 2008 is correct = 280 sq mi. Maximum, alternative 5 in the current DEIS = 935 sq mi.</p> <p>Page E-117. McGrail does not have the shallowest crest among shelf-edge banks (excusing FGB). Its shallowest crest is 144 ft deep. I've been scuba diving on Bright at 112 ft and on Geyer at 121 ft. Bright used to have significant areas or coral but that is gone now, probably due to treasure salvage activity and their use of explosives there.</p>	<p>(a) Amended text accordingly: "The East FGB is also home to one of the GOM continental shelf waters oceanic brine seeps."</p> <p>(b) Removed text about HAPCs and protective measures, and added other general text about HAPCs designations: "HAPCs are considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. The HAPC designation does not necessarily mean additional protections or restrictions upon an area, but they help to prioritize and focus conservation efforts."</p> <p>(c) The FGB Expansion EIS is not finalized; therefore, BOEM will not include this proposed expansion alternative. If/when the FGB Expansion EIS is finalized, it will be utilized during site-specific EA evaluations.</p> <p>(d) Although BOEM respects your personal observations, the text is a direct quote from NOAA's website at http://flowergarden.noaa.gov/about/mcgrailbank.html.</p>
1076-0083	<p>The DPEIS's discussion of Marine Protected Areas ("MPAs") is unclear and confusing. We have noticed that</p>	<p>(a) Deepwater habitat designations are described in Chapter 4.7.1 under the FGBNMS section as being deeper than 70 m (230 ft); that</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>BOEM tends to conflate various legally designated and non-legally designated terms, such as “Biologically Important Areas,” Environmental Important Areas. For example, “Deepwater MPA” appears to be a new construct because Deepwater MPAs are not, to our knowledge, formally designated regions. The DPEIS describes “Coastal MPAs” as consisting of national parks, national wildlife refuges, national estuarine research reserves, and State-designated MPAs (DPEIS at xxxv), but “Offshore MPAs” (a new term) are described as consisting of national marine sanctuaries (NMSs), Deepwater MPAs, and fishery management areas, with no further explanation of what defines a Deepwater MPA. Of the Offshore MPAs listed, it appears that the brine pool and chemosynthetic MPA sites (e.g., Green Canyon [“GC”] 233 Brine Pool, GC 234 Chemo Community, and Bush Hill Chemo Community) are deeper than 1,000 feet, but many of the coral and hardbottom sites listed are no deeper than 1,000 feet.⁴¹ In addition, Section 2.8-1 of the DPEIS (page 2-16) describes four “deepwater areas” for closure (the Central Planning Area (“CPA”) Closure Area, the Eastern Planning Area, the Dry Tortugas Closure Area, and the Flower Gardens Closure Area).⁴² BOEM should more clearly characterize these areas and explain their significance to the DPEIS’s analysis of seismic activities. In particular, closure of the CPA will lead to a significant loss of economic opportunities as many leaseholders in this area will be unable to fulfill lease commitments.</p>	<p>would include the coral and hard bottom sites referenced in the comment in waters deeper than 70 m (230 ft). The term “deepwater” is used by NOAA to distinguish the deeper FGBNMS habitats and is used in this Programmatic EIS for depths >70 m (230 ft).</p> <p>(b) For Alternative F closure area comments, the CPA, EPA, Dry Tortugas, and Flower Gardens Closure Areas are shown in Figure 2.8-1 of this Programmatic EIS. Chapter 2.8.3 provides rationale for the closure areas; in short, selection of the closure areas was based on densities of target species relative to other areas of the AOI, as well as biological importance to certain species, including the endangered sperm whale (<i>Physeter macrocephalus</i>) and Bryde’s whale (<i>Balaenoptera edeni</i>) (LaBrecque et al., 2015). Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F that were used to determine the socioeconomic impact of related mitigation measures. As stated in Chapter 2.8.2, the additional closure areas included in Alternative F, if implemented by BOEM, would only apply to new permitted or authorized G&G activities and would need to be included in the potential lease holder’s decision evaluation. Existing lease holders would continue to operate subject to the terms and conditions of the existing permit or authorization.</p>
1076-0084	<p>The DPEIS also suggests, without supporting explanation, that MPAs may be used to restrict activities. See, e.g., DPDEIS at 4-261 (“All sites listed are afforded some degree of protection based on their associated management plans.”); id. at 3-29 (“All authorizations for G&G surveys proposed within or near these [specific benthic locations and MPA] areas would be subject to the review noted previously to facilitate avoidance.”); id. at 4-269 (“While seismic surveys employing airgun arrays</p>	<p>Each listed MPA has a unique approved Management Plan that details the conditions the MPA has in order to protect specifically identified resources associated with that MPA. Activities planned within the boundaries and/or any designated buffer zones are subject to the conditions outlined in the MPA’s Management Plan, which could include activity review against those plans. Activity restrictions or prohibitions would be applied based on the protected resource and the proposed activity as outlined in each MPA’s Management Plan. The proposed activity reviews will be conducted by the entity that</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>and hydrophone streamers are not currently precluded from conducting surveys over deepwater MPAs, other G&G activities may not be allowed in designated No Activity Zones.”). Although it is appropriate under NEPA to describe these areas as parts of the existing environment that have ecological significance, if BOEM and/or NMFS intends to use these areas as a basis for implementing additional restrictions on activities, then that intention must be disclosed and clearly explained, and the supporting legal authority must be identified.⁴³</p>	<p>manages the MPA in relation to the existing Management Plan. Any additions or modifications to the MPA Management Plan would go through the Management Plan development and amendment process, which includes government and public reviews and input. This information is included in this Programmatic EIS as information regarding existing environment only.</p>
1130-0009	<p>Cumulative impacts, and noise impacts, to Flower Garden Banks National Marine Sanctuary (FGB): Ultimately, the issue is that the document makes a finding of “nominal to minor” cumulative impact of noise for FGB, but then presents results later in the same chapter that predict high cumulative noise levels. A large part of the problem is the lack of reconciling those results. However, another part of the problem is likely the dilution of results for FGB specifically in a larger category of “offshore MPAs”—we don’t have model results relevant to all the sites in that category, but we do for FGB, and FGB is special for several reasons that the document emphasizes. While we recognize that this document has to find a balance between analysis of specific regional features and its programmatic region-wide nature, FGB is the only NMS in the Area of Interest (AOI) and it now is the only Marine Protected Area (MPA) related directly to Alternative F and the modeling in CCE (for very specific reasons, of course, that relate to, as correctly stated in the document, NOAA’s heightened concern for this site and our role as a cooperating agency on the PEIS). Reference: Chapter 4, Section 4.7.</p>	<p>Text has been added and revised in Chapters 4.4.7.1.1, 4.5.7.1.1, and 4.7.7.1 to address the concerns regarding protection of additional resources in MPAs from noise and the closure areas associated with Alternative F, specifically the FGBNMS.</p> <p>Cumulative noise levels are not expected to be high in MPAs from the impact evaluations in Chapter 4.7, with nominal to minor impacts expected.</p> <p>Additional mitigation measures in Alternative F will reduce the potential direct impacts to resources within MPAs that may occur in four closure areas, including the Flower Gardens Closure Area, and the secondary impacts to resources within and near the closure areas. However, at the programmatic level, impact ratings were designed to address impact probability, severity, and duration to resource categories as a whole, rather than to individual components of a resource. The definitions of each impact level were purposely broad to avoid exceptions to a single impact rating due to the complexities of program-related IPFs to resources that occur within the AOI and over the 10-year period of this Programmatic EIS. This level of detail is expected to accompany analyses of impacts for future site-specific EAs and permit application evaluations.</p>
1130-0010	<p>Summary finding of noise impacts: Need to reconcile this with finding of CCE section (Section 4.14) which shows prediction of long term cumulative noise impact to the site to be amongst highest in region. The impacts discussed here again are species by species. We can assess the impacts discussed in the CCE analysis species by</p>	<p>Appendix K, which has been discussed in Chapter 4.2, estimates the chronic and cumulative effects on marine mammals and specifically on the Bryde’s whale communication area. These estimates are based on airgun surveys, other OCS activity, and ambient noise.</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>species as well, but the suggestion that the acoustic quality of the site, overall, has the potential to be affected more strongly than most other sites evaluated in the GOM needs to be discussed here for it to make any sense in the same document (much less Chapter). Reference: Chapter 4, Section 4.7.2.1.1, "Conclusion" on Page 4-271.</p>	
1130-0011	<p>Noise impacts to turtles and fish in FGB are considered nominal to minor based on the transience of these species and the source/surveys; however, as mentioned in the document, localized areas can have profound protective value if they contain resident populations or contain predictable, temporally restricted high densities engaged in biologically-important behaviors (e.g., feeding, spawning, protection of juveniles), even if these populations utilize a broader range over their entire life histories. This is documented (and should be more clearly stated in descriptions, see above) for several fish and turtle populations in the FGB, and it needs to be more clearly related to impact assessment at this site, for which that information is better understood. Again, it may be that information for the other offshore MPAs in this category is less rich but that should not dilute the finding for the FGB. The potential for loss of listening ability over time due to higher average noise levels in the planning area waters surrounding this site should be considered relative to enhanced biological value of the habitat within its boundaries for particular stocks, even if they are wider ranging during other portions of their life histories (as well as related to species that are resident within sanctuary waters). Reference: Chapter 4, Section 4.7.</p>	<p>The impact determination for sea turtles and fish recognized that seismic activities could disrupt normal activities, inflict physiological damage, impact behavioral responses, mask biological sounds, cause hearing loss, and result in mortality. These effects to sea turtles and fish are analyzed in Chapters 4.3.2.2 and 4.4.2.1, respectively. Evaluation of these resources in the context of MPAs resulted in a nominal to minor determination due to the mobile nature of seismic airgun surveys, the temporary surveying of small seafloor areas, and the propensity of animals to move away from noise affecting them. At this Programmatic EIS level, all MPAs were included in the analysis.</p> <p>This Programmatic EIS provides a programmatic-level evaluation, and BOEM will address impacts of future site-specific actions that would include any activities in or adjacent to the FGB in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p>
1130-0014	<p>Finding of impact to all MPAs continues to conflate those that are specifically part of Alternative F with all other MPA types in the region. This removes any possibility of looking at the impacts of the actual designed alternative on the MPAs that the Alternative affects. Reference: Executive Summary; Chapter 2, Section 2.13, Page 2-35 (MPA bullet); Chapter 4, Section 4.7.7.3, Page 4-288.</p>	<p>The closure areas included in Alternative F include the Flower Gardens Closure Area with the intended purpose of reducing impacts within the FGBNMS, as well as for individual resources located in the NMS. By design, direct impact reductions will be greatest in the closure areas. Chapter 4 evaluates potential impacts within specific areas but, due to the programmatic level of this Programmatic EIS, has to address the overall impact probability, severity, and duration to resource categories within the entire AOI resulting in a programmatic-</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
		level impact determination. More details will accompany analyses associated with future site-specific EAs and permit application evaluations tiered off of the program-level evaluations included in this Programmatic EIS.
1130-0031	<p>Revise descriptions about FGB resources and ONMS authorities and process (as provided below): Reference: Chapter 4 and Appendix E.</p> <p>a. Please augment both the shorter description in Vol. I and the more expanded description in Vol. II, Appendix E to more accurately include references to FGB resident species and/or species with high densities during biologically important time periods. Reference: Chapter 4, Section 4.7.1.1; Appendix E, Section 3.1 and Section 7.1.2.</p> <p>i. EDIT the statement that hawksbill, leatherback, and loggerhead turtles “inhabit” FGBNMS waters to more clearly discuss the relevancy of the site to these species. Reference: Chapter 4, Section 4.7.1.1, Page 4-263.</p> <p>“The Flower Garden Banks are home to resident subadult loggerhead sea turtles (<i>Caretta caretta</i>) and also hawksbill sea turtles (<i>Eretmochelys imbricata</i>). Manta rays (<i>Manta</i> sp.) are present within the sanctuary year round, and seasonally, schooling scalloped hammerheads (<i>Sphyrna lewini</i>) and spotted eagle rays (<i>Aetobatus narinari</i>) are present in large numbers during the winter months. Other occasional charismatic megafauna visitors include whale sharks (<i>Rhincodon typus</i>) and several different species of Mobulid rays.</p>	Additional text has been added in Chapter 4.7.1.1 to provide a more thorough description of the FGB.
1130-0032	<p>EDIT Section 3.1.3:</p> <ul style="list-style-type: none"> • Loggerhead Sea Turtle: Subadult loggerhead sea turtles are known to reside at FGBNMS, resting at night on the shallow caps of the coral reefs and coral communities, and foraging in the vicinity of 	Changes have been made in Appendix E, Sections 3.1.3 and 3.3.1 , as requested.

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>the banks during the day (Hickerson, 2000). Reference: Hickerson, E.L. Assessing and tracking resident, immature loggerheads (<i>Caretta caretta</i>) in and around the Flower Garden Banks, northwest Gulf of Mexico. M.S. Thesis. Texas A&M University, College Station, Texas. December 2000.</p> <ul style="list-style-type: none"> • Hawksbill Sea Turtle: Resident and transiting sea turtles have been documented utilizing the shallow coral caps and coral communities at the FGBNMS. 	
1130-0033	<p>Please change the description found at Chapter 4, Section 4.7.1.1, Page 4-264 to better reflect the suggested text in bold: "In deeper regions, Federal fishery management areas include McGrail Bank, designated as a coral HAPC, where deeper reef habitat includes extensive coralline algae and deep coral assemblages harboring unique hermatypic coral areas dominated by blushing star coral, <i>Stephanocoenia intersepta</i> (Schmahl and Hickerson 2006)." Reference: Schmahl, G.P., and E.L. Hickerson. 2006. McGrail Bank, a deep tropical coral reef community in the northwestern Gulf of Mexico. Proceedings of the 10th International Coral Reef Symposium, 1124-1130. Japanese Coral Reef Society, Tokyo, Japan.</p>	<p>Changes have been made in Chapter 4.7.1.1 to better reflect the suggestion.</p>
1130-0034	<p>Please clarify that exploration or development activities that disturb the submerged lands or bottom of the sanctuary outside a No Activity Zone are not allowed without an ONMS permit. Please also reconcile what appear to be contradictory statements regarding whether BOEM would itself issue permits to entities proposing bottom disturbing work inside the sanctuary, whether inside the No Activity Zone or otherwise. Reference: Chapter 4, Sections 4.7.2.1.1 and 4.7.2.1.4.</p>	<p>Changes have been made in Chapters 4.7.2.1.1 and 4.7.2.1.4 to add this information.</p>
1130-0035	<p>EDIT on page 4-269 as follows (new text is indicated in bold font): "BOEM will not issue permits for bottom-disturbing activities where prohibited. However, the G&G permittees for those permits that BOEM does issue are</p>	<p>Changes have been made in Chapter 4.7.2.1.1.</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>required to consult with the receive permits from the FGB(N)MS prior to the start of operations. The Permittee conditions will include must removal of all mooring buoys before and replace them immediately after operations. In addition, the permittee must announce the time that the mooring buoys will not be available in a Notice to Mariners.....Permits are required for any action that includes activities otherwise prohibited by sanctuary regulations.”</p> <p>“As discussed in Appendix B, the ONMS and BOEM will initiate consultation with ONMS under Section 304(d) of the NMSA. The NMSA and ONMS’ regulations have a broad definition of the terms “sanctuary resource” and “injury”; “sanctuary resources” are living and non-living attributes of the sanctuary and “injury” includes disruption of ecological processes inclusive of physical, physiological, and behavioral modifications. Therefore, sound producing activities (such as seismic surveys) proposed in or near the boundaries of an NMS would require BOEM to initiate consultation with ONMS in order to would initiate consultation between ONMS and BOEM to consider additional mitigation measures, if any, that are recommended to reduce or eliminate injury to sanctuary resources. Measures such as setback distances will be determined prior to any sound-producing surveys by BOEM and in consultation with ONMS pursuant to Section 304(d) of the NMSA.”</p>	
1130-0036	<p>EDIT on page 4-274 as follows (new text is indicated in bold font): “Seafloor-disturbing activities proposed within FGBNMS but outside No Activity Zones, or outside the FGBNMS but near its boundaries, may be assigned a setback distance as condition of a BOEM-issued permit/COA to be determined at the time the action is under review by BOEM and in coordination with the ONMS. Further, if BOEM finds that injury to sanctuary resources are likely to occur as a result of permitted discharges with or near the FGBNMS, BOEM will consult</p>	<p>The text on page 4-274 has been revised.</p>

Table M-13. Marine Protected Areas' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	with ONMS under NMSA Section 304(d). Sanctuary consultation would result in ONMS providing recommended alternatives to BOEM to reduce or eliminate such impacts.”	
1130-0037	Please reconcile statements that “Seafloor-disturbing activities proposed within the boundaries of FGBNMS would not be permitted within a No Activity Zone.” and “Seafloor-disturbing activities proposed within FGBNMS but outside No Activity Zones, or outside the FGBNMS but near its boundaries, may be assigned a setback distance as condition of a permit/COA to be determined at the time the action is under review by BOEM and in coordination with the ONMS.” with Table 2-2 summary which states that BOEM would not authorize any seafloor disturbance in FGBNMS, which is not limited to No Activity Zones, and would design setbacks for nearby activities. Reference: Chapter 4, Section 4.7.2.1.4, Page 4-275 and Table 2-2.	Information in Table 2.2-2 has been edited to resolve the conflict with Chapter 4 .

M.4.11 *Sargassum* and Associated Communities

A single comment requested that information included in **Chapter 4.8** be included in the **Executive Summary** relative to *Sargassum* habitat being designated as critical habitat for loggerhead sea turtles. The comment and response are provided in **Table M-14**.

Table M-14. *Sargassum* and Associated Communities' Detailed Comment Responses

Submission ID	Comment	Response
<i>Sargassum</i> and Associated Communities		
1063-0007	Page XXXVIII - Impact conclusions for <i>Sargassum</i> - There should be some acknowledgement that this community is considered critical habitat for loggerhead sea turtles for much of the GOM.	Text has been added to the Executive Summary of this Programmatic EIS.

M.4.12 Archaeological Resources

Some comments were concerned that impacts from seafloor disturbance and entanglement from bottom-founded equipment were not adequately covered in this Programmatic EIS. However, other comments concurred with this Programmatic EIS evaluation of impacts to archaeological resources. Detailed responses to specific comments are provided in **Table M-15**.

Table M-15. Archaeological Resources' Detailed Comment Responses

Submission ID	Comment	Response
Archaeological Resources		
1063-0032	<p>4.11.2.1.1 Seafloor Disturbance and Entanglement</p> <p>Page 4-355 Deployment of OBCs and OBNs may cause irreversible damage without seafloor survey coverage.</p> <p>"The placement of heavy objects (i.e., anchors and tethered nodes with sound dampeners), in conjunction with OBC and OBN surveys on the seafloor, have the potential to severely impact an archaeological site should they come into direct contact with a resource. The OBCs are deployed from a surface vessel onto the seafloor. While the cable itself is light and flexible, the acoustic node assembly and sound dampeners can weigh up to approximately 400 lb (181 kg). The 'blind' method of laying down and peeling up the cable from the seafloor could cause the cable to snag on a shipwreck, causing moderate to major impacts. The OBNs are either dropped from a surface vessel, with a localized impact over a large area, or placed by ROVs, thereby lessening potential impacts to any archaeological resources that may be present on the seafloor. The potential for impacts to archaeological resources resulting from G&G surveys could be reduced further through pre-disturbance survey plan reviews provided by BOEM"</p> <p>The document continues by stating the following:</p> <p>"In attempt to mitigate potential damages to archaeological resources BOEM also requires that, if a cable becomes snagged upon retrieval operations, the operator must verify the cause of the snag, which could possibly minimize further damage to archaeological resources."</p>	<p>Text has been revised in Chapter 4.11 to add clarifying language in the impact assessment of each alternative to describe how visual verification of snags would identify potential damage to archaeological resources should they occur during an OBC or OBN survey.</p>
1063-0033	<p>Page 4-359-360 Alternative B</p> <p>Impacts of Routine Activities: Entanglement is still an issue and not addressed outside of simply identifying the snag. This is not mitigation and should be labeled as a damage assessment.</p>	<p>Text has been revised in Chapter 4.11 to add clarifying language in the impact assessment of each alternative to describe how visual verification of snags would identify potential damage to archaeological resources should they occur during an OBC or OBN survey.</p>

Table M-15. Archaeological Resources' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Page 4-361 Alternative C: same as above Page 4-362-363 Alternative D: same as above Page 4-363-364 Alternative E: same as above Page 4-365-366 Alternative F: same as above Page 4-366 Alternative G: Only activity that will not impact a potential archaeological resource.</p> <p>In reference to the above descriptions: The seafloor impacts described in the document are centered on two sets of circumstances. The first is that there will be some pre-disturbance survey data that BOEM can review prior to placing OBNs and OBCs on the seafloor or that they use an ROV to individually place these tools on the seafloor. If there is pre-disturbance data, then the BOEM archaeologists could require avoidance mitigation of archaeological investigations prior to disturbing the seafloor. From BSEE's point of view, this would result in what is described as a Nominal impact in the document.</p> <p>The other scenario discussed in the document centers on a "blind" method of deployment. That is, to simply deploy these items (that may weigh 400 lbs or more) on the seafloor with no knowledge of what might be on the seafloor (archaeological sites, shipwrecks or other seafloor hazards). This is considered a Moderate to Major impact in the document.</p> <p>The document then goes on to explain that in the event that there is a snag during the retrieval of these nodes, the operator will immediately halt and investigate each snag and determine if it is a shipwreck of some other seafloor hazard. The document refers to this as a mitigation measure that will inform the operator and BOEM as to what they have become entangled in. This description of a mitigation is a misrepresentation of what would constitute a mitigation measure (i.e. avoidance criteria or an archaeological investigation). If the operator were to snag on an archaeological site, this investigation would constitute a</p>	

Table M-15. Archaeological Resources' Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>damage assessment rather than mitigation. The proper way to ensure that no adverse impacts occur to historic properties during the proposed undertaking(s) (as per section 106 of the NHPA) would be to acquire high-resolution survey data and an archaeological assessment prior to the development of the OBNs and OBCs. This would constitute a good faith effort to identify historic properties in the Area of Potential Effect (as per NHPA and NEPA). Avoidance mitigations and criteria could then be placed on the operators permit and follow up compliance reviews of the placement of the OBNs or OBCs could be reviewed and determined if the operator complied with the conditions of permit approval. This discussion does not provide that level of analysis or consideration of these archaeological resources.</p>	
1071-0003	<p>We reviewed the information submitted regarding the draft PEIS, and note that BOEM is seeking a wide range of information regarding resource assessment of all OCS areas in order to avoid, minimize or mitigate adverse effects on historic properties (specifically historic shipwrecks). Since measures consistent with NEPA and federal consistency requirements are in place for requisite site surveys to locate and evaluate historic sites and properties, and for the avoidance of adverse impacts to significant resources, this agency concurs that the proposed G&G activities will have no adverse impact on historic properties.</p>	<p>Thank you for your comment.</p>

M.4.13 Other Marine Uses

Multiple comments expressed opposition to any activities occurring east of the Military Mission Line that would negatively impact the military's utilization of the Joint Gulf Range Complex for required training. Detailed responses to specific comments are provided in **Table M-16**.

Table M-16. Other Marine Uses' Detailed Comment Responses

Submission ID	Comment	Response
Other Marine Uses		
0030-0003	<p>The Defense Support Initiative is a tri-county community based military and defense support organization. Eglin's Joint Gulf Range Complex, identified by the existing Military Mission Line as the Eastern Planning Area, is considered by DoD as a National Military Asset for testing and training.</p> <p>The DSI maintains its official position established in 2010 and opposes any oil exploration, drilling, or related activities east of the Military Mission Line that would negatively impact the military's utilization of the Joint Gulf Range Complex for required training and threaten the ecology and economy of the Gulf region.</p>	<p>In 2006, the Gulf of Mexico Energy Security Act (GOMESA) was signed into law by the President. Among other provisions, this Act issued a moratorium on oil and gas leases within 125 mi (201 km) of the Florida coastline in the EPA until at least 2022. The Act also issued a moratorium on new oil and gas leases from all areas in the EPA east of the Military Mission Line (86°41' W. longitude) and areas in the CPA within 100 mi (161 km) of the Florida coastline. The projected levels of G&G activities for oil and gas exploration, marine minerals projects, and renewable energy geophysical surveys are outlined in Tables 3.2-1, 3.2-2, 3.2-4, and 3.2-5 over the 10-year time period evaluated in this Programmatic EIS. The projected number of G&G activities in the EPA is much smaller than the number of surveys projected to take place in the WPA and CPA over the same period of time.</p> <p>Historically, military activities and oil and gas exploration and production have coexisted within the AOI. Any conflicts between G&G activities and scheduled military operations can be avoided through coordination as stated in NTL 2014-BOEM-G04 and standard GOM lease stipulations. In Chapter 4.12.2.1.3, the potential impacts of G&G activities to military range complexes, MWAs, or areas of other military use would be nominal and avoidable when coordinated with the U.S. Department of Defense (USDOD) prior to commencement, as has occurred in the past. BOEM is committed to maintaining close coordination with the USDOD to avoid impacts from G&G survey activities.</p>

Table M-16. Other Marine Uses' Detailed Comment Responses (continued)

Submission ID	Comment	Response
0032-0001	<p>I represent the Defense Support Initiative, a community based military and support organization of three northwest Florida counties. The GOM is a national test and training treasure and asset. The most sophisticated systems and aircraft require this test and training area, which cannot be replicated anywhere in the U.S. The implied threat of additional drilling in the Gulf is a strategic threat. The mere beginning of seismic analysis and testing begins the movement down the slippery slope of affecting the military importance of the Gulf test and training range.</p>	<p>In 2006, the GOMESA was signed into law by the President. Among other provisions, this Act issued a moratorium on oil and gas leases within 125 mi (201 km) of the Florida coastline in the EPA until at least 2022. The Act also issued a moratorium on new oil and gas leases from all areas in the EPA east of the Military Mission Line (86°41' W. longitude) and areas in the CPA within 100 mi (161 km) of the Florida coastline. The projected levels of G&G activities for oil and gas exploration, marine minerals projects, and renewable energy geophysical surveys are outlined in Tables 3.2-1, 3.2-2, 3.2-4, and 3.2-5 over the 10-year time period evaluated in this Programmatic EIS. The projected number of G&G activities in the EPA is much smaller than the number of surveys projected to take place in the WPA and CPA over the same period of time.</p> <p>Historically, military activities and oil and gas exploration and production have coexisted within the AOI. Any conflicts between G&G activities and scheduled military operations can be avoided through coordination as stated in NTL 2014-BOEM-G04 and standard GOM lease stipulations. In Chapter 4.12.2.1.3, the potential impacts of G&G activities to military range complexes, MWAs, or areas of other military use would be nominal and avoidable when coordinated with the USDOD prior to commencement, as has occurred in the past. BOEM is committed to maintaining close coordination with the USDOD to avoid impacts from G&G survey activities.</p>

Table M-16. Other Marine Uses' Detailed Comment Responses (continued)

Submission ID	Comment	Response
0612-0001	<p>WRT the military mission, any activity proposed near or east of the Military Mission Line needs to have specific items required as part of the permit process.</p> <ol style="list-style-type: none"> 1. Any activities must be pre-coordinated using the long range planning process of the scheduling office of the 96 Test Wing at Eglin AFB. 2. Any activities must be scheduled through the 96 Test Wing scheduling office at Eglin AFB (more detailed than the long range planning in item 1. 3. Any emissions must be pre-coordinated with and approved by the Gulf Area Frequency Control Office at Eglin AFB, FL to prevent any interference with military data collection activities. 4. Any frequencies approved by the GAFC office in 3, must also be scheduled for use during the process required in number 2 above. <p>The weapons and armament testing done in the GOM is too important to national security to allow any delays due to non-military activities. The test activities are too hazardous to allow operations in the GOM east of the MML that have not been completely coordinated with the 96 Test Wing.</p>	<p>In 2006, the GOMESA was signed into law by the President. Among other provisions, this Act issued a moratorium on oil and gas leases within 125 mi (201 km) of the Florida coastline in the EPA until at least 2022. The Act also issued a moratorium on new oil and gas leases from all areas in the EPA east of the Military Mission Line (86°41' W. longitude) and areas in the CPA within 100 mi (161 km) of the Florida coastline. The projected levels of G&G activities for oil and gas exploration, marine minerals projects, and renewable energy geophysical surveys are outlined in Tables 3.2-1, 3.2-2, 3.2-4, and 3.2-5 over the 10-year time period evaluated in this Programmatic EIS. The projected number of G&G activities in the EPA is much smaller than the number of surveys projected to take place in the WPA and CPA over the same period of time.</p> <p>Historically, military activities and oil and gas exploration and production have coexisted within the AOI. Any conflicts between G&G activities and scheduled military operations can be avoided through coordination as stated in NTL 2014-BOEM-G04 and standard GOM lease stipulations. In Chapter 4.12.2.1.3, the potential impacts of G&G activities to military range complexes, MWAs, or areas of other military use would be nominal and avoidable when coordinated with the USDOD prior to commencement, as has occurred in the past. BOEM is committed to maintaining close coordination with the USDOD to avoid impacts from G&G survey activities.</p>

M.4.14 Human Resources and Land Use

Several comments emphasized the negative impact that most of the alternatives would have on the economy of the GOM region and the Nation's energy security. These comments stated that jobs would be lost, which would impact the overall economy in the region and be detrimental to the Nation's energy security. Additional comments stated that the economic analysis presented in this Programmatic EIS is insufficient and that a cost-benefit analysis is needed.

The economic analysis performed as part of this Programmatic EIS focused only on additional expenditures for operating costs from implementing the proposed mitigation measures included in Alternatives A through F. The cost of the mitigation measures proposed for Alternatives E and F that would add additional operational cost are addressed quantitatively in the analysis. Alternative E options for a 10 percent and 25 percent reduction in line miles of deep-penetration, multi-client seismic airgun surveys (E1 and E2), as well as the closure areas proposed in Alternative F were addressed qualitatively. The economic analyses considered additional operating costs to be incurred, as well as the broader effects to industry, the local economy, and the supply chains from a reduction in activity and closure areas. Therefore, the resulting impact analysis qualitatively assessed potential impacts to the G&G industry, oil and gas industry, and regional economy as a whole. The 2017-2022 GOM Multisale EIS provides BOEM's estimates of each GOM area's overall economic dependence on the offshore oil and gas industry. Detailed responses to specific comments are provided in **Table M-17**.

