

**Before the  
Department of the Interior, Minerals Management Service**

**COMMENTS ON THE DRAFT PROPOSED 5-YEAR OUTER CONTINENTAL SHELF  
OIL AND GAS LEASING PROGRAM FOR 2010-2015**

Analysis of Environmental Impacts	)	74 Fed. Reg. 3631, Jan. 21, 2009, and
under the OCSLA; Interpretation	)	Secretary Salazar's announcement of
of the "Avoid Harm" Provision	)	Feb. 10, extending the comment period
of E.O. 13158 on Marine	)	to Sept. 21, 2009, 74 Fed. Reg. 9426.
Protected Areas ("MPAs")	)	

**The Center for Regulatory Effectiveness**  
Suite 500  
1601 Connecticut Avenue, NW  
Washington, DC 20009  
202.265.2383  
[www.TheCRE.com](http://www.TheCRE.com)

July 2009

COMMENTS ON THE DRAFT PROPOSED 5-YEAR OUTER CONTINENTAL SHELF  
OIL AND GAS LEASING PROGRAM FOR 2010-2015

INTRODUCTION

The Center for Regulatory Effectiveness (“CRE”), a regulatory watchdog, is pleased to provide these comments to the Minerals Management Service (“MMS”). In its capacity as a watchdog, CRE works to ensure federal compliance with “good government” laws that regulate the regulatory process including the Data Quality Act, the Paperwork Reduction Act, the Regulatory Flexibility Act, and the Unfunded Mandates Reform Act. CRE was established by former senior career officials from the White House Office of Management and Budget.

As part of its work to promote transparency regarding the Outer Continental Shelf (“OCS”) and other marine science issues, CRE established the Ocean Zoning Interactive Public Docket, found at <http://www.thecre.com/creipd/>.<sup>1</sup> For additional information about CRE, please see, [http://www.thecre.com/emerging/Jim\\_Tozzi\\_Bio.html](http://www.thecre.com/emerging/Jim_Tozzi_Bio.html).

Two of the issues that CRE has identified as relevant to the draft OCS oil and gas leasing plan that are addressed in these comments are:

1. Interpretation of the “Avoid Harm” provision of the Executive Order establishing Marine Protected Areas (MPAs) in light of the pro-development statutory requirements of the Outer Continental Shelf Lands Act (“OCSLA”); and
2. Seismic operations associated with oil and gas exploration on the OCS do not harm marine animals, when long-standing mitigation measures are applied:

CRE recognizes that there are myriad additional salient issues regarding MMS’ proposed five-year leasing plan. Thus, we request that stakeholders who would like to see our comments address one or more of these additional issues, please provide us your views either on the IPD or via email at [cmscomments@thecre.com](mailto:cmscomments@thecre.com). We also request that you provide us with your comments, suggestions and recommendations on these comments.

---

<sup>1</sup> For additional information about the IPD, please see CRE’s comments to the Office of Science and Technology Policy, <http://www.thecre.com/zoning-forum/wp-content/uploads/125/CRE%20Charting%20the%20Course%20Comments.pdf>

**I. Analysis of Environmental Impacts under the OCSLA; Interpretation of the "Avoid Harm" Provision of E.O. 13158 on Marine Protected Areas ("MPAs")**

*Summary*

Executive Order 13158 on Marine Protected Areas ("MPAs") contains a directive that agencies shall "avoid harm" to MPAs "to the maximum extent practicable", and other language in the Order adds emphasis to this apparent goal. However, the "avoid harm" directive is qualified so that it applies only "[t]o the extent permitted by law." There is authoritative legal precedent, in the D.C. Circuit, interpreting the environmental protection provisions of the Outer Continental Shelf Lands Act ("OCSLA"), principally section 18(a)(3), to require that the Department of the Interior and its Minerals Management Service give primary emphasis to the goal of developing new oil and gas resources, with potential environmental impacts a secondary concern. Although the Draft Proposed Plan for 2010-2015 (the "DPP") discusses this legal authority, the discussion does not explain the D.C. Circuit's finding that oil and gas leasing must be the primary emphasis under the OCSLA, and it does not explain that this legal authority counterbalances the "avoid harm" direction in the Order.<sup>2</sup> The discussion in the DPP should be expanded to address that point.

**A. Executive Order 13158 and Its "Avoid Harm" to MPAs Provision**

President Clinton issued Executive Order 13158 on May 26, 2000. The Order established the term "Marine Protected Area" ("MPA") as a term encompassing "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The Order established a "National System of MPAs", and provided various measures and policies to coordinate protection of MPAs.<sup>3</sup>

The Order contains a number of statements and provisions indicating that its purpose was not only to maintain the existing level of protection for MPAs, but to enhance protection. Section 1, on "Purpose," states that the Order "would enhance the conservation" of natural and cultural resources within the MPA system, and would "avoid causing harm to MPAs through federally conducted, approved, or funded activities." Section 4, on creation of the National System of MPAs, states that

---

<sup>2</sup> For additional crucial information on the relationship between MPAs and OCSLA, see "The Implications of the NOAA National System of Marine Protected Areas on the Outer Continental Shelf Lands Act" available at [http://thecre.com/pdf/20090615\\_MMS\\_MPA\\_Five\\_Year\\_Plan\\_Conflict.pdf](http://thecre.com/pdf/20090615_MMS_MPA_Five_Year_Plan_Conflict.pdf).

<sup>3</sup> For additional information on the establishment of MPAs, see CRE's "Comments on NOAA's Proposed National System of Marine Protected Areas (MPAs)" available at <http://thecre.com/pdf/NSSubmission.pdf>.

## Center for Regulatory Effectiveness

federal agencies should use a variety of enumerated measures "to further enhance and expand protection of existing MPAs . . . ."

Section 5 of the Order contains a direct Executive mandate to agencies with regard to protection of MPAs, stating:

*Each Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law, and to the maximum extent practicable, each Federal agency, in taking such action, shall avoid harm to the natural and cultural resources that are protected by an MPA. ...*

It appears that the OCSLA<sup>4</sup> is one of the laws providing for Federal actions potentially affecting MPAs because the Order states that it is issued "in furtherance of the purposes of the ... OCSLA," among other laws.

