

CRE BRAZIL'S COMMENTS ON:

**SCIENTIFIC SYNTHESIS ON THE IMPACTS OF UNDERWATER NOISE ON
MARINE AND COASTAL BIODIVERSITY AND HABITATS (“NOISE REPORT”)**

UNEP/CBD/SBSTTA/16/INF/12 (12 MARCH 2012)

<http://www.cbd.int/doc/meetings/sbstta/sbstta-16/information/sbstta-16-inf-12-en.pdf>

Executive Summary

The Center of Regulatory and Effectiveness Brazil (“[CRE Brazil](#)”), is a nonprofit, non-government organization located in São Paulo city. Our mission is to ensure that: 1) the data which governmental agencies disseminate to the public is of the highest quality; and 2) the public has access to the data used to develop governmental policies. CRE Brazil is associated with [The Center for Regulatory Effectiveness](#) (Washington, D.C.) (“CRE”): an internationally recognized organization to improve the federal regulatory process.

CRE Brazil is concerned that the Noise Report is marred by bias and inaccuracies. These flaws could bar its use by regulatory bodies. These flaws also impede its use as a basis for further research into the effects of anthropogenic sound on marine life.

These flaws include the following:

- The Noise Report’s position is that the effects of ocean noise on marine life are largely unknown; that current regulatory requirements are inadequate; and that a “precautionary principle” must therefore be applied when assessing and regulating noise. In fact, the U.S. and other countries have regulated anthropogenic noise in the ocean for decades. The effects of that noise and regulation have been studied extensively, and no study has found a population level change in marine mammals caused by exposure to anthropogenic noise. For example, with regard to oil and gas offshore seismic exploration, the U.S. Department of the Interior and the U.S. National Academy of Sciences/National Research Council concluded that “there have been no known instances of injury, mortality, or population level effects on marine mammals from seismic exposure” despite decades of seismic in the offshore U.S. in compliance with long-standing regulation.

The Noise Report should be revised to reflect these facts:

- The Noise report does not adequately take into account the mitigation measures that are followed during that are followed during offshore seismic operations. Examples of mitigation measures include pre-survey environmental and risk assessments, cetacean-free zones around the seismic source vessel, marine mammal observers, soft-start of seismic energy sources (gradual ramp-up of sound), and use of PAMGUARD. With these mitigation measures in place the level of sound that actually reaches a marine mammal outside the exclusion zone is significantly reduced and not harmful.

- The Noise report apparently takes the position that 180 dB SEL is inadequate to protect sea life from injury, and that lower dB levels are necessary. The 180/160 dB threshold criteria originated from the HESS (High Energy Seismic Survey) panel in 1997 where recommendations were made at the time: “Given what is known from the currently best available data and until additional information specific to marine mammals can be obtained....”¹

Extensive research into the effects of sound on marine life has been done since 1996. The 180 dB number is unsupported by empirical data and undefined in terms of frequency band, sound type, and signal duration. It becomes even more problematic when used to define physical impact to odontocetes. Work by Finneran with beluga whales showed that masked temporary threshold shift (MTTS) from exposure to watrgun pulses (which are richer in higher frequencies than airguns and so may be considered the conservative case for odontocetes) did not occur until exposure levels of 226 dB (re 1 μ Pa peak-to-peak) were reached. That equates to the maximum levels expected ~100m below the center of an airgun array. Those levels quickly diminish at emission angles off the vertical.

Now, the best available science is documented by Southall et al. (2007).² The *Southall Report* concludes that for cetaceans, the proposed criteria for injury by multiple pulses are 230 dB re:1 μ Pa (peak) and, following summation, 198 dB re: 1 μ Pa²-s in terms of SEL. For pinnepeds in water exposed to multiple pulses the injury threshold is 218 dB re: 1 μ Pa (peak), and the injury SEL criterion is 186 dB re: 1 μ Pa²-s.³

The Noise Report should be revised to thoroughly discuss the *Southall Report* and to state that water sound levels below 180 dB are not likely to injure marine mammals.