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses

Submission ID	Comment	Response
Human Resources, Land Use, and Economics		
0668-0002	<p>The recreational fishing economy is an indicator of a middle class in the region and another tier of local economy that would be nearly if not completely eliminated in the case of a large scale shutdown. I believe there is a very large and important port missing from the list of 2 ports on the bottom of page 4-385. The Port of Freeport in Brazoria County south of Houston portfreeport.com is very relevant to oil and gas in the Gulf Coast.</p>	<p>Potential impacts of the alternatives on recreational fishing are analyzed in Chapter 4.10. Recreational fishing uses smaller boat ramp access and marinas rather than the large ports that G&G surveys utilize.</p> <p>The role of the Port of Freeport is discussed in Dismukes (2011), which is cited in the prior paragraph indicating that the Port of Freeport is devoted to conventional bulk transport shipping. As noted in Chapter 4.13.1, Port Fourchon and the Port of Galveston are the primary ports supporting G&G activities, as indicated in G&G permit applications. The Port of Freeport is not indicated by G&G permit applications as a port from which G&G activities are based.</p>
0668-0003	<p>On page 9 of the Quick Look document, I see Table 1 Impact Levels by Resource and Applicable Impact-Producing Factor Across Alternatives a through G. When I look toward the bottom the page, I see Demographics, Socioeconomics, Economic Factors, and Cumulative Factors, I see several squares that say "No Impact." For me, I believe that limiting seismic usage would cause major impact. I do not foresee "No Impact." I also see squares on the table that say minimum impact, minimum to moderate impact, moderate impact, and major impact. I believe these impact expressed on these squares is seriously underrated.</p>	<p>Thank you for your comment. Table 2.13-1 has been corrected to match the impact analysis results included in Chapter 4.13.</p>
0668-0004	<p>Page 4-388 mentions a total of 79 companies identified as providing oil and gas services in the GOM. This number is way too low. Check the roster of the OTC Offshore Technology Conference for a more accurate number. It is important consider the concept of Tier 1, Tier 2, Tier 3 companies. For example, there is a certain number of Tier 1 companies such as Operators like ExxonMobil, Chevron. Then there are Tier 2 companies like Baker Hughes and Schlumberger that serve Tier 1 companies. This trend continues with Tier 3 companies whose major customers are Tier 2 companies. This is important to consider because if Tier 1 operations were impaired, it would</p>	<p>The 79 companies identified were one source's estimate (Eastern Research Group, Inc., 2011) of the number of G&G services providers, not the total number of oil and gas companies in the GOM. BOEM acknowledges that there are many more companies involved in the overall oil and gas industry supply chain. The 2017-2022 GOM Multisale EIS provides BOEM's estimates of each GOM area's overall economic dependence on the offshore oil and gas industry. A summary of the qualitative analysis has been added to Chapter 4.13.</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>not only affect the employees of the Tier 1 companies, but also the employees of the Tier 2 companies, Tier 3 companies, Tier 4, etc. There are many tiers of companies and all of them have employees that would be affected by reduced activity in the GOM. For example there are small to medium size companies in the Texas Gulf Coast perhaps Tier 4 or Tier 5 companies that repair heavy equipment used by Tier 1, Tier 2 and Tier 3 companies. If Tier 1, Tier 2 and Tier 3 companies suffer loss of revenue, loss of production feedstock, then Tier 1-6 companies in upstream and downstream and other community economies would suffer tremendously NOT JUST the employees of the Tier 1 companies. For this reason, I believe that the statement on page 4-389 "As a result these multimillion dollar industries employ thousands of workers throughout the Gulf Coast" I believe the actual defacto number of workers is a lot more than you might think. I refer to page 4-391 regarding newly displaced workers, I believe it is important to mention Brazoria County and Galveston County would be pummelled as well as engineering and oil and gas companies in The Woodlands Montgomery County area where ExxonMobil and Anadarko, etc. are located.</p>	
0668-0005	<p>Limitations on seismic in the Gulf would have massive economic repercussions. These economic repercussions would effect not only tier 1 people employed by the operators like Exxon, also tier 2 the people employed by the service companies, and tier 3 the people employed by the companies whose customers are the service companies. Also consider where people in tier 1, tier 2, and tier 3 spend money. How does their spending support or detract from the local economy where they live? There are many more tiers in this community. The daisy chain effect does not have to go on for too long for the local shopping centers to start to have retailers close stores.</p> <p>And we are only talking about tier 1, tier 2, and tier 3. What about the community spending? Who sponsors little league teams and volunteer fire department fundraisers? Where does that money come from? It comes from corporate matching programs matching employee donations. It comes from</p>	<p>Chapter 4.13 includes an evaluation regarding these potential impacts in the economic factors analysis. This type of detailed quantitative analysis of the impacts to the entire economy of the GOM is beyond the scope of this Programmatic EIS. This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>However, the 2017-2022 GOM Multisale EIS provides BOEM's estimates of each GOM area's overall economic dependence on the offshore oil and gas industry. A summary of this qualitative analysis has been added to Chapter 4.13.</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>employee donations out of their paycheck without corporate sponsorship. It comes from property taxes paid by the job sites in the community. And if the plant closed, the effects would be immediate, ongoing and devastating.</p>	
0668-0006	<p>Even a temporary shutdown could be devastating and continue to be devastating for years. The skilled blue collar labor force is a valuable and worthy natural resource of the Gulf just as the beautiful white sand of Gulf Shores Alabama is a valuable and worthy natural resource of the Gulf Coast. And if those skilled blue collar workers lose their jobs and lose their homes and have no choice to scatter among the other 45 states in the United States looking for new jobs and new homes? What then? If a change in policy decides to resume normal oil and gas activity in the Gulf, we can't just run down to Walmart and buy a replacement skilled blue collar labor force! How would function be restored once seriously interrupted? I ask you to consider this. It is a very big deal. Some things cannot be undone. And if they can, it takes years even decades to restore. And what about the function of the regions that Gulf Coast serves? The exploration and refineries in the Gulf Coast provide for the United States. How would massive shutdowns and layoffs in Gulf Coast communities effect the rest of the United States?</p>	<p>Thank you for your comment. BOEM has qualitatively addressed these effects within the economic factors analysis in Chapter 4.13.</p>
0999-0004	<p>Tidewater is certain that BOEM is well aware of the economic engine of offshore energy exploration and exploitation (E&E) and its impact on the Gulf States. We would urge BOEM that disruption of this economy without extreme environmental justification sufficient to offset the impact to jobs in those states would be unwarranted.</p>	<p>Thank you for your comment. BOEM has presented a detailed analysis of the potential economic impacts of the alternatives in Chapter 4.13.</p>
0999-0005	<p>The offshore hydrocarbon industry is commercially driven, but remains integral to the twin national goals of energy security and independence. We would remind BOEM that energy projects are time and capital-intensive. In other words; not only the current price of hydrocarbons, but also the projected future price determines the parameters of exploration for energy reserves but also the schedule of production of those reserves. As a result, uncertainty with respect to access, or due diligence in research of leases enters the decision-tree and, worst-case,</p>	<p>Thank you for your comment. BOEM has analyzed these potential impacts within its economic factors analysis in Chapter 4.13.</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	could result in National embarrassment in the matter of energy security.	
1075-0006	In general, BOEM's economic analysis found in Section 4.13 of the DPEIS is inadequate, especially in the assumptions made about activity levels in the face of overly restrictive mitigation measures. The analysis appears to completely ignore the potential of reduced future drilling and production because there would not be adequate GIG data, especially seismic data, available.	<p>BOEM believes the assumption that the predicted effort would remain constant is reasonable at the programmatic level and within the 10-year timeframe of this Programmatic EIS. While there has been a reduced level of exploration, G&G activity, and permit applications recently, BOEM assumes that activity will return to previous levels within the next 10 years. Therefore, BOEM must be prudent and conservatively consider the full range of potential impacts. The scenarios contain projections based on the analysis of recent historic activity levels and trends made by subject-matter experts who also considered industry-projected activity levels in their estimates.</p> <p>This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>BOEM acknowledges the cost to industry and the cost of implementing the mitigation measures, and includes this analysis in Chapter 4.13 and associated tables. BOEM has removed some conflicting language from this chapter.</p>
1075-0007	While the DPEIS describes the potential economic impacts of the various alternatives (e.g., increased cost leading to decreased profits; supply chain impacts; lost production), it does not provide cost estimates for direct, indirect and induced economic impacts over the 10-year time period, nor does it adequately account for the variability inherent in offshore oil and natural gas exploration and development. As such, stakeholders cannot evaluate the full economic impacts of the alternatives.	Additional text has been added to Chapter 4.13.1.5 . A synthesis of quantitative and qualitative information was used within this Programmatic EIS to assess and disclose the potential effects of permitting G&G activities (Chapter 4.13). Quantitative analysis for offshore oil and gas exploration and development is beyond the scope of this Programmatic EIS. However, Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity.

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities.</p> <p>The impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record.</p>
1075-0008	<p>BOEM has failed to provide an adequate accounting of potential economic impacts for stakeholders to make an adequate assessment of the practicability or feasibility of the proposed alternatives. Perhaps the absence of a trained economist listed as one of the preparers/reviewers for chapter four of the DPEIS caused the inadequate accounting. Barry Graham Oil Service, LLC respectfully urges BOEM to conduct the required quantitative analyses and provide the findings for appropriate consideration going forward.</p>	<p>BOEM acknowledges the cost to industry of implementing the mitigation measures and includes this analysis in Chapter 4.13 and its associated tables. In addition, Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities.</p> <p>In addition to the economists included in the list of contract preparers, economists at BOEM assisted in the preparation of Chapter 4.13, but they were inadvertently left off the draft list preparers. This has been corrected.</p>
1076-0062	<p>In general, BOEM's economic analysis found in Section 4.13 of the DPEIS is inadequate, especially in the assumptions made about activity levels in the face of overly restrictive mitigation</p>	<p>BOEM has provided adequate information to disclose potential effects of the alternatives analyzed in this Programmatic EIS. Specifically with regard to potential economic effects,</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>measures and the fact that the analysis appears to completely ignore the potential of reduced future drilling and production because there would not be adequate G&G data, especially seismic, available. In addition, while the DPEIS describes the potential economic impacts of the various alternatives (e.g., increased cost leading to decreased profits; supply chain impacts; lost production), it does not provide cost estimates for direct, indirect and induced economic impacts over the 10-year time period, nor does it adequately account for the variability inherent in offshore oil and natural gas exploration and development. As such, stakeholders cannot evaluate the full economic impacts of the alternatives.³⁴</p>	<p>Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F. The industry cost analysis for this Programmatic EIS focused only on additional expenditures for operating costs from the proposed mitigations for Alternatives A through F. This Programmatic EIS also analyzed the larger ranging effects to industry, the local economy, and supply chains from a reduction in activity and closure areas. BOEM did not quantify all of the direct, indirect, and induced impacts but discussed them qualitatively. This is because quantitative methods would be too speculative given that reductions in oil and gas activities are several steps removed from G&G activities and because of the variability inherent in the oil and gas industry. In addition, adjustment processes that are difficult to capture with quantitative methods would likely occur over time. However, there is sufficient information to reach overall impact conclusions and to satisfy NEPA requirements. Therefore, BOEM took the approach of providing a qualitative analysis of the indirect and induced impacts. Chapter 4.13 also references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities; the economic impacts from changes in overall oil and gas activities indirectly arising from changes in G&G activities would roughly follow these geographic patterns.</p> <p>The analysis for each alternative and the associated impact</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>conclusion were developed using the best available, scientifically credible information and generally accepted scientific methodologies. Additional text has been added to Chapter 4.13.1.5.</p>
1076-0064	<p>BOEM's analyses of the economic impacts associated with the proposed reductions in seismic surveys found in Alternatives E1 and E2 are particularly concerning:</p> <ol style="list-style-type: none"> 1. BOEM assumes that reducing seismic survey activity by 10% and 25% reduces direct employment by a proportional amount, resulting in 600 to 1,500 fewer jobs and economic/GDP impacts of \$294 million to \$735 million per year. This assumption is a good approximation of a portion of the direct impacts associated with reduced seismic survey activity. BOEM also mentions indirect and induced impacts but provides no calculations or estimates. DPEIS at 4-400, 401. There is no reason not to provide these estimates. According to estimates made using the IMPLAN model, adding in the indirect and induced impacts of reduced seismic survey spending more than doubles the employment impacts and increases GDP impacts by 70%. 2. BOEM describes the real possibility that investments in new wells and platforms could be delayed and some prospective areas will not be developed at all. However, BOEM does not provide an estimate of how much activity will be forgone and thus no estimate of potential economic impacts is given. This is a significant flaw in the economic analysis of Alternatives E1 and E2 and should be rectified prior to publication of the final PEIS. 3. BOEM attempts to rationalize and minimize the potential impacts of Alternatives E1 and E2 by highlighting "the substantial declines in oil and gas prices since mid-2014 will likely curtail oil and gas exploration activities, 	<p>The impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record. The industry cost analysis for this Programmatic EIS focused only on additional expenditures for operating costs from the proposed mitigations for Alternatives A through F; therefore, this cost analysis represents only one part of the whole economic analysis. Therefore, the economic analyses consider the additional operating costs to be incurred as well as the larger ranging effects to industry, the local economy, and supply chains from a reduction in activity and closure areas. BOEM did not quantify all of the direct, indirect, and induced impacts, but discussed them qualitatively. This is because quantitative methods would be too speculative given that reductions in oil and gas activities are several steps removed from G&G activities and because of the variability inherent in the oil and gas industry. In addition, adjustment processes that are difficult to capture with quantitative methods would likely occur over time. However, there is sufficient information to reach overall impact conclusions and to satisfy NEPA requirements. Therefore, BOEM took the approach of providing a qualitative analysis of the indirect and induced impacts. The analysis for each alternative and the associated impact conclusion were developed using the best available, scientifically credible information and generally accepted scientific methodologies.</p> <p>BOEM has developed this in-depth Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported. All of this information will be</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>implying that G&G activities may decline in absence of Alternative E.” DPEIS at 4-391, 392. However, the economic impacts are an estimate of future activity comparing the potential impacts with and without the proposed policy, not a comparison to an activity level in the past or a speculation about future oil prices as drivers of exploration. This comparison does not justify not including potentially large impacts of lost drilling activity.</p> <p>4. On pages 4-391 and 392, BOEM makes several statements regarding potential impacts of Alternative E that are not relevant to the economic analysis or are not justifiable. In particular, whether the impacts are “nominal or minor” relative to the overall economy of all the coastal states is irrelevant. The full economic impacts of the action, in and of itself, should be estimated. The statement that “the majority of workers that are displaced from the G&G industry would likely be able to find employment in the region” is neither justified nor plausible, especially in the case of non-maritime workers on seismic survey vessels.</p> <p>5. The statement that United States production will depend “on the extent to which oil and gas companies divert capital from offshore oil and gas development to onshore development in the US” is highly misleading. DPEIS at 4-401 and 4-403. Capital will move globally, not just within the United States. Restricted offshore GOM capital expenditures will likely go to the best second alternative, which will not necessarily be in the United States. Certain offshore specific assets, such as drilling rigs, will definitely be deployed in foreign offshore markets, not U.S. onshore.</p>	<p>considered by the decisionmaker in determining which alternative is selected in the ROD.</p> <p>Chapter 4.13 references the 2017-2022 GOM Multisale EIS, which provides forecasts of the direct, indirect, and induced economic impacts of offshore oil and gas activities. In Chapter 3.1 of the 2017-2022 GOM Multisale EIS, BOEM developed a robust range of oil and gas activity. After developing the alternatives for this Programmatic EIS, BOEM determined that the scenario described in the 2017-2022 GOM Multisale EIS is broad enough to encompass any indirect effects to the oil and gas industry from the range of G&G activity described in Alternatives A through F. In addition, the 2017-2022 GOM Multisale EIS provides a sense of the geographic patterns of economic impacts that arise due to offshore oil and gas activities.</p> <p>In addition, if NOAA moves forward with their proposed action (i.e., issuance of MMPA incidental take regulations), then a Regulatory Impact Analysis would accompany the rule.</p> <p>BOEM has made various changes to Chapter 4.13. For example, BOEM has rephrased the analysis for Alternative E to clarify the commenter’s points about the state of the overall oil and gas industry. BOEM has also clarified that it is analyzing the full impacts of the alternatives. Finally, BOEM has altered the language regarding the adjustments that would occur in the oil and gas industry.</p>
1076-0065	<p>The analysis BOEM has provided for Alternative F is no better. The potential economic impact would be dependent on the number of quality oil and gas targets in the four areas. In addition, there are at least 5,350 active leases in these areas</p>	<p>Based on BOEM’s active lease data as of June 2017, there are 638 active leases in the proposed closure areas included in Alternative F (Boudoin, 2017). The closures are applicable to airgun surveys only. Non-airgun surveys operating at</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>whose potential value would be greatly compromised. Any current investment in these areas would be essentially stranded and the value of lost revenue could be in the billions of dollars, yet BOEM has not provided estimates for these lost opportunities.</p>	<p>frequencies >200 kHz could occur in the closure areas. However, currently authorized G&G activities in the closure areas would be allowed to continue subject to the terms and conditions of existing permits or authorizations and without being required to implement additional mitigation measures.</p>
1076-0066	<p>BOEM has determined that Alternative G—a complete halt to seismic surveys— would only have a “moderate” socioeconomic impact. This is a stunning remark coming from BOEM, suggesting it does not grasp that offshore oil and gas exploration and development fundamentally require seismic data acquisition in order to pursue and support ancillary activities. Without seismic data, offshore oil and gas exploration and development would simply not be economically viable. The complete collapse of the offshore oil and natural gas industry in the GOM, including the loss of all direct, indirect and induced jobs and GDP contributions for operations in federal waters, would hardly be a “moderate” impact. The impacts of shutting down seismic surveys in the GOM are clearly “major” and Alternative G should be dropped from further consideration. BOEM has failed to provide an adequate accounting of potential economic impacts for stakeholders to make an adequate assessment of the practicability or feasibility of the proposed alternatives. The Associations respectfully urge BOEM to conduct the required quantitative analyses and provide the findings for appropriate consideration going forward.</p>	<p>BOEM's analysis of the potential economic impacts of Alternative G is presented in Chapter 4.13.8. BOEM concluded that the economic impacts of Alternative G would be major. BOEM's analysis of the impacts to other aspects of socioeconomics (i.e., environmental justice, demographics, land use, and infrastructure) would be minor to moderate. Chapter 4.13 has been restructured to clarify the different aspects of socioeconomics and the resultant impact rating.</p>
1077-0004	<p>BOEM fails in its DPEIS to satisfy a mandate under the Outer Continental Shelf Lands Act (“OCSLA”) to assess and then balance the costs and benefits of listed alternative restrictions on G&G activities against a requirement for “expeditious and orderly development” of Gulf resources. OCSLA requires that the Gulf Outer Continental Shelf, which Congress deemed to be “a vital national resource,” be “made available for expeditious and orderly development, subject to environmental safeguards . . .” 43 U.S.C. § 1332(3) (emphasis added). Yet, BOEM admittedly failed to use reliable data to determine whether benefits exist from the restrictions; BOEM then failed to analyze whether perceived benefits outweigh their negative impact on “expeditious and orderly” development of offshore resources.</p>	<p>This Programmatic EIS was prepared in order to analyze potential impacts of BOEM authorizing G&G survey activities in the GOM. The statutory authority for BOEM to issue such permits or authorizations is provided by the OCSLA. This Programmatic EIS does not address elements beyond those required by NEPA (e.g., the stated proposed action, purpose, and need as described in Chapter 1.1.2).</p> <p>A cost-benefit analysis is not required to satisfy NEPA analysis requirements, particularly if there are important qualitative considerations (40 CFR § 1502.23). However, an EIS should indicate considerations, including factors not related to environmental quality, that are likely to be relevant and</p>

Table M-17. Human Resources, Land use, and Economics Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Chevron responded to Congress' initiative by investing billions of dollars in Gulf exploration and development activities. BOEM should account for such reliance interests before deciding to use methods and data that BOEM admits to being unrealistic, and which could lead to measures that threaten the availability of seismic information needed for basically any meaningful exploration and development.</p>	<p>important to a decision (40 CFR § 1502.23). Therefore, only a cost analysis of the proposed mitigation measures was performed and is included in Chapter 4.13. Chapter 4.13 provides an analysis of and tables showing the incremental cost and percent cost change per survey, the total annual survey incremental cost, and the percent reduction in efficiency per survey for Alternatives B through F. BOEM considers many factors, including the cost of implementing mitigation measures, in selecting the Preferred Alternative. If NOAA moves forward with their proposed action (i.e., issuance of MMPA incidental take regulations), then a Regulatory Impact Analysis would accompany the rule. BOEM prepared this Programmatic EIS using the best available data and included conservative assumptions to avoid underestimating impacts. BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best available scientific information and professional judgment of subject-matter experts. BOEM developed this in-depth Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.</p>
1127-0001	<p>Our industry provides an important service to America, producing the energy needed to power businesses, hospitals, schools, and other institutions, as well as households.</p>	<p>Thank you for your comment. BOEM has analyzed these factors in Chapter 4.13.</p>

M.4.15 Public Involvement and Agency Consultation Coordination

Comments requested clarification of cooperating agencies' roles and specific text edits to accurately describe the roles and responsibilities of cooperating agencies. The State of Florida requested access to geological datasets collected in the coastal areas of Florida for future research. It was noted that the public participation and comment opportunity was appreciated. Detailed responses to specific comments are provided in **Table M-18**.

Table M-18. Public Involvement and Agency Consultation Coordination Detailed Comment Responses

Submission ID	Comment	Response
Public Involvement and Agency Consultation Coordination		
1069-0010	<p>Finally, Shell appreciates the opportunity to comment on this important review of the NEPA process and looks forward to actively participating in the remaining steps.</p> <p>The evidence available to the government demonstrates the enormous economic, energy, and environmental value associated with safely managed exploration and production of the nation’s OCS oil and gas resources – and the relative value of this program compared against the drastic and stark restrictions proposed on the G&G technology that forms the basis of this program.</p> <p>Moreover, it is essential that BOEM coordinates closely with its sister agencies on this PEIS and future agency actions so that breakdowns in the regulatory processes – as witnessed recently in the Alaska and Atlantic OCS arenas – are not repeated.</p>	<p>All comments received on the Draft Programmatic EIS were considered during preparation of this Final Programmatic EIS. BOEM will continue coordination with all cooperating agencies, including BSEE and NOAA. The environmental review process ends following a 30-day period after release of this Final Programmatic EIS with issuance of a ROD. The ROD will state the decision of the agency (BOEM); identify the alternatives considered, including the environmentally preferable; identify and discuss the factors involved in the decision; and state whether all practical means to avoid or minimize environmental harm have been adopted, and if not, why not.</p> <p>In addition, BOEM is working with NOAA and BSEE on MMPA rulemaking for these G&G activities to ensure close coordination and that this Programmatic EIS meets agency needs.</p>
1071-0010	<p>The FGS has the ability to archive geologic samples (e.g., cores and cuttings) and geophysical data collected offshore of Florida and to make those samples and data available for future research. It is requested that the FGS be given access to any geological, geochemical and geophysical data, to include bottom samples, borings and stratigraphic test information as well as high resolution shallow penetration sub-bottom profiler, side scan sonar, swath bathymetry, and traditional bathymetric survey data that might be collected proximal to the coast of Florida. The FGS is interested in what these data sets might reveal regarding the geology of Florida. For example, these data sets would provide insights into groundwater/seawater interaction, help determine the location of submarine springs and thus enhance our understanding of the hydrogeology of Florida. They would be useful in addressing potential geo-hazards to bottom supported and bottom involved structures. These data sets might also serve to better delineate areas of live bottom and hard ground. Our use of these data sets would also facilitate both qualifying and quantifying</p>	<p>Information that can be publicly released will be made available to the FGS. Depending on the survey, some data collected during G&G surveys may be considered proprietary and, therefore, not available for public distribution.</p>

Table M-18. Public Involvement and Agency Consultation Coordination Detailed Comment Responses (continued)

Submission ID	Comment	Response
	reserves of beach restoration quality sand proximal to points of potential need and the resolution of potential resource conflicts related to the sequestration of beach restoration quality sands by bottom involved structures and their appurtenances prior to their emplacement.	
1130-0001	<p>We respectfully submit that we have experienced serious challenges with BOEM's management of the cooperating agency relationship thus far, in part because BOEM's actions have not always followed the direction in the September 8, 2015, Memorandum of Agreement between the agencies. In our view, issues include (but are not limited to): unilateral changes to agreed-upon timelines, lack of appropriate responses to cooperating agency comments and input relating to development of the draft PEIS, failure to implement verbally agreed-upon changes designed to make aspects of the published draft PEIS palatable to NOAA, and changes to the draft PEIS following the final version provided for NOAA's review that implicated NOAA in statements the agency disagrees with. In order to address these issues, we kindly request that BOEM ensure NOAA be afforded the opportunity to participate in any meetings relating to comment resolution and response, PEIS content, or preparation of the final PEIS. BOEM must allow NOAA the opportunity to ensure that the final PEIS fully satisfies its obligations under NEPA. We also request that BOEM provide written responses to the comments attached to this letter, including justification or resolution where BOEM declines to accept NOAA's recommendations. We expect that BOEM will provide NOAA a copy and summary of all comments received during the draft PEIS public comment period, that NOAA will have an opportunity to review a preliminary final version of the final PEIS, and that NOAA will be notified of any changes to the final PEIS prior to publication. Finally, we request that BOEM keep NOAA fully informed with regard to development of any timelines pertaining to the PEIS and, as necessary, alteration of any timelines pertaining to the PEIS process.</p>	<p>BOEM takes your comment very seriously and considers the cooperating agency relationship to be exceedingly important under NEPA. While the development of this Programmatic EIS has been challenging, BOEM has appreciated NOAA's role throughout this process, providing significant input and expertise. Consistent with obligations under NEPA, BOEM remains committed to working with NOAA as a cooperating agency, keeping NOAA informed and ensuring that NOAA's comments are considered. As BOEM and NOAA have continued discussions after the comment period closed and in preparing this Final Programmatic EIS, BOEM has seriously considered and responded to NOAA's comments and has incorporated the additional ideas and expertise into this Programmatic EIS. As required by NEPA regulations and as noted in this appendix, BOEM has responded to NOAA's comments and has indicated where proffered language was accepted or accepted with modifications and included in this Final Programmatic EIS.</p>

Table M-18. Public Involvement and Agency Consultation Coordination Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0002	<p>1. Revise the NOAA cooperating agency explanation in the Executive Summary and Chapter 6 (as provided below) for consistency and accuracy regarding NOAA's jurisdiction and purpose to serve as a cooperating agency. Although NOAA's previous comments concerning this topic were partially addressed during pre-draft versions, the descriptions in the Draft PEIS for public review are inconsistent. Reference: Executive Summary, Page vii, Background, Third Paragraph and Chapter Six, Page 6-7, Section 6.3.3.2., First Paragraph. "NOAA is serving as a cooperating agency because the scope of the proposed action and alternatives involve G&G survey activities that have the potential to impact protected resources under NOAA's jurisdiction, including marine mammals, Endangered Species Act (ESA) listed marine species, Essential Fish Habitat (EFH) and National Marine Sanctuaries (NMS). NOAA's National Marine Fisheries Service (NMFS) has a statutory responsibility to protect, conserve and recover marine mammals and threatened and endangered species. This includes the authority to authorize incidental take of marine mammals, engage in consultations with other federal agencies, which can allow for take of threatened and endangered species, and enforce against unauthorized take. NMFS executes these authorities pursuant to the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.) and the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 et seq.). NMFS has additional responsibilities to conserve and manage fishery resources of the United States. This includes consultations with other federal agencies pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the implementing regulations at 50 CFR Part 600 for actions that may adversely affect EFH. NOAA's Office of National Marine Sanctuaries (ONMS) has a statutory responsibility to protect and conserve NMS.</p> <p>This includes the authority to issue authorizations and general or special use permits pursuant to the National Marine Sanctuaries Act (NMSA) (16 U.S.C. §§ 1431-1445c-1) and the regulations for implementing NMSA (15 CFR 922) and engage</p>	<p>The NOAA's proposed action has been edited in Chapter 1.1.1 in accordance with input from NOAA. Also, the cooperating agency designation has been edited, as necessary, from NMFS to NOAA throughout this Programmatic EIS.</p>

Table M-18. Public Involvement and Agency Consultation Coordination Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>in consultations with other federal agencies pursuant to NMSA, Section 304(d) for actions that are likely to injure sanctuary resources internal or external to a NMS.”</p> <p>Remove inconsistent references to NMFS as the cooperating agency throughout the Draft PEIS. Even though NMFS is the lead office within NOAA, NOAA is the cooperating agency. Therefore, always refer to NOAA as the cooperating agency except when specifically addressing NMFS’s proposed action per the MMPA.</p> <p>2. Revise the proposed action description in Section 1.1.1, last paragraph (as provided below) for accuracy and consistency regarding the purpose and intent of including a proposed action description for NMFS. Although NOAA’s previous comments concerning this topic were partially addressed during pre-draft versions, the description in the Draft PEIS for public review requires additional changes. Reference: Chapter 1, Section 1.1.1, Page 1-4.</p>	
1130-0003	<p>Remove inconsistent references to NMFS as the cooperating agency throughout the Draft PEIS. Even though NMFS is the lead office within NOAA, NOAA is the cooperating agency. Therefore, always refer to NOAA as the cooperating agency except when specifically addressing NMFS’s proposed action per the MMPA.</p>	<p>Text throughout this Programmatic EIS has been changed to reflect NOAA as the cooperating agency.</p>
1130-0038	<p>Revise as follows: “The NOAA’s Office of National Marine Sanctuaries (ONMS) has a statutory responsibility to protect and conserve the NMS. Consultation pursuant to Section 304(d)303(d) of the National Marine Sanctuaries Act (NMSA) is required of all Federal agencies for actions that are likely to injure sanctuary resources internal or external to a national marine sanctuary that are likely to destroy, cause the loss of, or injure sanctuary resources. In addition to consultation requirements, permits authorizations and general or special use permits may be required pursuant to the NMSA (16 U.S.C. §§ 1431-1445c-1) and the regulations for implementing the NMSA (15 C.F.R. Part 922).” Reference: Chapter 6,</p>	<p>The requested changes have been made in Chapter 6.3.3.2.</p>

Table M-18. Public Involvement and Agency Consultation Coordination Detailed Comment Responses (continued)

Submission ID	Comment	Response
1130-0061	<p>Section 6.3.3.2, Page 6-7.</p> <p>In Vol. I, Chapter 6, Section 6.3.2, how were the public scoping comments from November 18-December 22 2004 relevant to this PEIS? If this is not relevant, this statement and reference should be deleted. If those comments were addressed in this PEIS, what were they and how were they addressed? Some relevance or context should be provided if there is a need to point this out. NOTE: the Scoping Report that is referenced states “The NEPA process began with the Notice of Intent (NOI) to prepare a Programmatic EIS, which was published in the Federal Register on May 10, 2013 (78 FR 27427) and a correction was published on June 5, 2013 (78 FR 33859) to extend the comment period, closing it on July 9, 2013.” This is a document BOEM is directing the public to rely on but this document does not address comments from 2004.</p>	<p>The intent of providing information about the 2004 scoping was to provide the procedural history of past NEPA efforts on these issues. The 2013 scoping process for this Programmatic EIS provided the most relevant information for development of this Programmatic EIS.</p>

M.4.16 Acoustic Propagation and Exposure Modeling (Appendix D)

Some comments asserted that the exposure analysis that was conducted was overly conservative, representing a worst-case scenario, resulting in exposure estimates that are unreasonably high and not reflective of a reasonable estimate of the total number of animals that potentially could be taken.

To address these comments, BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as limitations that may be inherent in any modeling effort. There were some erroneous occurrences of the phrase “worst-case” in this Programmatic EIS, which have been removed. Modeling scenarios used in this Programmatic EIS were developed from industry input and review of historical G&G permit application data. They represent a reasonable level of activities and equipment specifications over the 10-year period of this Programmatic EIS. While the results of the modeling may be conservative, they do remain the most credible, scientific-based information available at this time. An outline of the inputs to the modeling effort and their justification follows:

- **Sound Source Properties:** After discussions with marine geophysical contractors, who consider the airgun volumes and configurational arrangements of individual airguns within an array to be proprietary information, BOEM determined that a small 2 x 90 cubic inch configuration, and a larger array of 8,000 cubic inches were most representative of the activity expected to occur during the time period of this Programmatic EIS after discussions with several industry companies. BOEM acknowledges that, although there are airgun arrays used in the Gulf of Mexico with both smaller and larger total volumetric displacement than the 8,000 cubic inch array provided, the horizontal modeling of the 8,000 cubic inch array should give sound pressure results similar to the other configurations.
- **Sound Propagation:** The JASCO Marine Operations Noise Model (MONM) is based on a well-developed and tested Parabolic Equation program (PE-RAM) (Collins, 1993). The MONM is essentially the product of adding an improved bottom loss model to the PE-RAM code. Furthermore, the predictions of the MONM model have been compared with measured levels. The comparison of model results and measurements show that MONM can produce reliable results in challenging acoustic propagation conditions (Hannay and Racca, 2005).
- **Animal Density Data:** The density data represent the best available information for the region (Roberts et al., 2016). Habitat-based density layers were derived from a compilation of sightings over many years, the results of which were published in a peer-reviewed scientific journal paper. By linking sightings with environmental conditions, habitat-based density layers represent smoothed surfaces that are not biased by anomalous conditions. This makes them

particularly appropriate for the 10-year timeframe of this Programmatic EIS, which will span varying environmental conditions.