The issue then is whether E.O. 13158 established a new, higher level of protection for MPAs and their natural and cultural resources that might be affected by OCSLA leasing in stating the agencies must "avoid harm" "to the maximum extent practicable," or whether the initial qualifier that the "avoid harm" directive applies only "[t]o the extent permitted by law" counterbalances that directive in the case of the OCSLA.

***B. The Extent of MPAs with a Potential for Being Affected by OCSLA Leasing***

MPAs added to the National System of MPAs and subject to E.O. 13158 are located in virtually all of the coastal waters of the United States.<sup>5</sup> There are currently nearly 1,700 MPAs, designated and managed by federal, State, territorial, and local agencies. The MPAs are located in marine waters 0-200 miles from the coast and under both primary federal and State jurisdiction or partnership.

If E.O. 13158 is interpreted to require that MPA's be given a higher level of protection than prior to its issuance (avoid harm "to the maximum extent practicable"), the Order's policy could have a significant impact on federal oil and gas leasing decisions under the OCSLA. The Department of the Interior would have to make OCS lease planning decisions so as to give priority to protection of the natural and cultural resources within every potentially affected MPA, regardless of the value of those MPA resources in comparison to the Nation's need for domestic oil and gas sources.

---

<sup>4</sup> 42 U.S.C. §§ 1331 *et seq.* The Act was amended substantially in 1978.

<sup>5</sup> See [http://mpa.gov/pdf/national-system/nat\\_sys\\_snapshot.pdf](http://mpa.gov/pdf/national-system/nat_sys_snapshot.pdf).

## Center for Regulatory Effectiveness

**C. The Environmental Protection Provisions of the OCSLA**

At the planning stage of the leasing process, which is currently ongoing, the key provision of the OCSLA concerning consideration of environmental impacts is section 18(a)(3), 43 U.S.C. § 1344(a)(3),<sup>6</sup> which states:

*The Secretary [of the Interior] shall select the timing and location of leasing, to the maximum extent practicable, so as to obtain a proper balance between the potential for environmental damage, the potential the discovery of oil and gas, and the potential for adverse impact on the coastal zone.<sup>7</sup>*

The Act gives no specific guidance with regard to what constitutes “a proper balance.” On its face, however, the phrase appears to rule out an interpretation that gives more weight to environmental impacts than to energy development, which seems to be an interpretation otherwise supported by much of the language of E.O. 13158. And, as will be seen below, section 18(a)(3) and the phrase “a proper balance” has been interpreted on this point by judicial precedent that remains firmly in place.

Other provisions of the OCSLA addressing assessment of environmental impacts of OCS oil and gas leasing at the stages beyond the planning/area selection phase (leasing, oil and gas development and production), indicate that energy development on the OCS is to be given more weight than potential environmental impacts, and that significant risk or degree of environmental impact is considered acceptable. For example:

- The provisions on “Administration of leasing,” 43 U.S.C. §1334, provide that the Secretary may cancel a lease if he determines that the leasing activity “would probably cause serious harm of damage to life (including fish and other aquatic life) . . . or to the marine, coastal, or human environment, “and “the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time.” Sec. 1334(a)(2)(A) (emphasis added).
- The provisions on “Oil and gas development and production,” 43 U.S.C. § 1351, contain similar qualifications, stating that the Secretary shall disapprove a development and production plan if he determines, “because of . . . exceptional resource values in the marine or coastal environment, or other exceptional circumstances, that (i) implementation of the plan would probably cause serious harm or damage to life (including fish and other aquatic life) . . . or to the marine, coastal or human environments, (ii) the threat of harm or damage will not disappear or decrease to an

---

<sup>6</sup> Section 18 was added by the 1978 amendments to the OCSLA.

<sup>7</sup> The “coastal zone” is defined as “the coastal waters (including the lands therein and thereunder) . . . in proximity to the shorelines of the several coastal States . . . which zone extends seaward to the outer limit of the United States territorial sea . . . .”

## Center for Regulatory Effectiveness

acceptable extent within a reasonable period of time, and (iii) the advantages of disapproving the plan outweigh the advantages of development and production.” Sec. 1351(h)(1)(D).

**D. Potential for Conflict between the E.O. and the OCSLA**

Executive Order 13158 gives the impression that its intention is to increase the degree of protection from federal activities, including activities under the OCSLA, given to MPA's prior to issuance of the Order. However, section 5 of the Order (and under general principles of law the rest of the Order) is subject to the stated qualification that its directives apply “[t]o the extent permitted by law. . . .” Therefore, if the Draft Proposed 5-yr Plan does not clearly explain the extent to which the OCSLA permits consideration of environmental impacts in OCSLA decisions, the Executive Order could be viewed as supporting objections to OCS leasing plans based on low probability of slight risks of impacts on natural and cultural resources within MPAs. The established legal precedent regarding the limited weight that should be given to potential environmental impacts in relation to oil and gas development is described below.

**E. Case Law Interpreting Section 18(a)(3) of the OCSLA**

The U.S. Court of Appeals for the District of Columbia Circuit has directly addressed interpretation of section 18(a)(3) of the OCSLA. No other federal Circuit Court has addressed the issue, nor has the U.S. Supreme Court.

The leading case is *State of California ex rel. Brown v. Watt*, 668 F.2d 1290 (D.C. Cir. 1981). The court found that, although section 18(a)(3) does not define the “proper balance” between oil and gas development and environmental concerns, a correct interpretation could be derived from statements of Congressional purpose and other provisions of the Act.

First, the court observed that in the Act Congress declared it to be the policy of the United States that “the outer Continental Shelf is a vital national resource . . . which should be made available for orderly and expeditious development, subject to environmental safeguards . . . .” 43 U.S.C. § 1332(3). At 1315. The court found that this statement of purpose reflected the Act’s “primary emphasis on expeditious development of the OCS, qualified by the recognition of a need for measures to alleviate or minimize its adverse impacts.” *Id.* (emphasis added). See also 43 U.S.C. §1802. It found this view to be supported also by the Act's legislative history.