- Contrary to what the Noise Report states, studies of seismic effects on sperm whales do not show any harm to sperm whale foraging or any other aspect of sperm whale life. The U.S National Oceanic and Atmospheric Administration’s (“NOAA”) National Marine Fisheries Service (“NMFS”) recently issued a biological opinion which concluded, based on several studies, that oil and gas seismic does NOT affect Sperm Whale behavior such as foraging:

¹ HESS Report, Appendix 5, Hugh Energy Seismic Survey review process and interim operational guidelines for marine surveys offshore Southern California, Camarillo: Report from HESS Team for California State lands Commission and U.S. Minerals Management Service (1999), www.mms.gov/omm/pacific/lease/fullhessrept.pdf.

² The *Southall Report* is available online at http://thecre.com/pdf/Aquatic%20Mammals%2033%204_FINAL1.pdf.

³ *Id.*, page 443.

*These studies suggest that sperm whales exhibit considerable tolerance of seismic sources (e.g., no apparent disruption of behaviors such as foraging or calling), or possibly some degree of habituation.*⁴

This NOAA biological opinion also concluded

*exposure to seismic pulse energy from the proposed seismic activities is not likely to cause a reduction in an individual whale's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). As a result, we do not expect the proposed action to have an effect on the extinction risk of the population(s) these individuals represent or the whale species these population(s) comprise.*⁵

The Noise Report should be revised to state that oil and gas seismic under current regulation does not adversely affect sperm whales.

These and other flaws in the Noise Report are discussed in more detail below. Unless they are corrected, U.S. and other regulatory bodies cannot use the report, and it is of limited value to anyone else. That result would be unfortunate for many reasons, one of which is the Report's correct encouragement of Passive Acoustic Monitoring ("PAM"). Academic groups (University of St. Andrews, Oregon State University, Herriot Watt University, and Scripps Institute of Oceanography), environmental groups (EcoLogic), and select oil and gas companies (through the International Association of Oil and Gas Producers) have spent considerable time, effort and money developing a freely available version of PAM called PAMGUARD.

The Noise report should be revised to discuss PAMGUARD and to encourage its use.

PAM is being recommended for required use offshore Brazil.⁶ Consequently, PAM and the freely available PAMGUARD are among the main reasons why CRE Brazil is filing these comments on the Noise Report. We would be pleased to work with UNEP and the Convention on Biological Diversity members to further the use and proper application of PAMGUARD.⁷

⁴ Pages 73-74 of NOAA Biological Opinion available online at http://www.nmfs.noaa.gov/pr/pdfs/consultations/biop_usgs2011.pdf.

⁵ *Id.*

⁶ See, e.g., page 415 of the document available online at http://www.aprh.pt/rgci/pdf/rgci-251_Parente.pdf.

⁷ The PAMGUARD website is at <http://www.pamguard.org/home.shtml>.

The Noise Report Is Not Useful in its Current Form Because It Does Not Meet Quality Standards

Nations like the United States have uniform quality standards that must be met before scientific studies can be used for regulations. The purpose of these quality standards is to ensure that important regulatory decisions are based on accurate, reliable, and peer reviewed information.

We provide the following example of how these quality-standards work. Several years ago, some Brazilian authors produced a study linking oil and gas seismic to whale strandings in Brazil. The 2004 International Whaling Commission's Report of the Scientific Committee's Standing Working Group on Environmental Concerns relied on this Brazilian study to conclude that oil and gas seismic can cause whale strandings. Subsequent analysis by others including CRE revealed that the Brazilian study is inaccurate and unreliable. Consequently, the U.S. NOAA/NMFS sent CRE a letter explaining that they cannot use the Brazilian study because it does not meet U.S. Government Information quality standards.⁸

These Government-wide standards require all U.S. agencies produce a record demonstrating that information is accurate, reliable and reproducible before the agencies use or rely on the information. NOAA/NMFS have established rigorous guidance governing their application of these information quality standards, and this guidance applies to information generated by international bodies like the IWC and UNEP.⁹

The U.S. Navy has implemented Information Quality standards similar to NOAA/NMFS'.¹⁰ The U.S. Navy uses sonar. NOAA/NMFS is a U.S. agency that regulates oil and gas seismic and U.S. Navy sonar.

We assume that UNEP wants the Noise Report to be useful to NOAA/NMFS and to the US Navy. The Report is not useful in its current form because it does not meet U.S. Information Quality standards.

⁸ See NOAA/NMFS' letter to CRE available online at http://thecre.com/pdf/NOAA-IWC_Letter.pdf.