- **Exposure Thresholds:** The behavioral threshold for behavioral response from impulsive noise sources has traditionally been a universal, one-step function at received levels of 160 dB re 1 μ Pa (RMS). This means that any animal exposed to a received level of 160 dB re 1 μ Pa (RMS) will experience a behavioral response. BOEM agrees that this threshold is outdated but that was the regulatory threshold when the impact analysis was completed. In anticipation of the changing regulatory threshold, the Wood et al. (2012) criteria were also used to evaluate the results. The Wood et al. (2012) function acknowledges that behavioral harassment is not a simple one-step function and that responses can occur at received levels below 160 dB, which is consistent with the best available science. The series of step functions provided within Wood et al. (2012) for porpoises/beaked whales (50% at 120 dB; 90% at 140 dB), migrating mysticete whales (10% at 120 dB; 50% at 140 dB; 90% at 160 dB), and all other species/behaviors (10% at 140 dB; 50% at 160 dB; 90% at 180 dB) attempt to provide a more realistic behavioral paradigm, which is probabilistic and acknowledges that not all exposures are expected to yield similar responses for every species and/or behavioral context (Ellison et al., 2012).

Additional comments indicated that BOEM was not clear on how take was being defined in this Programmatic EIS and that BOEM was quite emphatic in stating that exposure does not equal take, but the model still treats any exposure that exceeds threshold as a take. In addition, some comments suggested BOEM did not account for aversion or mitigation in its exposure modeling, resulting in exposure estimates that are unrealistically high.

To address these comments BOEM asserts that, since this Programmatic EIS is a NEPA document, it addresses acoustic exposure and does not quantify take. BOEM has tried to clarify language in this Programmatic EIS to be more consistent in using terminology. "Take" is a specific legal term used in the Endangered Species Act and Marine Mammal Protection Act. The estimation of takes of listed species and evaluating the effects of an action on ESA-listed species and critical habitat and on marine mammals are ultimately under the purview of the appropriate services charged with implementation of those statutes (i.e., FWS and NOAA). The NEPA's focus, however, is broader. It mandates that Federal agencies, prior to undertaking a major action, identify and analyze potentially significant impacts to the environment from the proposed action and alternatives, direct and indirect effects, and consider the incremental contribution to cumulative effects.

In addition, the question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in **Chapter 4.2**.

Many comments noted that BOEM did not implement NMFS' new acoustic guidance (2016). In addition, there were conflicting comments about whether BOEM should use the acoustic guidance or not.

Results became available in May 2017 and are included in this Programmatic EIS as **Appendix N**. The acoustic guidance from NMFS reflects the latest and best available science. It was prepared by an expert agency and was peer and publicly reviewed. The comments regarding NMFS' criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (*Federal Register*, 2017).

Several commenters raised concerns that are based on work published by Kujawa and Liberman (2009), who reported that neural damage occurred at pressure levels lower than those expected to cause PTS.

BOEM is committed to the preparation of a sound Programmatic EIS based on the best-available scientific information and professional judgment of its subject-matter experts. BOEM has developed this in-depth Programmatic EIS to inform the public and the decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.

BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion).

Because this is a Programmatic EIS, the exposure numbers derived from both Level B criteria are informative. Furthermore, no actual takes are authorized through this Programmatic EIS as that will be done under the final MMPA authorization that may be issued from the consultation process currently underway between BOEM and NMFS.

Additional comments suggested that BOEM evaluated the Level B harassment exposures using two criteria, i.e., those from NMFS (unweighted 160 dB RMS) and the Wood et al. (2012) step-wise function. Additional criteria (i.e., Nowacek, 2015) were also suggested to be used.

The following explanation is provided to explain what was done. The behavioral threshold for behavioral response from impulsive noise sources has traditionally been a universal, one-step function at received levels of 160 dB re 1 μ Pa (RMS). This means that any animal exposed to a received level of 160 dB re 1 μ Pa (RMS) will experience a behavioral response. Although this threshold is outdated, it was the regulatory threshold when the impact analysis was completed. In anticipation of the changing regulatory threshold, the Wood et al. (2012) criteria were also used to evaluate the results. The Wood et al. (2012) function acknowledges that behavioral harassment is not a simple one-step function and that responses can occur at received levels below 160 dB, which is consistent with the best available science. The series of step functions provided within Wood et al. (2012) for porpoises/beaked whales (50% at 120 dB; 90% at 140 dB), migrating mysticete whales

(10% at 120 dB; 50% at 140 dB; 90% at 160 dB), and all other species/behaviors (10% at 140 dB; 50% at 160 dB; 90% at 180 dB) attempt to provide a more realistic behavioral paradigm, which is probabilistic and acknowledges that not all exposures are expected to yield similar responses for every species and/or behavioral context (Ellison et al., 2012).

The differences between Wood et al. (2012) and Nowacek et al. (2015) stem from how probabilities at corresponding received levels are assigned, with both methodologies seemingly relying upon professional judgment in interpreting available data to make these decisions. Nowacek et al. (2015) offer minimal detail on how their recommended probabilistic function should be derived/implemented (e.g., What is slope? What are the basement/ceiling points?). Additionally, the Nowacek et al. (2015) function provides no quantitative recommendations for acknowledging that behavioral responses can vary by species group and/or behavioral context. For example, relying upon Nowacek et al. (2015), compared to Wood et al. (2012), does not adequately acknowledge that beaked whale species have previously been identified as particularly sensitive species (i.e., behaviorally respond at lower received levels than other species; Southall et al. [(2007)]). Therefore, it was decided that Wood et al. (2012) had more substantial foundation for implementation.

Clarifying comments were received from Roberts regarding the density estimates that were implemented (Roberts et al. [2016]). Other Comments stated that habitat-based density modeling may not capture all the habitat variables that are important to the animals, and consequently places modeled animals in areas where they never or rarely go.

BOEM utilized the Duke density model (Roberts et al., 2016) since it is the latest and best available science, which has gone through peer review during its publication in a scientific journal. Habitat-based density layers were derived from a compilation of sightings over many years, the results of which were published in a peer-reviewed scientific journal paper. By linking sightings with environmental conditions, habitat-based density layers represent smoothed surfaces that are not biased by anomalous conditions. This makes them particularly appropriate for the 10-year timeframe of this Programmatic EIS, which will span varying environmental conditions.

Several comments asserted that, for a variety of issues, BOEM did not use the best available science.

BOEM is committed to complying with the requirements and intent of NEPA, in preparing a sound Programmatic EIS based on the best-available scientific information and professional judgment of its subject-matter experts. BOEM has developed this in-depth Programmatic EIS to inform the public and decisionmaker of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.

The impact analysis considered the modeling results, in conjunction with subject-matter expert review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgment by the subject-matter experts,

the resulting impact conclusions remain credible in light of the available scientific record. A review of the sources of information for the analysis is provided below:

- **Operational Scenario Development:** The source and operations scenarios were based on historical permit information. BOEM sought industry input and used historical data to develop the specification of the nominal airgun array. The array specifications and level of survey effort were intended to be representative of future activity, not a conservative over-estimate.
- **Acoustic Modeling:** The propagation model output has been compared with measured data and been shown to be reliable. The physical inputs to the model are the best available data. The full sound field was used to predict exposures, not a 'maximum over depth' simplification.
- **Animal Modeling:** The 3MB model is one of the few models available that incorporates full four-dimensional movement. Properly applied, such models provide the most accurate predictions of acoustic exposure.
- **Animal Density:** The density and distribution data used were the latest available and represent the latest synthesis and analysis.
- **Effects Criteria:** The current NMFS Level B threshold of 160 dB is widely considered to be outdated, which is why it was supplemented with the Wood et al. (2012) criteria. The current NMFS (2016) acoustic guidance was not available during the preparation of this Programmatic EIS.

Additional commenters stated that the assumption used in the exposure modeling were overly conservative and did not reflect the best available science or forecast realistic scenarios.

BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as limitations that may be inherent in any modeling effort.

- **Source Characteristics:** The nominal airgun array characteristics used for modeling efforts were based on industry input and historical permit information. It was designed to be a representative example, not a worst-case scenario. While smaller arrays will have lower source levels, the difference is typically small.
- **Level of Industry Effort:** BOEM attempted to predict exploration effort that would be constant over the 10-year timeframe of this Programmatic EIS and would include a return to historic exploration levels.
- **Mitigation and Aversion:** One decision made in the modeling effort was not to include the effects of animals avoiding sound source (aversion) and the effect of marine mammal mitigation (shutdowns). BOEM determined that the details of

how animals react to moderate (i.e., behavioral exposure) levels of sound are not sufficiently understood and that the effectiveness of mitigation is not well defined. Therefore, the modeling effort avoided these two sources of uncertainty. The resulting increase in predicted number of exposures is recognized and considered in the interpretation of the modeling results.

- **Recovery Function:** The decision to not include a recovery function was made based on a lack of scientific understanding of the recovery process in real animals. It is understood that such a recovery process is almost certainly present, and this will be considered in the interpretation of the modeling results.

Detailed responses to specific comments are provided in **Table M-19**.

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses

Submission ID	Comment	Response
Acoustic Propagation and Exposure Modeling (Appendix D)		
0006-0002	<p>The Bureau of Ocean Energy Management has released a draft environmental impact statement that concludes seismic surveys for oil and gas exploration in the Gulf of Mexico would cause significant harm to marine mammals. The analysis finds that as many as 31.9 million marine mammals in the Gulf of Mexico will be injured and harassed by oil and gas seismic surveys. This includes 80 percent of the Gulf's endangered sperm whale population, estimated at 763 animals. Sperm whales will experience as many as 760,000 harassing exposures to airgun blasting over the next decade. The draft estimates that seismic blasting would cause as many as 588 injuries to the Gulf's Bryde's whales of which only 33 individuals remain about 17 times for each member of this imperiled population.</p> <p>These airgun blasts can effectively reach more than 250 decibels and so can cause hearing loss in marine mammals, disturb essential behaviors such as feeding and breeding over vast distances, mask communications among whales and among dolphins, and reduce catch rates of commercial fish.</p> <p>The new report finally acknowledges what environmental groups have long warned: that these sonic blasts cause harm to marine mammals. The report estimates that oil and gas seismic surveys will harm whales and dolphins with as many as 4.3 million instances of injury, including permanent hearing loss.</p>	Thank you for your comment.
0343-0001	Both acoustic modeling of 3-D sound propagation based on six different G&G survey types and animal modeling of animal movement scaled to the appropriate density were used to estimate the numbers of marine mammal takes. In recent months, NMFS's new acoustic guidance for Level A harassment has been finalized but unfortunately has yet to be incorporated into BOEM's take estimation process. The new cumulative sound exposure level (SELcum) thresholds have decreased and the weighting functions have changed both in shape and	Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N . This represents the best available scientific information and criteria issued by NOAA.

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>amplitude from those previously analyzed in support of the DPEIS⁴, which were from Finneran and Jenkins (2012). As noted by BOEM, those differences⁵ account for a total threshold change of -22 dB for low-frequency cetaceans exposed to seismic surveys, which would increase both the impact area and the numbers of takes. The peak sound pressure level (SPL_{peak}) threshold⁶ also decreased for low-frequency cetaceans. BOEM indicated that similar, but not as pronounced, effects are observed based on the revised SEL_{cum} thresholds for non-impulsive sources as well. BOEM stated that it intends to review the guidelines further and work with NMFS regarding how to apply the new thresholds. The Commission advocates the use of best available science, especially for programmatic environmental compliance documentation that includes EISs and LOA applications. Thus, the Commission recommends that BOEM revise its Level A harassment take estimates and associated mitigation zones based on NMFS's new acoustic thresholds prior to finalizing the PEIS and submitting its LOA application to NMFS.</p>	
0343-0002	<p>BOEM used two different types of thresholds to estimate the numbers of Level B harassment takes—one based on NMFS's unweighted SPL_{rms} threshold and the other based on a probability of response scale for M-weighted SPL_{rms} thresholds⁷ adapted from Wood et al. (2012; see Table 6 in Appendix D). However, BOEM did not stipulate which thresholds ultimately were to be used to estimate the total numbers of marine mammal takes. Further, BOEM has not provided summary tables that either stipulate the total numbers of takes estimated to occur on a yearly basis for the six survey types combined or the total numbers of takes that are associated with each of the seven alternatives—the latter issue is further compounded because some of the alternatives include reductions in activity levels and implementation of time-area closures, neither of which appear to be incorporated into modeling results for the various marine mammal species in Appendix D. All of these issues make it very difficult for both the public and the Commission to evaluate the appropriateness of the alternatives and have a clear understanding of the total</p>	<p>Thank you for your comment. BOEM clearly identified in Chapter 4.2 that the established 160-dB Level B threshold criteria were used in the effects analysis. In addition, harassment thresholds based on Wood et al. (2012) were also modeled in order to have this information available should emerging science shift the appropriate Level B threshold criteria away from the established 160-dB Level B threshold criteria.</p> <p>Impact-level definitions are defined for each resource in Chapter 4. The term “significance criteria” has been replaced with “impact-level criteria.”</p> <p>Therefore, BOEM believes this Programmatic EIS included the relevant information, identified the criteria used to evaluate this information, and explained for the public and the decisionmaker how BOEM reached its impact conclusions in Chapter 4.</p> <p>As noted in Chapter 1.2.5, there is no generally accepted</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>estimated takes for each marine mammal species or stock. The Commission therefore is unsure how BOEM assigned significance criteria⁸ to evaluate the overall level of impact for the various stressors under the seven alternatives.</p>	<p>scientific consensus on how to quantify mitigation effectiveness. Therefore, implementation of mitigation could not be readily incorporated into the model.</p>
<p>0343-0003</p>	<p>The Commission is concerned that BOEM's approach is neither accurate nor transparent and runs counter to the guidance provided in the National Environmental Policy Act (NEPA) implementing regulations. Section 1502.8 of the regulations states that EISs shall be written in plain language and may use appropriate graphics so that decision makers and the public can readily understand them. The Commission believes that BOEM has not met this directive under NEPA and recommends that BOEM specify (1) which Level B harassment threshold it intends to use and (2) the total numbers of marine mammals that could be taken by both Level A and B harassment incidental to G&G surveys under each of the seven alternatives in its final PEIS and the Preferred Alternative in its LOA application.</p>	<p>Thank you for your comment. BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best-available scientific information and professional judgment of its subject-matter experts. BOEM has developed this in-depth Programmatic EIS to inform the public and decisionmakers of the potential reasonably foreseeable impacts of the proposed action and alternatives to ensure that any decision regarding G&G activities is fully supported.</p> <p>The impact conclusions for each alternative are a synthesis of a variety of qualitative and quantitative available scientific information. The impact analysis considered the modeling results, in conjunction with subject-matter expert review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they do remain the most credible, scientific-based information available at this time.</p> <p>While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p> <p>This Programmatic EIS would also support NOAA authorization of the incidental take of marine mammals under the MMPA and will use the best available science and applicable thresholds.</p>
0343-0004	<p>Throughout the DPEIS, BOEM noted as part of its model caveats that it and NMFS do not believe that every exposure to sound results in a ‘take’ as defined in section 101(a)(5)(A) or (D) of the MMPA. BOEM therefore indicated that exposure estimates delineated in the DPEIS are not the same as a ‘take’ or an injury to an animal. Multiple mischaracterizations seem to be present in these assertions. First, taking requiring authorization under section 101(a)(5)(A) and (D) of the MMPA is not limited to taking by injury. While only taking by harassment (Level A and B harassment) can be authorized under section 101(a)(5)(D), taking under section 101(a)(5)(A) can include taking by harassment, serious injury, and mortality. The vast majority of the takes authorized by NMFS under sections 101(a)(5)(A) and (D) of the MMPA are for Level B harassment, which is based on the potential to disturb not to injure a marine mammal or marine mammal stock. The current structure of BOEM’s statement sounds as though it is considering only takes by injury.</p>	<p>Thank you for your comment. The modeling does estimate both Level A and Level B exposures. Both types of exposures are considered and presented in Appendix D (Tables 76 through 82) and Appendix F of Appendix D.</p> <p>Revisions were made to Chapter 1.2.5 to include discussions on key model components, including source, propagation, density and abundance, and threshold.</p>
0343-0005	<p>Second, the main objective of modeling the numbers of exposures based on certain sound thresholds is to estimate the overall numbers of takes of the various species. The only time in which an exposure above those thresholds would not be considered a take is when the likelihood of such exposure has been reduced due to presumed effectiveness of mitigation measures or assumed avoidance (or aversion as noted in Appendix D) by certain species. That is a strategy that the Navy has used multiple times to reduce take estimates and with which the Commission disagrees. However, Appendix D noted that mitigation effectiveness is influenced by the ability to detect</p>	<p>Thank you for your comment. The modeling does estimate both Level A and Level B exposures. Both types of exposures are considered and presented in Appendix D (Tables 76 through 82) and Appendix F of Appendix D.</p> <p>Revisions were made to Chapter 1.2.5 to include discussions on key model components, including source, propagation, density and abundance, and threshold.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>animals within the exclusion zone, which is based on the species' dive profile and surfacing behavior, weather conditions, and observational platforms. Because weather conditions are unknown beforehand and detection probabilities are difficult to predict, mitigation effectiveness is not included in the exposure estimates. Further, Appendix D recognized that aversion is a context dependent behavioral response affected by energetic and reproductive state, social behavior, and health status of individuals. Since too little is known about the factors that lead marine mammals to avoid sound sources, aversive behavior also was not included in the exposure estimates. Given that neither 'reduction' was included in the exposure estimates nor presumably would be included post processing, it is unclear why BOEM believes that the exposure estimates would not equate to estimated takes. It also is unclear if NMFS agrees with the model caveats stated throughout the DPEIS. Since NMFS is a cooperating agency on the DPEIS, it would be prudent for BOEM to ensure that NMFS agrees with those caveats.</p>	
0343-0006	<p>If both BOEM and NMFS believe that the exposure estimates are unreasonably high and not reflective of a reasonable estimate of the total numbers of animals that potentially could be taken, that concern could have been addressed by incorporating some measure of uncertainty in the exposure or take estimates. Appendix D discussed uncertainties associated with both acoustic and animal modeling that were analyzed via various test case scenarios. However, it does not appear that those data have been used to the fullest extent, if at all. Because BOEM has not provided summary tables that delineate the total numbers of marine mammals that could be taken by both Level A and B harassment, the intent of BOEM's assertions regarding exposures and takes remains uncertain.</p>	<p>Thank you for your comment. Refer to Chapter 1.2.5 where revisions were made to include discussions on model methodology and key model components, including source, propagation, density and abundance, and threshold.</p> <p>While BOEM acknowledges that the modeling inputs may be conservative, BOEM also acknowledges the modeling results are reasonable and remain the most credible, scientific-based information available at this time.</p>
0343-0007	<p>The point BOEM may have been attempting to convey in its model caveat sections is that every estimated exposure or take is not necessarily realized in practice. That is, for example, all 500,000 takes of sperm whales estimated by the model may not occur. This can be because the total number and type of seismic surveys used to derive the take estimates does not occur or does not occur in the proposed timeframe or area. If</p>	<p>Thank you for your comment. Refer to the revised text in Chapter 1.2.5.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>that is what was intended by BOEM, the DPEIS should be amended accordingly to state that point more clearly. Thus, the Commission recommends that BOEM, prior to finalizing the PEIS and submitting its LOA application to NMFS, consult with NMFS regarding BOEM's assertion that exposures do not equate to estimated takes under section 101(a)(5)(A) of the MMPA and clarify what it intended in making those assertions throughout the DPEIS. Uncertainty can be incorporated in the take estimates through reporting of probability distributions or confidence intervals, and a single take number could be authorized based on the median or mean number of estimated takes.</p>	
0899-0002	<p>BOEM's peer review of the PEIS should include external review of all the Appendix D Models. These models include the Marine Mammal Movement and Behavior Model ("3MB") developed by Dr. Dorian Houser. The 3MB Model has already failed peer review.¹⁰</p> <p>The Navy performed external peer review of this Appendix D model. The Navy peer reviewers recommended that the "3MB model should only be used for research purposes, not for estimating takes" because it is not accurate and reliable enough to be used for regulatory risk assessment purposes.¹¹ Therefore, BOEM's proposed use of the 3MB found the model to be not accurate and reliable.¹²</p> <p>BOEM itself repeatedly emphasizes that the PEIS Appendix D models do not reflect reality.¹³ For example, BOEM explains, "the PEIS modeled exposure estimates do not reflect BOEM's determination of the actual expected physical or behavioral impacts to marine mammals...."¹⁴</p> <p>BOEM further states, "The modeling effort in Appendix D, which provides numbers estimated for incidental exposures of marine mammals, are higher than BOEM expects would actually occur."¹⁵</p>	<p>Thank you for your comment. There are only three models that are widely accepted and used for this type of analysis, and the only one that is generally commercially available is the peer-reviewed ESME system on which 3MB is based. Each of these models has strengths and weaknesses; the 3MB model represents the best available system that was available to the contractor in this case and was updated to include as current information as possible. BOEM believes that the 3MB Model does comply with CREM guidelines for the following reasons. The referred document considered the entire Navy system (NUWC-NEMO-ESME modeling suite), and 3MB is only one component of that suite. The finding given in the report is "The overall opinion of the CIE review panel was that each model sufficiently considered all relevant biological and physical variables." The specific quote included in CRE's comment is the opinion of one of the panel members, not an overall finding. Furthermore, some of the criticism of 3MB involved HOW it was used in the Navy system. The manner in which 3MB was used by JASCO in the BOEM modeling differs in that a full 3D movement model was used.</p> <p>An expanded discussion of the model, inputs, and reasonable assumptions is provided in Chapter 1.2.5. That discussion provides additional insight on the synthesis of modeling data and qualitative analysis, where quantitative data were unavailable or could not be reasonably quantified. In addition,</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>In other words, there is no support in the PEIS record for any assumption that the Appendix D model results reflect reality. Even BOEM agrees they don't reflect the real world.</p> <p>Neither BOEM nor any other federal agency can use these models to regulate until and unless the models have been properly validated. Validation requires demonstrating that model predictions reflect reality. This demonstration requires comparing model predictions with field data--with real-world observations.</p> <p>The National Academy of Sciences ("NAS") emphasizes that, "[i]n all cases, field data must be collected to validate the model predictions."¹⁶</p> <p>Another NAS report, "Models in Environmental Regulatory Decision Making (2007)," similarly explained that "[c]omparing model results with observations is a central component of any effort to evaluate models."¹⁷</p> <p>The NAS rendered this advice during its peer review of models guidance being developed by EPA's Council for Regulatory Environmental Modeling ("CREM"). After NAS review, EPA published final CREM Guidance. The CREM Guidance explains that evaluation of model quality requires an answer to the following question: "How closely does the model approximate the real system of interest?"¹⁸</p> <p>The Navy peer reviewed the 3MB Model to determine whether it complies with the CREM Guidance. The peer reviewers concluded that it doesn't.¹⁹</p> <p>Consequently, the Navy peer reviewers concluded, "None of these models can, nor should they purport to, model ecosystems."²⁰</p> <p>CONCLUSION AND RECOMMENDED ACTION: BOEM's</p>	<p>the exposure estimates are only one part of the overall impact analysis. The suite of IPFs is described in Chapter 4, where each alternative is analyzed by IPF and where associated mitigation measures are considered. The impact significance criteria and resulting impact levels are described in detail and will inform the decision that will be selected in the ROD.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>proposed use of the Appendix D models violates OMB's Peer Review Bulletin requirements that the models be peer reviewed before BOEM uses them.²¹ It also violates the IQA Guidelines and fundamental principles of scientific quality because the models do not approximate field conditions. They are not realistic. Consequently, they are inaccurate and unreliable, and BOEM should not use or rely on them.</p>	
0899-0005	<p>BOEM did not use NMFS' new Acoustic Guidance in the PEIS because the final Guidance was published too late to be in the PEIS.³⁸ However, BOEM warns that it "will implement any requirements or conditions of approval set out by NMFS in site-specific reviews and permits once the new acoustic guidance is finalized."³⁹</p> <p>NMFS' new Acoustic Guidance is now final.</p> <p>For the reasons set forth below, neither BOEM nor NMFS should use NMFS' final Acoustic Guidance for any purpose.</p> <p>NMFS intends to use its new Acoustic Guidance to regulate offshore oil and gas exploration using seismic airguns, even though NMFS itself admits, "there is no evidence that serious injury, death, or stranding by marine mammals can occur from exposure to [oil and gas] airgun pulses, even in the case of large airgun arrays."⁴⁰</p> <p>In other words, NMFS has consistently and correctly concluded that there is no evidence offshore oil and gas G&G activities ever cause the injuries that the Acoustic Guidance aims to prevent, and BOEM agrees.⁴¹</p> <p>NMFS' new Acoustic Guidance imposes unnecessary regulations on offshore oil and gas that cannot be met because they require exclusion zones that are too large for monitoring, compliance and successful operation. This violates the MMPA statutory requirement that NMFS' regulation of sound be practicable.⁴² In addition, NMFS' development of the Acoustic</p>	<p>Thank you for your comment. The <i>Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts</i> was issued in August 2016 after public notice and multiple opportunities for comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. This represents the best available scientific information and criteria issued by NOAA.</p> <p>The guidance from NMFS reflects the latest and best available science, was prepared by an expert agency, and was peer and publicly reviewed. The comments regarding NMFS' criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (<i>Federal Register</i>, 2017).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Guidance violates the OMB Peer Review Bulletin and Executive Orders 12866 and 13563.</p> <p>A) NMFS' Development of the Acoustic Guidance Violates the OMB Peer Review Bulletin</p> <p>NMFS conducted four peer reviews of its Acoustic Guidance. All four peer reviews failed to meet the requirements of the OMB Peer Review Bulletin.</p> <p>NMFS agrees that its Acoustic Guidance is a Highly Influential Scientific Assessment ("HISA") under OMB's Peer Review Bulletin. However, NMFS' responses to CRE's comments, and other correspondence with CRE on the Acoustic Guidance, indicate NMFS' mistaken belief that it has complete "discretion" in selecting "an appropriate peer review mechanism" for this and any other HISA.</p> <p>This position is irreconcilable with OMB's Peer Review Bulletin, which clearly "applies stricter minimum requirements for the peer review of highly scientific assessments."⁴⁴</p> <p>OMB's Peer Review Bulletin states unequivocally that it "requires a more rigorous form of peer review for highly influential scientific assessments,"⁴⁵ such as the Acoustic Guidance.</p> <p>NMFS's development of the Guidance violates several of the Bulletin's "minimum requirements."</p> <p>For example, NMFS released a March 2016 draft of its Acoustic Guidance for concurrent public comment and peer review.⁴⁶ Submitting public comment to these peer reviewers was possible, feasible and practical. NMFS violated the HISA requirements in OMB's Peer Review Bulletin by not allowing public comment to the peer reviewers on the March 2016 draft, and by not providing peer reviewers with copies of the public</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>comments on the March 2016 draft.⁴⁷</p> <p>As another example, NMFS violated the OMB Peer Review Bulletin’s “minimum requirements” by not informing peer reviewers of applicable “objectivity, reproducibility and other quality standards under federal information quality laws.”⁴⁸</p> <p>These are not just procedural violations without substantive impact. Had NMFS made the comments of the reviewers available for public comment, the public could have provided data supporting the views of the peer reviewer who concluded: “Given the importance of the modelled data (both approaches), it would seem justifiable to me to delay the revision of the NOAA Guidance in order to achieve peer-reviewed publication of those data.”⁴⁹</p> <p>In other words, NMFS’ own peer reviewers did not think NMFS should use the Acoustic Guidance without further peer review of EPA’s “modelled data.”</p> <p>B) The Acoustic Guidance is a Rule, and NMFS’ Development of it Violates Executive Orders 12855 and 13563. NMFS has not complied with any of the Executive Orders’ regulatory review requirements for the Acoustic Guidance.</p> <p>NMFS claims that the Acoustic Guidance is not a regulatory action or rule subject to the Executive Orders.⁵⁰ This claim is incorrect because the Guidance binds both regulators and regulated entities with new, impracticable and highly influential regulatory requirements; therefore, the Guidance is subject to the Executive Orders’ regulatory review and cost benefit analysis requirements.</p> <p>NMFS’ Federal Register notice of its new Acoustic Guidance states that, after a brief transition period, “all applications for MMPA incidental take authorization (ITA) and all requests for ESA section 7 consultations involving noise that may affect</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>marine mammals will include full consideration of the” Acoustic Guidance.⁵¹</p> <p>The Acoustic Guidance meets the Executive Orders’ definitions of “rule” and “regulatory action” because the Guidance must be used in MMPA and ESA permitting. The Guidance is “designed to implement, interpret, or prescribe law or policy or to describe the procedure or practice requirements of an agency.” In this case, the “agency” includes NMFS and all other agencies regulating MMPA and ESA permitting and take authorizations.</p> <p>A new variance requirement is part of this new binding regulatory regime. Either you comply with the new specific standards, or you comply with the new variance procedure. One way or another, you have to comply.</p> <p>This two-pronged regulatory scheme in the Acoustic Guidance is new and binding on the permit applicant. The applicant must comply with the Guidance in order to obtain and keep a Take Permit under the MMPA and ESA. This is a rule.</p> <p>And none of this new binding regulatory regime has ever gone through the Executive Orders’ required regulatory review and cost benefit analysis process.</p> <p>C) BOEM and NMFS Do Not Have, and OMB Should Not Approve, an ICR authorizing Use of the Acoustic Guidance</p> <p>BOEM’s use of the Acoustic Guidance would constitute a significant change in regulation of GOM G&G.⁵² NMFS admits that OMB has not authorized an Information Collection Request (“ICR”) for the Acoustic Guidance.⁵³ BOEM does not have one either.⁵⁴</p> <p>OMB should not approve such an ICR because, e.g.:</p> <p>1) NMFS’ Acoustic Guidance does not comply with the</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>OMB Peer Review Bulletin, and compliance with the Bulletin is necessary for the proper performance of BOEM and NMFS' duties;</p> <p>2) NMFS' Acoustic Guidance does not comply with Executive Orders 12866 and 13563, and compliance with the Executive Orders is necessary for the proper performance of BOEM and NMFS' duties;</p> <p>3) NMFS' Acoustic Guidance flunked peer review;</p> <p>4) NMFS's Acoustic Guidance lacks practical utility and does not comply with various IQA Guidelines; and</p> <p>5) NMFS' Acoustic Guidance is not necessary for the proper performance of BOEM and NMFS' duties. It is not the least burdensome alternative, and an ICR for it should not be granted. Current regulation and current acoustic standards and current ICRs are sufficient.</p> <p>In addition, the PEIS Tables 4.13.9-1 through 4.13.9-2 purport to assess the economic impacts of Alternatives A through G.⁵⁵ These Tables do not appear to include any consideration of Acoustic Guidelines use. Yet BOEM and NMFS say the Guidelines will be used to regulate oil and Gas G&G in the GOM.⁵⁶ Use of the Acoustic Guidelines will affect operational costs significantly.⁵⁷ The PEIS does not assess the benefits of using the Guidelines, perhaps because there are none. Consequently, BOEM's economic impact considerations are incomplete and inaccurate.</p> <p>These and other Acoustic Guidance comments are discussed in much more detail in the Appendix to these comments. This Appendix is incorporated by reference as if fully set forth herein.</p> <p>CONCLUSION and RECOMMENDATION: BOEM and NMFS should not use the Acoustic Guidance in the PEIS or for any</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	other purpose.	
1066-0001	<p>3. Differences between our abundance estimates and those from the NOAA Stock Assessment Reports (SARs)</p> <p>In Table 4.2-1 of the PEIS, differences may be noted between the SAR and CetMap abundance estimates, with our estimates (CetMap) often being higher. This resulted from two important differences in methodology:</p> <p>a. In order to produce sufficiently reliable and detailed density surfaces (maps), we combined multiple NMFS cetacean surveys and modeled density using a habitat-based approach (Miller et al. 2013), while the SAR estimates utilized only the most recent NMFS survey and estimated density using traditional distance sampling (Buckland et al. 2001). The two approaches, while compatible and based on a common statistical framework (distance sampling), can yield different results, depending on complex factors such as whether population sizes have changed, or species habitat preferences have shifted over time. Neither approach will necessarily yield a higher abundance estimate than the other, and the pattern of our estimates being consistently higher most likely results from the second important methodological difference:</p> <p>b. In order to estimate density and abundance as accurately as possible, we corrected for availability bias and perception bias in our models, while indications are that the SAR estimates did not. Availability bias occurs when a model assumes that animals are always available to be observed by the survey team when, in fact, they are not. Cetaceans are diving animals; while submerged, they are unavailable. Assuming diving animals are always available results in an underestimation of abundance, because while they are diving they are present but not counted by the survey team. Perception bias occurs when a model assumes that animals will always be detected when they are on the survey trackline, when, in fact, detection is not certain because the animal is small, camouflaged by its color, and so on. Assuming that difficult-to detect animals will always be</p>	<p>Thank you for your comment and your clarifying information about the differences between the SAR and Roberts et al. (2016) abundance estimates. BOEM was aware of the difference between the two datasets and utilized the Roberts et al. (2016) abundance estimates with the Appendices D and N modeling outputs, which used the Roberts et al. (2016) density layers to maintain consistency throughout the analyses. Additionally, refer to the revisions in Chapter 1.2.5.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>detected results in an underestimation of abundance, because some animals will be missed.</p> <p>Density models and abundance estimates that have been corrected for availability or perception bias are known as “g(0) corrected”, in reference to them not assuming that the g(0) parameter—the probability of detecting an animal on the survey trackline—is 1. Historically, SAR abundance estimates for the Gulf of Mexico have not been g(0) corrected.</p> <p>This may be observed in Waring et al. (2016), Appendix IV, Table A, in which the “Corrected for g(0)” column is “N” for surveys in the Gulf of Mexico. The most recent shipboard survey utilized by Waring et al.’s (2016), Survey Number 38 conducted in 2009, is blank in the “Corrected for g(0)” column. Nevertheless, we suspect the estimates produced from this survey were not g(0) corrected, in keeping with historical practice.</p> <p>In the traditional distance sampling method used to produce the Gulf of Mexico SAR estimates, density and abundance scale inversely with g(0). For example, if an uncorrected abundance estimate is 1000 and g(0) is 0.5, the g(0) corrected estimate is $1000/0.5 = 2000$. Long-diving animals such as sperm whales, beaked whales, and Kogia whales may remain submerged for extended periods, resulting in high availability bias and corresponding low g(0) values. For example, for those three long-diving taxa, for shipboard surveys we drew from the literature g(0) values of 0.53, 0.23, and 0.35. Had NMFS applied these g(0) values to their uncorrected abundance estimates (the SAR Abundance column of Table 4.2-1 of the PEIS), their estimates would have been 1.89, 4.35, and 2.86 times higher, respectively.</p> <p>In Appendix D of the PEIS, JASCO estimated cetacean Level A and Level B exposures using our density estimates. Presumably, when evaluating the seven Alternatives proposed by the PEIS, BOEM compared these exposure estimates to</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>cetacean stock parameters estimated by the SARs, such as the Minimum Population Estimate and Potential Biological Removal (PBR). This leads to a potentially problematic situation in which the exposure estimates have, essentially, been $g(0)$ corrected but the stock parameters have not. In short, if $g(0)$ is substantially less than 1, the estimated number of exposures will be too high.</p> <p>Should BOEM's decision regarding the seven Alternatives evaluated by the PEIS depend on the number of exposures modeled relative to SAR-derived stock parameters, we suggest that the stock parameters first be corrected by the same $g(0)$ estimate that we used, so that the stock parameters are not artificially low relative to the exposure estimates. To do this for a given cetacean stock, we recommend:</p> <ol style="list-style-type: none"> 1. Determine whether the stock parameters were estimated from a shipboard or aerial abundance survey. 2. Look up the $g(0)$ value we used for that platform for that taxon in the taxon-specific supplementary report of Roberts et al. (2016). 3. Divide the $g(0)$ value into the SAR's Minimum Population Estimate and Potential Biological Removal parameters. (These parameters scale linearly with total estimated abundance (Wade & Angliss 1997), and total abundance scales inversely with $g(0)$ (Buckland et al. 2001).) 	
1066-0002	<p>Also, in the Discussion section of each taxon-specific supplementary report of Roberts et al. (2016), we detail possible reasons for differences between our estimates and the SAR estimates. Please see these reports for more in-depth discussion.</p>	<p>Thank you for your comment. BOEM has reviewed the differences in the density estimates and understands them.</p>
1066-0003	<p>We at the Duke University Marine Geospatial Ecology Lab (MGEL) are the developers of marine mammal density models utilized in this PEIS, referred to variously as "Roberts et al.</p>	<p>Thank you for drawing attention to this issue. It has been corrected throughout this Programmatic EIS.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>(2016)", "Roberts et al., in preparation", and "CetMap". We have several comments on the use and interpretation of these models within the PEIS.</p> <p>1. Model publication and peer review status</p> <p>The citations "Roberts et al. (2016)", "Roberts et al., in preparation", and "CetMap" all refer to the same body of work: the cetacean density models developed by MGEL and our collaborators over the 2011-2015 period. In January 2015 we completed these models in and began preparation of a manuscript to be submitted to a scientific journal. In February 2015, at the request of the NMFS Permits and Conservation Division we provided the models to JASCO for use in preparing the report shown in Appendix D of the PEIS. At that time, the models were considered "preliminary results"—i.e. not yet formally peer reviewed and therefore potentially subject to change during the peer review process—and the manuscript was considered "in preparation". JASCO's report in Appendix D refers to them as such. In fall of 2015 we completed the manuscript and submitted it to the journal Scientific Reports for peer review and publication. In March 2016 it was published and then became known as Roberts et al. (2016).</p> <p>After the models were provided to JASCO, no changes were made to any density surfaces or abundance estimates except for one species, Bryde's whale, which we discuss in detail below. Therefore, with the exception of Bryde's whale, the density surfaces and abundance estimates used to produce the PEIS (e.g. JASCO's report in Appendix D and Table 4.2-1) are identical to the peer-reviewed and published results. Thus there should be no concern that the portions of the PEIS that were based on our work were derived from density or abundance estimates that were not peer reviewed or published in a scientific journal.</p>	
1066-0004	2. Bryde's whale density model	Thank you for your comment. As per Chapter 1.2.5 , BOEM used the best available science in developing our impact modeling. Specifically, we used the final Roberts et al. (2016)