In arguing its case, the State of California contended that the term “balance” in section 18(a)(3) meant that the three factors in the provision -- the potential for environmental damage, the potential for the discovery of oil and gas, and the potential for adverse impact on the coastal zone -- should be weighed equally in the lease planning process. The court explicitly disagreed, holding that meeting national energy needs should be considered the most important objective:

## Center for Regulatory Effectiveness

*That the Act has an objective -- the expeditious development of OCS resources -- persuades us to reject petitioners' view that the three elements in section 18(a)(3) are "equally important" and that no factor is "inherently more important than another."*

[Footnote omitted] *The environmental and coastal zone considerations are undoubtedly important, but the Act does not require they receive a weight equal to that of potential oil and gas discovery. A balancing of factors is not the same as treating all factors equally. The obligation instead is to look at all factors and then balance the results. The Act does not mandate any particular balance, but vests the Secretary with the discretion to weigh the elements so as to "best meet national energy needs."*

At 1316-17 (emphasis added). The court also endorsed the Secretary's approach of weighing oil and gas benefits against potential environmental costs, and stated with regard to the State's concerns regarding this approach:

*Petitioners' objection to this view is essentially that it allows even significant environmental costs and coastal zone impacts to be overridden [sic]. Yet this is precisely what the Act intends, provided that the potential oil and gas benefits exceed those potential costs.*

In other words, in order to achieve a "proper balance" under section 18(a)(3), the Secretary must not weigh the factors in section 18(a)(3) "equally"; but rather, must give the greatest weight to the "inherently more important" objective of best meeting national energy needs.

The continuing validity of the Circuit Court's 1981 decision in *State of California ex rel Brown*, has been recognized in *Natural Res. Def. Council v. Hodel*, 865 F.2d 288, 302 (D.C. Cir.1988) ("The primary purpose of OCSLA is expeditious, orderly development of the oil and gas resources of the OCS, with due consideration for the impact of that development . . .", citing *State of California*). Very recently, in *Center for Biological Diversity v. U.S. Dept. of the Interior*, 563 F.3d 466, 472 (D.C. Cir. 2009), the D.C. Circuit again reaffirmed that the primary purpose of the Act is "to ensure 'the expeditious but orderly development of OCS resources,'" citing its 1981 decision in *State of California ex rel. Brown*.

Potential environmental or other impacts on MPAs cannot be given equal or greater weight, as might be considered to be implied by E.O. 13158 and its directive to "avoid harm" "to the maximum extent practicable." Instead, the avoidance of harm to MPAs must be limited to "the extent permitted by law" under *State of California ex rel Brown, supra*, which established that development of oil and gas resources on the OCS must be considered the primary objective of the Act.

## Center for Regulatory Effectiveness

**F. Department of Commerce/NOAA Interpretation of E.O. 15138**

In November 2008, the Marine Protected Areas Center of the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce published a document entitled FRAMEWORK FOR THE NATIONAL SYSTEM OF MAINE PROTECTED AREAS OF THE UNITED STATES OF AMERICA.<sup>8</sup> This Framework document contains extended discussion of implementation of E.O. 15138. One section of the Framework document describes and discusses section 5 of the Order -- the “avoid harm” provision.

The Framework document first notes that “[e]ach federal agency is responsible for its own implementation of its responsibilities under Section 5.” At 43. The document then cites a list of legal authorities to which the Order is applicable, which includes the OCSLA. Thus, it is clear that the Department of Commerce/NOAA/MPAC position is that it is not its responsibility to interpret section 5 for other federal agencies, and that interpretation of the OCSLA is the province of the Department of the Interior. The Framework document does not contain any discussion or commentary on the responsibility of the Department of the Interior to “avoid harm” under established interpretation of the OCSLA.

The Framework document also comments that “[t]he implementation of Section 5 is governed by existing authorities . . . . The Order does not provide any new authority for any federal agency or the MPA Center to review activities of any other federal agency or alter standards for existing review.” At 44.

**G. Department of the Interior/MMS Interpretation of the OCSLA**

The Minerals Management Service (MMS) regulations implementing the OCSLA do not address the issues that are the subject of this paper.<sup>9</sup> On the other hand, the Draft Proposed Plan (“DPP”) does address the balancing provision of section 18 of the OCSLA as interpreted in *State of California ex rel Brown, supra*, and it quotes much of the same language as quoted above (at 114-16). However, the DPP does not refer to the passage of the court’s opinion quoted above regarding expeditious energy development being the primary emphasis of the Act, and does not explain that the “balancing” required by section 18(a)(3), and as explained by the Court of Appeals, requires that this primary emphasis be incorporated into the balancing.

The DPP also does not contain any reference to, or discussion of, section 5 of E.O. 13158 in relation to section 18(a)(3) of the OCSLA and its authoritative judicial interpretation in *State of California ex rel. Brown*.

---

<sup>8</sup> Available at [http://mpa.gov/pdf/national-system/finalframework\\_full.pdf](http://mpa.gov/pdf/national-system/finalframework_full.pdf).

<sup>9</sup> 30 CFR Ch. II.

## Center for Regulatory Effectiveness

**H. Conclusions**

Section 5 of E.O. 13158 directs all federal agencies, including the Department of the Interior in its implementation of the OCSLA, to “avoid harm” to all MPAs “to the maximum extent practicable.” But, it qualifies this directive by stating that it applies only “[t]o the extent permitted by law.” Under *State of California ex rel Brown*, oil and gas development on the OCS must be considered the “primary emphasis” in the balancing of oil and gas development and environmental impacts required by section 18(a)(3) of the OCSLA, and environmental considerations are not entitled to equal weight. However, the federal agency responsible for implementing the OCSLA, the Department of the Interior/MMS, has not expressly interpreted section 5 of E.O. 13158 in light of that judicial authority.