⁹ See, e.g., NOAA/NMFS' Information Quality Act guidelines available online at *Policy Directive on Policy on the Data Quality Act*, <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/policies/04-108.pdf>. See also NOAA/NMFS documents available online at <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/procedures/04-108-03.pdf>; at <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/procedures/04-111-01.pdf>; at <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/procedures/04-108-02.pdf>; at <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/procedures/30-123-01.pdf>; and at <https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/policies/04-111.pdf>.

¹⁰ See, e.g., U.S. Navy documents available online at http://www.fas.org/irp/doddir/navy/secnavinst/5720_48.pdf.

Those standards are designed to ensure that regulation is based on accurate, reliable and reproducible information. The Noise Study is not useful to any other regulatory entity who is interested in that goal.

The Noise Report Does Not Meet Information Quality Peer Review Standards

At page 2, the Noise report states, “An earlier draft of this report was circulated for peer-review through notification SCBD/STTM/DC/RH/VA/78671 (2012-012) dated 23 January 2012 and comments were taken into account in finalizing the report.”

We have found no record of:

- the comments received on the Noise report;
- the identity of the commenters;
- the qualifications of the commenters to perform peer review of the Report;
- whether the commenters have any disqualifying bias;
- whether comments were received from a representative cross section of the various stakeholders and interests; and
- UNEP’s response to the comments.

The Noise report does not meet U.S. Peer Review standards until and unless there is a public record of these important facts. Without such a record, the Noise Report cannot be used by any entity in the U.S. Government, including NOAA/NMFS and the Navy.¹¹

Equally important is the fact that the U.S. peer review standards are designed to ensure adequate, informed, and unbiased review of important scientific documents. Consequently, any document which does not meet these peer review standards, like the Noise Report, should not be used by any regulatory body that is interested in the quality of its regulation.

The Noise Report Does Not Meet Information Quality Standards Because It Does Not Accurately State Current Science On The Effects of Anthropogenic Sound on Ocean Life

The Noise Report takes the position that a precautionary principle should be applied to regulating ocean sound because there is so much uncertainty about the effects of ocean sound. For example, the Report at page 52 states:

It should be noted here that the overall high level of uncertainty that currently exists regarding many of the effects of anthropogenic noise on

¹¹ U.S. peer review standards are available online at <http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2005/m05-03.pdf>.

marine fauna means that it is very important to use a precautionary approach when undertaking noise emitting activities in the marine environment. The application of the precautionary principle to the issue of marine noise has been discussed in some detail. The precautionary approach may be inconvenient to those with narrow commercial interests, but precaution in the face of uncertainty is rational and is an approach that is now deeply embedded in the way that society operates. Reducing uncertainty by increasing our knowledge and understanding of the issue will be the best guard against excessive precaution and over-regulation.

This position is inconsistent with the growing body of evidence discussed in various regulatory risk assessments for ocean sound, including those produced by the U.S. Department of the Interior and NOAA/NMFS. These risk assessments correctly conclude that, under the long-standing regulation criticized by the Noise Report, cetacean and pinniped stocks are growing concurrent with decades of oil and gas seismic and other sound-producing operations. The Noise Report does not mention these risk assessments, which show that there is no basis for the Report's recommended excessive precaution and over-regulation. There is no basis for questioning current regulatory requirements because the record shows they are the working.

Despite its criticism of current regulatory requirements, the Noise Report does not and cannot cite a single study that has found a population level change in marine mammals caused by exposure to anthropogenic sound.

The many studies that have found no effect, and which are not cited by the Noise Report, include a U.S. Department of Interior Environmental Impact Statement for Gulf of Mexico OCS Oil and Gas exploration and production. This EIS states that, despite more than 50 years of oil and gas seismic and other sound-producing activities, "there are no data to suggest that activities from the preexisting OCS Program are significantly impacting marine mammal populations":

Overall, within the CPA [Gulf Central Planning Area], 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. Therefore, in light of the above analysis on the proposed action and its impacts, the incremental effect of the proposed action on marine mammal populations is not expected to be significant when compared with all other past, present, and reasonably foreseeable future activities.¹²

This EIS for the Gulf of Mexico is not limited to marine mammals. For example, with regard to sea turtles, it states that the U.S. Department of Interior's