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>After we sent the density models to JASCO, we continued to review model predictions with coauthors and colleagues. During the course of these reviews, we decided to update the Bryde's whale model. The first model (called Version 2 in our Bryde's whale supplementary report), which JASCO used, was a single covariate model that predicted Bryde's whales in a "depth ring" around the Gulf in a certain depth range. This model was chosen because there were very few sightings, making complex models hard to support statistically. Some of our coauthors pointed out that Bryde's whales have not been sighted in the central and western Gulf since the early 1990s, and asserted a belief that Bryde's whales no longer inhabit these areas. We therefore adjusted the model to use data starting in 1994 instead of 1992, eliminating the one reported sighting west of the Mississippi Delta and adjusted the model to reflect this belief. This model (Version 3) was included in the Roberts et al. (2016) publication.</p> <p>The resulting predictions estimate lower density in the central and western Gulf, and a lower total abundance (44 whales, vs. 66 in the Version 2 model). If Bryde's whales are of critical interest to BOEM's decision among the seven Alternatives proposed by the PEIS, we recommend that JASCO's exposure estimates be recalculated using our new results.</p>	<p>data.</p>
1074-0050	<p>NRDC commented that the Wood et al. 2012 behavioral step functions are outdated and inconsistent with the best available science and provide less conservative results compared to the 160 dB step function. Specifically, NRDC indicates Wood et al. 2012 does not fully capture data available for vocalizing and non-migrating baleen whales (e.g., Castellote et al. 2012; Blackwell et al. 2013; Cerchio et al. 2014), sperm whales that are "highly sensitive to low-frequency sound" (e.g., Miller et al. 2009), and data for other odontocete species (e.g., Miller et al. 2005). NRDC advocates Wood et al. 2012 be replaced with a probabilistic function, with 50% midpoint of 140 dB, as recommended by Nowacek et al. 2015.</p>	<p>Thank you for your comment. The Wood et al. (2012) functions are consistent with the best available science. Both the Wood et al. (2012) and Nowacek et al. (2015) functions acknowledge that behavioral harassment is not a simple one-step function and responses can occur at received levels below 160 dB. The series of step functions provided within Wood et al. (2012) for porpoises/beaked whales (50% at 120 dB; 90% at 140 dB), migrating mysticete whales (10% at 120 dB; 50% at 140 dB, 90% at 160 dB), and all other species/behaviors (10% at 140 dB; 50% at 160 dB; 90% at 180 dB) attempt to provide a more realistic behavioral paradigm, which is probabilistic and acknowledges that not all exposures are expected to yield similar responses for every species and/or behavioral context (Ellison et al. 2012). The differences between Wood et al.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>(2012) and Nowacek et al. (2015) stem from how probabilities at corresponding received levels are assigned, with both methodologies seemingly relying upon professional judgement in interpreting available data to make these decisions.</p> <p>Regarding mysticetes, changes in vocalization associated with exposure to seismic activities within migratory and non-migratory contexts have been observed (e.g., Castellote et al., 2012; Blackwell et al., 2013; Cerchio et al., 2014). The potential for anthropogenic sound to have impacts over large spatial scales is not surprising for species with large communication spaces like mysticetes (Clark et al., 2009). Additionally, because of existing acoustic monitoring techniques, detecting changes in vocalizations at further distances from the source/activity is more likely, opposed to observing other types of responses (e.g., visual changes in behavior) at these distances. However, the consideration of these observed vocal responses is not contrary to Wood et al. (2012). Specifically, Blackwell et al. (2013) report the onset of changes in vocal behavior for migratory bowhead whales at received levels that are consistent with those provided in the Wood et al. (2012) function for migrating mysticete species. Cerchio et al. (2014) observed the number of singing humpback whales in a breeding habitat off northern Angola decrease in the presence of increasing background received levels during seismic surveys. However, because the study was opportunistic, specific information on distances between singers and seismic vessels, as well as received levels at the singers, could not be obtained. Nevertheless, some probability of these vocal responses would likely be captured by the Wood et al. (2012) function for all other species/behaviors. Moreover, a decision about the appropriateness of a particular function should be based on how well it reflects best available information and not on the resulting number of estimated acoustic exposures (i.e., the use of the Wood et al. [2012] function should not be considered arbitrary and capricious just because it results in a lower exposure estimate than the 160-dB step function or any other function).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>Concerning sperm whales, NRDC admonishes Wood et al. (2012) for not properly distinguishing sperm whales from other odontocetes and advocates that sperm whales are “highly sensitive to low-frequency sound.” The NRDC specifically relies upon Miller et al. (2009) as demonstrating “sperm whale foraging success... was found to decline significantly on exposure to airgun received levels above 130 dB (RMS)...” However, Miller et al. (2009) indicate that none of the eight individuals in this controlled exposure experiment changed behavioral state (i.e., foraging or resting) and that variation in buzz rate (proxy for prey capture) was not statistically significant due to natural variation in this vocalization and small sample size (i.e., Miller et al. [2009] concludes “subtle effects” on foraging behavior). Furthermore, the onset of these subtle changes in buzz rate from Miller et al. (2009) occur at received levels that are not inconsistent with the probabilities predicted by the Wood et al. (2012) function for all other species/behaviors. Additionally, the probabilistic function recommended by Nowacek et al. (2015) does not make distinctions between any species or species groups, including sperm whales (i.e., Nowacek et al. [2015] offers a single function for all species and contexts).</p> <p>Considering other odontocetes, NRDC refers to data from Miller et al. (2005) as not being included by Wood et al. (2012). The Miller et al. (2005) data were available and considered within the Wood et al. (2012) analysis (i.e., the Wood et al. [2012] analysis relied upon data provided in Southall et al. [2007], which included the Miller et al. [2005] study).</p> <p>Finally, other than providing the 50 percent midpoint, Nowacek et al. (2015) offer minimal detail on how their recommended probabilistic function should be derived/implemented (e.g., What is slope? What are the basement/ceiling points?). Additionally, the Nowacek et al. (2015) function provides no quantitative recommendations for acknowledging that behavioral responses can vary by species group and/or</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
		behavioral context. For example, relying upon Nowacek et al. (2015), compared to Wood et al. (2012), does not adequately acknowledge that beaked whale species have previously been identified as particularly sensitive species (i.e., behaviorally respond at lower received levels than other species; Southall et al. [2007]).
1074-0051	<p>As noted, the DEIS relies in part on a bright-line 160 dB re 1 μPa (RMS) threshold for harm, which NMFS conventionally applies. For years, however, a diverse group of ocean noise specialists, including many leading biologists and bioacousticians, have decried the 160 dB threshold—which came out of the High Energy Seismic Survey panel report in 1999 and was based largely on 1980s data—as outdated and incongruous with more recent science. With the development of compact data tags⁸¹ and the continued refinement of locational passive acoustic monitoring, researchers can now track animals over greater periods of time and across longer distances, allowing them to retrieve a continuous account of the tracked animal’s response to a disruptive stimulus or document changes in the vocalizations of multiple animals over, in some cases, very large scales. Using these data, researchers are finding that behavioral disruptions occur at much lower noise exposure levels than what NMFS currently accepts as the threshold for Level B disturbances, and at much larger distances than what on-board observers are capable of observing. The 160 dB threshold is simply not supportable as best available science.</p> <p>Reliance on the outdated, arbitrary 160 dB threshold is nontrivial. It results in a gross underestimate in the DEIS of the activity’s impact area and of the harm or “take” experienced by marine mammals, and therefore undermines the document’s impact analysis. The evidentiary record for a lower threshold substantially exceeds the one for mid-frequency sonar in <i>Ocean Mammal Institute v. Gates</i>, 546 F. Supp. 2d 960, 973–75 (D. Haw. 2008), in which a U.S. District Court judge invalidated a Fisheries Service threshold that ignored documented impacts at lower received levels as arbitrary and capricious. BOEM must use take standards in line with the best available science.</p>	Thank you for your comment. BOEM agrees that the 160-dB threshold is outdated, but that was the regulatory criteria at the time the modeling was performed. However, in anticipation of the changing regulatory threshold, this is one of the reasons that the Wood et al. (2012) criteria were also used to evaluate the results. Those criteria assign impact for received levels as low as 120 dB.

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
1074-0052	<p>The DEIS provides a second set of take estimates using an alternative set of thresholds, one derived from an environmental impact report, prepared under the California Environmental Quality Act in 2012, for an earthquake hazard survey intended for the central California coast. This report used simple step-functions to represent take probabilities for three broad categories of cetaceans: beaked whales and porpoises, for which 50% take was assumed at 120 dB; migrating baleen whales, for which 50% take was assumed at 140 dB; and all other cetacean species and behavioral contexts, for which 50% take was assumed at 160 dB.</p> <p>This particular approach, while interesting at the time, has since been outstripped by the scientific literature for baleen whales and is inconsistent with the best available science for baleen whales, sperm whales, and other species; and its specific application here, in the DEIS, is non-conservative.</p> <p>...Given all this, BOEM's use of a step function for baleen whales (10% take at 140 dB, 50% take at 160 dB, and 90% take at 180 dB) that appears, in its results, even less conservative than the outdated 160 dB threshold is plainly arbitrary and capricious. If anything, the 140 dB function recommended by Nowacek et al. (2015) may be insufficiently conservative for these species based on the best available data; but it certainly comes closer to reflecting those data than the Wood et al. (2012) step function. BOEM cannot use the Wood et al. (2012) approach in modeling take of Bryde's whales (and non-resident baleen whales) in the Gulf of Mexico.</p> <p>...Again, although one could argue for a more conservative approach, we recommend use of the Nowacek et al. (2015) standard as coming substantially closer than Wood et al. (2012) or NMFS' 160 dB standard to reflecting the best available science on the behavioral impacts of seismic surveys on sperm whales.</p> <p>...Use of the Wood et al. (2012) thresholds, which are</p>	<p>Thank you for your comment. The threshold for Level B impacts that was used in this Programmatic EIS was 160 dB (refer to Chapter 4). The alternative using Wood et al. (2012) was provided for informational purposes only.</p> <p>BOEM agrees that the issue of predicting behavioral response to anthropogenic noise is a difficult one. Our state of knowledge is still a work in progress, with continued ongoing research in the field. Nevertheless, BOEM is compelled to move forward with the best available guidance.</p> <p>The characterization of the Wood et al. (2012) criteria is incorrect. The comment that the threshold for ALL species needs to be based on the most sensitive species ignores the effect of context and individual variability. The Wood et al. (2012) criteria begin to bring these variables into consideration.</p> <p>The criteria are admittedly simple, which reflects our current state of knowledge.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	nonconservative for most marine mammal species (i.e., species other than harbor porpoises, beaked whales, and migrating baleen whales), without incorporating its more conservative elements, such as its standard for biological significance, would be arbitrary.	
1074-0056	In assessing the injury that would result from the proposed activity, the DEIS attempts to apply the guidance that NMFS issued earlier this year, or, rather, an earlier version of the same, along with the agency’s longstanding 180 dB re 1 µPa (RMS) threshold. See DEIS at D-287 to D-367. This reliance is mistaken.	This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N . This represents the best available scientific information and criteria issued by NOAA.
1074-0057	<p>BOEM, in choosing to rely on NMFS’ auditory guidance, must revise its estimates of auditory impacts based on the final version of that guidance.</p> <p>...In estimating auditory take for Bryde’s whales and sperm whales, the agencies should, at the very least, produce an alternative, more conservative estimate, either by retaining the Mweighting curve for low-frequency cetaceans from Southall et al. (2007) or by extending the left end of NMFS’ weighting function for low-frequency cetaceans to match the Southall et al. (2007) M-weighting curve.</p>	Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N . This represents the best available scientific information and criteria issued by NOAA.
1074-0059	<p>Even with its revisions, the guidance released by NMFS is flawed and non-conservative. Its thresholds and weighting systems are subject to considerable uncertainty, with experimental data available for only a few species, a small number of individuals, and a limited set of noise sources. In our comments, attached hereto, we identified numerous technical problems with the models that the agency had adopted from the Navy—numerous ways in which the assumptions made by the agencies were plainly erroneous, inconsistent, or non-conservative.</p> <p>Many of the problems we identified were echoed by expert commentators. Wright (2015) published a criticism of the guidelines in a peer-reviewed journal, identifying several significant statistical and numerical faults in NOAA’s approach—</p>	<p>Thank you for your comment. The <i>Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts</i> was issued in August 2016 after public notice and multiple opportunities for comment.</p> <p>The guidance from NMFS reflects the latest and best available science, was prepared by an expert agency, and was peer and publicly reviewed. The comments regarding NMFS’ criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (<i>Federal Register</i>, 2017).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>such as pseudo-replication, misapplication of medians and means, and inconsistent treatment of data—that tend to bias the proposed criteria towards an underestimation of effects.⁹⁸ Similar and additional issues were raised by a dozen scientists during the public comment period on the draft revised criteria.⁹⁹ At the root of the problem is the agency’s broad extrapolation from a small number of individual animals, mostly bottlenose dolphins, without taking account of what Racca et al. (2015) have succinctly characterized as a “non-linear accumulation of uncertainty.”¹⁰⁰</p> <p>The revised draft, other than mitigating its flagrantly misguided weighting system for midfrequency cetaceans, failed to address the basic errors identified by these and other experts; nor did it perform a sensitivity analysis to understand the potential magnitude of those errors. The agencies should not rely exclusively on NMFS auditory guidance in determining “Level A” take, but should, at minimum, produce a conservative upper bound (such as by retaining the 180 dB threshold, or by performing a sensitivity analysis).</p>	
1074-0060	<p>The DEIS uses permanent threshold shift as a proxy for all forms of potential injury from seismic exploration. This approach is not supported by the best available science.</p> <p>First, the DEIS must take account of alternative mechanisms of auditory injury. NMFS guidelines use permanent threshold shift (“PTS”), specifically the destruction of hair cells in the inner ear, as its basis for auditory injury. Yet consideration of PTS alone is not sufficient to cover all incidences of permanent hearing loss. On the contrary, the best available evidence shows that temporary threshold shift (“TTS”) results, at least in part, from swelling of cochlear nerve endings—a mechanistic process that differs from destruction of the hair cells—and that noise levels causing reversible hearing loss can also lead to permanent degradation of cochlear nerves.¹⁰¹ The outcome, as summarized by Tougaard et al. (2015),¹⁰² is a compromise in complex auditory processing and “a reduction of stimulus encoding under noisy conditions, tinnitus, and hyperacusis.”</p>	<p>Thank you for your comment. BOEM prepared this Programmatic EIS using the best available science in conjunction with the best professional judgement of subject-matter experts. The guidance from NMFS reflects that the latest and best available science was prepared by an expert agency and was peer and publicly reviewed. The comments regarding NMFS’ criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (<i>Federal Register</i>, 2017).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>Additionally, it is known that repeated episodes of TTS can also result in PTS itself.¹⁰³ While the neural damage seen in Kujawa and Liberman (2009) occurred not far below exposure levels productive of PTS, it remains unknown if smaller exposures would lead to “irreversible neural degeneration,” as NMFS itself observed in its draft guidance.¹⁰⁴</p> <p>Second, the DEIS must account for behaviorally-mediated injury resulting from exposure to seismic airguns and other disruptive noise. Nowacek et al. (2004) observed that right whales, responding to relatively low received levels from an acoustic alarm (133-148 dB re 1 µPa (RMS)), broke off their foraging dives and positioned themselves directly below the water surface, leaving themselves at substantially greater risk of vessel collision.¹⁰⁵ And numerous studies, including post-stranding pathology, laboratory study of organ tissue, and theoretical work on dive physiology have linked the severe decompression-like pathologies seen in beaked whales exposed to naval sonar to a maladaptive alteration of the dive pattern.¹⁰⁶ Notably, the acute secondary effects seen in right whales and beaked whales are known or are presumed by modeling to occur well below the received levels suggested by NMFS’ auditory guidelines.¹⁰⁷ BOEM should conservatively assume that at least some of the sources used in G&G exploration, such as certain multibeam echosounders (see section III.G.1), with acoustic characteristics similar to naval mid-frequency sonar, could induce similar responses in beaked whales. And in the case of the Gulf Bryde’s whale, BOEM must take a highly precautionary approach and assume that moderate exposures to a variety of noise sources can increase ship-strike risk. At least one Bryde’s whale, presumably a member of the remarkably small Gulf population, is known to have been struck by a ship, near Tampa, Florida.</p>	
1074-0061	<p>The take estimates in the DEIS depend on BOEM’s projections of G&G activity, subdivided by survey type and general location, from 2016 through 2025. DEIS at D-193 to D-194. The DEIS does not clearly explain, however, how these consequential numbers were derived. Do the estimates assume (as it</p>	<p>Thank you for your comment. BOEM believes that the assumption that the predicted effort would remain constant is reasonable at the programmatic level and within the 10-year timeframe of this Programmatic EIS. While BOEM acknowledges the recent reduced level of exploration G&G</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>appears) a renewal of the Congressional moratorium, in a portion of the Eastern Planning Area, which otherwise will sunset in 2022? Prepared more than one year ago, do they reflect the unusual Gulf of Mexico leasing scheme in the new 2017-22 OCS Program? Do they assume market recovery and a rise in oil and gas prices and, if so, when? And what is the rationale for each assumption? The DEIS does not explain.</p> <p>Furthermore, BOEM's approach makes no allowance for contingency. Given political and economic uncertainties, it is appropriate for the agency to model several activity scenarios, representing a range of reasonably foreseeable outcomes. For example, the DEIS does appear to assume that Congress will renew the current moratorium in at least coastal Florida waters and that industry, sharing this assumption, will not conduct any seismic exploration for oil and gas before the decision is made. See DEIS at D-193 to D-194 (zone 1). The present political environment suggests, however, that this assumption may not hold. Modeling increased activity within the moratorium area might well yield substantially larger take estimates, over time, for Bryde's whales, one of the Gulf's most vulnerable populations, given its apparently constricted range in the Eastern Planning Area.</p> <p>Finally, BOEM should make clear how its activity projections will affect its application of the activity reductions set forth in Alternative F. If its estimates are highly conservative, for example, meant to obviate the need for additional NEPA analysis by providing a substantial buffer, as the Navy has claimed about some of its activity projections, see Conservation Council, 97 F. Supp. 3d at 1222, some of the anticipated conservation benefit might not be realized. It may therefore be necessary for BOEM to model a best estimate of future activity as well as a more conservative one.</p>	<p>activity and the corresponding decrease in permit applications, BOEM assumes that future levels will return to previous historic levels within the next 10 years. BOEM must, therefore, be prudent and conservatively consider the full range of potential impacts. Therefore, the scenarios contain projections based on the analysis of recent historic activity levels and trends made by BOEM's subject-matter experts who also considered industry-projected activity levels in their estimates. This Programmatic EIS provides a programmatic-level evaluation for reasonably foreseeable G&G activities that could be utilized for any of BOEM's three Program Areas (i.e., Oil and Gas, Renewable Energy, and Marine Minerals). BOEM will address the impacts of future site-specific actions in subsequent NEPA evaluations (40 CFR § 1502.20) using a tiered process based on this programmatic evaluation.</p> <p>Text that describes how the projected scenarios were developed is included in Chapter 3.2.</p> <p>BOEM explored many options regarding how to implement Alternative E, which proposed a 10% and 25% reduction in line miles from multi-client, deep-penetration surveys. In order to fulfill the spirit of the alternative, BOEM may place an overall limit on survey line miles and issue permits on a first come-first serve basis. BOEM does not expect that the method of implementing this reduction of line miles would influence the impacts as considered in this Programmatic EIS. Any specific method of implementation may be specified further through an NTL or other guidance.</p> <p>The ROD can explain the logistical difficulties in implementing this option as well as the limited influence the reduction in activity had on overall impact levels.</p>
1076-0020	<p>However, by BOEM's admission, the DPEIS presents an unrealistic worst case assessment of the potential effects of seismic activities on marine mammals that is purposefully constructed to overestimate levels of projected adverse effects.</p>	<p>Thank you for your comment. There were some erroneous occurrences of "worst-case" in this Programmatic EIS, and those have been removed. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

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	<p>Specifically, the effects analysis is based solely on modeling (Appendix D) that “creates an estimate of the potential number of animals exposed to the sounds.” DPEIS at 1-16. BOEM explains:</p> <p>This estimate alone does not reflect BOEM’s determination of the actual expected physical or behavioral impacts to marine mammals but rather an overly conservative upper limit because none of the mitigations examined in this Programmatic EIS were modeled. Biological significance to marine mammals is left to interpretation by the subject-matter experts.</p>	<p>modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they do remain the most credible, scientific-based information available at this time.</p> <p>While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p> <p>Also, as noted in this Programmatic EIS, site-specific analyses will be performed for each survey to determine the specific impacts from the survey; the biological significance of those impacts will be determined by the subject-matter experts.</p>
1076-0022	<p>The exposure estimates themselves “are based on acoustic and impact models that are, by their nature, conservative and complex.” DPEIS at 1-19. Indeed, “[e]ach of the inputs into the models is purposely developed to be conservative, and this conservativeness accumulates throughout the analysis.” Id. (emphasis added). As a result, the exposure estimates are “higher than BOEM expects would actually occur in a real world environment.” Id.; id. at 1- 20 (“This estimate does not reflect an actual expectation that marine mammals will be injured or disturbed. It is an overly conservative estimate.”). BOEM further admits that using the exposure models as a basis for the effects analysis “requires accepting a worst-case scenario, which ultimately overestimates the numbers of ‘take’ under the [Marine Mammal Protection Act (“MMPA”)] by equating those numbers</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the acoustic impact modeling and associated assumptions.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

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	<p>with the exposures identified in the modeling rather than real world conditions.” Id. (emphasis added).....to over 100,000 times higher. There are multiple conservative assumptions that produce this extraordinary outcome: the assumption that exposure equals take, the conservative linkage of permanent hearing decrements to temporary hearing decrements, assumptions about the accumulation of hearing effects over time without recovery between exposures, and assumptions about how many of these exposures actually have any meaningful biological consequences. The MMPA defines “harassment” with reference to two categories: Level A harassment (potential to “injure”) and Level B harassment (potential to “disturb”). NMFS applies acoustic thresholds to estimate the amount of harassment for each category that may result from an activity. The acoustic thresholds are often mistakenly assumed to mean that an injury or mortality will occur, with 100% of the exposed animals being injured or killed, or that 100% of exposures at behavioral thresholds will cause behavioral change and that the consequences of the change are a significant and meaningful loss of food, energy, or some other key biological function. In fact, both thresholds imply a probability of there being an effect upon exposure. BOEM was quite emphatic in stating that exposure does not equal take, but the model still treats any exposure that exceeds threshold as a take. This is the first of many features within the Acoustic Risk Threshold part of the model that lead to large over-estimates of take. Additionally, the DPEIS is not always clear when and how animals are removed from the model to prevent multiple takes of the same individual (e.g., being counted as a Level B take and then exceeding Level A criteria and also being counted as a Level A take). Removals need to be handled carefully to prevent gradual reductions of model ‘animats’ in the sound field as “taken” animats are removed. The most recent threshold criteria for Level A takes are based on empirical data for the threshold at which a temporary decrease in hearing sensitivity (TTS) occurs across a narrow frequency range of hearing (NMFS, 2016; Finneran, 2015). BOEM also variously cites NMFS 1995; Southall et al 2007; Finneran and Jenkins, 2012: it</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>is not yet clear which criteria they plan to use in the Final EIS, making analysis of the DPEIS difficult. JASCO in Appendix D modeled the 1995 threshold. The simplest Level A threshold, long since superseded by scientific data but still in use by NMFS, is 180 dB SPLrms (root mean squared – an average over some specified time period, and since it is an average of a logarithmic scale, dB, a square root of the mean of summed square values is required rather than a simple average). Despite being outdated by more than 20 years, BOEM still modeled takes using this hyper-precautionary threshold. This provides a threshold that is some 10 to 1,000 times more precautionary than the current best data derived from TTS thresholds for both impulse and tonal sources; the peak SPL or the summed sound energy over time (SEL), although we shall see later in this section that the SEL has also been subjected to additional conservative assumptions that render it some 10-1,000 times more conservative than SPLpeak. The values of 10 to 1000 times are based on SPLpeak thresholds of 230-200 dB SPLpeak, and an estimate of 180 dB SPL rms being comparable to 190 dB SPL peak (200 dB is ten times 190 dB and 2230 dB is one thousand times 190 dB on the same scale, in this case SPLpeak). Permanent Threshold Shift (PTS) is not tested directly, and is assumed to occur at a level above TTS consistent with marine mammal TTS data and human/lab animal data. PTS, as for TTS, is not a threshold for deafness or major loss of hearing, but for a small decrement of hearing sensitivity within a narrow frequency range, a 'hearing notch'. This is a liberal interpretation of "injury", since the original sense of the term in MMPA was intended for animals that lost eyes, limbs, or suffered broken bones and spinal injuries during interactions with fisheries or due to being struck by ships, shot at, or otherwise seriously injured. The criterion is rendered even more conservative by the use of a 15 decibel difference between TTS and PTS when the data from other species, including humans, indicates PTS onset at 20-40 dB above TTS threshold. Since even this conservative addition of only 15 dB to TTS produces thresholds of PTS above the source level of the sound source, Southall et al (2007) and subsequent criteria (NMFS 2016) have</p>	