**I. Recommendations for Changes to the Proposed Plan**

We recommend that the discussion of the “balancing” requirement of section 18(a)(3) of the OCSLA that is currently contained in the Draft Proposed Plan be expanded to address clearly the relationship between section 5 of E.O. 13158 and *State of California ex rel. Brown*. The Draft Plan should explain that under *State of California ex rel. Brown*, section 5 of the Executive Order must be interpreted so that the goal of oil and gas development on the OCS is given “primary emphasis,” with potential environmental impacts given lesser emphasis.

**II. Oil and Gas Seismic Operations Do Not Affect Sperm Whale Foraging*****Summary***

Despite extensive research, there are no reliable data showing that oil and gas seismic operations adversely affect sperm whales' foraging for food. United States regulatory agencies are fully aware of all the foraging effects studies and have correctly decided not to regulate seismic on the basis of foraging effects. MMS and other regulatory agencies should state clearly that there are no reliable data showing adverse effects from seismic when they discuss the foraging issue.

**A. *There are No Data Showing That Seismic Exposure Reduces Foraging in Sperm Whales***

One study concluded that oil and gas seismic operations caused no measurable effects on the feeding activities of grey whales.<sup>10</sup>

---

<sup>10</sup> “Feeding of western gray whales during a seismic survey near Sakhalin Island, Russia,” Yazvenko, McDonald, Biokhin, Johnson, Melton, Newcomer, Nielson and Wainwright, *Environmental Monitoring and Assessment* 2007;134(1-3):93-106, which concludes, inter alia, that an oil and gas seismic survey had no measurable effect on bottom feeding activity of western gray whales of Sakhalin Island.

## Center for Regulatory Effectiveness

Another study found no effects from low frequency sound on the foraging actions of fin blue and balaenoptera whales. The abstract for this article is quoted in part below:

*We conducted a manipulative field experiment to test the effects of loud, LF noise on foraging fin blue (*B. musculus*) and (*Balaenoptera physalus*) whales off San Nicolas Island, California. Naive observers used a combination of attached tracking devices, ship-based surveys, aerial surveys, photo-identification and passive monitoring of vocal behaviour to examine the behaviour and distribution of whales when a loud LF source (US Navy SURTASS LFA) was and was not transmitting. During transmission, 12-30% of the estimated received levels of LFA of whales in the study area exceeded 140 dB re 1  $\mu$ Pa. However, whales continued to be seen foraging in the region. Overall, whale encounter rates and diving behaviour appeared to be more strongly linked to changes in prey abundance associated with oceanographic parameters than to LF sound transmissions. In some cases, whale vocal behaviour was significantly different between experimental and non-experimental periods. However, these differences were not consistent and did not appear to be related to LF sound transmissions.<sup>11</sup>*

With regard to sperm whales, another article concludes that “no statistically significant effects of airgun activity on sperm whales were found during” a UK study.<sup>12</sup> However, this study did not directly investigate seismic effects on sperm-whale feeding activity.

The only direct research on seismic effects on sperm whale feeding is presented in the 2008 Synthesis Report on the Sperm Whale Seismic Study in the Gulf of Mexico (“Synthesis Report”), which is published by the U.S. Minerals Management Service (“MMS”).<sup>13</sup> The Synthesis Report discusses data on the foraging behavior and avoidance movements of 8 tagged sperm whales in the Gulf of Mexico during exposure to airguns (“Study”). This Study rests on the assumption that whales' buzz rates reflect the rates of their foraging for food.

---

<sup>11</sup> Croll, D.A., Clark, C.W., Calambokidis, J., Ellison, W.T., and Tershy, B.R. 2001. Effect of anthropogenic low frequency noise on the foraging ecology of Balaenoptera whales. *Animal Conservation* 4:13-27.

<sup>12</sup> The effects of seismic airguns on cetaceans in UK waters, Stone and Tasker, J. *Cetacean Res. Manage.* 8(3): 255-263, 2006, available online at [http://www.carolynbarton.co.uk/Stone\\_Tasker\\_2006.pdf](http://www.carolynbarton.co.uk/Stone_Tasker_2006.pdf).

<sup>13</sup> The Synthesis Report is available online at <http://www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4444.pdf>.

## Center for Regulatory Effectiveness

Section III of CRE's comments presents a technical analysis of MMS' version of this Study.<sup>14</sup>

The scientists who conducted the Study recently wrote an article about it. These scientists described their Study as follows:

*The behavioral response experiments were performed in August-September of 2002 and June of 2003 in the northern Gulf of Mexico. The experimental procedure involved the following steps: (1) tagging one or more whales with Dtags, (2) following tagged whales at a distance to fix their surfacing locations, (3) after a pre-exposure period, exposing the tagged whales to sound from an airgun array on a dedicated seismic source vessel at a controlled distance, (4) continuing to follow tagged whales after the airguns were turned off to record post-exposure behavior, and (5) recovering the tag once it detached from the whale.*<sup>15</sup>

This Article contains the most recently published discussion of the Study by the researchers who actually conducted it. This Article differs from the Synthesis Report and other discussions of the Study in at least two respects.

***B. The Article Does Not Mention the 60% Whale or the Bayesian Analysis***

First, according to the Synthesis Report, the Study authors performed a nonparametric rotation test on the seven whales who made foraging dives. This test "found no evidence for a concerted reduction in foraging rate during airgun exposure by all seven whales." However, according to the Synthesis Report, the same test showed a 60% reduction in foraging for one whale.<sup>16</sup> By contrast, the Article does not even mention the 60% whale or the nonparametric rotation test.

Second, the Article does not mention any Bayesian statistical analysis. Yet the Synthesis Report claims that the Study authors performed Bayesian analysis on the foraging effects data because ANOVA analysis did not show any statistically significant relationship between seismic exposure and buzz rate/foraging among the seven whales who made foraging dives. By contrast to the Article, the Synthesis Report discussed this Bayesian analysis extensively. The Synthesis Report claims that the analysis

---

<sup>14</sup> See CRE comments, *infra* at page 15.

<sup>15</sup> Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico, Deep Sea Research Part I: Oceanographic Research Papers, Volume 56, Issue 7, July 2009, Pages 1168-1181, P.J.O. Miller, M.P. Johnson, P.T. Madsen, N. Biassoni, M. Quero, P.L. Tyack, available online at <http://thecre.com/pdf/Airguns.pdf>.