NTL 2007-G02, 'Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program,' minimizes the potential of harm from seismic operations to sea turtles and marine mammals; these

¹² Page 4-231 of document available online at http://www.boem.gov/BOEM-Newsroom/Library/Publications/2012/2012-058_vol_1-pdf.aspx

*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 sea turtles 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.*¹³

This EIS further concludes, “Marine mammals may exhibit some avoidance behaviors, but their behavioral or physiological responses to noise associated with the proposed action, however, are unlikely to have population-level impacts to marine mammals in the northern Gulf of Mexico.”¹⁴

The U.S. National Academy of Sciences/National Research Council has agreed with the U.S. Department of Interior that “there are no documented or known population-level effects due to sound,” and has concluded with regard to the entire U.S. Outer Continental Shelf that:

*[T]here have been no known instances of injury, mortality, or population level effects on marine mammals from seismic exposure but... the potential for these types of impacts may exist without appropriate mitigation measures. The [Interior]-approved seismic surveys include mitigation measures designed to reduce the potential for effects to occur.*¹⁵

The U.S. NOAA/NMFS has reached similar conclusions about oil and gas seismic in the Arctic. For example, a recent NOAA/NMFS Biological Opinion concluded that marine mammals are flourishing and increasing in the Arctic despite increasing oil and gas seismic activities there:

Data indicate that bowhead whales are robust, increasing in abundance, and have been approaching (or have reached) the lower limit of their historic population size at the same time that oil and gas exploration activities have been occurring in the Beaufort Sea and, to a lesser extent, the Chukchi Sea.

To our knowledge, no whales or other marine mammals have been killed or injured by these past seismic operations, and the BCB population of bowhead whales continues to increase at an annual rate estimated more than 3 percent. Because the Western Arctic bowhead whale population is approaching its pre-exploitation population size and has been documented to be increasing at a roughly constant rate for over 20 years, the impacts of oil and gas industry on individual survival and reproduction in the past

¹³ *Id.* page 4-242.

¹⁴ *Id.*, page 4-225 to 4-226.

¹⁵ See, e.g., Outer Continental Shelf Oil & Gas Leasing Program, 2007-2012 Final Environmental Impact Statement, page V-64 (MMS April 2007), available online at <http://www.boemre.gov/5-year/2007-2012DEIS/VolumelI/Sand6-ConsultationPreparers.pdf>.

have likely been minor (Angliss and Outlaw 2010). These activities are unlikely to have any effect on the other four stocks of bowhead whales. Similarly, only the western North Pacific stock of humpback whales and the Northeast Pacific stock of fin whales would be potentially affected by oil and gas leasing and exploration activities in the Chukchi Sea. The described work would have no effect on the remaining worldwide stocks of humpback or fin whales. No injury or lethal takes are anticipated from these activities, nor are population level consequences to the stocks expected. Most impacts would be due to harassment of whales, which may lead to behavioral reactions from which recovery is fairly rapid. Mitigative measures will be recommended to reduce harassment and the possibility of harm or lethal takes.”¹⁶

The U.S. NOAA/NMFS NMFS has correctly emphasized that “to date, there is no evidence that serious injury, death, or stranding by marine mammals can occur from exposure to airgun pulses, even in the case of large airgun arrays.”¹⁷

The Noise Report also discusses the effects of anthropogenic sound on fish. For example, at page 39 it states (footnotes omitted):

In comparison to marine mammals research into the effects of anthropogenic noise on marine fish is still very much in its infancy and there is far less information available.

The Noise Report ignores the extensive U.S. risk assessments of sound effects on fish. The U.S. Department of Interior and NOAA/NMFS always assess the effects of sound on fish in relevant regulatory actions. They have always concluded in their risk assessments that anthropogenic sound is not a significant threat to fish.¹⁸

Mitigated Seismic Sound Does Not Adversely Affect Sperm Whales

The Noise Report states at page 35 (footnotes omitted) that

¹⁶ Pages 64-65, ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION BIOLOGICAL OPINION, Incidental harassment authorization to allow for incidental takes of marine mammals during shallow hazards survey in the Chukchi Sea, Alaska, 2011 (NOAA/NMFS 2011), available online at http://www.nmfs.noaa.gov/pr/pdfs/permits/statoil_biop2011.pdf.