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	<p>arbitrarily set the SPL peak metric for PTS at a mere 6 dB above TTS threshold, or almost ten times lower (and therefore productive of ten times as many exposures and takes). The best predictor of TTS and therefore PTS, at least for tonal sounds, is SEL, a product of both signal intensity (not amplitude) and duration. It is not clear how well this relationship holds up for an impulse signal like compressed air (CA) sources, so relationships for tonal signals are applied to impulse thresholds. SEL is referenced to a time duration, typically one second, but for sounds less than 1 second long, like impulse sounds, SEL does not always hold up. Furthermore, models like the BOEM DPEIS treat multiple exposures separated by many seconds or even hours or days, as if the sound exposure had been continuous. Near the source a geophysical survey produced 0.1 s of sound every 10-20 seconds, expressed as a “duty cycle” of approximately 1-2%. Further from the source the energy in the impulse may spread in time, increasing the duty cycle, but at ranges meaningful for Level A determination, the duty cycle remains below 10%, meaning that 90% of the time the ear is capable of recovering from some of the induced fatigue or threshold shift. Early TTS studies noted that the animals recovered from low levels of TTS within seconds or minutes, and subsequent ongoing studies are consistent, suggesting that it make take considerably more intermittent exposures to produce TTS or PTS than would be predicted by simply adding up multiple pulses as if they all occurred in succession without any time for recovery (In other words 12 pulses of 0.1 second duration each are treated as a continuous 1.2 second pulse and not what they are, which 1.2 seconds of sound within ten 15 second intervals or 150 seconds of ambient sound only). The case for some sort of recovery function is even stronger for intermittent passes of an array that may be separated by 4, 8, 16 or more hours, in which case hearing is likely fully recovered and no accumulation of SEL should be carried forward. NMFS has traditionally carried SEL forward for 24 hours, a scientifically unwarranted precaution that leads to over-estimations of take by another 10-100 times, if not more. The current modeling exercise</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

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	<p>suggests in places that SEL accumulation was carried forward even further for weeks or even months. Appendix K offers annual summations of SEL and a similar cumulative sound metric, Leq, for an entire year. This is not scientifically justified and leads to overestimates of takes by tens or even hundreds of thousands of takes, both Level A and Level B. Because we do not have a specific recovery function to offer yet, BOEM has not included ANY recovery in their model, whereas a model consistent with best available science should include at the very least a recovery function consistent with human and other mammalian hearing. Absence of a recovery function is likely adding another 10 to 100 fold over-estimation to Level A take. Thresholds for Level B take have been difficult to derive, although more and more publications have offered data and a proposed threshold function: most of these papers are not cited or reviewed in the EIS, or in the reference used by the Phase II model (Appendix D), which is an unpublished contract report to a California utility company (Wood et al 2012). Wood et al (2012) also presents a potential conflict of interest, since the author of Appendix H (Brandon Southall) is also a co-author of the Wood et al (2012) report. The industry is sponsoring a review of the behavioral effects literature, but that review will not be published in time to inform the current PEIS. In any case, the Wood et al recommendation was a step function of increasing behavioral response at increasing exposure levels, and in this respect Wood et al (2012) is similar to other Level B risk assessments like the US Navy Programmatic EISs (2009; 2014, draft 2017). All recognize that out of a given group of animals, a few will respond at low levels, with increasing recruitment up to an exposure level that approaches thresholds for TTS and PTS. BOEM also applied the outdated NMFS 1995 Level B threshold of 160 dB SPLrms. The outcome of applying any of these thresholds is the generation of tens of thousands to millions of Level B takes in which the vast majority of “takes” are transitory disturbances that last hours or a day or two and have no impact at all on foraging success, breeding success, growth, health or any other biologically meaningful metric. The hypothetical possibility that cessation of feeding for a day or</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

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	<p>movement a few miles from the source, or a change in vocal behavior “might” lead to biologically meaningful consequences means that the model calculations are treated as “takes” under MMPA even though all acknowledge that exposures don’t equal takes and takes do not equal meaningful effects. The development of the PCOD model, and population of that model with data, confirm that behavioral disturbance from sound needs to be reduced to a “biologically significant” number that is a fraction of the counted exposures; anywhere from a conservative 1% to a more realistic 0.001% or less. In other words, estimates of thousand to millions of takes in the model are like to result in fewer than 1 to 1000 takes with actual biological consequences. These numbers, spread across large areas like the Gulf and multiple species are mathematically too low to result in a population level consequence from Level B takes (e.g. elevation of baseline mortality, decrease in baseline fecundity). This is consistent with history, where more than five decades of regular geophysical survey effort all over the globe has not generated any evidence that observed behavioral responses to the sound has any biological consequence. Calculation of grossly inflated Level B take numbers in the GOM DPEIS is not consistent with current best information, and greatly over-estimates the consequences for the stocks of marine mammals being managed. Finally, behavioral aversion was not applied to this model, even though a preliminary Phase I model showed that even small amounts of aversive greatly affected both Level A and Level B takes. If behavioral aversion is a trigger for Level B take then it cannot subsequently be omitted from modeling of Level A takes, since the low level exposures that trigger aversion will reduce the likelihood of higher levels of exposure. Additional aspects of threshold assessment that may lead to over-prediction of takes include:</p> <ul style="list-style-type: none"> • Conservative thresholds for low frequency whales. Current conservative thresholds for whales increase the estimated Level A and Level B takes for these species by some 4 to 10 times over best available science predictions. Arguments for unreasonable precaution in 	

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	<p>the face of uncertainty are not consistent with mammalian auditory biology in general.</p> <ul style="list-style-type: none"> • JASCO applied novel uses of weighting functions, using outdated M1 weighting functions from Southall et al (2007) on SPL thresholds, where weighting functions should not be applied. • Kogia are considered to have the same hearing thresholds as porpoises, even though they are unrelated and the evidence for high sensitive is based largely on data about Kogia vocal behavior and some inconsistent evoked potential audiometry. • Modifications to beaked whale Level B thresholds unique to this EIS are applied without justification other than precaution. The Associations appreciate BOEM's candor in providing accurate descriptions of the substantial shortcomings of the exposure modeling. However, such candor does not excuse BOEM from performing a lawful evaluation of the actually anticipated direct and indirect effects of the proposed action. As stated above, both direct and indirect effects must be "caused by" the action, and indirect effects must be "reasonably foreseeable." 40 C.F.R. § 1508.8. By BOEM's admission, the exposure estimates presented in the DPEIS do not accurately represent effects that BOEM expects to be "caused by" the proposed action or that are "reasonably foreseeable." 	
1076-0025	<p>...the DPEIS fails to meet these rigorous standards because it wrongly omits any consideration of mitigation measures and relies on flawed and biased modeling.</p>	<p>Thank you for your comment. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p>
1076-0026	<p>NEPA requires an EIS to address “any adverse environmental effects which cannot be avoided,” which necessitates an analysis of available mitigation measures. 42 U.S.C. § 4332(C)(ii) (emphasis added); see Robertson, 490 U.S. at 351-52, 353. However, the DPEIS turns this statutory mandate on its head by evaluating speculative adverse effects that can be (and are already being) avoided through the implementation of mitigation measures. In fact, these mitigation measures are an integral part of the proposed actions evaluated in the DPEIS. See, e.g., DPEIS at 1-3, 1-4 (proposed action includes BOEM authorizations of G&G activities and NMFS incidental take authorizations, both of which must include mitigation measures). Nonetheless, the DPEIS expressly declines to evaluate the countervailing beneficial effects of the very mitigation measures that are integral to the proposed actions. See DPEIS at 1-16 (“The modeling is conservative because it did not apply any of the 19 different mitigations analyzed in [the DPEIS].”); id. at 1-19 (“The modeling effort in Appendix D does not, for example, take into account any mitigation measures incorporated into the alternatives because the effect of those measures cannot be quantified with statistical confidence at this time.”); id. at 4-14 (mitigation measures not considered as part of effects analysis).</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the modeling assumptions within this Programmatic EIS.</p>
1076-0027	<p>BOEM’s election to ignore the beneficial effects of mitigation measures is particularly arbitrary because BOEM knows--unconditionally--that the mitigation measures would substantially decrease any adverse effects postulated by the overly conservative exposure modeling. As addressed below, there are no demonstrated adverse effects on any marine mammal populations (in the GOM or the Arctic) resulting from mitigated</p>	<p>Thank you for your comment. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>seismic survey activities. In addition, Appendix D itself demonstrates the effectiveness of currently employed mitigation measures. Specifically, in Phase I of the exposure modeling described in Appendix D where various modeling methods, inputs, and assumptions are assessed, Sections 6.5.3 and 6.5.4 consider the effects of incorporating mitigation measures and aversive responses into the exposure modeling. Tables 40 and 44 show that the implementation of shutdowns may reduce the number of estimated Level A exposures by 10% to 80%.¹⁰ Similarly, the effect of modeling aversive responses by marine mammals also shows potentially large reductions in the percentages of animals exposed above Level A criteria (40% to 85% for the peak sound pressure level [“SPL”] criteria and 14% to 20% for the root-mean-square [“rms”] SPL).</p> <p>Despite these demonstrations of significant and meaningful reductions in the number of estimated exposures as a result of mitigation measures and aversive responses, and the fact that both are likely to occur under all of the alternatives considered in the DPEIS, they are inexplicably not included in the final (Phase II) modeling used to estimate exposures for the impact assessments and ultimately not considered as part of the effects analysis. Although there are uncertainties associated with including these measures in the modeling process, those uncertainties are not substantially different than uncertainties associated with other inputs to the modeling process and they should not be disqualified from use for that reason.</p>	<p>implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p>
1076-0029	<p>The exposure modeling set forth in Appendix D makes many biased assumptions that substantially contribute to the inaccuracy of the DPEIS’s effects analysis. Specifically, the modeling analysis in Appendix D contains multiple layers of precaution that aggregate in the annual and 10-year estimates. Attachment A to this letter provides a more detailed assessment of the overly conservative (i.e., unrealistic) assumptions used in the modeling. These assumptions contribute anywhere from 10% to multiple orders of magnitude above the mean or most likely exposures outcome (i.e., 100 to 1,000 times the “most likely” number of exposures). In aggregate, these compounding</p>	<p>Chapter 1.2.5 has been revised to include information on the modeling assumptions.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	highly conservative assumptions produce a predicted number of exposures that is thousands to millions of times greater than the average or most likely outcome.	
1076-0030	<p>The Phase II model assumes a source array of 8,000 cubic inches. This is at, or very near, the upper limit of the largest source arrays used in the GOM. See DPEIS at 3-18, Appx. D at D-25. The actual distribution of array sizes in the GOM ranges from 8,400 cubic inches to less than 2,000 cubic inches, with a mean value of 5,600 cubic inches. The scaling differences in the range to threshold criteria produced by an overestimated array size of 8,000 cubic inches cascade down through the calculations, so that when a threshold range four times larger than produced by a typical survey source is established using hearing injury thresholds 10 or a hundred times lower than actual measured thresholds, and applied to numbers of animals (using the Duke model) that are 10 times higher than any previous estimates, the outcome is a prediction that 10,000 to 100,000 times more exposures might occur than use of the “best available data” values might otherwise have calculated. See Attachment A. Instead of this overly precautionary and unrealistic approach, BOEM could have used the data for all array sizes used in the GOM in the past 10 or 20 years, plotted them on a typical bell-shaped curve, and calculated the mean or median and variance or mode.....BOEM treats all geophysical surveys as if they were all conducted with the largest arrays in use. The nominal value of 8000 cubic inches is an approximation of the maximum array size currently used in the Gulf, typically 7900 to 8500 cubic inches. Based on a quick survey of IAGC members over the past decade, a little less than one third of all surveys use arrays of that size. The other two-thirds of surveys in the GOM use arrays that range in size from 6000-2000 cubic inches, for a mean array size of 5600 cubic inches. Since the different sizes are not distributed normally around that mean value (i.e. not a smooth bell shaped distribution), some other value of central tendency, like the median (5100 cubic inches) might be deemed a more appropriate central value. But in any case, using 8000 cubic inch sources for all modeled surveys greatly overestimates</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the source and its selection for modeling.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p data-bbox="380 248 510 277">actual use.</p> <p data-bbox="380 315 1138 1138">The source level of a compressed air array increases as the cube root of its volume, all else being equal, so a difference of 8000 and 5600 cubic inches might seem trivial. But we have seen that it is not trivial in terms of the outcome of concern; the number of animals exposed, because of the resulting expansion of the acoustic ‘footprint’ of the array and the number of animals likely to be found within that footprint. Furthermore, the modeled array is not only extreme in the total volume modeled, but also in the number of elements within the array. A typical large array of 8000 cubic inches might include 48 elements and sometimes as many as 60, but the BOEM DPEIS used 72 elements. Why is this important? Because array source level may only increase trivially with total volume, but it is directly proportional to the number of elements. An array with 72 elements has double the amplitude of an array of 36 elements; volume and air pressure being equal. Therefore the combination of using an array at the extreme upper end of normally used array sizes, coupled with a number of elements in that array which also greatly exceeds the average, can by itself produce estimates of takes that are 1.5 to over 2 times as large as would be predicted by using the normal range of array sizes and numbers of elements actually in use. Based on this variable alone one would be justified in taking the final model predictions and halving them. But there are many more conservative assumptions in the model. Also potentially capable of altering the model outcome, but not addressed in this quick analysis, are:</p> <ul data-bbox="380 1175 1138 1414" style="list-style-type: none"> <li data-bbox="380 1175 1138 1414">• The number of source vessels. When multiple source vessels are used they are used at intervals that are similar to a single source. The total acoustic energy is therefore not increased over using a single source operated at the same inter-pulse intervals, but the total area ensonified is slightly increased, depending on the spatial separation of the vessels. This may be compensated by the fact that each vessel is only 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

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	<p>producing sound every 60 seconds instead of every 15 seconds for a single source vessel). In the BOEM DPEIS, the maximum number of source vessels, four, is used for all surveys that might use multiple sources, even though many of those surveys, such as NAZ, WAZ and coil surveys, might more often use only one or two sources, and rarely use as many as four source vessels.</p> <ul style="list-style-type: none"> • Longitudinal tracks were only used during modeling on the slope region of the Gulf, which has the potential to alter sound fields and estimated takes relative to using both lateral and longitudinal tracks typical of most surveys. • The choice of depth at which the array was towed was set at 8 meters, but other tow depths are common (6 meters is considered the default 'standard') and the choice of tow depth affects the frequency structure and propagation of the resulting sound field. • The choice of pulse intervals typically varies from 10 to 20 seconds, with the DPEIS selection of 15 seconds being fairly typical. A four source survey would result in each source operating at 60 second intervals. • Durations of surveys were not clear. On page 3-23 a nominal survey duration of 10.5 months was applied to all surveys, but elsewhere in the document, e.g. D-177, the survey durations varied. • Survey areas, line separations, and other parameters on page D-177 appear to be in the same conservative direction as the array size and element count; suggesting that line spacing and area covered by a modeled 2D, 3D, WAZ or other survey may be greater than average and thus produce elevated sound 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>exposures and take estimates.</p>	
<p>1076-0031</p>	<p>Another example of excess precaution built into BOEM's effects analysis is found in the values entered into the transmission loss model. On pages D-100 through D-123 of Appendix D, the analysis acknowledges that (1) the "worst case" sound speed profile produces propagation at a given range that is 10 decibels ("dB") better than the average; (2) the actual-versus-modeled bathymetry and bottom properties probably add another 4 dB; and (3) using a smooth rather than wavy ocean surface might add another 1-2 dB over the actual transmission loss. In aggregate, an added 16 dB or so of "precautionary assumptions" translates to sound propagation that would travel more than 10 times farther than the result that would be produced by the "most likely" propagating environment (using a typical hybrid transmission loss value of $15\log(R)$). Again, this single example is combined with other examples of precaution to predict exposure numbers that are thousands to millions of times higher than the most likely outcomes.....BOEM is to be commended for having run some preliminary models (Phase I modeling in Appendix D) to quantify some of the consequences of using simplifying or conservative assumptions (e.g. see pages D-100; D-106; D-113; D-122). Therefore we can assign some quantities to what is otherwise a very complicated variable, the day-to-day fluctuations in wind, temperature, currents, and other factors that affect sound propagation through the water between the sound source and the animals of concern.</p> <p>The modeling of sources of variance yielded a 10 decibel difference in sound transmission between an average sound speed profile in the water and the extreme case used in the model (10 decibels is an order of magnitude or ten times the average). Use of hard or median properties for the seafloor added another 4 dB over the most likely outcome, with most of the Gulf being covered with soft sediment that is a poor reflector of sound). Use of a flat sea surface instead of a rough sea surface adds another 2 dB minimum, resulting in a conservative value of over-estimated propagation of 16 decibels or 60 times</p>	<p>Thank you for your comment. The use of the term "worst-case" was incorrectly used in Appendix D, Phase 1 and has been corrected to add a more accurate term to reflect the work that was done.</p> <p>Maximum-over-depth was not used for exposure estimates. Three-dimensional movement of the animats was convolved with computed 3D sound fields. Maximum-over-depth plots were included as illustrations in the report as a matter of convenience only to convey radial ranges of sound pulses.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>(!) the amount of energy propagated than would be expected on average. Add this to the conservatism we saw for the source itself, and we already have an ensonified area and number of animals ensonified that would be 90 to 120 times the reasonably expected exposures. A “best reasonable estimate” of 100 would become an estimate of 9,000 to 12,000 from these two precautionary measures alone.</p> <p>Also potentially capable of altering the model outcome, but not addressed in this quick analysis, are:</p> <ul style="list-style-type: none"> • A single uniform propagation regime is used for the entire deepwater zone (Zone 7). Assumptions of flat bottom and maximum depth are not met in all cases and propagation is therefore subject to additional over-estimation factors in the deep water region. • Survey days and survey effort appear to have been evenly distributed across the area and seasons, although this is likely not the case for actual survey effort. Theoretically this might average out, but it is also possible that fewer actual survey days in winter, when propagation conditions are best, will lead to actual surveys producing fewer takes than the model estimated by using equal division across winter and summer. • SPLrms for longer range propagation is derived from the SEL values produced by the model. As JASCO acknowledges (D-49), modeled SEL at range tends to over-predict SPLrms as the signal is spread over time. Time resolution of the model also hinders accurate modeling of SPLrms based on proper analytic units such as rms.⁹⁰ (average sound pressure over the time than encompasses 90% of the total pulse energy). • Single frequency long range propagation modeling 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>leads to increased errors in pulse properties with range. For modeling purposes a single frequency at the center of each 1/3 octave band is treated as ‘representative’ of all the sound energy within that frequency band. In practice, selection of a non-representative frequency (e.g. located at a ghost notch or filtered by propagating environment) can lead to errors in weighted SEL values needed for determining effects thresholds.</p> <ul style="list-style-type: none"> • Use of “maximum over depth” in some model estimates of take creates a worst-case scenario where all individuals are assumed to be at the depth of highest sound exposure all the time. It is not clear in what context JASCO used maximum over depth as a simplifying step in modeling, but it will always greatly over-estimate takes when used.(D-296). • Ranges to effect for mitigation monitoring and shutdown (but not for take estimation?) were calculated from unweighted values, whereas hearing frequency weighting needs to be applied to SEL threshold values (JASCO also seems to have applied weighting to SPLrms data, which may also be inappropriate – see section on Threshold Criteria, below). 	
1076-0032	<p>Yet another example occurs where the effects of running the animat exposure models for only 24 hours and then scaling those results up to longer survey periods (e.g., 30 days) are assessed in Section 6.5.1. Using this method, the total exposure estimates based on the rms SPL criteria are found to vastly “overestimate the number of animats exposed to levels exceeding threshold....” DPEIS, Appx. D at D-69. Nonetheless, this method is used in Phase II (App. D at D-180) to produce the final exposure estimates (App. D Section 7.3.4).</p>	<p>Thank you for your comment. The 24-hour reset period rule is currently required by NMFS (average exposure estimates were calculated for 24 hours). This is, in effect, a recovery step function at 24 hours. BOEM discussed the possibility of using a different recovery function, such as a leaky integrator, but it was decided that, at this point, there is not enough biological data upon which to base an alternate recovery function. It is commonly accepted that the number of exposed animals is fewer than the number of predicted exposures.</p>
1076-0033	<p>Section 6.5.2 analyzes potential contributions to uncertainty from the sound source characterization modeling, and from sound speed profiles, geoacoustic parameters, bathymetric data, and sea state inputs to the acoustic propagation modeling. This analysis concludes that the various uncertainties in the</p>	<p>Thank you for your comment. A sensitivity study, as is suggested, adjusting all the variables in acoustic propagation modeling is indeed theoretically possible. However, the number of variables and sites involved make such an exercise impractical. This is why the variables were considered</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>acoustic field represent a “multi-dimensional envelope” and that these different dimensions “cannot be summed to yield a ‘total’ uncertainty as this would be a meaningless quantity.” However, this conclusion is incorrect. There are ways to quantify the uncertainty in a meaningful way despite challenges to directly calculating the total uncertainty (or statistical variance). For example, the combined uncertainty contributed by environmental and model parameters could be further evaluated by comparing the outputs from multiple runs of the entire modeling process (both acoustic propagation modeling and exposure modeling) in which one or more of the parameters are adjusted across reasonable levels in each competing model run. The parameter-specific uncertainty analyses presented in Phase I of Appendix D are useful for identifying which parameters to adjust within the competing full modeling runs, but alone they only reinforce the fact that significant uncertainty is present at many steps within the modeling process. Multiple runs of the full modeling process using alternative parameter estimates should be conducted to improve the understanding of the total uncertainty surrounding the final results.</p>	<p>separately.</p>
1076-0034	<p>In addition, the analyses set forth in Section 6.5.2 of Appendix D use various methods to assess uncertainty around the parameters used in acoustic propagation modeling. However, in all examples only the “typical” (average or median) and “worst case” values are evaluated. As a result, uncertainties are only characterized in one direction from the typical or expected result, and that direction results in longer-range propagation of sounds. When characterizing uncertainty around estimates, it is common practice to not only report the upper confidence limits (“worst case” results in this example), but to also report the lower confidence limits. Without an understanding of the lower confidence limit values, it is not possible to properly bound and assess the range of outcomes from the modeling and interpret the likelihood of potential impacts. The failure to characterize the lower confidence limits results in a flawed and arbitrary analysis that is significantly biased. BOEM summarizes the significant biases of the modeling as follows:</p>	<p>Thank you for your comment. The point that the lower bound was not evaluated in the manor of the upper bound (i.e., “worst case”) is valid. The description would be more complete with this addition. However, the assertion that this biases the results is unfounded since the median cases, not the upper bound inputs, were used as model inputs.</p> <p>The question of implementing mitigation in the modeling was considered at length. But there are no generally accepted metrics on the effectiveness of mitigation; therefore, inclusion of mitigation effects would have left the modeling results open to the additional criticism and debate. The fact that mitigation is NOT considered in the modeling effort is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2 (i.e., the modeling results are overestimates of actual numbers of takes, since mitigation clearly affects reducing the exposure of marine animals).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>The existing modeling largely does not account for uncertainty in the data inputs and also selects highly conservative data inputs. This bias often produces unrealistically high exposure numbers and “takes” that exponentially increase uncertainty throughout each step of the modeling. The modeling does not incorporate mitigation or risk reduction measures designed to limit exposure. The modeling is an overestimate and should be viewed with that understanding. DPEIS at 4-47 (emphases added).</p>	
1076-0035	<p>An analysis that, by the agency’s admission, purposely overestimates effects and relies upon incorrect and unrealistic assumptions, is, by definition, “inaccurate” and therefore contrary to applicable NEPA standards.</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the modeling methodology and assumptions.</p>
1076-0067	<p>In August 2016, NOAA issued its Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (the “Guidance”). The Guidance establishes acoustic criteria for evaluating Level A harassment and TTS. Despite the availability of drafts of the Guidance and the scientific bases for the Guidance for many months prior to August 2016, the DPEIS’s exposure modeling analysis does not use the Guidance. See DPEIS at 1-17 and 1-20. The Associations assume that BOEM will use the Guidance in subsequent action-specific NEPA analyses.³⁶ However, even if this assumption is correct, BOEM must clarify and better explain the relevance of the Guidance in the DPEIS.</p>	<p>Thank you for your comment. The <i>Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts</i> was issued in August 2016 after public notice and multiple opportunities for comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. This represents the best-available scientific information and criteria issued by NOAA.</p> <p>Chapter 1.2.5 has been revised to include information on the modeling methodology and assumptions. Additionally, refer to Appendix N for the application of the new NMFS’ 2016 Technical Guidance to the impact analysis. The comments regarding NMFS’ criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (<i>Federal Register</i>, 2017).</p>
1076-0068	<p>...the DPEIS states that “at a first glance, there are differences between the values [generated by the Guidance and by the DPEIS exposure modeling], but they do appear significant at a programmatic level.” DPEIS at 1-18. It is not clear from this statement whether BOEM intends to say that the differences are or are not likely to be significant at the programmatic level considered in the DPEIS. Additionally, the DPEIS states that “there is the potential for some fairly large differences in results</p>	<p>Chapter 1.2.5 has been revised to include information on the modeling methodology and assumptions. Additionally, refer to Appendix N for the application of the new NMFS’ 2016 Technical Guidance to the impact analysis.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>from the modeling done by BOEM and the 2016 NMFS acoustic guidance” and cites an example for low-frequency (“LF”) cetaceans.</p> <p>However, this example makes a number of simplifying assumptions, such as “most of an airgun’s energy is produced in the 100- to 300-Hz frequency band.” Id. This assumption is not entirely correct because sounds produced by airguns contain substantial energy from 10 to 60 Hz. Additionally, the -13 dB difference between the two frequency weighting functions noted in the DPEIS are calculated by considering only the 200 Hz frequency band, while substantial differences between the frequency weighting functions are present from 30 to 1,000 Hz.</p>	
1076-0069	<p>...for mid-frequency (“MF”) and high-frequency (“HF”) cetaceans, the frequency weighting curves shown in the DPEIS are even more dramatically different across the 100 to 300 Hz band selected to represent airgun sounds. Id. However, the preliminary analysis in the DPEIS does not address how this may dramatically reduce the area or volume within which MF and HF cetaceans may be considered exposed above the criteria. Instead, the DPEIS goes on to address high resolution geophysical (“HRG”) sources and indicates they would be evaluated as non-impulsive sources. Treating HRG sources as non-impulsive would be a break from traditional assessments, yet this is not explained or justified in the DPEIS or its appendices. Moreover, the summary paragraph on page 1-19 does not provide an example similar to that for LF cetaceans to support why BOEM believes the number of exposures of MF and HF cetaceans would “remain the same or slightly reduced overall” if the Guidance were used.</p>	<p>Thank you for your comment. Treating non-airgun HRG sources as non-impulsive is the appropriate practice because they are not impulsive sources unless they include a small airgun or sparker. In those instances where HRG sources are considered to include small airguns or sparkers, it is specifically described as such. Appendix D describes how impulsive and non-impulsive sources were treated in the modeling. The discussion of NMFS’ Acoustic Guidelines in Chapter 1 has been edited to correct errors in the examples provided of the impact of the new guidelines on the exposures estimates included in this Programmatic EIS.</p>
1076-0070	<p>...the analytical methods and criteria that are used in the acoustic analyses supporting the Appendix D modeling are less than straightforward. For example, starting on page 4-12 of the DPEIS, BOEM refers to the NMFS 1995 criteria (180/160 dB re 1 µPaSPL rms), a set of 2012 weighting functions (e.g., those used in the modeling for the DPEIS) for which a reference is not provided, and to the NMFS July 2016 criteria. Appendix D uses the NMFS 1995 criteria, but applies Southall et al. (2007)</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the acoustic thresholds.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>M-1 weighting to those values, which were originally unweighted values. DPEIS, Appx. D at D-174. The Appendix D modeling also uses Southall et al. (2007) SPL peak Permanent Threshold Shift (“PTS”) onset values, but for LF cetaceans creates its own PTS onset threshold of 192 dB re 1 μPa² s SEL by subtracting 6 dB from the MF cetacean onset value of 198 dB re 1 μPa² s (another precaution layered on top of already precautionary numbers). Id. at D-55. Another example of unclear development of a threshold value appears in the very next paragraph where the analysis cites a value of 187 dB SEL as the MF cetacean threshold, derived by using a beluga TTS onset of 186 dB, applying Finneran and Jenkins (2012) Type II M-weighting to derive a weighted value of 172 dB and then adding 15 dB to produce a PTS threshold for MF cetaceans of 187 dB. Obviously, the methods for deriving the criteria used in the analysis are hardly clear. Nowhere in Appendix D or the body of the DPEIS is there a simple table listing the threshold values that were applied in the exposure analysis.</p>	
1076-0071	<p>...the failure of the DPEIS to use the Guidance in its effects analysis is legally and scientifically tenuous. See <i>N. Plains Res. Council, Inc. v. Surface Transp. Bd.</i>, 668 F.3d 1067, 1086-87 (9th Cir. 2011) (“Reliance on data that is too stale to carry the weight assigned to it may be arbitrary and capricious.”). Proper application of the Guidance in action-specific NEPA evaluations may remedy this shortcoming; however, to the extent the final PEIS does not address this issue in a more robust manner, NMFS’s future reliance on the final PEIS for the MMPA incidental take rulemaking process could be jeopardized. It is imperative that the public be provided a reasonable opportunity to carefully review and comment on the application of the Guidance as it directly pertains to the current action. Regardless of its future application, if BOEM does not intend to use the Guidance in the modeling that will support the final PEIS, then it must provide a more developed and accurate assessment of the differences that result from application of the Guidance compared to the criteria and methods actually used. BOEM must also more clearly explain those criteria and methods in the final PEIS.</p>	<p>Thank you for your comment. The <i>Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shift</i> was issued in August 2016 after public notice and multiple opportunities for comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS, and updated modeling results using this guidance are included in Appendix N. This represents the best-available scientific information and criteria issued by NOAA.</p> <p>The NMFS’ 2016 Technical Guidance reflects the latest and best available science, was prepared by an expert agency, and was peer and publicly reviewed. The comments regarding NMFS’ criteria are not within the scope of this Programmatic EIS. The NMFS responded to public comments on the guidance (<i>Federal Register</i>, 2017).</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0072	<p>The Phase I modeling in Appendix D uses Navy Operating Area Density Estimates (“NODES”) and NMFS Stock Assessment Reports (“SARs”) marine mammal population data. However, the Phase II modeling inconsistently uses the 2016 Duke model of animal distribution and abundance. The following summarizes some of the problems associated with Appendix D’s use of varying datasets and models related to marine mammal abundance and density.</p> <p>First, a problem with habitat-correlated density modeling is that the model may not capture all the habitat variables that are important to the animals, and consequently places modeled animals in areas where they never or rarely go. For example, Bryde’s whales are rarely if ever seen outside De Soto Canyon, yet the Duke model places modeled Bryde’s whales in relatively high density at the continental shelf edge from Texas to the Florida Straits because the habitat suitability model indicates that they “could” use those places. The Duke model thus results in the calculation of densities of Bryde’s whales in Zone 4 of the Appendix D’s seven zone system when that clearly is not supported by the available sighting data.....This is a complex set of variables, with precautionary assumptions literally varying for each of the species modeled. But overall, the use of the Duke model creates an increase in predicted abundance that is about double the official NMFS abundance numbers in the SARs. Some additional modifications in the use of those data by JASCO add to the conservatism (over-prediction) by a fractional amount, in most cases.</p> <p>The Duke model is a novel approach to forecasting animal distribution and density from historical correlations with readily available environmental data, typically not the true environmental predictors like prey patches or features like fronts, currents and eddies that are less easy to predict or track. As such, there are some things that the Duke model likely does better than the SARs, such as predicting average abundance of pelagic dolphins that move in and out of the US EEZ from one survey to the next, leading to large sampling variability.</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the marine mammal densities. In short, that is the best available science at the time of this analysis.</p> <p>Phase 1 modeling used the NODES data because it was available at the time that these scientific investigations were being conducted. It was not critical for these analyses that the latest marine mammal densities be used. However, it was critical that the 2016 Duke data be used in the Phase 2 analysis.</p> <p>With respect to the comment on Monte Carlo methods and running the model multiple times, the overpopulation of the model has the exact same effect as multiple runs, as each animat is completely independent of all other animats. A run of 100 animats will produce the same fundamental result as 10 runs of 10 animats.</p> <p>Animats crossing the boundaries were replaced at the opposite boundary continuing in the same initial direction as when the boundary was crossed. When an animat crosses the boundary, its exposure history is frozen (it stops accumulating acoustic exposure) and the entering animat is considered new (with no exposure history).</p> <p>There are different approaches that can be taken, but this method preserves modeling density and effectively simulates drawing animals from a larger area. To some degree, it discounts the possibility of animats accumulating sound over long periods to reach an SEL threshold and conversely increases the number of animals that might exceed a one-time threshold (e.g., SPL threshold) because “new” animats can now be counted if they eventually exceed the threshold. The edges of the survey area are chosen to be below thresholds so movement of animats in these areas should not contribute to the overall exposure estimate.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>However, other similar models for the US west coast, for the UK, and for global oceans, have shown some extreme misses in their predictions, an expected outcome for models in the early stages of development for species that are infrequently counted and whose habits are still poorly understood relative to land animals for example. Too great dependence on a single very new model like the Duke model can therefore be expected to result in some improvements on the SAR or US Navy NODES data resources, but is also likely to produce some extreme “misses”. Species with wide disparities between historical data and Duke model predictions include Atlantic spotted dolphins (from no historic estimates in SAR, to over 45,000 animals predicted by the Duke model, making them the third most abundant species in the Gulf, virtually overnight. Duke predictions of Clymene dolphin abundance are about 85 times higher than the SAR figures, Kogia numbers are increased by a factor of 12, rough-toothed dolphins by a factor of 8 and killer whales by a factor of more than 7. These are radical changes to our understanding of marine mammal abundance in the Gulf that require more than blind acceptance of a new model simply because it is generally “better” than the SARs (D-65).</p> <p>Some of the animal abundance and distribution modeling may be unfamiliar and counter-intuitive to the average reader. The model in the BOEM DPEIS uses electronic representations of individual animals, or ‘animats’, to construct time series of exposure for a realistic number of animals, ‘behaving’ in realistic ways, so that the animats move about and dive at realistic speeds and distances relative to the sound source, which is also moving. As might be expected, capturing the complexities of animal behavior and all of the other variability of the sound source and the propagating ocean is impossible, so certain statistical techniques are used to smooth out some of the variability in outcome that can occur just from sampling errors alone. These techniques, such as over-populating the sound field with hundreds or thousands of times more animats than animals (and then reducing the result proportionally to the actual population) do not affect the outcome but do reduce the</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>likelihood of random extreme variation in outcomes. Monte Carlo methods, or running the same simulation over and over hundreds or thousands of times also helps smooth out the distribution of outcomes. Because the animats are seeded randomly for each model run and because they run independently according to user-specified rules, no single model run will produce the same result (as in real life) and so the model must be run many, many times in order to arrive at a statistical average. This process, which is widely accepted as statistically legitimate and even necessary to producing realistic model outcomes, should not be confused with the selection of variables to put into the animat models and Monte Carlo simulations: those variables, like the source and propagating environment variables, can and do produce biases in the outcome, as will be discussed in detail below.</p> <p>Animal survey data for the Gulf of Mexico is sparse overall, and therefore statistically weak. Various techniques have been applied to the data to generate estimates of population abundance, density and distribution. The official NMFS Stock Assessment Reports (SAR) are an official estimate by NMFS of the best estimate of population abundance in a region, but they do not offer information about animal distribution, forcing the user to either evenly distribute the animals even across the habitat, even though it is known the animals do not use all of the habitat equally. Alternatively, the modeler can generate 'expert' assumptions about how the animals use the habitat, but those assumptions can create unrealistic estimates of take if the assumptions are not good. For example, JASCO placed all sperm whale animats in water depths greater than 1000 meters because sperm whales are deep divers that tend to occupy deep water. However, a look at the data show that many, if not most, sightings of sperm whales occur in water depths of 400-800 meters, and this is largely confirmed by tagged whale data from the BOEM SWSS research project.</p> <p>Alternative to applying a population estimate for the entire Gulf evenly or selectively across the Gulf is to use habitat features</p>	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>correlated with animal sightings to predict where animals are most likely to be seen based on 'suitability' of habitat. The statistical aspect of this process is quite well worked out as in the Duke University model applied in the BOEM DPEIS, but there are still 'human-in-the-loop' decisions that can affect model outcome. Something like the Duke model is therefore a "work in progress" in which model predictions may be more or less accurate, depending on the habitat variables available to the modeler and whether they are in fact strongly predictive of where animals will in fact be. A few "warning flags" about the novel predictions by the Duke model are:</p> <ul style="list-style-type: none"> • The distribution of Bryde's whales across the entire GOM shelf edge by the inclusion of "unidentified baleen whale" data as Bryde's whale data. Actual observations suggest that the Bryde's whales are confined to a relatively small area of habitat around De Soto Canyon in the Eastern Planning Area (EPA), and in fact this site has been selected as a special mitigation zone. But the Duke model "places" Bryde's whales across large swaths of area where they have never been seen, greatly elevating the predicted takes in the WPA and CPA by what are probably orders of magnitude (hundreds or even thousands of modeled takes not supported by the real data). • Several species for which there are low sighting data produced low likelihoods of occurrence across vast areas of the Gulf in the Duke model, which were further simplified to even probabilities across entire modeling zones: false killer whales, killer whales and several other species are therefore equally likely of being taken wherever surveys occur, when in reality there are probably higher and lower areas of likelihood. It is hard to predict how the "fuzzy" predictions of the Duke model, and the modifications of the JASCO model affect take outcomes but generally speaking, these species tend to have predicted abundances derived from Duke 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>density models that are among the highest deviations of the Duke model from SARs (e.g. 6 times SAR for killer whale, 14 times SAR for pygmy killer whale).</p> <ul style="list-style-type: none"> • Deep divers that are seldom seen during visual surveys were subjected to some assumptions about sightability that greatly elevated predicted abundance and greatly expanded habitat occurrence over the SARs; 12 times the SAR for Kogia and about 8 times the abundance for beaked whales (based on Cuvier’s beaked whale modeling). This radical departure from historical estimates of abundance is somewhat consistent with comparisons elsewhere (Atlantic, California, Bahamas, eastern north Atlantic sites), but on the high side. It is also higher than predictions by passive acoustic surveys and modeling by Hildebrand, Moretti, and others. Just how “precautionary” the Duke model is for these species is hard to estimate at this time, but it is fairly clear that the Duke model is over-predicting deep diver abundance and distribution leading to excessive estimates of takes. <p>Additional aspects of animal distribution and movements information that may lead to over-prediction of takes include:</p> <ul style="list-style-type: none"> • Assumptions used to deal with the large number of modeling cells that yield zero abundance and zero takes can lead to over-prediction of takes. JASCO notes that the outcomes that yielded a probability of Level A take greater than one (1) was less than 0.2% (i.e., only 2 out of a thousand model results yielded a take of 1 or more animals)(D-123, D-129). The average number of Level A takes was 0.0195 or about 2 per 100, the result of a very small number of model outcomes that yielded more than one Level A take. • The 3MB model used to set swimming and dive parameters for the animals rely on limited data, quite often from related species studied at different locations 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>than the Gulf. It is therefore hard to predict whether the overall effect of the values entered into the 3MB model resulted in overprediction of takes or under-prediction, but the most likely outcome is that the values used were conservative, precautionary values that added to the over-prediction of takes.</p> <ul style="list-style-type: none"> • The modelers assumed that the animals did not undergo long-term, large-scale movements. Certainly it is widely assumed that animals do not migrate in and out of the Gulf in great numbers, although sperm whales, a variety of baleen whales, and probably many other species do move between the Gulf and Atlantic or Caribbean. But the currently available data do not offer enough information, especially for winter months, to determine whether other species exhibit moderate north-south or east-west movements with the seasons similar to the inshore/offshore movements of estuarine bottlenose dolphins in the late winter and spring, or during other seasons. It is well known that large numbers of animals may travel from east to west, tracking the warm core rings spun off by the Loop Current, but this phenomenon is not sufficiently documented to inform the model. • JASCO modeled the effect of group size on outcome. They did not see a significant difference in average outcome from using single, ungrouped animats, although they did note that obtaining the same outcome regardless of group size means that there will be more zero-take model runs as group size increases (D-135; D-174). As animats move over time, and if animats are removed once they exceed a take threshold, then the probability of take will decline over time as there are fewer and fewer animats in the field. JASCO used a common technique for keeping the number of animats constant and thus keeping probability of take constant over time by introducing new animats on the opposite side from which an animat had just left (D-49; D-82; 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>D201). It is also not clear if and how animals were removed or replaced once taken. This is especially important where animals were left in the field to accumulate SEL for days or weeks. There are other nuance to re-seeding the sound fields that can result in skewed results, but a full treatment is beyond the scope of this short review.</p>	
1076-0073	<p>...the Appendix D makes unsupported revisions to some results from the Duke model, which were themselves arbitrary or poorly supported. For example, the Duke model places sperm whales and Kogia whales in 500 m of water even though the available sighting data shows that they occur in shallower water. The Appendix D modeling, however, goes one step further and pushes all sperm whales into 1,000 m water depth or deeper, further exaggerating the disparity between actual observations (which tend to be biased toward shallower water) and the model (which uses "expert knowledge" to put the animals where the modeler thinks they ought to be).</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the marine mammal densities. In short, that is the best available science at the time of this analysis.</p>
1076-0074	<p>...the Appendix D modeling evenly spreads species for which little data are available (e.g., killer whales, false killer whales, Fraser's dolphins) across all habitats the modelers deem appropriate (generally deeper water, Zones 4-7). Some species, such as Fraser's dolphins and false killer whales, are therefore assumed to be abundant and widespread in areas where they are historically seldom seen.</p>	<p>Thank you for your comment. It should be noted, as in Appendix D, that the exact location of any given future survey is unknown. Statistically, over numerous surveys, this is the equivalent of the impacts to an average density for marine mammals in that zone over the duration of all those surveys.</p>
1076-0075	<p>...rather than use a specific value for each 100 km square, the Appendix D modeling averages the values from each 100 km² box across an entire zone containing hundreds or thousands of 100 km² boxes. This enables the placement of animals into the outermost Zone 7 where there is little or no data and therefore no modeling by Duke. By expanding the Duke averages into areas outside the scope of the model, Appendix D increases the total number of animals present beyond the predictions of the SARs, NODES, or the Duke model. Appendix D presents the averaged values as a minimum, maximum, and mean, which is an appropriate way to convey some of the statistical uncertainty about the model numbers (see DPEIS, Appx. D at D-201), but there is insufficient information to determine how these values</p>	<p>Thank you for your comment. Animals crossing the boundaries were replaced at the opposite boundary continuing in the same initial direction as when the boundary was crossed. When an animal crosses the boundary, its exposure history is frozen (it stops accumulating acoustic exposure) and the entering animal is considered new (with no exposure history).</p> <p>Tables D-62 through D-68 clearly indicate the minimum, mean, and maximum density values for each modeling zone. Note that these modeling zones are the smaller boxes, not the entire portion of the Gulf of Mexico.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>were obtained from the source information.</p>	<p>Additionally, it should be noted, as in Appendix D, that the exact location of any given future survey is unknown. Statistically, over numerous surveys, this is the equivalent of the impacts to an average density for marine mammals in that zone over the duration of all those surveys.</p>
<p>1076-0087</p>	<p>As we will see from the following quick-look at the GOM DPEIS, there are many more variables in the model than the simple four variable example described above. And the levels of precaution are not simple doubling of expected values, but multiples that may range from addition of some percentage (less than doubling) to increases that are orders of magnitude greater than the “most reasonable” value (orders of magnitude are multiples of ten, such as 10, 100, 1000, etc.). The downstream consequences are also more complicated than the simple two times two example above, with some variables interacting in other than simple multiplicative ways.</p> <p>For example, use of an 8000 cubic inch sound source rather than the mean or median of sizes actually used (5,600-5,100 cubic inches) would appear to only create a difference of about 30-37%, but that difference in size produces a difference in source sound level of 3-6 decibels, depending also on the number of elements in the source array. The difference in source level needs to get translated into a difference in the area covered by the sound from the two different sources, because that will change how many animals are within the two respective areas, all other factors being equal. The 33-37% difference in the size of the two arrays translates into an increase of some 45-50% (roughly) in the area exposed and therefore the number of animals taken. That is, if one uses an 8000 cubic inch array as the precautionary standard and that results in a take estimate of 150 individuals, then use of the more likely mean value of 5,600 cubic inches will result in a take of 100 individuals. Needless to say, this is a pretty large downstream consequence from alteration of a single value by what might superficially look like a pretty small amount. As we will see, factoring in the other parts of the model where similar conservative assumptions are exercised results in a prediction of takes that is millions, possibly</p>	<p>Chapter 1.2.5 has been revised to include information on the impact modeling.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	billions, of times greater than the outcome predicted by using most likely outcomes only.	
1076-0088	<p>This list includes only the most obvious and clearly unsupported precautionary assumptions of the model:</p> <ul style="list-style-type: none"> • Source <ul style="list-style-type: none"> o Extreme array size and number of elements increases exposures by 1.5 to 2 times. o Six additional precautionary assumptions were not analyzed. • Propagation <ul style="list-style-type: none"> o Conservative or simplifying assumptions about the propagating environment add 10-16 dB minimum to the propagated sound. o Combined with the precautionary source assumptions, this results in a 90-120 time increase in estimated takes, all other variables being equal. o Six additional precautionary assumptions were not analyzed. • Animal Abundance, Density and Movements <ul style="list-style-type: none"> o NMFS’s Stock Assessment Reports (“SARs”) and Duke Model differ on average by a factor of 2. A minimum compromise for uncertainty would be to reduce abundance and density estimates by 25% to 1.5 times SAR. o Three specific groups showed even more extreme differences, but were not separated in this simple analysis: expansion of Bryde’s whale habitat leading to more takes; large increases in numbers of deep divers (beaked whales, sperm whales, Kogia); extremely large increases in pelagic dolphin numbers (over 80 times for two species) o Five additional precautionary assumptions were not analyzed. 	<p>Chapter 1.2.5 has been revised to include information on the impact modeling.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<ul style="list-style-type: none"> • Threshold Criteria <ul style="list-style-type: none"> o Level A calculations from SPLrms and SEL used precautionary assumptions that overestimated take by 10-1,000 times. SPLpeak takes were overestimated at least twofold by using 6 dB instead of 15 dB to derive PTS from TTS. Level B calculations make generous assumptions about the likelihood of response and assume all exposures that exceed threshold are biologically significant, over-estimated biological consequence by at least 1,000 to more than 100,000 times. o No allowance for reduced Level A due to behavioral avoidance of the source (reductions of Level A up to 85%). o No allowance for hearing recovery between pulses (likely reduction of cumulative SEL from a continuous pulse train of 50% or more); no allowance for hearing recovery between passes separated by hours or days (fewer than 1% of successive passes, those within 8 hours or less, will accumulate and trigger Level A criteria). o Four additional contributors to precautionary over-estimation were not analyzed, including application of weighting functions to impulse SPL metrics. • Mitigation <ul style="list-style-type: none"> o No reduction in take was allocated for mitigation. While setting a specific value for mitigation may be difficult, it clearly is not zero and therefore some reduction of takes due to mitigation should be factored into the model. o Reductions from multiple proposed mitigations were not estimated. <ul style="list-style-type: none"> --Vessel separation and dolphin shutdowns modeled, with questionable effectiveness --Increased time/area closures and 10-25% effort reductions were not estimated. 	