<sup>16</sup> Synthesis Report, page 263 (emphasis added). See also Synthesis Report at pages 13, 259, 261.

## Center for Regulatory Effectiveness

“indicated that the odds favor that, during exposure, there was a decrease in foraging activity of approximately 20% rather than that there was no change in foraging activity” of the seven whales.<sup>17</sup>

These two claims are prominent in the Synthesis Report's discussion of the Study. By not mentioning these claims in their peer-reviewed Article on the Study, the authors of the Study appear to abandon them, perhaps because their underlying analysis is flawed.<sup>18</sup>

**C. *The Study's Pitching Data Do Not Show Adverse Foraging Effects***

The Synthesis Report explains that the Study “used the animal's pitching energy, which reflects fluking movements, to estimate locomotion costs....”<sup>19</sup>

The Synthesis Report acknowledges that except for one whale who took a nap, the tagged “whales continued to make deep foraging dives during controlled acoustic exposure.”<sup>20</sup>

However, according to the Synthesis Report, “Results of an ANOVA statistical test for changes in foraging behavior of in the 7 whales that did foraging dives during exposure indicated a statistically significant decrease in pitching movements generated by swimming motion during full-array exposure as compared to post-exposure periods.”<sup>21</sup>

By contrast, the Article imposes several caveats on these pitching data (emphasis added):

*Although pitching movements likely correlate with swimming effort, it is not possible to estimate energy expenditure in absolute terms from accelerometer measurements because the relationship between fluking and energy expenditure [citation omitted] has not been calibrated for sperm whales. Moreover, the relationship between fluke oscillations and body pitching angle depend upon the location of the tag on the animal which varies from whale to whale.*

\*\*\*

*We only examined pitching movements during the search phase of echolocation-mediated foraging, and not during prey capture attempts.*

---

<sup>17</sup> Synthesis Report, page 283.

<sup>18</sup> See *infra* at page 6, for a discussion of the flaws in their analysis.

<sup>19</sup> Synthesis Report, page 258.

<sup>20</sup> Synthesis Report, page 283.

<sup>21</sup> Synthesis Report, page 283.

\*\*\*

*The seven whales that conducted foraging dives during and after airgun exposure all had lower pitching effort during full airgun-array exposure compared to the post-exposure period, with a statistically significant difference of 6.4%. Although the relationship between pitching effort, as quantified here during the search phase of echolocation-based foraging, and energy expenditure is not simple, the implication is that whales expended less energy during exposure. **This result was contrary to the hypotheses that fluking effort might increase during exposure if sperm whales actively swam away from the source or if finding prey in increased noise required more swimming effort.** However, this pattern is maintained, in a more extreme way, by the one whale that did not perform a deep dive until after airgun transmissions ceased. Thus, all eight tested whales seem to have had lower expenditure of energy on locomotion when airguns were firing than in the immediately subsequent post-exposure condition.<sup>22</sup>*

The change in pitching, assuming it occurred, could indicate that whales had an easier time foraging during airgun exposure because they did not have to expend as much energy in finding food. This seems unlikely, so the pitching data most likely has no biological significance at all.

The “*one whale that did not perform a deep dive until after airgun transmissions ceased*” took a nap after being tagged. Napping is normal for sperm whales. The whale's long nap cannot be attributed to seismic exposure because the Article explains that he started napping *before* he was exposed to seismic:

*Sperm whales worldwide conduct stereotyped resting drift dives during which they maintain a vertical posture near the sea surface [citation omitted]. The tag data for whale sw173b recorded the whale to be in a resting bout that lasted 265 min. The resting bout started 14 min after the tag was deployed, continued throughout pre-exposure, rampup and full-array conditions, and ceased 4 min after the final airgun pulse [citation omitted]. It is unknown if the whale had been resting prior to tag attachment.*

#### **D. The Study Data Have Other Flaws**

The Article explains that the Study does not include pre-seismic exposure foraging data for the napping whale or for any of the other whales:

---

<sup>22</sup> The Article as purchased online is not paginated. As noted above, the purchased Article is freely available online at <http://thecre.com/pdf/Airguns.pdf>.

## Center for Regulatory Effectiveness

*Therefore, to reduce the risk of making comparisons to 'baseline' behavior that had been influenced by tagging, we did not use the pre-exposure condition as a baseline for studying effects on foraging behavior in the 2002 experiments. We had solved this problem by 2003, indicated by long intervals between tagging and the start of exposure [citation omitted]. However, rather than split an already small data set, we used the post-exposure condition as the non-exposure condition for comparison.*

The Article concludes that:

*[t]he sample size from this study was insufficient to generate conclusive results on the effect of seismic airguns on the foraging of sperm whales in the Gulf of Mexico. We found consistent, but small, changes in pitching effort which is a behavior completely under each animal's control. However, our sample size was too small for conclusive results on buzz-rates, which, as an interaction between whale and prey, have additional sources of variability. Nonetheless, our results provide preliminary evidence that airgun operations might affect the foraging behavior of sperm whales negatively, possibly reducing their foraging rate even at the moderate received levels and large ranges between whale and sound source used here. Behavioral changes may include, at one extreme, delay of diving to avoid high-intensity exposure when horizontally close to an airgun array, and, at lower levels, disruption of the whales' foraging, perhaps linked with behavioral reactions of prey, as mentioned above.*

This conclusion is very equivocal. It could not support regulation of seismic on the basis of adverse foraging effects in sperm whales, especially given the other problems with the Study discussed above and below.

***E. MMS and NMFS Know About the Foraging Studies and Correctly Aren't Using Them to Regulate Seismic***

MMS and the U.S. National Marine Fisheries Service ("NMFS") have known the Study results since at least 2006.<sup>23</sup> Since then, NMFS and MMS have taken many actions regulating seismic effects on sperm and other whales. None of them regulate on the basis of the Study, and none of them impose any new regulatory requirements to prevent seismic effects on sperm whales' foraging.