¹⁷ 75 FR 49795-96 (Aug. 13, 2010), page 49795, available online at <http://edocket.access.gpo.gov/2010/2010-19962.htm>.

¹⁸ See, e.g., page xviii of Draft PEIS Volume I, available online at <http://www.boem.gov/oil-and-gas-energy-program/GOMR/GandG.aspx>.

Observations of sperm whales that were resident in an area with seismic surveys occurring over many years did not record any avoidance behaviour, which may indicate habituation, but did see more subtle changes in foraging behaviour at sound levels that were considerably below the threshold level used to predict a disruption of behaviour. These subtle changes were only picked up because of a rigorous experimental design.

This statement refers to a study of oil and gas seismic effects on sperm whales in the Gulf of Mexico. This study was conducted jointly by the U.S. Department of the Interior, industry, the U.S. Navy, the U.S. National Science Foundation and some academics.¹⁹ Its results are discussed in a report called the Sperm Whale Synthesis Report.

The Noise Report's contrary and erroneous statement about sperm whale foraging effects is based on a flawed analysis of the sperm whale study.²⁰

The U.S. NOAA/NMFS published a biological opinion which concluded that the Sperm Whale Synthesis Report and other studies suggest that seismic does NOT affect Sperm Whale behavior such as foraging:

These studies suggest that sperm whales exhibit considerable tolerance of seismic sources (e.g., no apparent disruption of behaviors such as foraging or calling), or possibly some degree of habituation.²¹

NOAA/NMFS' biological opinion also concludes that:

The evidence available leads us to conclude that exposure to seismic pulse energy from the proposed seismic activities is not likely to cause a reduction in an individual whale's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). As a result, we do not expect the proposed action to have an effect on the extinction risk of the population(s) these individuals represent or the whale species these population(s) comprise.²²

NOAA/NMFS' conclusions are supported by the results of recent controlled sound exposure experiments on a sperm whale, which concluded:

¹⁹ The sperm whale seismic study has its own website: <http://seawater.tamu.edu/swss/>.

²⁰ The flaws in this analysis are addressed by CRE in their document available online at <http://www.thecre.com/creipd/wp-content/uploads/2011/10/nrdc-cre-response.pdf>.

²¹ Pages 73-74 of NMFS biological opinion available online at http://www.nmfs.noaa.gov/pr/pdfs/consultations/biop_usgs2011.pdf.

²² *Id.*, page 86.

*In neither CEE [controlled sound exposure experiment] did this individual appear to demonstrate obvious behavioral responses, as seen in the dive profiles below; no clear changes in the production of echolocation clicks were observed in either case.*²³

A 180 dB level Is Too Low

The Noise Report states at page 52 (footnotes omitted), “A level of 180 dB re 1 μ Pa rms for cetaceans (both baleen and toothed whales) and 190 dB re 1 μ Pa rms for pinnipeds has been used as a generic exposure criterion in the U.S., although these have been criticised as being set too high.”

In fact, the *Southall Report*, which is generally regarded as the best available science on this issue, concludes that 180/190 dB is TOO LOW for protecting against physical harm to marine mammals.

The *Southall Report* is extensively discussed in a CRE document²⁴ and elsewhere. The *Southall Report*

*undertook a review of the impacts of underwater noise on marine mammals and used this to define criteria for predicting the onset of injury and behavioural response in marine mammals with different hearing characteristics (high-, mid- and low-frequency hearing types) subjected to different types of noise (single pulse, multiple pulse and non-pulse). These criteria are now widely recognised within the scientific community as the appropriate precautionary noise criteria for assessing the impact of underwater noise on marine mammals (JNCC, 2010b).*²⁵

The *Southall Report* concludes that for cetaceans, the proposed criteria for injury by multiple pulses are therefore 230 dB re:1 μ Pa (peak) and following summation, 198 dB re: 1 μ Pa²-s in terms of SEL. For pinnepeds in water exposed to multiple pulses the injury threshold is 218 dB re: 1 μ Pa (peak), and the injury SEL criterion is 186 dB re: 1 μ Pa²-s.²⁶

²³ Biological and Behavioral Response Studies of Marine Mammals in Southern California, 2010 (“SOCAL-10”), Project Report, 26 February 2011, page 24, available online at http://www.cascadiaresearch.org/reports/SOCAL10_final_report-2010.pdf.