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<ul style="list-style-type: none"> • Total Multiplicative Precautions (short list) <ul style="list-style-type: none"> o [Source+Propagation (90-120x)] x [abundance (2x)] x [conservative threshold criteria (100-10,000x)]x [no recovery factor (10-100x)] x [no allowance for aversion (6.7 x LevelA)] x [no mitigation (1.1 – 2x)] = o 1.3 million to 3.2 billion more takes than the number that would be produced by using average or most likely values for all variables. 	
1076-0089	<p>Re-calculate takes using average or most-likely values, quantify and report the overall level of uncertainty in the modeling results, and add an agreeable level of precaution to the final results, not the individual elements.</p> <ul style="list-style-type: none"> • Maybe double is reasonable? • A statistical measure of extreme confidence like 3 sigma still covers 99.7% of all possible outcomes (370 times the central value) and is not nearly so unreasonable as the present model • It seems unlikely that 1 million to 3 billion times the most likely outcome, which covers 99.9999% or more of all possible outcomes, is a reasonable level of 'precaution'. 	<p>Chapter 1.2.5 has been revised and includes details on key model components and assumptions.</p>
1076-0090	<p>BOEM allowed no reduction in the estimated take for mitigation. This is a highly over-conservative assumption, justified by the relatively little data available on mitigation effectiveness, together with the likely variability in mitigation effectiveness between mitigation service providers, types of marine species present, monitoring conditions and other variables. Some analysis on page D-151 suggests ranges of observer mitigation effectiveness from near zero to over 70%. One cannot require mitigation and at the same time treat it as if it provides no reduction in takes. BOEM needs to come up with some metric for the benefits from required mitigation. A variety of other possible mitigations have been proposed in the GOM DPEIS, ranging from alternative source technologies and active acoustic</p>	<p>Chapter 1.2.5 has been revised to include information on the source and its selection for modeling.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>mitigation to time/area closures, vessel separation schemes, and reduced quantities of geophysical survey effort of 10-25%. At least two of the suggested mitigation measures, vessel separation (Table ES-1; page 1-10; page 2-10; B-32; page 2-38; and D-162-163) and shutdowns for dolphins approaching vessels or bowriding (p. 2-24) offer the possibility of actually increasing takes through expansion of ensonified areas (vessel separation), or extremely high increases in shutdowns with associated prolongation of survey effort (and sound exposure) to achieve survey completion (an estimated 35-40% increase).</p>	
1076-0097	<p>Actual distribution of array sizes ranges from 8400-less than 2000 with a mean value of 5600 cubic inches. Assuming the use of an 8000 cubic inch array overestimates reasonably expected source energy for a typical year or decade of effort. Additionally, using an excessively high number of elements in the array (the PEIS assumes the 8,000 cubic inch array is composed of 72 elements, when it would more likely be composed of 48 to 60 elements) further overestimates the expected source amplitude.</p>	<p>Thank you for your comment. Chapter 1.2.5 has been revised to include information on the source and its selection for modeling.</p>
1076-0102	<p>Although a 10 dB adjustment is common, there is insufficient detail provided here to support that it is appropriate for the HRG sources. This is especially true at greater ranges where the impulse shape of the signal is changed to an amplitude modulated signal over a variable time window.</p>	<p>10 dB is a conservative correction to convert SPL to SEL and was used for simplification. Effectively, this is assuming that a pulse from an HRG transmission is only on for 1/10th of a second per any one second. This is a reasonable approximation to simplify the variability across all HRG sources. It should be noted that, except for small airguns and sparkers, these signals are not impulsive and, therefore, the comment on impulsive is generally not applicable.</p>
1076-0103	<p>Using only the range value would appear to neglect the depth of the animat at the time it was within the (assumed maximum-over-depth) range. If slant range and 3D peak SPL sound field were used, this should be specified.</p>	<p>Thank you for your comment. Maximum-over-depth was not used for exposure estimates. Three-dimensional movement of the animats was convolved with computed 3D sound fields. Maximum-over-depth plots were included as illustrations in the report as a matter of convenience only to convey radial ranges of sound pulses. Ranges to isopleths are provided for informational purposes, not for exposure calculation.</p>
1076-0104	<p>AASM generates a vector-specific level at any angle and in fact downward energy does not make a substantial reflective or refractive contribution to the longer range propagated signal, so</p>	<p>Thank you for your comment. The AASM signatures include the amplitude at each angle. Therefore, the maximum value for the downward beam is only used for the downward angles.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	this use of the downward maximum overestimates exposure.	Shallower angles have reduced amplitudes, as predicted by AASM.
1076-0105	These boxes do not appear to show the same geospatial shift as shown for the two survey areas in Figure 10.	Figure 10 of Appendix D shows the area at the two sites (i.e., A and B) where the source tracks will occur. In order to capture the animals in the modeling that may be impacted, a larger area (i.e., one that is bigger than either source track areas A and B, and that encompasses those areas but also a buffer area around them) is used for the actual animal movement and impact modeling. It is these larger animal movement areas that are shown in Appendix D, Figures 13 and 14 . The figures are correct.
1076-0106	Not enough detail is provided, but if the ranges to animats used were simply horizontal distance rather than slant-ranges, then this calculation assumes maximum over-depth, which would result in more exposures of deep-diving marine mammals than is realistic.	Thank you for your comment. A full 3D sound field is produced by the acoustic model. The range, bearing, and depth of the animat is used to determine the predicted exposure level. This represents the slant range, not the simple horizontal distance. Ranges to isopleths are provided for informational purposes, not for exposure calculation. Maximum-over-depth plots were included as illustrations in the report as a matter of convenience only to convey radial ranges of sound pulses
1076-0107	<p>There is insufficient description of how the Median and standard deviation values shown in Table 30 were calculated to interpret the results. Presenting differences between worst-case and median models in terms of dB at a maximum distance to a threshold is not as useful as showing actual variation in distances to that threshold or areas exposed above the threshold.</p> <p>Table 30 shows that the median difference between “worst-case” and “median” SSPs in the Shelf Zone result in +0–15 dB at/near the 160 dB range. +15 dB SPL would be a very large distance and therefore difference between median and worst case results.</p>	Thank you for your comment. BOEM has reviewed the discussion and has concluded that the description is sufficient. In Appendix D, Table 30 (page D-84), the column R simply presents the difference in the maximum range to the 160-dB isopleth between the "worst-case SVP" and "median SVP" cases. The Median and St. Deviation is a straightforward calculation given the difference in sound fields for the two conditions (e.g., Appendix D, Figure 49).
1076-0108	No actual analysis was performed to assess the variability in model results caused by increasing sea state. All modeling assumes perfect reflectance; however, this statement makes it clear that the long distance estimates resulting from the presence of sound channels in unrealistic in high sea states,	Thank you for your comment. As stated on pages D-99 and D-100, the topic was considered. The basic physics of the issue did not warrant a qualitative analysis. Given the minimal effect of sea surface on propagation, BOEM concluded that the given assumptions use the best available data, include

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	and perhaps moderate, however, no effort is made to quantify this. This should have been quantified and/or a moderate (median) sea state used in all modeling scenarios.	reasonable assumptions, and are valid.
1076-0109	The DPEIS builds a strong case that some sort of mitigation reduction or aversion effect should be incorporated and would make a considerable difference in the take estimates, but neither well established phenomenon is taken into account.	Thank you for your comment. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2 . It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such a reduction cannot be quantified at this time.
1076-0110	The JASCO Phase I model clearly shows that separation schemes and 'corridors' are most likely not meaningful or used by the animals, and that the effect of such schemes is more likely to increase exposure, especially Level B SEL. We are hopeful that this proposed added mitigation will therefore be removed from consideration.	Thank you for your comment. The Phase I modeling found that, when multiple surveys are to be conducted in close spatial and temporal proximity, the numbers of exposed animals could be adequately assessed by modeling each survey independently rather than combining surveys within a single model run. It does not address the issue of whether the animals benefit from the corridors. In part, this is due to the lack of inclusion of an aversion response because there are no generally accepted metrics on the effectiveness of mitigation. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2 . It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such a reduction cannot be quantified at this time.
1077-0005	BOEM admits the methodology and data set forth in the DPEIS	Thank you for your comment. Throughout this Programmatic

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>are substantially inaccurate and not related to real world conditions:</p> <ol style="list-style-type: none"> 1. "Without a rigorous methodology to do this interpretation, BOEM and other agencies must move forward with an overly conservative scenario equating the number of exposures to the number of 'takes' under the MMPA and ESA. This often produces unrealistically high exposure/take numbers. In this instance, the exposure/take numbers were also modeled without the application of mitigation measures, adding to the unrealistically high exposure/take numbers." (1-21 (emphasis added).) 2. The Model Methodology "creates an estimate of the potential number of animals exposed to the sounds. This estimate alone does not reflect BOEM's determination of the actual expected physical or behavioral impacts to marine mammals but rather an overly conservative upper limit because none of the mitigations examined in this Programmatic EIS were modeled. Biological significance to marine mammals is left to interpretation by the subject-matter experts." (1-16 (emphasis added).) 3. "It is important to note that BOEM and NMFS do not equate every exposure to sound results in 'take' as defined by the MMPA's Section 101(A)(5)(A-D). Therefore, exposure estimates used in this Programmatic EIS are not necessarily the same as a 'take' or an injury to an animal under the MMPA or ESA." (1-19.) 4. "The existing modeling largely does not account for uncertainty in the data inputs and also selects highly conservative data inputs. This bias often produces unrealistically high exposure numbers and 'takes' that exponentially increase uncertainty throughout each step of the modeling. The modeling does not incorporate mitigation or risk reduction measures designed to limit exposure. The modeling is an overestimate and should be viewed with that understanding." (4-47 (emphasis added).) 	<p>EIS, BOEM has clarified the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p> <p>There were some erroneous occurrences of "worst-case" in this Programmatic EIS, and those have been removed.</p> <p>There has been some confusion in this Programmatic EIS regarding terminology using exposure versus take. We have tried to clarify language in this Programmatic EIS to be more consistent in using terminology. "Take" is a specific legal term used in the ESA and MMPA. The estimation of takes of listed species and the evaluation of the effects of an action on ESA-listed species and critical habitat, as well as on marine mammals, are ultimately under the purview of the appropriate services charged with implementation of those statutes (namely, NOAA and FWS). The focus of NEPA, however, is broader. It mandates that Federal agencies, prior to undertaking a major action, identify and analyze potentially significant impacts to the environment from the proposed action and the alternatives and the direct and indirect effects, and to consider the incremental contribution to cumulative effects. The NEPA analysis is to be made available to the public and is to inform the decisionmakers in reaching their ultimate</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>5. "Using the model estimates most often requires accepting a worst-case scenario, which ultimately overestimates the numbers of 'take' under the MMPA by equating those numbers with the exposures identified in the modeling rather than real world conditions." (1-20 (emphasis added).)</p> <p>It is axiomatic that using unrealistic methods and data leads to false conclusions. Based on its own candid admissions, BOEM's methods and data must be rejected as a matter of law. First, BOEM's failure to conduct a cost-benefit analysis or even to consider beneficial effects of existing mitigation measures is arbitrary and capricious. E.g., <i>Friends of the Boundary Waters Wilderness v. Dombeck</i>, 164 F.3d 1115, 1128 (8th Cir. 1999) (EIS must allow a balancing of costs and benefits). Second, NEPA regulations prohibit BOEM's use of admittedly "unrealistic" data; they require BOEM to rely on "high quality" information and "accurate scientific analysis." 40 C.F.R. § 1500.1(b) ("Accurate scientific analysis [is] essential to implementing NEPA."); see also <i>id.</i> § 1502.22 (evaluation must be based upon "credible scientific evidence"). Third, the Council on Environmental Quality concluded long ago that the type of "worst case analysis" BOEM used in the DPEIS is "an unproductive and ineffective method of achieving [NEPA's] goals; one which can breed endless hypothesis and speculation." 51 Fed. Reg. 15,618 (Apr. 25, 1986). The Supreme Court has agreed. <i>Robertson v. Methow Valley Citizens Council</i>, 490 U.S. 332, 354-56 (1989) (confirming that worst case analysis is no longer applicable).</p>	<p>decision.</p> <p>The NEPA analyses are not limited to criteria mandated by other statutes. Therefore, BOEM's analysis is intended to evaluate impacts from the proposed action and alternatives to all relevant resources, regardless of whether it would also be a compliance or consultation trigger under another statute. For these reasons, BOEM has clarified language in this Programmatic EIS to more consistently refer to modeled and quantified <i>exposures</i> to certain sound levels for analyzing impacts. The determination of what qualifies as an individual <i>take</i>, which has a specific legal meaning under the ESA and MMPA, will ultimately be determined by NOAA through its MMPA Incidental Take Authorization development process and when a specific request for authorization for G&G survey activities is received.</p> <p>While in many situations, exposure to certain thresholds of sound may ultimately be confirmed by NOAA as appropriate for estimating incidental take, BOEM has determined that it would be premature to equate those terms at this time. While NOAA's estimate of take is based on specific harassment criteria, the modeling in this Programmatic EIS went further and estimated exposures relative to those thresholds, as well as to other risk assessment schemes available in the literature (e.g., Wood et al., 2012). This approach is reasonable under the circumstances and serves to fully inform the public and decisionmakers of the potential impacts to the resources analyzed, regardless of whether those impacts implicate terms of art under other statutes.</p>
1077-0006	<p>In addition to using admittedly erroneous models and data in the DPEIS, BOEM ignores existing real world observations that directly contradict the model estimates. BOEM's failure to account for real world observations is arbitrary and capricious. For example, and as set forth in more detail in the Associations' comments, BOEM fails to evaluate accumulated observational data collected by Protected Species Observers on survey vessels in the Gulf as part of the DPEIS's effects analysis.</p>	<p>Thank you for your comment. BOEM is committed to complying with the requirements and intent of NEPA in preparing a sound Programmatic EIS based on the best-available scientific information and professional judgment of its subject-matter experts. BOEM has developed this in-depth Programmatic EIS to inform the public and decisionmakers of the potential reasonably foreseeable impacts of the proposed action and the alternatives to ensure that any decision</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>These directly relevant but ignored data show negligible effects on marine species from seismic activities. Indeed, the Associations' comments show BOEM's estimates are wrong not just by orders of magnitude but "10,000 to 100,000 times greater than 'best available data,'" which combined with other errors create exposure estimates that are "millions of times higher than the most likely outcomes" in several instances.</p> <p>BOEM also ignores its own recent admissions that no scientific evidence exists contradicting the real-world observations of negligible impact: To date, there has been no documented scientific evidence of noise from air guns used in geological and geophysical (G&G) seismic activities adversely affecting marine animal populations or coastal communities. This technology has been used for more than 30 years around the world. It is still used in U.S. waters off of the Gulf of Mexico with no known detrimental impact to marine animal populations or to commercial fishing.</p> <p>http://www.boem.gov/BOEM-Science-Note-August-2014/ (Science Note, August 22, 2014) (emphasis added); see also https://www.boem.gov/BOEM-Science-Note-March-2015/ (Science Note, March 9, 2015) (there has been "no documented scientific evidence of noise from air guns used in geological and geophysical (G&G) seismic activities adversely affecting animal populations."). BOEM's failure to account for this evidence is arbitrary and capricious.</p>	<p>regarding G&G activities is fully supported.</p> <p>BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., the inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they are the most credible, science-based information available at this time. The question of implementing mitigation in the modeling was considered at length. There are currently no generally accepted metrics on the effectiveness of mitigation. Therefore, inclusion of a quantification of mitigation effects was not reasonable. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such reduction cannot be quantified at this time.</p> <p>In addition, studies have shown that marine mammals react to underwater noise. Reactions may include physical displacement from or avoidance of the area of ensonification and/or altering their vocalizations. This Programmatic EIS acknowledges that acute physical injury, other than auditory, or death of marine mammals is not likely to be a direct result of seismic noise. It does, however, acknowledge that disruption of behavioral patterns or auditory injury is possible, which may reduce fitness for individual animals. Population-level impacts related to energetic effects or other impacts of noise are difficult to determine. BOEM, however, does not assume that lack of demonstrated adverse population-level effects from seismic surveys means that those effects may not occur.</p>
1091-0001	<p>Sperm whales' unique life history and behavior makes them particularly at risk to injury and behavioral impacts from seismic testing. NOAA's latest abundance estimates find that 763 individual sperm whales exist in the Gulf of Mexico (NOAA, 2015b), while Roberts et al. (2016) generated a density model</p>	<p>Thank you for your comment. The New et al. (2013) paper is an attempt to demonstrate the use of the PCoD model, which is a very data-heavy analysis approach for understanding how individual impacts may result in population-level consequences. While it would be ideal to conduct such an</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>that, when applied to the area, results in an estimate of 2,128 sperm whales in the Gulf of Mexico, which is the number used in NOAA's CetMap. From 2009 to 2013, there were eight strandings of sperm whales in the northern Gulf of Mexico, though the cause has not been determined (NOAA National Marine Mammal Health and Stranding Response Database unpublished data as cited in NOAA SAR 2015b). It is noteworthy that the 763 estimate is substantially lower than NOAA's abundance estimate from 2008, which was 1,665 (NOAA SAR 2008). The estimate decreased from 1665 to 763 after a 2009 survey (i.e., pre-Deep Water Horizon oil spill), and we contend that it is impossible to rule out the role of ongoing seismic surveys in this apparent population decline. The sperm whale is a very long-lived species, and prolonged exposure to noise can indeed, via mechanisms such as chronic stress, impact the reproductive success of mammals. We bring out this point primarily to illustrate the need for population level modeling (e.g., New et al., 2013) to better understand the potential long term consequences of the proposed, prolonged exposure.</p>	<p>analysis for sperm whales in the GOM, the level of available data does not support such an analysis. As the commenter points out that there is still much uncertainty associated with even the most basic of information about sperm whales, for example, how many of them inhabit the GOM.</p> <p>In addition, through the Monitoring Plan (Chapter 1.2.3.4), BOEM will consider future data during the site-specific analyses performed for the individual surveys based on the best available information at that time.</p>
1091-0009	<p>The step functions used in the Draft Programmatic Environmental Impact Statement—180 dB re: 1 µPa or above for Level A Harassment and 160 dB re: 1 µPa for Level B Harassment—have been commonly used over the past decade to assess sound exposure levels to marine mammals. These criteria, however, have not been well tested for marine mammals—particularly for odontocetes—and their efficacy is both poorly understood and controversial (Southall, et al., 2007). In particular, applying these exposure criteria to sperm whales is particularly inadequate. The Miller et al. (2009) experiment on seismic testing and sperm whales in the Gulf of Mexico demonstrates that sperm whales exhibited signs of possible behavioral response at ranges lower than the commonly employed Level B take levels (160 dB re: 1 µPa), as the sample group (n=8) were exposed to sound pressure levels of 152-162 dB peak-peak re: 1 µPa. Furthermore, though sperm whales are classified as mid-frequency specialists (150 to 160 kHz), they range on the lower spectrum of that range (NOAA, 2016). The National Marine Fisheries Service notes in</p>	<p>Thank you for your comment. BOEM agrees that behavioral response is not a well understood topic. There are many examples of such responses occurring at levels both above and below the current 160-dB threshold. However, it is worth pointing out that the SPL metric for behavior responses is not adjusted by the hearing-group specific hearing/filtering functions. Therefore, the categorization of sperm whales does not affect the modeling of behavioral response.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>their recent report, "Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing," that they considered classifying sperm whales separately from other mid-frequency cetaceans, but that not enough data exists to make this classification (NOAA, 2016). Given the little information known about sperm whales' hearing range, their apparently decreasing numbers, criticisms of the step function in general, and the likely violation of the cumulative exposure criteria, precaution should be applied vigorously to protecting sperm whales from acoustic impacts.</p>	
1130-0019	<p>NOAA disagrees that the PEIS analysis is based on the "upper limit" of potential marine mammal exposures to sound produced by G&G activities. The PEIS provides no reasonable justification as to why the exposure estimates described in Appendix D should be considered as "conservative upper limits", represent an "overestimate", or are "unrealistically high." Appendix D does not appear to quantitatively consider uncertainty or variation in major modeling input parameters in a way that provides confidence intervals around the given exposure estimates and, therefore, upper or lower limits of exposure. NOAA believes that the exposure estimates represent a conservative but reasonable best estimate. Therefore, BOEM must remove reference to "upper limits" or provide a more thoroughly reasoned justification for this contention. Reference: Executive Summary, pg xix; Chapter 1, pg 1-16, 1-21; Chapter 4, pg 4-15, 4-47, 4-59, 4-60.</p>	<p>Thank you for your comment. There were some erroneous occurrences of "worst-case," "upper limit," and other similar language in this Programmatic EIS, and those have been removed. BOEM has clarified throughout this Programmatic EIS the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the results of the modeling may be conservative, they do remain the most credible, scientific-based information available at this time.</p> <p>In addition, the impact conclusions are a synthesis of a variety of qualitative and quantitative available scientific information. The impact analysis considered the modeling results in conjunction with subject-matter expert review of scientifically credible information using accepted approaches and research methods. While this analysis required some professional judgement by the subject-matter experts, the resulting impact conclusions remain credible in light of the available scientific record. Though mitigation could be not considered directly in the modeling effort, it is incorporated in the interpretation of the modeling results in the impact analysis presented in Chapter 4.2. It is reasonable to conclude that the proposed mitigation measures would likely reduce the potential impacts to marine mammals, though the amount of such a reduction cannot be quantified at this time.</p>
1130-0020	<p>BOEM apparently believes that the exposure modeling is conservative in large part because the modeling did not quantify</p>	<p>Thank you for your comment. Chapters 1.2.5 and 4 have been revised to address this comment.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>the effects of “19 different mitigations.” NOAA notes that, of these 19 mitigations, some are not applicable to marine mammals (e.g., “Avoidance of Historic and Prehistoric Sites”). Of greater importance is that the majority of the remaining mitigation measures are not designed to reduce exposures, but rather to reduce the intensity of exposures, thereby reducing the assumed level of potential consequences to individual marine mammals, but having little to no effect on the overall number of actual exposures. If BOEM intends to invoke mitigation measures as a reason why the estimated exposure numbers are “conservative upper limits” or overestimates, it must provide a more detailed description of how and to what degree it assumes the analyzed mitigation measures would reduce the actual number of marine mammal exposures to levels of sound exceeding harassment thresholds. As noted in Section 4.2.4.1.2, “survey mitigation measures are not likely to eliminate or significantly reduce behavioral responses.” Reference: Chapter 1, Section 1.2.5, pgs 1-16, “Model Methodology” and “Model Limitations”, 1-19, 1-21; Chapter 4, pg 4-14, 4-15, 4-16, 4-47, 4-48.</p>	
1130-0021	<p>NOAA disagrees that “each of the inputs into the models is purposely developed to be conservative.” Although it may be correct that conservativeness accumulates throughout the analysis, BOEM has not adequately described the nature of conservativeness associated with model inputs or to what degree (either quantitatively or qualitatively) such conservativeness “accumulates.” While exposure modeling is inherently complex, complexity does not inherently result in overestimation of exposures. NOAA feels these statements are misleading and must be removed or better supported.</p> <p>Overall, it appears that BOEM’s intention is to qualify the exposure estimates in a way that calls into question their usefulness with regard to the analyses presented in the PEIS. NOAA strongly disagrees that the exposure estimates are “overly conservative,” are “upper limits,” or that these estimates are in some way differentiated from what might actually be expected to occur. However, if BOEM does believe there is</p>	<p>Thank you for your comment. There were some erroneous occurrences of “worst case” in Appendix D, and they have been removed. Throughout Appendix D, BOEM clarified the assumptions and scenarios used in the modeling, as well as the limitations that may be inherent in any modeling effort (e.g., inability to account for mitigation measures and aversion). While the modeling results may be conservative, they are the most credible, science-based information available at this time.</p> <p>New text was added to Chapter 1.2.5 to further clarify modeled estimates.</p>