For example, MMS issued 5-year leases for the period 2007-2012 for the U.S. Outer Continental Shelf. These leases include areas in the Gulf of Mexico, where the Study occurred. Environmental groups sued MMS on these leases, and succeeded in part. This suit did not include any seismic foraging claims.

---

<sup>23</sup> See, e.g., <http://www.gomr.mms.gov/PI/PDFImages/ESPIS/3/3600.pdf> for 2006 document discussing the foraging data.

## Center for Regulatory Effectiveness

As another example, MMS' new Notice to Lessees for oil and gas seismic operations does not include any requirements to prevent or mitigate foraging effects.<sup>24</sup>

As a final example, NMFS has issued several IHAs that discuss the foraging Study, but don't impose any new conditions as a result of the Study.<sup>25</sup>

This absence of regulatory consequence is not surprising because there are no reliable data showing that seismic causes adverse foraging effects.

**F. Regulatory Agencies Such as MMS and NMFS Should Clearly State that the Data Do Not Support A Conclusion that Seismic Causes Foraging Effects**

There follows a recent statement by NMFS on seismic foraging effects. This statement is from an IHA for a Rice University seismic vessel in the Atlantic (emphasis added):

*Most studies of sperm whales exposed to airgun sounds indicate that this species shows considerable tolerance of airgun pulses (Stone, 2003; Moulton et al., 2005, 2006a; Stone and Tasker, 2006; Weir, 2008). In most cases, the whales do not show strong avoidance and continue to call (see Appendix A of Rice's EA for review). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging effort is somewhat altered upon exposure to airgun sounds (Jochens et al., 2006, 2008). In the SWSS study, D-tags (Johnson and Tyack, 2003) were used to record the movement and acoustic exposure of eight foraging sperm whales before, during, and after controlled sound exposures of airgun arrays in the Gulf of Mexico (Jochens et al., 2008). Whales were exposed to maximum received sound levels between 111 and 147 dB re 1  $\mu$ Pa (rms) (131 to 164 dB re 1  $\mu$ Pa pk-pk) at ranges of approximately 1.4 to 12.6 km (0.9 to 7.8 mi) from the sound source. Although the tagged whales showed no horizontal avoidance, some whales changed foraging behavior during full array exposure (Jochens et al., 2008).<sup>26</sup>*

The unqualified NMFS statement that "some whales changed foraging behavior during full array exposure" is based on the Synthesis Report (i.e., "Jochens et al., 2008").

This statement is misleading given the subsequent Study article's much more equivocal statements (e.g., "*our results provide preliminary evidence that airgun operations might affect the foraging behavior of sperm whales negatively, possibly reducing their foraging rate...*"); given the

---

<sup>24</sup> <http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf>.

<sup>25</sup> E.g., Rice University IHA at 74 FR 28890, 28899 (June 18, 2009).

<sup>26</sup> 74 FR 28890, 28899 (June 18, 2009).

## Center for Regulatory Effectiveness

fact that there are no data showing a statistically significant relationship between seismic exposure and reduced buzz rates/foraging; and given the many flaws in the Study.

MMS and other regulatory agencies should be careful to state that the Study does not support any conclusions that oil and gas seismic operations adversely affect sperm whale foraging.

### III. Technical Analysis of MMS' Sperm Whale Seismic Study

The Sperm Whale Seismic Study (SWSS) was a five year, multi-institutional research program that focused on sperm whales in the northern Gulf of Mexico. SWSS objectives were to establish the normal behavior patterns of sperm whales, characterize habitat use, and to determine possible changes in behavior of sperm whales when exposed to noise from seismic gun arrays. The Minerals Management Service (MMS) produced two documents: Sperm Whale Seismic Study in the Gulf of Mexico Synthesis Report (MMS 2008-006) and Sperm Whale Seismic Study in the Gulf of Mexico Summary Report (MMS 2006-034). These documents summarized the SWSS program results. Our comments focus on section 6 of the MMS Synthesis Report (*Response of Sperm Whales of the Northern Gulf to Anthropogenic Noise*) and section 7.3.5 of the MMS Summary Report (*Analysis of Whale Movement and Behavior in Relation to Controlled Experimental Exposures from a Seismic Array*).

#### A. Foraging Behavior

Sperm whales were temporarily tagged with digital-recording acoustic tags (D-tags) that record whale orientation (pitch, roll, and heading), depth, and sounds produced and received by whales. These D-tags were used in controlled exposure experiments to measure responses of the tagged whales to sounds produced by seismic airguns. The effects of air-guns on foraging behavior were estimated by assessing the differences in responses between exposure and post-exposure control periods for 7 exposed and 13 non-exposed whales. Foraging was determined by changes in echolocation sounds, called buzzes, believed to be produced when whales attempt to capture prey.

As reported in the Summary Report, an ANOVA analysis indicated that there was a statistically significant decrease in swimming movements during a full-array airgun exposure as compared to post-exposure periods. The authors reported on page 253, that pitching movements generated by swimming motion were 6% lower during exposure ( $p = 0.014$ ). Buzz rates were 19% lower during exposure to airgun sounds, but this effect was not statistically significant ( $p = 0.141$ ). In the Synthesis Report, the authors refer to another document (Miller et al., 2005) that reports the pitching motions were 11% lower ( $p < 0.05$ ) and the buzz rates were 24% lower ( $p = 0.16$ ).

The authors also conducted a Bayesian analysis to quantify the odds-ratio. The Bayesian analysis indicated that a decrease in buzz rate is 3.6 times more likely than no change given the data and a decrease in pitching movement is 2.9 times more likely than no change.

## Center for Regulatory Effectiveness

***B. Avoidance***

Longer-term avoidance or horizontal displacement behaviors of sperm whales exposed to seismic airgun sounds were evaluated using Satellite-tracked radio telemetry tags (S-tags). The researchers attempted to determine whether satellite-tracked sperm whales occurred less frequently than expected in the vicinity of active seismic vessels (a possible indication of avoidance). Using location data from tagged sperm whales and seismic lines, the researchers tracked 12 whales that were determined to be within 25 km of an active seismic vessel. Analyses of the data suggest that there is no horizontal avoidance of sperm whales to seismic survey activities in the Gulf of Mexico. Moreover, the data do not support the assumption that whales swim away from an airgun array as it ramps up or approaches the whale at full power.

