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GEOLOGICAL SOCIETY OF GREECE
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Athens, 7 September 2015

Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
ITP.Cody@noaa.gov

Subject: 0648-XE125- *Comment on "Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December 2015"*

Dear Ms. Harrison:

I am writing to support the permitting and operation of the scientific research program using marine seismic methods around Santorini, Greece, this year. Specifically Lamont Doherty Earth Observatory (LDEO) applied for an incidental harassment authorization (IHA) to operate a high-energy seismic survey in the waters around Santorini from mid-November to mid-December, 2015. (The IHA is a protocol established by the Marine Mammal Protection Act to authorize, monitor, and mitigate activities that might result in unintentional disruption of the natural behavioral patterns of marine mammals).

The planned study is funded by the U.S. National Science Foundation (NSF) and will use seismic methods to examine the entire crustal magma plumbing system beneath Santorini volcano. Santorini is unique for this study because it recently experienced significant unrest, is well-studied, and is a semi-submerged volcanic system, making it an ideal location for collecting dense 3D marine-land seismic data using the US *R/V Langseth* airgun source, 93 short period ocean bottom seismometers, and 26 land seismometers. The proposed high-density spatial sampling of the seismic wavefield and state-of-the-art travel time and waveform inversion methods will provide new insights into the structure of the whole crustal magmatic system and its surroundings. This will allow the scientists to determine the magma geometry and connections throughout the crust – physical parameters that control magma migration, storage, and eruption and are thus important to understand geohazards. More broadly, this study will also help scientists answer questions about how the processing of magma at arc volcanoes forms the rock compositions that dominate the continental crust.

The U.S. State Department has already been given approval by the Greek Government for this research project that will be conducted in Exclusive Economic Zone of Greece and surrounding international waters. The research has also been reviewed and approved by the Greek ΕΧΑΕΘ committee.

I am **Professor Efthimios Lekkas**, **President of Greek Geological Society** (http://www.geosociety.gr/index.php/en/) and I have discussed this project with the Principal Investigators directly and know that this project will have beneficial broader impacts for my

community. I also know that the acquisition plans have been designed to minimize the impact on marine life, and still adequately address the geohazard and scientific questions. The research will follow all standard monitoring and mitigation measures for seismic surveys as well as any additional IHA requirements established specifically for this project. Finally the research team will follow all requirements listed in the Greek foreign clearance document.

NSF and LDEO have followed the appropriate IHA process and have conformed with the associated requirements. As a U.S. research vessel, *R/V Langseth* operates entirely within the U.S. regulatory process, and, when appropriate, international laws, required to mitigate the potential impacts of sound in the environment. The Environmental Assessment (EA), and the associated application for an IHA for this 3D seismic experiment around Santorini lay out the program, its potential consequences, and the rationale for why the proposed action is the most efficient and safe program. It also lists the monitoring and mitigation measures that will be implemented to minimize any potential adverse impacts. By following this established approach previous *R/V Langseth* seismic surveys have not caused any obvious observed impacts on marine mammals.

Given the importance to our citizens of understanding the volcanic and earthquake hazards at Santorini and the surrounding regions, I urge you to authorize LDEO to conduct NSF's program of *Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015* (0648XE125).

Respectfully,

ΕΛΛΗΝΙΚΗ ΓΕΩΛΟΓΙΚΗ ΕΤΑΙΡΙΑ
1951

Prof. Efthimios Lekkas
President of Greek Geological Society

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Information: Dimitris Georgiou

Thira, 7 September 2015

To: **Jolie Harrison, Supervisor**
Incidental Take Program
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
ITP.Cody@noaa.gov

Subject: 0648-XE125 - Comment on "Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015"

Dear Ms. Harrison

I am writing to you in my authority as mayor of the island of Santorini (Thira), regarding the planned Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November–December 2015. As you know, the municipality of Santorini considers this survey as extremely important, since the better understanding of the Santorini volcano not only allows the more efficient handling of a volcanic unrest (whenever it occurs) but also of the volcanic environment where Santorini's citizens and visitors reside. Without such a knowledge and understanding, it is not possible to achieve a sustainable development and maintain the necessary balance between the natural volcanic environment and our current way of living. Within this context, the municipality of Santorini is supporting all activities that lead to a better understanding of the associated volcanic and earthquake risks. For example, due to the lack of a national state institution that handles volcanic risk, the municipality supports the operation of the non-profit Institute for the Study and Monitoring Of the Santorini Volcano (ISMOSAV), which operates a real-time observation network on the island and provides scientific advice and support to our municipality.

The planned study is funded by the U.S. National Science Foundation (NSF) and will use seismic methods to examine the entire crustal magma plumbing system beneath

National & Kapodistrian
University of Athens

Department of Geology and Geoenvironment

Sector of Dynamic Tectonic Applied Geology

Postgraduate Program
ENVIRONMENTAL DISASTER & CRISIS MANAGEMENT STRATEGIES

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Panepistimioupoli, Zografou
157 84, Athens
Tel.: 210 727 4825, Fax.: 210 727 4414

Athens, 9 September 2015

Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
ITP.Cody@noaa.gov

Subject: 0648-XE125- *Comment on "Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December 2015"*

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National & Kapodistrian University of Athens

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Panepistimioupoli, Zografou
157 84, Athens
Tel.: 210 727 4825, Fax.: 210 727 4414

I am **Professor Efthimios Lekkas**, Director of Master's Course in: Environmental Disaster & Crisis Management Strategies (http://www.edcm.edu.gr/) and I have discussed this project with the Principal Investigators directly and know that this project will have beneficial broader impacts for my community. I also know that the acquisition plans have been designed to minimize the impact on marine life, and still adequately address the geohazard and scientific questions. The research will follow all standard monitoring and mitigation measures for seismic surveys as well as any additional IHA requirements established specifically for this project. Finally the research team will follow all requirements listed in the Greek foreign clearance document.