Table M-19. Acoustic Propagation and Exposure Modeling Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>some differentiation between the exposure estimates and what would reasonably be expected to occur in the real world on the basis of the activity scenarios presented in the PEIS, NOAA suggests that proper context could be provided by answering the following questions regarding the conservativeness of model inputs: (1) for the selection of model input parameter values, why was a given choice made relative to other available choices, if the selected value is in fact “conservative”?; (2) what is the approximate expected impact of this choice on the modeling results (i.e., would it be expected to have roughly a low, medium, or high degree of effect on the results of the modeling exercise)?; and (3) what type of exposure effect would the selection of a “conservative” value for a particular input have relevance for (e.g., behavioral harassment, injury)?</p> <p>In addition, BOEM could provide context by discussing the likelihood that the number of individual animals exposed to noise may be overestimated, as these estimated exposures likely represent repeated exposures of some individuals on subsequent days. Appendix D contains a potentially useful test case investigation, which BOEM and NMFS specifically worked to develop, that may help us to address this specific issue. Reference: Chapter 1, Section 1.2.6, pg 1-19; Chapter 4, pg 4-14, 4-15, 4-47, 4-50.</p>	

M.4.17 Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K)

Comments asserted that assumptions used in the cumulative and chronic analysis were not valid, and suggested that parameters and assumptions be adjusted and impacts be re-evaluated. Comments further identified additional sources of cumulative noise, ongoing studies of ocean noise, and consistency with recent studies on marine mammal responses. Conversely, other comments contended that the analysis contained novel concepts that have no scientific precedence and are not peer reviewed. Comments further asserted that, due to the omission of recent literature and the utilization of incomplete and overly conservative assumptions, **Appendix K** is not consistent with best available science and not meaningful to regulatory decisionmaking. Comments indicated that the results and discussion of **Appendix K** were not incorporated into the impact analysis in **Chapter 4** of this Programmatic EIS. Detailed responses to specific comments are provided in **Table M-20**.

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses

Submission ID	Comment	Response
Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K)		
0343-0008	<p>As indicated herein, Appendix K delved into the loss in listening area and change in communication space primarily for Bryde's whales that are likely to result from the proposed activities. However, section 2.3.2 in Appendix K indicated that the top 10 percent of the greatest pulse exposures were removed from those analyses. Given that SELcum exposures are dominated by the source pulses generated closest to the receiver from spatially distributed and moving sound sources, inclusion of those pulses in a chronic effects assessment during a one-year period was considered unrepresentative and more relevant for assessing acute effects. The Commission is not convinced that that is a valid assumption and suspects those pulses would not be filtered out by the animal receiving them. Thus, those pulses invariably would contribute to the overall reduction in listening area and communication space. It also would be helpful to be able to compare the full dataset with the reduced dataset to distinguish how much those 'acute' effects add to the overall chronic exposure of the animal. Therefore, the Commission recommends that BOEM re-estimate the various listening area and communication space parameters based on the entire dataset rather than removing the greatest 10 percent of pulse exposures.</p>	<p>The attempt with this modeling exercise was to create a tool that could help evaluate loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. Masking realized by individual calling and receiving animals due to noise at relatively close proximity to a single intermittent source is an important but limited evaluation of the real-world contexts within which populations of marine mammals and other animals are exposed to noise from multiple seismic surveys in a region like the Gulf of Mexico. This modeling sought to account for the known attributes of airgun noise, by which low-frequency energy lost laterally attenuates over large spatial scales with loss of impulsive features, leading to elevated background noise conditions, particularly when multiple surveys are concurrent with an acoustic region. Close range pulse energy would entirely drown out such evaluation and would not account for the different acoustic characteristics of the signal and potential masking at such scales. Thus, while masking of specific signals relative to the near-field of operating air gun arrays does need evaluation, there are concerns with considering such effects with the modeling approach presented here.</p> <p>BOEM and NOAA concur that the methods applied here are imperfect in categorizing exposure implications for animals close to the modeling locations as "acute" and in dominating evaluation of injury and behavioral disruption as separate and separable from loss of hearing opportunities experienced by animals farther from source locations.</p>
0343-0009	<p>In addition, BOEM indicated that the chronic effects assessment was intended to ensure consideration of the longer-term and wider-ranging noise effects from the various sources and to augment the more traditional analysis of acute effects (i.e., Level A and B harassment). However, beyond presenting the results and the various associated caveats in section 4.14 of the DPEIS, BOEM has not fully described what, if anything, it plans to do with the</p>	<p>This Final Programmatic EIS has incorporated Appendix K into Chapter 4.2. The purpose of Appendix K was to create a tool that could help evaluate loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. Bryde's whale was modeled specifically as it is a low-frequency cetacean and has shown through exposure models to be sensitive</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>results of that assessment. The Commission believes the chronic effects assessment should inform BOEM's selection of a preferred Alternative. More specifically, given that take estimates for sperm whales are in some cases two orders of magnitude greater than for Bryde's whales, it would be prudent to investigate the sperm whale's communication space as well.</p> <p>That analysis should incorporate the assumption that the acoustic field produced by airguns above 1 kHz is stochastic and thus the airgun array is effectively omnidirectional. For certain locations, such as sites 5 and 6 where sperm whales are known to occur in greater numbers and which have reasonably flat bathymetries, a normal mode or BELLHOP model could be used to analyze the data much more quickly than using the full 3-D parabolic equation-based model, particularly as the higher-frequencies and lower effective source levels involved reduce the effective propagation range of concern. Other alternatives that have yet to be formalized could be analyzed in a similar manner.</p> <p>Thus, the Commission recommends that BOEM assess the communication space parameters for sperm whales under the various alternatives and any new alternatives to inform its selection of a Preferred Alternative. A substantial portion of this analysis can be performed with simplified (and much more rapid) acoustic modeling by focusing on regions with relatively flat bathymetry. The Commission also notes that incorporating figures for selected sites and functional hearing groups would allow the analysis to be more comprehensible than using the current multitude of tables.</p>	<p>to the sound generated from airgun surveys.</p>
1067-0002	<p>These harms do not occur on a blank slate. These whales and the Gulf's marine mammals have already been paying the price for poor regulation of offshore oil and gas development. The Deepwater Horizon explosion occurred in the Mississippi Canyon, a nursery for sperm whales and the heart of their habitat. The Gulf's iconic coastal bottlenose dolphins have suffered a five-year die-off, with</p>	<p>Appendix K, which has been incorporated into Chapter 4.2, estimates chronic and cumulative effects on marine mammals and specifically on Bryde's whale communication area. These estimates are based on airgun survey, other OCS activity, and ambient noise.</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>poor health outcomes and numerous stillbirths in the spill zone. The Gulf's Bryde's whale--one of the most endangered populations of whales on the planet--may already have lost much of their canyon habitat due to seismic blasting. As the draft analysis indicates, these populations cannot survive another decade of continued damage from this kind of activity.</p>	
1074-0004	<p>To make matters worse, all of these surveys are taking place in a context of chronic industrial noise: noise from the industry's support vessels, from its construction of offshore facilities, from its routine operations, and from its platform decommissioning....</p> <p>Many of the marine mammal populations that seismic operators are affecting—Bryde's whales, sperm whales, and coastal and near-coastal bottlenose dolphins, among others—may already be seriously compromised by the Deepwater Horizon spill.</p>	<p>Appendix K, which has been incorporated into Chapter 4.2, estimates chronic and cumulative effects on marine mammals and specifically on Bryde's whale communication area. These estimates are based on airgun survey, other OCS activity, and ambient noise.</p> <p>The baseline for resources in this Programmatic EIS includes the best available information for that resource and its current state.</p>
1074-0009	<p>...it is evident that management must focus in substantial part on reducing acoustic disturbance and acoustic habitat degradation for certain Gulf populations, whose conservation status, sensitivity to anthropogenic noise, and/or susceptibility to Macondo spill effects make them particularly vulnerable. NOAA's new Ocean Noise Strategy prioritizes management aimed at reducing cumulative and chronic impacts, such as area closures, activity reduction, and the promotion and adoption of noise-quieting technology.² And this approach is echoed in the last several years of scientific and policy literature on ocean noise, including seismic surveys, part of what one NOAA scientist identified as "a shift underway to focus on more ecologically relevant spatial and temporal scales."³ There are few parts of the world more in need of a paradigm shift in underwater noise management than the Gulf of Mexico.</p>	<p>Thank you for your comment. This Programmatic EIS has been revised to include the 2016 Technical Guidance issued by NMFS. The updated modeling results using this guidance are included in Appendix N, and the chronic and cumulative model information is included in Appendix K. This represents the best-available scientific information and criteria issued by NOAA.</p>
1074-0063	<p>Our organizations appreciate the agencies' work in Appendix K on communication space and listening area, which represents a significant advance over the analyses prepared in other federal environmental compliance</p>	<p>This Final Programmatic EIS has incorporated Appendix K into Chapter 4.2. Appendix K was created as a tool that could help evaluate loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>documents for seismic exploration. It must be recognized that work is limited, particularly with respect to species other than the Bryde's whale, and has not been integrated into the DEIS' impacts and alternatives analysis. To this end, we offer the following observations:</p> <p>First, we agree with the Marine Mammal Commission that the agencies should expand their communication space analysis to sperm whales. Take estimates for sperm whales are remarkably high for their numbers: 760,000 instances of harassment, applying NMFS' outdated 160 dB standard (see DEIS at D-287 to D-367), compared to a population size currently estimated at 763 individuals.¹⁰⁹ As the Commission gently observes, it would therefore "be prudent to investigate the sperm whale's communication space as well."¹¹⁰ In doing so, we recommend that the agencies consider sperm whale vocalizations of various frequencies, keeping in mind that sperm whales, on the basis of their anatomy and sound production, defy easy placement within the category of mid-frequency cetacean, as noted above, and regularly produce sounds from 200 Hz to 32 kHz.¹¹¹ Notably, recordings of two neonate sperm whales showed vocalizations with centroid frequencies of 300-1,000 Hz and 500-1,700 Hz for clicks, and 200-700 Hz for grunts, indicating low-frequency sensitivity.¹¹²</p> <p>Second, we recommend that the agencies analyze survey density scenarios beyond the one examined in Appendix K. The newly released 2017-22 OCS Program takes a different approach to Gulf of Mexico leasing than we have seen in past years, allowing companies to bid on any lease block not presently barred, until 2022, by Congressional moratorium, rather than bid within defined sale areas. This change in policy could result, for example, in substantially more proposed survey effort in Appendix K's activity zone 6, which presumably would increase chronic seismic airgun noise in Bryde's whale habitat. See DEIS at K-42. Moreover, the Congressional moratorium itself will expire in</p>	<p>of a wide variety of regional animals. Bryde's whale was modeled specifically as it is a low-frequency cetacean and has shown through exposure models to be sensitive to the sound generated from airgun surveys.</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>2022—well within the life of the present EIS—and, if left unrenewed, could substantially increase G&G activity in zone 5, again threatening Bryde’s whale habitat. See id. Finally, the incoming administration, given its stated priorities, could encourage offshore oil and gas production, increasing activity across the northern Gulf.</p> <p>Third, the modeling results in Appendix K are consistent with a suggestion made by Rosel and Wilcox (2014), in their paper on evolutionary divergence in Gulf Bryde’s whales. Following Reeves et al. (2011), the authors observe that whaling logbooks support a wider distribution of Bryde’s whales than we see today, with considerable numbers of whale records reported to the south and west of the Mississippi River Delta, and state that habitat disruption from energy exploration and production in those areas may have led to a contraction of habitat: “the abandonment of the northwestern [Gulf of Mexico] by Bryde’s whales.”¹¹³ Interestingly, the remarkably shallow waters currently occupied by that population along the upper slope of De Soto Canyon were modeled as virtually free of industrial noise, given the particular bathymetry of the area and the low incidence of oil and gas exploration activity to the north (zone 5) and south (zone 6), whereas sites to the west were substantially degraded. DEIS at K-33.</p> <p>The possibility that oil and gas activity has already caused or contributed to a substantial contraction of the range of a critically endangered baleen whale population must be considered. Bryde’s whale vocalization, modeled with a source level of 152 dB in 100 Hz 1/3-octave band, makes them extremely vulnerable to loss of communication space from seismic exploration, much as, according to the best available models, shipping has an outsized effect on right whale communication space.</p>	
1074-0066	...the DEIS has made a point of considering the effects of other past, current, and reasonably foreseeable activities apart from the proposed action. DEIS at 4-77. Doing so is	Potential impacts from G&G activities are included in the cumulative analysis; their potential effects are added to other Federal and non-Federal actions within the northern Gulf of

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>all the more inappropriate given that seismic exploration may act as a growth inducer, leading to OCS development activities such as construction, machinery and infrastructure operations, vessel movement, acoustic communications, and explosive platform removal, all of which add to the cumulative effects of industrial activity in the Gulf.</p> <p>Numerous studies associate vessel noise and vessel movement with behavioral effects, physiological stress response, and masking in cetaceans,¹¹⁸ and, over time, the disruption of normal foraging and communication behaviors may have important long-term population-level effects.¹¹⁹ Significant effects, such as habitat displacement, loss of anti-predator response, and chronic stress, have been documented in a variety of fish and invertebrates. The agencies must consider the cumulative effects of vessel noise and other stressors together with those of the proposed action.</p>	<p>Mexico OCS and are analyzed in a revised cumulative analysis sections in this Final Programmatic EIS. Further, many of these impacts are outside the scope of this Programmatic EIS but are analyzed in detail in BOEM's 2017-2022 GOM Multisale EIS.</p>
1076-0076	<p>Appendix K contains novel concepts that are inconsistent with a substantial amount of scientific literature addressing the topics of hearing masking and chronic effects of sound. For example, Appendix K presents new concepts, such as "lost listening area," which have no scientific precedent. Additionally, Appendix K introduces novel risk metrics like annual cumulative SEL and equivalent continuous sound level ("Leq") that are not biologically realistic concepts (pages K-22 and K-24), and other ideas that have no apparent basis, such as the Cumulative and Chronic Exposure metric (page K-10). Equally concerning, the novel analysis in Appendix K is introduced, for this first time, without any serious peer-review or expert evaluation.</p>	<p>The concept of a listening area has been published in peer-reviewed literature and applied in impact assessment contexts in terrestrial resource management (refer to the references in Appendix K).</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
1076-0077	<p>Appendix K presents a hypothetical analysis of “lost communication space” for Bryde’s whales (pages K-32 to K-41) without any evidence to support an actual (not hypothetical) baseline for this or any related species. Communication space is considered to be the maximum detectable range of a sound, which far exceeds the actual communication space for any species, terrestrial or marine. Another omission in Appendix K is the lack of reference to a recent and very thorough review of the subject of hearing masking (Erbe et al. 2015). Instead, Appendix K primarily references Clark et al. (2009) for masking, even though it has been demonstrated to be an incomplete model that overestimates the risk of masking.</p>	<p>Communication space is defined for this modeling exercise in Appendix K, Section 2.6 and is supported with accepted peer-reviewed literature. The baseline levels for the model are also supported by the best available scientific data.</p>
1076-0078	<p>In addition, the Appendix K analysis is based on assumptions about hearing and hearing masking that are clearly incomplete and overly conservative, such as assuming that the animal requires signal excess of 10 dB to detect a conspecific call (page K-17), when the standard in the literature is detection at -3 to -6 dB below ambient. Appendix K treats received sound as being the same at all depths (2D “disk” model of masking, page K-17), and no directional release from masking is provided? not because the animals cannot use the 3 to 12 dB of gain they get from directionality, but because the analysis suggests that the survey tracks are “randomly oriented” (page K-19). This inability to determine the angular resolution between receiver, conspecific caller, and the seismic source is puzzling because the Phase I and Phase II exposure models provide very specific direction-dependent transmission loss model data and are dynamic 4D models that should easily yield the necessary information to insert spatial release from masking in the communication space equation. Instead, a generic “signal processing gain” term is used to account for the various features of a signal that enable the receiver to pick it out of sound. Finally, Appendix K uses an unrealistic and simplistic formula (Sirovic et al. 2014) for determining the bandwidth of the signal (to the human, not the whale listener) and call length</p>	<p>The use of 10 dB is discussed in Clark et al. (2009) relative to the broader evaluation of communication space loss at habitat scales.</p> <p>While a model evaluating masking potential over a wide variety of ranges from an individual airgun pulse to individual Bryde’s whales could incorporate information regarding directionality and to investigate the time-space contexts in which signal transmission could be improved by mechanisms acting on the signaler or receiver, this is not the focus of this examination of masking. BOEM and NOAA were interested in evaluating a more cumulative nature of low-frequency, long-distance propagating relatively low-intensity energy from multiple seismic surveys operating concurrently in a region. The purpose of Appendix K was to create a tool that could help evaluate loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals.</p> <p>Given the focus on this scale and the noise source in question, loss of the ability to detect lower-frequency signals in different regions of the GOM were examined. However, more pointed examination of masking implications for conspecific Bryde’s or sperm whales communicating in close proximity to seismic surveys are necessary, and could, as the comment discusses, build on the modeling completed for take evaluation.</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	(without redundance or signal variance and periodicity), ignoring substantial literature on this topic for humans and other species (page K-20).	
1076-0079	Appendix K is premature, inappropriate, and not consistent with the best available science. Moreover, its relevance to the DPEIS is not explained by BOEM. Because of its many defects, Appendix K should be removed from the DPEIS.	The purpose of Appendix K was to create a tool that could help evaluate the loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. This is one part of the vast amount of the best available information that subject-matter experts used to analyze proposed activities and cumulative impacts on various resources.
1076-0111	This is a novel and poorly supported idea within the research community and is not well enough developed or supported by data to be treated as a meaningful regulatory concept.	The purpose of Appendix K was to create a tool that could help evaluate the loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. This is one part of the vast amount of the best available information that subject-matter experts used to analyze proposed activities and cumulative impacts on various resources.
1076-0112	No formula or rationale for use of Leq is provided. Leq is not used in the rest of the PEIS. Introduction of a new, unjustified metric is not warranted.	The purpose of Appendix K was to create a tool that could help evaluate the loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. This is one part of the vast amount of the best available information that subject-matter experts used to analyze proposed activities and cumulative impacts on various resources.
1076-0113	This is a novel and scientifically controversial idea; it is not mature enough for regulatory application. A DPEIS is not the place to introduce a radically different concept for UW sound regulation: this should be further developed and vetted as a policy or regulatory rule-making on its own before it is considered solid enough for regulatory application.	The purpose of Appendix K was to create a tool that could help evaluate the loss of ability to detect signals of biological importance over spatial scales relevant to the sources and hearing capabilities of a wide variety of regional animals. This is one part of the vast amount of the best available information that subject-matter experts used to analyze proposed activities and cumulative impacts on various resources.
1076-0114	This is not an accepted ISO or ANSI standard, and for good reason. Concepts of hearing recovery, effective quiet and other basic hearing phenomenon would need to be considered and are not, leading to absurd expressions of acoustic energy "accumulation" that are biologically impossible and biologically meaningless even if possible.	The methods used here for accumulating energy from seismic surveys over space and time are conservative in that they exclude contributions made by pulses in closest proximity to the modeling locations. As such, they attempt to examine the portion of low-frequency acoustic energy lost from seismic surveys that has been empirically measured in many contexts around the world to

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
		<p>generate higher chronic, longer-term average noise levels. Animals that lose hearing permanently are more likely to be vulnerable to masking over large spatial scales. Additionally, repeated temporary hearing loss would increase vulnerability to masking over time. As such, opportunities for recovery and spatial release from masking are important to evaluate relative both to animals experiencing higher levels of exposure and those that are not “taken” but inhabit regional zones with chronically inflated background levels.</p>
1095-0002	<p>The cumulative injury to both individual animals and their Gulf populations is tremendous, gratuitous, and vastly disproportionate to any economic value of hydrocarbon protection.</p>	<p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility, economic viability, environmental impacts, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. Further, potential impacts from G&G activities are included in the cumulative analysis (including the modeling done in Appendix K); their potential effects are added to other Federal and non-Federal actions within the northern Gulf of Mexico OCS and are analyzed in the revised cumulative analysis chapter of this Final Programmatic EIS.</p>
1095-0005	<p>...the context for this assault is an already deeply compromised Gulf ecosystem, already imperiled by climate change, oil spills, and overfishing. There exists no excess margin, in this Gulf ecosystem, of geographic space, prey fish, or individual cetacean health that BOEM may exploit without serious harm to the animals that you are legally and morally obligated to respect.</p>	<p>BOEM and NOAA developed the alternatives and mitigations in this Programmatic EIS based on technical feasibility, economic viability, environmental impacts, and other factors, and consider them a reasonable range of alternatives for NEPA analysis. Further, potential impacts from G&G activities are included in the cumulative analysis (including the modeling done in Appendix K); their potential effects are added to other Federal and non-Federal actions within the northern Gulf of Mexico OCS and are analyzed in the revised cumulative analysis chapters in this Final Programmatic EIS. BOEM is also mandated by the OCSLA to expeditiously and orderly develop, subject to environmental safeguards, energy and mineral resources on the OCS.</p>
1130-0008	<p>It is not appropriate to call out the chronic and cumulative effects analysis (CCE; Appendix K) in a way that implies it is solely NOAA’s or NMFS’s product or that its purpose is solely in support of BOEM’s MMPA petition for incidental take regulations. The entirety of the PEIS is the product of the lead as well as the cooperating agencies, and the CCE was developed primarily in support of analysis relating to</p>	<p>This Final Programmatic EIS has incorporated Appendix K into Chapter 4.2.</p>

Table M-20. Cumulative and Chronic Effects in the Gulf of Mexico (Appendix K) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>provisions IX(A)(2) and IX(B) of the Settlement Agreement (Appendix C) (“...agree to analyze...mechanisms to reduce cumulative or chronic exposure of marine mammals to noise...” and “agree to analyze...development of a...plan that addresses potential cumulative and chronic impacts...”). Further, the CCE may be used in support of any necessary ESA or NMSA consultations, in addition to being used in support of BOEM’s MMPA petition. Reference: Chapter 4, Section 4.14, Page 4-405.</p> <p>Of greater importance, however, is that the CCE is not effectively integrated into the analyses presented in the PEIS (aside from Section 4.14, there is only brief reference to Appendix K on pgs 4-59 and 4-60) and the results/predictions are not discussed at all within assessments of cumulative impact per alternative/resource. We understand that this was of necessity due to time constraints; however, NOAA feels it is important to better integrate the CCE results and will appreciate the opportunity to work with BOEM to accomplish that.</p>	

M.4.18 Panel Reports (Appendix L)

BOEM received several comments regarding the lowest practicable source standard. These comments included disagreement with the Panel Report conclusion that determining a standard was not feasible and requesting that assumptions be re-evaluated. Several of the comments offered suggestions regarding how to accomplish determining this standard, such as requiring operators to justify and demonstrate the need for the selected source size or having industry measure and report the horizontal sound leakage of their airguns and then investigate options to minimize it. Once these data are obtained and analyzed, it could allow BOEM to set a threshold. One comment suggested that this topic be elevated for consideration by the National Academy of Sciences.

Several comments indicated that the definition of duplicative survey standards be clarified and refined while others indicated that the definition should be consistent with the Amended Settlement Agreement. Detailed responses to specific comments are provided in **Table M-21**.