***C. Reported Study Conclusions***

- More research is needed to define the effects of sounds from seismic airguns on foraging behavior on sperm whales.
- Additional controlled experiments are necessary to increase the sample size to numbers yielding the desired statistical power.
- The data indicate a significant change in feeding behavior associated with exposure to seismic air-gun sounds with received levels ranging from <130 to 162 dBp-p re 1  $\mu$ Pa (decrease in fluking movement at  $p < 0.02$ ).
- Bayesian analyses suggest a 20% decrease in foraging attempts at exposure levels ranging from <130 to 162 dBp-p re 1  $\mu$ Pa at distances of roughly 1 to 12 km from the sound source, is more likely than no effect. The odds are about three times more likely that there is a 20% reduction in foraging during air-gun exposure than that there is no effect.
- There appeared to be no horizontal avoidance by sperm whales to controlled exposure of seismic airgun sounds.

***D. Assessment of Sperm Whale Seismic Study*****1. Study Strengths**

- The study is adequate for screening foraging behavior, but an expanded study is needed to address concerns about potential confounding factors and statistical analysis difficulties.

- The use of D-tags enabled researchers to track the 3-dimensional movement and sounds produced and received by exposed whales.
- In general, the descriptions of how the foraging behavior and avoidance experiments were planned and carried out are clear and understandable. The statistical experimental design and analysis are also clearly explained, but no supporting evidence for the conclusions was provided. This point is discussed below in the section Study Weaknesses and Uncertainties.
- The use of Bayesian analyses is a useful addition. The small data set benefits from these analyses.

## **2. Study Weaknesses and Uncertainties**

There are several factors that were not considered in the design and analysis of the study that are particularly relevant considering the small sample size.

- The results of the statistical analyses are presented in the two documents (the Summary Report and the Synthesis Report), but there does not seem to be a unified report that presents all the results. Also the analyses in the two documents do not always agree: (1) as noted in the opening summary of this document, there were apparently slightly different summary statistics for the same analyses in two different reports; (2) the Synthesis Report discusses a discrete distribution (Poisson) for the buzz production while the Summary Report seems to assume a continuous distribution for the buzz production. It would be useful to combine all the data analyses into one section of the document and present the results in a unified format.
- Availability of sperm whale prey was not evaluated during the controlled exposure experiments.
  - Prey availability and density affects foraging behavior of sperm whales.
  - The observed decrease in whale foraging behavior could have been due to random differences in prey distribution and density.
    - Whales in the controlled exposure experiments were at different locations. There are geographic variations in prey availability and density.
    - The controlled exposure experiments occurred in different years and seasons (spring, early and late summer). There are seasonal and annual variations in prey availability and density.
  - The statistical analysis in the Summary Report was based on individual whale differences (change scores), which may mitigate some of these

## Center for Regulatory Effectiveness

problems. However, it is important to assess the level of prey availability to assure that the difference analysis is adequate to control for this important point.

- There were 2 adult males in the group of 7 exposed whales. It is uncertain whether gender and age differences in the exposed whales had an effect on foraging behavior. The authors state on p. 264 of the Synthesis Report "It is also reasonable to expect that different age/sex classes and individual whales with different histories of exposure would have different patterns of behavioral response." As noted, some of the statistical analyses were based on difference scores that might mitigate the gender effect, but some test of the adequacy of the scores to account for these differences is important
- Control (non-exposed) whales included whales from locations other than the Gulf of Mexico. The sperm whale population in the Gulf of Mexico is genetically unique from those populations in the North Atlantic Ocean, Mediterranean Sea, and North Sea. Moreover, Gulf of Mexico sperm whales are also smaller than sperm whales from other areas. Differences in whale sizes and populations may be additional confounding factors. As noted, some of the statistical analyses were based on difference scores that might mitigate the size and location effects, but some test of the adequacy of the scores to account for these differences is important.
- The statistical model is a repeated measures ANOVA. This is appropriate for this type of experimental design, but perhaps not for the buzz production and movement data. The analysis for buzz production appears to be based on the buzz rate. The rate has a mean of about 0.01 buzzes per second based on the discussion in the Synthesis Report (section 6.2.3). The rate would be about 36 buzzes per hour and would not likely to be a continuous measure as required by the ANOVA. There does not seem to be any information concerning the specific measure used for pitching movement, so it is not possible to assess the appropriateness of this analysis.
- **The authors report the significance level (p-value) for the exposure no-exposure comparison, but no other results. It is not possible to statistically assess the overall interpretation without these results.** The authors should provide an ANOVA summary table.
- Since the sample size is small and significance level of the test for a noise effect is near the critical 0.05 level (reported *p* values were 0.014 and 0.141 for the buzz and locomotion measures respectively), it is important to test the ANOVA

assumptions necessary to assess the statistical significance of the results. Some of the tests that need to be done are:

- a test for the serial independence of the data values.
- a test for the normality of the residuals.

a test for the homogeneity of the variance among the individual whales. Figure 7.3.11 (Summary Report, page 252) shows a summary of the buzz rates for the 20 whales; based on the length of the confidence intervals, it does not seem as if the variances can be considered homogenous. The lack of homogeneity can be due to variation in the response pattern from whale-to-whale or due to a different number of replicate measures from each whale. **If there is a large difference in the number of replicates per whale then the standard analysis of the split plot ANOVA may not be correct.** It is important to estimate the expected mean squares used to form the F-test to determine if they are correct for the sample sizes that were used. **If the authors used the mean response then the homogeneity of the variances assumption would not be met and might invalidate the results.**

- **The results of the analysis should be open to question until it can be shown that the ANOVA assumptions have been met.**
- The results are presented as a percent change in behavior from noise exposure to no exposure, but the analyses are based on the observed data difference.
  - If the authors wanted to report the results as a percent change, then the analyses should have been based on percent change. They could either analyze the difference score, as they did, and report a difference or they can analyze a ratio score and report the ratio. **From the reported analysis we know there is a statistically significant difference ( $p = 0.014$ ) between the pitching during and after the air-gun noise, but we do not know if the percent change is statistically significant.** The analysis can be thought of as based on a difference, but the reported percent change is on the ratio of the responses. The percent change is a ratio because the percent difference is  $(\text{NOISE}-\text{NONOISE})/\text{NOISE}$  or  $1-\text{NONOISE}/\text{NOISE}$ . **This transformation can make a difference in the statistical significance of the results.**
- The time intervals of the exposure and post-exposure periods are not reported. If the time intervals are not equal, or nearly equal, the statistical analyses may be compromised because of unequal estimates of variability between periods and between whales. This is an example of incomplete data reporting.