²⁴ This CRE document is available online at http://thecre.com/pdf/THE_FEDERAL_GOVERNMENTS_LONGSTANDING_REGULATION_OF_SE_ISMIC_AIRGUNS.pdf. It includes a link to the *Southall Report* itself.

²⁵ Page 8-9 of Shell risk assessment available online at http://www-static.shell.com/static/gbr/downloads/upstream/fram_8_underwater_noise.pdf.

²⁶ Page 443 of *Southall Report* available online at http://thecre.com/pdf/Aquatic%20Mammals%2033%204_FINAL1.pdf.

Based on Southall, the U.S. National Science Foundation recently concluded in an Environmental Impact Statement for NSF's international ocean-going operations that:

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. Temporary threshold shift (TTS) has been demonstrated and studied in certain captive odontocetes and pinnipeds exposed to strong sounds (reviewed in Southall et al. 2007). However, there has been no specific documentation of TTS let alone permanent hearing damage (i.e. PTS, in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions). Current NMFS policy regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds should not be exposed to impulsive sounds 180 and 190 dB re 1 μ Parms, respectively (NMFS 2000). Those criteria have been used in establishing the safety (=shut-down) radii planned for numerous seismic surveys conducted under U.S. jurisdiction. However, those criteria were established before there was any information about the minimum received levels of sounds necessary to cause auditory impairment in marine mammals. As discussed below,

- *the 180 dB criterion for cetaceans is probably quite precautionary (i.e., lower than necessary to avoid temporary auditory impairment let alone permanent auditory injury, at least for delphinids);*
- *TTS is not injury and does not constitute "Level A harassment" in MMPA [Marine Mammal Protection Act] terminology;*
- *the minimum sound level necessary to cause permanent hearing impairment ("Level A harassment") is higher, by a variable and generally unknown amount, than the level that induces barely-detectable TTS; and*
- *the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. The actual PTS threshold is likely to be well above the level causing onset of TTS (Southall et al. 2007).*

Recommendations for new science-based noise exposure criteria for marine mammals, frequency weighting procedures, and related matters were published recently (Southall et al. 2007). Those recommendations have not, as of late 2009, been formally adopted by NMFS for use in regulatory processes and during mitigation programs associated with seismic surveys. However, some aspects of the recommendations have been taken into account in certain EISs and small-take authorizations. NMFS has indicated that it may issue new noise exposure criteria for marine mammals that account for the now available scientific data on TTS, the expected offset between the TTS and PTS thresholds, differences in the acoustic frequencies

*to which different marine mammal groups are sensitive, and other relevant factors.*²⁷

As noted above, the U.S. NOAA/NMFS and the U.S. Navy now both heavily rely on the *Southall Report* in assessing and regulating sound in the ocean.²⁸

The U.S. is not alone in this. For example, based on *Southall*, Greenland now recommends that the 180 dB level be raised because it is too low.²⁹

The Noise Report only briefly cites *Southall* twice in passing. The Noise Report cannot be a reliable discussion of ocean noise without a much more thorough discussion of the *Southall Report*.

The Noise Report and the Convention Should Encourage the Use of PAM and PAMGUARD

The Noise Report extensively discusses PAM as a tool to help prevent marine mammals and perhaps other sea life from coming too close to high levels of sound in the water. The Report simultaneously advises the use of PAM and criticizes the current use of PAM. For example, at page 68 the Noise Report states:

*PAM
Recognised but not being used to its full potential
Lack of training and guidance on implementation
Not being used to its full potential
Lack of training and guidance on implementation
Often deployed more than 1 km ahead of the survey vessel

Prioritise the development of PAM training programmes
PAM monitoring occurs too far from the air guns to be effective*

The Noise Report further states at pages 79-80 (footnotes omitted):

As well as improving mitigation procedures and measures it is important that industry is encouraged to improve existing mitigation tools such as the

²⁷ Pages E-23 to E-24 of Programmatic EIS/OEIS for NSF-Funded Marine Seismic Research (June 2010), available online at <http://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/app-e-effects-of-seismic-sonar-on-marmam.pdf>.

²⁸ See, e.g., document available online at <http://www.gpo.gov/fdsys/pkg/FR-2012-02-28/pdf/2012-4695.pdf>.