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses

Submission ID	Comment	Response
Panel Reports (Appendix L)		
0343-0010	<p>As part of the June 2013 settlement, BOEM enlisted an expert panel to investigate the use of LPSL to both acquire the necessary subsurface target data and minimize horizontal propagation of sound that may affect marine mammals. Given the complexity of seismic surveys, the panel determined that it would not be reasonable or practicable to develop such metrics. Essentially, there is no one-size-fits-all survey design. Commission agrees that LPSL is not feasible but believes that a better criterion than LPSL may involve determining how much acoustic energy is ‘wasted’— that is, how much energy radiates laterally⁹ instead of penetrating the ocean floor. Instead of implementing a prescriptive restriction on seismic surveys, a more reasonable regulatory approach may be to require industry operators to measure and report the horizontal leakage of the various array configurations by analyzing the ratio of the sound intensity directly below the array to the intensity at the critical angle¹⁰, essentially a ‘waste ratio’. Basic array theory suggests that there are a variety of ways to reduce this horizontal ‘sidelobe’ leakage below 200 Hz, which includes increasing the number of towed strings (while reducing the volume of individual airguns) and shortening the spacing between the airguns. Further, if airguns could be designed to have more reproducible signatures above 500 Hz, the horizontal leakage also might be reduced. The Commission recommends that BOEM require industry operators to measure and report the horizontal leakage of their various airgun arrays and investigate options to minimize horizontal sound leakage from those array configurations. Once sufficient data are obtained to inform a baseline distribution of the waste ratios, BOEM could set a threshold¹¹ for the operators to meet based on the median of those ratios.</p>	<p>Thank you for your comment. BOEM agrees that ways of reducing horizontal propagation is something to consider. The issue of horizontal propagation, however, is outside the scope of the LPSL panel. It is important to note that operators are currently required to confirm through the permitting process that the airgun arrays used have been calibrated/tuned to maximize subsurface illumination and minimize, to the extent practicable, horizontal propagation of noise.</p>
1074-0015	<p>BOEM should revisit its “lowest practicable source level” standard, to establish a process whereby the operator determines the minimum optimal source level, or, relatedly, the minimum field effort, necessary to image the survey target through vertical propagation. Such analyses are performed by</p>	<p>Appendix L, Section 1 provides the Lowest Practicable Sound Source Panel Report.</p>

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	operators of land-based seismic surveys.	
1074-0016	BOEM, in developing its “duplicative survey” standard, should clarify aspects of its panel’s duplicative survey definition that could narrow the standard to the point of inutility.	The definition provided in the LPSL report was a composite definition agreed upon by the panel members after a robust discussion.
1074-0038	<p>BOEM was required, as a condition of the NRDC v. Jewell settlement agreement, to determine the feasibility of developing a “lowest practicable source level” standard for deep-penetration seismic surveys. If such a standard were deemed feasible, the agency was required to “include and evaluate such standards” in the DEIS; if not, BOEM was required to include its rationale for public comment. Settlement Agreement § VIII.A. BOEM’s determination, set forth in the DEIS at Appendix L, that such standards are not feasible is misguided as it misapprehends the operative question—and we urge the agency to reconsider it.</p> <p>BOEM appears to reach its conclusion by making a number of artificially limiting misassumptions about the “lowest practicable source level” standard. Notably, it seems to assume that the objective of the standard is to reduce direct horizontal propagation from the seismic array while leaving vertical propagation otherwise undisturbed. Thus it finds that any modification “to achieve reduced lateral propagation will be difficult and will most certainly reduce image quality,” as such a modification would interfere with an array design optimized to support vertical propagation (DEIS at L-10). But this statement of the objective presumes that the seismic operator has already chosen the minimum optimal source level necessary to achieve her vertical imaging goals—a presumption that the agency makes no attempt to verify.⁶⁴</p> <p>Additionally, BOEM seems to assume that ostensibly small reductions in source level, such as 3 or 6 dB (SPL), would not achieve a biologically significant attenuation of the sound field (DEIS at L-5). But this ignores that even small numerical declines in sound pressure levels, as measured in decibels, can make a significant difference in acoustic propagation, given the logarithmic nature of the decibel scale. The question BOEM</p>	<p>As part of their good faith efforts to comply with the Settlement Agreement, the panel members met on numerous occasions to discuss whether lowest practicable sound source criteria could be reasonably developed. The panel members represented differing expertise and viewpoints. Ultimately, the panel determined that such criteria were not feasible for a number of reasons. While these reasons are more fully discussed in Appendix L, some of the reasons include operator specific data needs, the proprietary nature of airgun arrays, existing survey limitations that weigh in favor of appropriately calibrated sound sources over larger sources (e.g., sound distortion and cancellation), and the great variability in water and geological characteristics that impact both sound propagation and imaging effectiveness. The panel considered generally whether it was prudent for BOEM to attempt to prescribe lowest practicable sound sources over the described data needs of the operator. This was found to not be feasible, given that the risk of an operator not obtaining the needed data compared with having to perform a duplicative survey to fill in data gaps or reshoot an entire survey. This, among other reasons, is why field testing for lowest practicable sound source was not found by the panel to be reasonable, although it might be useful for horizontal propagation analyses for exclusion zones. Ultimately, the risk of an ineffective survey may be more harmful to the environment.</p> <p>In theory, many of the proposed approaches are feasible on a small scale or in a land-based survey; however, as a general approach, each of these techniques has a potential to significantly increase the duration of the survey, the number of shots transmitted, the cost of the operation, and the potential overall impact to the marine environment. For example, the land-based surveys all have sources on the Earth’s surface as</p>

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>should have considered—and the one that a “lowest practicable source level” should be designed to address—is whether the operator has selected the minimum optimal source level, or, relatedly, the minimum field effort, necessary to image the survey target through vertical propagation. Such analysis has been done at least for land-based seismic surveys.⁶⁵ For in-water seismic, it could be undertaken in several ways: by using existing seismic data to perform signal strength testing (i.e., decimating common depth point stacks particularly in what are expected to be poor signal areas and then performing signal strength analysis), by modeling expected geology with various source strengths, and/or, perhaps most usefully, by field testing (i.e., acquiring selected lines over both good and poor expected signal areas using highest sampling and largest source strength, and then decimating common depth point stacks and performing signal strength analysis using on-board processing). It may be that seismic operators are already universally following such protocols for all their surveys in the Gulf of Mexico, but that is by no means certain—and is certainly not currently required. If they are not, some number of seismic companies may well be choosing source designs that produce a greater seismic signal than is strictly necessary to accomplish their objectives. BOEM must consider a standard that would require such an analysis and selection of the minimum optimal seismic source level.</p>	<p>opposed to ocean surveys where the depth of the ocean itself, and the ocean’s propagation characteristics can further complicate the uncertainty and variability of the minimum required sound signal over relatively short distances.</p>
1074-0040	<p>We appreciate the analysis presented by BOEM’s panel at Appendix L, and make the following comments and recommendations.</p> <p>(1) The DEIS panel report defines a duplicative seismic survey as one “whose acquisition parameters, design, technology, and geospatial surface location metrics make it essentially the same as an existing seismic survey.” DEIS at L-14. While the operative standard (“essentially the same”) is somewhat vague, the use of the strong word “same,” together with the inclusion of a large number of metrics (see DEIS at L-37 to L-38), enables an interpretation that would overlook duplication except in the highly unlikely case of a nearly identical survey, with the</p>	<p>BOEM concluded that the definition of a duplicative survey provided in the panel report is reasonable given the number and complexity of survey parameters. The panel results assume a knowledgeable person reviewing the parameters in a reasonable manner.</p> <p>In response to points (4) and (5), BOEM developed the alternatives (included the programmatic mitigation measures) in this Programmatic EIS based on technical feasibility, economic viability, and other factors, and considers them to be a reasonable range of alternatives for NEPA analysis. This Programmatic EIS establishes a framework for BOEM and NOAA for subsequent environmental documents related to</p>

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>identical number of streamers, channels, streamer depth, and so on. A more reasonable definition would find duplication where a survey shares a similar geospatial location and similar objectives as another survey from the same “generation” of seismic imaging. BOEM needs to make clear, in advancing the standard, that surveys of the same generation need not be nearly identical to be considered duplicative.</p> <p>(2) The proposed definition of a “duplicative survey” may imply that the survey must be wholly redundant of another survey to be considered duplicative. DEIS at L-14 (defining a duplicative survey as one whose relevant parameters and metrics “make it essentially the same as an existing seismic survey”). If so, the definition would not include deep-penetration seismic surveys that are duplicative in part of another survey or surveys. As the Settlement Agreement in NRDC v. Jewell recognizes, an analysis should consider “the geographic area of the proposed survey or parts thereof” (Settlement Agreement § 4.A), and a failure to do so would not minimize or prevent unnecessary environmental impacts, particularly but not exclusively in cases of larger-area surveys.</p> <p>The panel report does suggest that consideration of the “geospatial location” of a proposed survey should take into account “overlap with current datasets and the extent of that overlap” (DEIS at L-37), but any definition adopted by BOEM should still clarify that a survey may be considered duplicative in whole or in part.</p> <p>(3) The proposed definition of a “duplicative survey” states that the survey must be redundant of an “existing seismic survey” to be considered duplicative. DEIS at L-14. This language might be interpreted to include only completed, not proposed or pending, seismic surveys—a potentially significant omission given the two years that may elapse between a permit application and permitting and completion of the survey and the potential for multiple company interest in similar areas as parts of the Gulf are offered for leasing. In adopting a definition,</p>	<p>site-specific actions and identifies and analyzes appropriate mitigation measures to be used programmatically or considered at future site-specific levels (tiered analysis). Requiring verification that proposed surveys are non-duplicative as a mitigations measure can be considered at the site-specific level. Multiclient and “group shoot” surveys are functionally equivalent in offering multiple companies the same dataset(s) and reducing potential additional survey efforts. Appendix L, Section 2.8 provided additional rationale for the use of multi-client seismic data and also the limited scope for proprietary surveys, which are primarily used for field development.</p>

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>BOEM should make clear that the definition applies to proposed and permitted deep-penetration seismic surveys as well as to completed ones.</p> <p>(4) Having concluded that it is feasible to determine whether proposed surveys are duplicative, and that such determinations “can help BOEM achieve its mission by the reduction and/or prevention of unnecessary seismic survey acquisition,” BOEM must consider, as a mitigation measure, disallowing surveys, and parts of surveys, that are duplicative of other activity. 40 C.F.R. § 1502.14(a) (an EIS must “[r]igorously explore and objectively evaluate all reasonable alternatives”); see also Settlement Agreement § VIII.A.</p> <p>(5) Finally, in addition to advancing a “duplicative survey” standard, presumably within the framework of individual survey review that is anticipated by the panel, BOEM should consider other potentially reasonable mechanisms for reducing or consolidating survey effort, such as the prescription of “group shoot” surveys (DEIS at L-16) or the denial of proprietary seismic applications other than those focused on leased areas on behalf of a lessee.</p>	
1076-0060	<p>Appendix L incorrectly states that “[a] duplicative seismic survey is a deep penetration geophysical survey, as defined in [the Settlement Agreement], whose acquisition parameters, design, technology, and geospatial surface location metrics make it essentially the same as an existing seismic survey.” DPEIS, Appx. L at L-14 (emphasis added). The Settlement Agreement does not define a duplicate seismic survey as being “essentially” the same as an existing seismic survey. Accordingly, Appendix L should be revised to be consistent with the Settlement Agreement.</p>	<p>The panel report was only referencing the definition of “deep-penetration seismic surveys” as defined in the Settlement Agreement (refer to I.A. Definitions) to characterize the surveys BOEM considered in the panel report. The report independently defined what was considered as duplicative.</p>
1091-0020	<p>In particular, the idea that a standard for LPS cannot be established demonstrates a lack of imagination and determination. Appendix L cites the differences in survey objectives as a primary reason for the inability to settle on a standard for LPS, and we agree that a single standard for LPS is difficult. However, differential survey objectives are in no way</p>	<p>The panel members represented differing expertise and viewpoints. Many criteria options were discussed. Ultimately, the panel determined that such criteria were not feasible for a number of reasons, although imagination did not enter into the scientific discussion. While these discussions are more fully discussed in Appendix L, some of the reasons include</p>

Table M-21. Panel Reports (Appendix L) Detailed Comment Responses (continued)

Submission ID	Comment	Response
	<p>a hindrance to requiring that a LPS requirement is used. Indeed, the very idea is that LPS itself constitutes the 'least practicable' for that survey. Therefore, instead of trying to attain a single standard, BOEM should require that for each survey the size and configuration of the source be justified by the operator to demonstrate the need for that particular source, e.g., a full source should not be allowed for conducting a shallow gas hazards survey.</p>	<p>operator-specific data needs, the proprietary nature of airgun arrays, existing survey limitations that weigh in favor of appropriately calibrated sound sources over larger sources (e.g., sound distortion and cancellation), and the great variability in water and geological characteristics that impact both sound propagation and imaging effectiveness. The panel considered generally whether it was prudent for BOEM to attempt to prescribe lowest practicable sound sources over the described data needs of the operator. This was found to not be feasible, given that the risk of an operator not obtaining the needed data compared with having to perform a duplicative survey to fill in data gaps or reshoot an entire survey. This, among other reasons, is why field testing for lowest practicable sound source was not found by the panel to be reasonable.</p> <p>It should be noted that, at times, both deep-penetration seismic surveys and secondarily shallow hazard surveys can be accomplished by a single survey and signal reprocessing, thus reducing the need for an additional survey. As a matter of course, the possibility of this would be reviewed by the acquisition company; however, the source requirements for the two types of surveys usually do not overlap, and different acoustic sources and surveys are needed.</p>
1091-0021	<p>Appendix L states that a DSS is attainable but not feasible for the PEIS. We contend that this conclusion is insufficient and that BOEM must offer a plan for DSS. We furthermore recommend that this issue and the LPS be elevated for consideration by the National Academy of Sciences, perhaps by the BOEM advisory panel at NAS.</p>	<p>The panel decided that a determination of duplicative surveys was feasible and listed metrics to assist in making that determination. A plan to implement this decision process is outside of the scope of the panel; however, BOEM is continuing to discuss the finding of the panel reports and how they might be incorporated into future decisionmaking for G&G activities. BOEM will take your recommendation for National Academy of Science evaluation of the lowest practicable sound source and determination of duplicative seismic surveys under consideration.</p>

M.5 REFERENCES

- Adachi, T., J.L. Maresh, P.W. Robinson, S.H. Peterson, D.P. Costa, Y. Naito, Y.Y. Watanabe, and A. Takahashi. 2014. The foraging benefits of being fat in a highly migratory marine mammal. *Proceedings of the Royal Society B: Biological Sciences* 281:20142120.
- Aoki, K., Y.Y. Watanabe, D.E. Crocker, P.W. Robinson, M. Biuw, D.P. Costa, N. Miyazaki, M.A. Fedak, and P.J. Miller. 2011. Northern elephant seals adjust gliding and stroking patterns with changes in buoyancy: Validation of at-sea metrics of body density. *Journal of Experimental Biology* 214:2973-2987.
- Barkaszi, M.J., M. Butler, R. Compton, A. Unietis, and B. Bennet. 2012. Seismic survey mitigation measures and marine mammal observer reports. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-015. 28 pp. + apps.
- Boudoin, C. 2017. Official communication. Email to T. Olivier concerning the Bureau of Ocean Energy Management's active leases in closure areas: Data and map. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. June 29, 2017.
- Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: Intuitions, analysis, and implication. *Marine Ecology Progress Series* 395:201-222.
- Collins, M.D. 1993. A split-step Padé solution for the parabolic equation method. *Journal of the Acoustical Society of America* 93:1736-1742.
- Dismukes, D.E. 2011. OCS-related infrastructure fact book. Volume I: Post-hurricane impact assessment and Volume II: Communities in the Gulf of Mexico. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2011-043 and 2011-044. 372 pp. and 163 pp., respectively.
- Dooling, R.J., M.R. Leek, and A.N. Popper. 2015. Effects of noise on fishes: What we can learn from humans and birds. *Integrative Zoology* 10(1):29-37.
- Eastern Research Group, Inc. 2011. Analysis of the oil services contract industry in the Gulf of Mexico region. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEMRE 2011-001.
- Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. *Conservation Biology*, online version published December 19, 2011. doi:10.1111/j.1523-1739.2011.01802.x.
- Erbe, C., C. Reichmuth, K. Cunningham, K. Lucke, and R. Dooling, R. 2015. Communication masking in marine mammals: A review and research strategy. *Marine Pollution Bulletin* 103:15-38.
- Federal Register*. 2008. Implementation of the National Environmental Policy Act (NEPA) of 1969. 73 FR 200, pp. 61292-61323. October 15, 2008.

- Federal Register*. 2016. Draft programmatic environmental impact statement for geological and geophysical activities on the Gulf of Mexico Outer Continental Shelf (OCS). 81 FR 190, pp. 67380-67381. September 30, 2016.
- Finneran, J.J. and A.K. Jenkins. 2012. Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. San Diego, CA: SPAWAR Systems Center Pacific.
- Franklin, C.A., J.W. Thelin Jr., A.K. Nabelek, and S.B. Burchfield. 2006. The effect of speech presentation level on acceptance of background noise in listeners with normal hearing. *Journal of the American Academy of Audiology* 17:141-146.
- Hannay, D. and R. Racca. 2005. Acoustic model validation. Document 0000-S-90-04-T-7006-00-E, Revision 02. Technical report for Sakhalin Energy Investment Company by JASCO Research.
- Hassel, A., T. Knutsen, J. Dalen, K. Skaar, S. Lokkeborg, O.A. Misund, O. Ostensen, M. Fonn, and E.K. Haugland. 2004. Influence of seismic shooting on the lesser sand eel (*Ammodytes marinus*). *ICES Journal of Marine Science* 61(7):1165-1173.
- Hawkins, A.D., A.E. Pembroke, and A.N. Popper. 2014. Information gaps in understanding the effects of noise on fishes and invertebrates. *Reviews in Fish Biology and Fisheries* 1-26.
- Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2008-006. 341 pp.
- Kujawa, S.G. and M.C. Liberman. 2009. Adding insult to injury: Cochlear nerve degeneration after “temporary” noise-induced hearing loss. *The Journal of Neuroscience* 29(45):14077-14085.
- LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. Biologically important areas for cetaceans within U.S. waters – Gulf of Mexico region. *Marine Aquatic Mammals* 41(1):30-38.
- National Research Council. 2003. Ocean noise and marine mammals. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. Washington, DC: The National Academies Press. 151 pp. + app.
- National Research Council. 2005. Marine mammal populations and ocean noise: Determining when noise causes biologically significant effects. Committee on Characterizing Biologically Significant Marine Mammal Behavior. Washington, DC: The National Academies Press. 99 pp. + apps.
- Nedelec, S.L., S.D. Simpson, E. Morley, and A.N. Radford. 2015. Impacts of regular and random noise on the behavior, growth and development of larval Atlantic cod (*Gadus morhua*). *Proceedings of the Royal Society B: Biological Sciences* 282:20151943.

- New, L.F., D.J. Moretti, S.K. Hooker, D.P. Costa, and S.E. Simmons. 2013. Using energetic models to investigate the survival and reproduction of beaked whales (family Ziphiidae). *PLOS ONE* 8:e68725.
- New, L.F., J.S. Clark, D.P. Costa, E. Fleishman, M.A. Hindell, T. Klanjšček, D. Lusseau, S. Kraus, C.R. McMahon, P.W. Robinson, R.S. Schick, L.K. Schwarz, S.E. Simmons, L. Thomas, P. Tyack, and J. Harwood. 2014. Using short-term measures of behaviour to estimate long-term fitness of southern elephant seals. *Marine Ecology Progress Series* 496:99-108.
- Nowacek, D.P., L.H. Thorne, D.W. Johnston, and P.L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. *Mammal Review* 37(2):81-115.
- Nowacek, D.P. 2015. Seismic surveys and marine wildlife: Impacts, the lack thereof, and thoughts on managing both. *The Journal of Acoustical Society of America* 138(3):1848-1848.
- Nowacek, D.P., C.W. Clark, D.A. Mann, and B. Southall. 2015. Marine seismic surveys and ocean noise: Time for coordinated and prudent planning. *Frontiers in Ecology and the Environment* 13(7):378-386.
- Peña, H., N.O. Handegard, and E. Ona. 2013. Feeding herring schools do not react to seismic air gun surveys. *ICES Journal of Marine Science* 70:1174-1180.
- Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. *Marine mammals and noise*. San Diego, CA and London, UK: Academic Press. 575 pp.
- Roberts, J., B. Best, L. Mannocci, E. Fujioka, P. Halpin, D. Palka, L. Garrison, K. Mullin, T. Cole, C. Khan, W. McLellan, D.A. Pabst, and G. Lockhart. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6:22614.
- Robinson, P.W., S.E. Simmons, D.E. Crocker, and D.P. Costa. 2010. Measurements of foraging success in a highly pelagic marine predator, the northern elephant seal. *Journal of Animal Ecology* 79:1146-1156.
- Rolland, R.M., R.S. Schick, H.M. Pettis, A.R. Knowlton, P.K. Hamilton, J.S. Clark, and S.D. Kraus. 2016. Health of North Atlantic right whales *Eubalaena glacialis* over three decades: From individual health to demographic and population health trends. *Marine Ecology Progress Series* 542:265-282.
- Romano, T.A., M.J. Keogh, C. Kelly, P. Feng, L. Berk, C.E. Schlundt, D.A. Carder, and J.J. Finneran. 2004. Anthropogenic sound and marine mammal health: Measures of the nervous and immune systems before and after intense sound exposure. *Canadian Journal of Fisheries and Aquatic Sciences* 61:1124-1134.
- Saetre, R. and E. Ona. 1996. Seismike undersøkelser og på fiskeegg og -larver en vurdering av mulige effekter på bestandsniva. (Seismic investigations and damages on fish eggs and larvae; an evaluation of possible effects on stock level). *Fisken og Havet* 1996:1-17, 1-8 (in Norwegian, with an English summary).

- Simpfendorfer, C.A. and T.R. Wiley. 2005. Determination of the distribution of Florida's remnant sawfish population and identification of areas critical to their conservation. Final report to the Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.
- Simpson, S., J. Purser, and A.N. Radford. 2015. Anthropogenic noise compromises antipredator behavior in European eels. *Global Change Biology* 21:586-593.
- Simpson, S.D., A.N. Radford, S.L. Nedelec, M.C.O. Ferrari, D.P. Chivers, M.I. McCormick, and M.G. Meekan. 2016. Anthropogenic noise increases fish mortality by predation. *Nature Communications* 7:10544.
- Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33:411-522.
- U.S. Dept. of Commerce. National Marine Fisheries Service. 2009. Smalltooth sawfish recovery plan (*Pristis pectinata*). Silver Spring, MD. 91 pp. + apps.
- U.S. Dept. of Commerce. National Marine Fisheries Service. 2013. National standards for a protected species observer and data management program: A model using geological and geophysical surveys. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-OPR-49. 81 pp.
- U.S. Dept. of Commerce. National Marine Fisheries Service. 2016. Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing—underwater acoustic thresholds for onset of permanent and temporary threshold shifts. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-OPR-55, July 2016. 178 pp.
- U.S. Dept. of Commerce. National Oceanic and Atmospheric Administration. 2017. Policy and procedures for implementing the National Environmental Policy Act and related authorities. Companion Manual for NOAA Administrative Order 216-6A. January 13, 2017.
- U.S. Dept. of the Interior. Bureau of Ocean Energy Management. 2017a. Gulf of Mexico OCS oil and gas lease sales: 2017-2022; Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 259, and 261—final multisale environmental impact statement. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. OCS Report BOEM 2017-009.
- U.S. Dept. of the Interior. Bureau of Ocean Energy Management. 2017b. Catastrophic spill event analysis: High-volume, extended-duration oil spill resulting from loss of well control on the Gulf of Mexico outer continental shelf; 1st revision. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. OCS Report BOEM 2017-007. xi + 339 pp.
- Waters, J.D., R. Coelho, J. Fernandez-Carvalho, A.A. Timmers, T. Wiley, J.C. Seitz, M.T. McDavitt, G.H. Burgess, and G.R. Poulakis. 2014. Use of encounter data to model spatio-temporal

distribution patterns of endangered smalltooth sawfish, *Pristis pectinata*, in the western Atlantic. *Aquatic Conservation* 24:760-776.

Wiley T.R. and C.A. Simpfendorfer. 2010. Using public encounter data to direct recovery efforts for the endangered smalltooth sawfish *Pristis pectinata*. *Endangered Species Research*. 2010:179-191.

Wolvovsky, E. and W. Anderson. 2016. OCS oil and natural gas: Potential lifecycle greenhouse gas emissions and social cost of carbon. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Sterling, VA. OCS Report BOEM 2016-065. 44 pp.

Wood, J., B.L. Southall, and D.J. Tollit. 2012. PG&E offshore 3D seismic survey project EIR - marine mammal technical draft report. Report code SMRUL NA0611ERM. SMRU Ltd. 123 pp.

APPENDIX N

ADDENDUM TO ACOUSTIC PROPAGATION AND MARINE MAMMAL EXPOSURE MODELING



Addendum to Acoustic Propagation and Marine Mammal Exposure Modeling of Geological and Geophysical Sources in the Gulf of Mexico

Exposure Estimates for Seismic Surveys Using NOAA Technical Memorandum NMFS-OPR-55 For Estimating Injury

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Disclaimer:

The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

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1. Addendum

As cooperating agencies, the Bureau of Ocean Energy Management (BOEM), the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), and the Bureau of Safety and Environmental Enforcement (BSEE) developed a Draft Programmatic Environmental Impact Statement (PEIS). This document evaluates the potential significant environmental impacts of multiple geological and geophysical (G&G) activities within federal waters of the Gulf of Mexico's (GOM) Outer Continental Shelf (OCS) and adjacent state waters (BOEM 2016). Potential injurious impacts to marine mammals due to acoustic exposure to seismic surveys in the GOM were investigated for the PEIS. As feed-in data for the impact assessment (Appendix D of the Draft PEIS in BOEM 2016; Zeddies et al. 2015), JASCO estimated the exposure probability for the various species through a modeling process that simulated animals moving in sound fields generated by defined sources in specific environments. As part of this modeling process and exposure estimate analysis, the sound fields were filtered (frequency weighted) to account for the hearing range and sensitivity of different marine mammal hearing groups. Threshold levels of exposure, over which injury may occur, were associated with the hearing groups.

After the draft PEIS was developed, NOAA released technical guidance *NMFS-OPR-55* (NMFS 2016) for frequency-weighting functions and associated thresholds. This addendum conveys, as Excel Workbooks, the updated 24-hr injury-exposure probability estimates using the Technical Guidance (NMFS 2016) for predicted G&G airgun array survey activity in the GOM between 2016–2025. All other aspects of the modeling remained the same as described in Appendix D of the Draft PEIS. Table 1 shows the threshold levels used to estimate exposure probability. Section 1.1 explains the weighting functions used.

Notes:

- (1) While the work in this addendum updates the peak SPL and SEL injury estimates, the Excel Workbooks contain the (unchanged) exposure probability estimates for potential behavioral disruption and prior NMFS criteria so that all the current data are located together.
- (2) Animal movement was identically replicated in most cases, but it was found that for most species in Box 1 (beaked whales, bottlenose dolphins, clymene dolphins, false killer whales, killer whales, pantropical spotted dolphins, Risso's dolphins, and rough toothed dolphins) and some species in Box 5 (pantropical spotted dolphins, Risso's dolphins, rough toothed dolphins, and killer whales) the initial seeding was lost. These species represent new animal movement modelling runs and, therefore, a statistical comparison to the prior work instead of an exact replication.

Table 1. Summary of relevant permanent threshold shift (PTS) onset acoustic thresholds (NMFS 2016).

Hearing group	Threshold
Low-frequency (LF) cetaceans	_{peak} SPL, flat: 219 dB SEL, 24h: 183 dB
Mid-frequency (MF) cetaceans	_{peak} SPL, flat: 230 dB SEL, 24h: 185 dB
High-frequency (HF) cetaceans	_{peak} SPL, flat: 202 dB SEL, 24h: 155 dB

Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

_{peak} SPL, flat—peak sound pressure is flat weighted or unweighted and has a reference value of 1 μ Pa.

SEL denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 μ Pa²s.

The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting.

1.1. Marine Mammal Weighting Functions

The potential for anthropogenic sounds to impact marine mammals is largely dependent on whether the sound occurs at frequencies that an animal can hear well, unless the sound pressure level is so high that it can cause physical tissue damage regardless of frequency. Weighting functions reflect an animal’s ability to hear a sound. Sound spectra are weighted at particular frequencies in a manner that reflects an animal’s sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007). Auditory weighting functions have been proposed for marine mammals, specifically associated with PTS acoustic thresholds expressed in metrics that consider what is known about marine mammal hearing (e.g., SEL) (Southall et al. 2007, Erbe et al. 2016, Finneran 2016). Marine mammal auditory weighting functions published by Finneran (2016) are included in the NMFS 2016 Technical Guidance for use in conjunction with corresponding SEL PTS (injury) onset acoustic criteria (Table 1).

1.1.1. Type III marine mammal frequency weighting functions

In 2015, a U.S. Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10 \log_{10} \left[\left(\frac{(f/f_{lo})^{2a}}{[1 + (f/f_{lo})^2]^a [1 + (f/f_{hi})^2]^b} \right) \right]$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid-, and high-frequency cetaceans, phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA’s technical guidance that assesses noise impacts on marine mammals (NMFS 2016). Table 2 lists the frequency-weighting parameters for each hearing group. Figure 1 shows the resulting frequency-weighting curves.

Table 2. Parameters for the auditory weighting functions recommended by NMFS (2016).

Hearing group	<i>a</i>	<i>b</i>	<i>f_{lo}</i> (Hz)	<i>f_{hi}</i> (kHz)	<i>K</i> (dB)
Low-frequency cetaceans	1.0	2	200	19,000	0.13
Mid-frequency cetaceans	1.6	2	8,800	110,000	1.20
High-frequency cetaceans	1.8	2	12,000	140,000	1.36
Phocid pinnipeds in water	1.0	2	1,900	30,000	0.75
Otariid pinnipeds in water	2.0	2	940	25,000	0.64

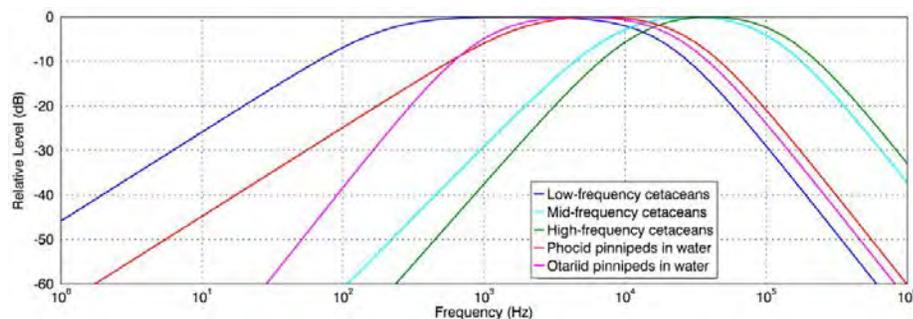


Figure 1. Auditory weighting functions for functional marine mammal hearing groups recommended by NMFS (2016).

2. Literature Cited

- [BOEM] Bureau of Ocean Energy Management. 2016. *Gulf of Mexico OCS Proposed Geological and Geophysical Activities. Western, Central, and Eastern Planning Areas. Draft Programmatic Environmental Impact Statement Volume 1: Chapters 1-8*. Prepared by CSA Ocean Sciences, Stuart, Florida. 702 pp. <https://www.boem.gov/BOEM-EIS-2016-049-v1/>.
- [NMFS] National Marine Fisheries Service. 2016. *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset Permanent and Temporary Threshold Shifts*. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. 178 pp. http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf.
- Erbe, C., R. McCauley, and A. Gavrilov. 2016. Characterizing Marine Soundscapes. In Popper, N.A. and A. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Springer New York, New York, NY. 265-271. http://dx.doi.org/10.1007/978-1-4939-2981-8_31.
- Finneran, J.J. 2015. *Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores*. San Diego: SSC Pacific.
- Finneran, J.J. 2016. *Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise*. Technical Report. 49 pp.
- Nedwell, J.R. and A.W. Turnpenny. 1998. The use of a generic frequency weighting scale in estimating environmental effect. *Workshop on Seismics and Marine Mammals*. 23–25th June 1998, London, U.K.
- Nedwell, J.R., A.W.H. Turnpenny, J. Lovell, S.J. Parvin, R. Workman, and J.A.L. Spinks. 2007. *A validation of the dB_{ht} as a measure of the behavioural and auditory effects of underwater noise*. Report No. 534R1231 prepared by Subacoustech Ltd. for the UK Department of Business, Enterprise and Regulatory Reform under Project No. RDCZ/011/0004. www.subacoustech.com/information/downloads/reports/534R1231.pdf.
- Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, et al. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33(4): 411-521.
- Zeddies, D.G., M. Zykov, H. Yurk, T. Deveau, L. Bailey, I. Gaboury, R. Racca, D. Hannay, and S. Carr. 2015. *Acoustic Propagation and Marine Mammal Exposure Modeling of Geological and Geophysical Sources in the Gulf of Mexico: 2016-2025 Annual Acoustic Exposure Estimates for Marine Mammals*. Volume JASCO Document 00976, Version 3.0. Technical report by JASCO Applied Sciences for Bureau of Ocean Energy Management (BOEM).



The Department of the Interior Mission

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) is responsible for managing development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.