## Center for Regulatory Effectiveness

- Pre-exposure data were not used in the analysis due to the difficulty in collecting pre-exposure data.
  - Pre-exposure foraging activity may have had an effect on subsequent foraging activity due to satiated appetite or need for rest.

**3. Suggestions for Improvement**

- More controlled exposure experiments with an increased number of whales are needed to address the potential difficulties with experimental design and analyses. Additional experiments would also add statistical power and aid the understanding of foraging and avoidance behavior in sperm whales exposed to sounds from seismic airguns.
- Conducting all controlled exposure experiments within the same year, season, and general location (within the Gulf of Mexico) would reduce experimental variability. Jaquet et al. (2000) reported that diving behavior of New Zealand sperm whales was significantly different between summer and winter. New Zealand sperm whales dived longer, stayed longer at the surface, and traveled further between consecutive fluke-ups in summer than in winter, indicating that there are seasonal differences in foraging behavior.
- Use of fishery echosounders to evaluate the density and distribution of biological assemblages (sperm whale prey) during exposure experiments could clarify observed foraging behavior in exposed whales. Miller et al. (2008, p. 225 Synthesis Report) reported “the foraging behavior of sperm whales in the Gulf of Mexico appears to be strongly related to vertical biological assemblages that can be tracked using acoustic techniques. Moreover on p. 284 of the Synthesis Report, it is recommended that future controlled exposure experiments " should include monitoring the prey field (for example by using fishery echosounders) before, during, and after exposure to test whether behavioral variations among acoustically exposed sperm whales could be explained by changes in the prey field.”
- We suggest that the authors use a mixed model design for analysis instead of using the traditional ‘split plot’ repeated measures design that has several additional assumptions beyond those mentioned above (symmetry of the subject matrix, etc). The mixed model design has few assumptions (or more control over the assumptions) and would be a more powerful (smaller chance of committing a false negative error) test. The assumptions of normality of the residuals and homogeneity of the variances have to be checked for this type of analysis also. The serial dependence is accounted for in the mixed-model parameters.

Center for Regulatory Effectiveness

Suggested references are: Pinheiro and Bates (2002), Littell et al. (1996), Milliken, and Johnson (1984).

- Regarding the Bayesian analyses, the form of the prior distribution was well described in the reports, but the stated reasons for choosing the specific prior were not obvious. We suggest a sensitivity type analysis to see how the results would have differed with the use of a uniform or other prior.
- If there are different numbers of sample data for each whale, then determine if the results are affected by the unequal sample size. Provide a summary table of number of observations and mean response per whale.
- Provide a complete ANOVA table for the analyses and a table of means and summary statistics so the reader has a better understanding of the measured values.
- In the legend for Figure 7.3.11 (Summary Report, page 252) change “The horizontal bars are one standard error of the percent difference in buzz rate.” to “The vertical .... bars”.

***E. References***

Jaquet, N., S. Dawson, and E. Slooten. 2000. Seasonal Distribution and Diving Behaviour of Male Sperm Whales off Kaikoura: Foraging Implications. *Canadian Journal of Zoology* 78(3):407-419.

Littell, R.C., G. A. Milliken, W. W. Stroup, and R. D. Wolfinger. 1996 . SAS System for Mixed Models. SAS Institute, Cary, North Carolina.

Miller, P., M. P. Johnson, P. L. Tyack, P. T. Madsen, and S. L. Watwood. 2005. Controlled Seismic Airgun Exposures: Effects on the Movement and Foraging Behavior of Sperm Whales. In McKay, M. and J. Nides, eds. *Proceedings: Twenty-third Gulf of Mexico Information Transfer Meeting*, January 2005. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-066. Pp. 284-288.

Miller, P. J. O., D. C. Biggs, A. Kaltenberg, A. Jochens, and L. Belabbassi. 2008. Foraging Behavior of Sperm Whales in Relation to Oceanographic Characteristics in the Northern Gulf of Mexico p. 218-227 in *Sperm Whale Seismic Study in the Gulf of Mexico*. Synthesis Report. OCS Study MMS 2008-006.

Center for Regulatory Effectiveness

Milliken, G.A. and D. E. Johnson. 1984. *Analysis of Messy Data, Volume I: Designed Experiments*. Van Nostrand Reinhold Company, New York.

Minerals Management Service. 2006. *Sperm Whale Seismic Study in the Gulf of Mexico. Summary Report, 2002-2004*. Minerals Management Service, Gulf of Mexico OCS Region OCS Study MMS 2006-034.

Minerals Management Service. 2008. *Sperm Whale Seismic Study in the Gulf of Mexico. Synthesis Report. Gulf of Mexico OCS Region. OCS Study MMS 2008-006*. 323 pp.

Pinheiro, J. C. and D. M. Bates. 2002. *Mixed-Effects Models in S and S-PLUS*. Springer-Verlag, New York.

**IV. Recommendations**

1. The Draft Proposed Plan’s discussion of the “balancing” requirement of section 18(a)(3) of the OCSLA should be expanded to clearly address the relationship between section 5 of E.O. 13158 and *State of California ex rel. Brown*. Specifically, the Draft Plan should explain that under *State of California ex rel. Brown*, section 5 of the Executive Order must be interpreted so that the goal of oil and gas development on the OCS is given “primary emphasis”, with potential environmental impacts given lesser emphasis.
2. MMS should recognize that seismic operations do not harm marine mammals as long as the operations are conducted in accordance with the long-standing mitigation provisions.