²⁹ See page 4.1 of GUIDELINES TO ENVIRONMENTAL IMPACT ASSESSMENT OF SEISMIC ACTIVITIES IN GREENLAND WATERS (2nd edition), available online at <http://www2.dmu.dk/pub/fr785.pdf>.

mechanisms of sound emission by developing quieter noise sources through engineering modifications (e.g., shorter duration, narrower directionality or eliminating unnecessary frequencies). The development of passive acoustic monitoring (PAM) systems or other remote sensing techniques to detect a range of marine taxa is an important step for improving mitigation. For example, PAM will become more successful as a mitigation tool if it is able to accurately detect a significant number of vocalising marine mammal species within exclusion zones, identify each marine mammal species and provide a reliable range measurement to the animal.

Recent Brazilian studies have recommended the increased use of PAM to help protect sea life from sound in water:

“The possibility of detecting marine mammals by hydrophone arrays linked to special software (Passive Acoustic Monitoring – PAM) has shown promise as a monitoring tool for some species of marine mammal with frequent vocalization (e.g. Swartz *et al.*, 2002; Mellinger, 2004). PAM has been suggested as an alternative or additional technique to improve the effectiveness of monitoring marine mammals (Lewis *et al.*, 1998). This acoustic technique has been used to complement visual surveys during periods of darkness and may have advantages over the visual technique in areas with strong wind and poor visibility (Swartz *et al.*, 2003). Considering all of these factors, it is recommended to start experiments with PAM in Brazilian waters as an auxiliary tool to document the presence of marine mammals during seismic surveys.”³⁰

The U.S. Department of the Interior regulates offshore oil & gas seismic operations primarily through *Notice to Lessees and Operators* (“NTL”) 2007-G02. This NTL has a section which encourages, but does not require, the voluntary or “experimental” use of PAM:

Experimental Passive Acoustic Monitoring

*Whales, especially sperm whales, are very vocal marine mammals, and periods of silence are usually short and most often occur when these animals are at the surface and may be detected using visual observers. However, sperm whales are at the greatest risk of potential injury from seismic airguns when they are submerged and under the airgun array. Passive acoustic monitoring appears to be very effective at detecting submerged and diving sperm whales, and some other marine mammal species, when they are not detectable by visual observation. MMS strongly encourages operators to participate in an experimental program by including passive acoustic monitoring as part of the protected species observer program. Inclusion of passive acoustic monitoring does **not** relieve an operator of any of the mitigations (including visual observations) in this NTL **with the following exception**: Monitoring for whales with a passive acoustic array by an*

³⁰ Effectiveness of Monitoring Marine Mammals during Marine Seismic Surveys off Northeast Brazil, Parente and de Araújo, *Journal of Integrated Coastal Zone Management* 11(4):409-419 (2011), available online at http://www.aprh.pt/rgci/pdf/rgci-251_Parente.pdf.

observer proficient in its use will allow ramp-up and the subsequent start of a seismic survey during times of reduced visibility (darkness, fog, rain, etc.) when such ramp-up otherwise would not be permitted using only visual observers. If you use passive acoustic monitoring, include an assessment of the usefulness, effectiveness, and problems encountered with the use of that method of marine mammal detection in the reports described in this NTL. A description of the passive acoustic system, the software used, and the monitoring plan should also be reported to MMS at the beginning of its use.³¹

Academic groups (University of St. Andrews, Oregon State University, Herriot Watt University, and Scripps Institute of Oceanography), environmental groups (EcoLogic), and select oil and gas companies (through the International Association of Oil and Gas Producers) have spent considerable time, effort and money developing a freely available version of PAM called PAMGUARD. The PAMGUARD web site discusses PAMGUARD in considerable detail, and provides free, public access to PAMGUARD.³² The site is worth quoting at some length:

Background

The PAMGUARD project was set up to provide the world standard software infrastructure for acoustic detection, localisation and classification for mitigation against harm to marine mammals, and for research into their abundance, distribution and behaviour. Many marine activities involve underwater sound emissions. These may be a by-product of the activity (e.g. piling or explosives), or a tool (e.g. air guns used for seismic surveys in oil and gas exploration, or military/commercial sonar). To mitigate against harm to marine mammals, observers are often employed to visually scan the sea surface for the presence of animals. In the event of a sighting, procedures such as suspension/delay of activities may be implemented to avoid harm.

Current Methods

Visual observations play a vital role, but marine mammals are difficult to spot on the sea surface, especially when weather and light conditions are poor. However, many marine mammals produce loud and distinctive vocalisations, which can often be detected more reliably than visual cues. For these species, passive acoustic monitoring (PAM) offers an effective means of detection. Furthermore, the creatures do not need to be on the surface to be detected.

Why do we need PAMGUARD?

³¹ NTL 2007-G02, available online at http://sero.nmfs.noaa.gov/sf/deepwater_horizon/Appendix_A_Seismic_NTL_2007-G02.pdf (emphasis in the original).

³² The industry-sponsored PAMGUARD website is available online at <http://www.pamguard.org/home.shtml>.

While PAM software already exists, the source code is not freely available for others to help to expand and improve. This means that assumptions, and therefore margins for error, are not readily understood, that code evolves more slowly, or not at all, and source code improvements are at the mercy of the time and resources that the few responsible developers can commit. In the case of the military and some commercial organisations, detection, classification and localisation (DCL) technologies are in-house and protected. What is needed is an environment which raises the profile of PAM and creates a means of tapping into the intellectual resources of the research community. Industry and marine environmentalists are well aware of the need to upgrade and modernize.³³

The Sound and Marine Life Joint Industry Program (SAML JIP) Annual Report for 2009 also contains extensive, detailed documentation of PAMGUARD.³⁴ This report explains:

A software package called PAMGUARD has been released that can interpret and display calls of vocalising marine mammals, locate them by azimuth and range and identify some of them by species. These abilities are critical for detecting animals within safety zones and enabling shut-down.³⁵

The 2010 seismic guidelines for the UK's Joint Nature Conservation Committee ("JNCC") include the following section encouraging the use and further testing of PAMGUARD:

In the last few years, software that processes and analyses cetacean sounds has been developed. PAMGUARD is open source software that has been developed as part of the International Association of Oil and Gas Producers Joint Industry Project (JIP). JNCC recognises that PAMGUARD is currently in a transition period between use as a research tool and widespread adoption as a monitoring technique. Moreover, JNCC recognises the need to balance proactive implementation of PAM with the need to further develop its capability, for example to include species recognition and baleen whale detection, and therefore encourages users of these systems to actively contribute to their development and refinement.³⁶

PAMGUARD has undergone beta testing:

³³ PAMGUARD site available at <http://www.pamguard.org/background.shtml>.

³⁴ See 2009 Report, pages 1, 2, and 3, available online at <http://www.soundandmarinelife.org/Site/Basics/AnnRep3.pdf>.

³⁵ *Id* at 1.

³⁶ JNCC Guidelines for Minimising the Risk of Injury and Disturbance to Marine Mammals from Seismic Surveys (August 2010), Section 4,1, available online at http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Seismic%20Guidelines_August%202010.pdf.

Last year Ocean Science Consulting agreed to help the PAMguard team (www.pamguard.org) with their ongoing development project to improve the functionality of PAMguard for understanding small cetacean survey work. The PAMguard team have just built a new installer and have asked us to try it out in field conditions. Our Passive Acoustic Monitoring (PAM) operators are currently trialling the installer on various seismic vessels operating around the world. This involves OSC providing comments and feedback about the current features of PAMguard, the types of features we would like to see and actual testing the developing software....Generic problems with publicly revealed versions of PAMGUARD are also being tested....This collaborative effort informs the developers of what's happening in real field conditions, and how the programme can be improved.³⁷

In sum, there is general agreement that PAM is an important tool to help ensure that no marine mammals are adversely affected by seismic sound sources.

PAMGUARD is an open source, freely available version of PAM.

We believe that encouraging and helping to perfect the use of PAMGUARD is the most useful action that UNEP and a revised Noise Report can take to protect sea life.

CRE Brazil would be pleased to work with UNEP to achieve this goal.

CRE Brazil welcomes comments at **e-mail:** contato@cre.org.br.

³⁷ Ocean Science Consulting, “Advisors to the New Zealand Government,” blog entry dated March 15, 2012, available online at <http://www.osc.co.uk/blog/index.php/2012/03/ongoing-beta-testing-of-pamguard/>.