NSF and LDEO have followed the appropriate IHA process and have conformed with the associated requirements. As a U.S. research vessel, *R/V Langseth* operates entirely within the U.S. regulatory process, and, when appropriate, international laws, required to mitigate the potential impacts of sound in the environment. The Environmental Assessment (EA), and the associated application for an IHA for this 3D seismic experiment around Santorini lay out the program, its potential consequences, and the rationale for why the proposed action is the most efficient and safe program. It also lists the monitoring and mitigation measures that will be implemented to minimize any potential adverse impacts. By following this established approach previous *R/V Langseth* seismic surveys have not caused any obvious observed impacts on marine mammals.

Given the importance to our citizens of understanding the volcanic and earthquake hazards at Santorini and the surrounding regions, I urge you to authorize LDEO to conduct NSF's program of *Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015* (0648XE125).

Respectfully,

Prof. Efthimios Lekkas

Santorini volcano, providing new insights into the structure of the whole crustal magmatic system and its surroundings, and allowing us to better understand the components that affect volcanic hazard for Santorini. I have discussed this project with the Principal Investigators directly and especially the members of the Institute for the Study and Monitoring of the Santorini Volcano (ISMOSAV), who supports this research program, and I understand that the project has been designed to minimize the impact on marine life, while still adequately addressing the geohazard and scientific questions.

Given the importance to our island of the improved understanding of the volcanic and earthquake hazards at Santorini and the surrounding regions, I would like to express my full support for the NSF program of Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November-December 2015 (0648-XE125).

I remain at your disposal for any additional information and clarification

The Mayor of Thira

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ ΔΗΜΟΣ ΘΗΡΑΣ

Anastasios Nikolaos Zorzos

HELLENIC REPUBLIC
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Prof. E. Lekkas
President of Board of Directors of EPPO

Athens, 9 September 2015
Ref. No: οικ 1313

To: Jolie Harrison, Chief
Permits and Conservation
Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910
ITP.Cody@noaa.gov

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The U.S. State Department has already been given approval by the Greek Government for this research project that will be conducted in Exclusive Economic Zone of Greece and surrounding international waters. The research has also been reviewed and approved by the Greek ΕΧΑΕΘ committee.

I am **Professor Efthimios Lekkas**, President of **EPPO** (Earthquake Planning and Protection Organisation) and **ECPFE** (European Centre on Prevention and Forecasting of Earthquakes) and I have discussed this project with the Principal Investigators directly and know that this project will have beneficial broader impacts for my community. I also know that the acquisition plans have been designed to minimize the impact on marine life, and still adequately address the geohazard and scientific questions. The research will follow all standard monitoring and mitigation measures for seismic surveys as well as any additional IHA requirements established specifically for this project. Finally the research team will follow all requirements listed in the Greek foreign clearance document.

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Given the importance to our citizens of understanding the volcanic and earthquake hazards at Santorini and the surrounding regions, I urge you to authorize LDEO to

conduct NSF's program of *Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015* (0648XE125).

Respectfully,

Prof. Efthimios Lekkas

President of EPPO & ECPFE

Marcus Langseth Science Oversight Committee (MLSOC)
Dr. Nathan Bangs, Chair
University of Texas at Austin, Institute for Geophysics
mlsoc@mail.unols.org

Jolie Harrison, Supervisor
Incidental Take Program
Permits and Conservation Division,
Office of Protected Resources
National Marine Fisheries Service
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Silver Spring, MD 20910
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September 23, 2015

Subject: 0648-XE125 - *Comment on "*Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015*"*

Dear Ms. Harrison:

The Marcus Langseth Science Oversight Committee (MLSOC) welcomes the opportunity to comment on the application for an Incidental Harassment Authorization (IHA) for the proposed marine seismic investigation of the Santorini Volcano, a Greek island in the eastern Mediterranean, to study the subsurface structure and magma migration processes within this active volcano. The results from this study are an essential component in assessing volcanic, earthquake and tsunami hazards and are relevant to understanding hazards associated with the active Cascade, Hawaiian, and Aleutian volcanoes of the United States. This program utilizes *R/V Marcus G Langseth (R/V Langseth)*, a unique asset of the Federal Academic Fleet with its specially designed capabilities to conduct the proposed seismic program. MLSOC supports the application for an IHA and endorses National Marine Fisheries Service (NMFS) commitment to science-based decisions in its regulatory process.

The MLSOC is a committee within the University National Oceanographic Laboratories System (UNOLS) and consists of a diverse group of professionals, including geophysicists, geologists, oceanographers, and marine engineers, who provide advice on the scientific operations of *R/V Langseth.* The committee's members have extensive experience conducting seismic operations around the world aboard *R/V Langseth* and other seismic vessels, as well as knowledge and experience in mitigation and monitoring identified and/or required under the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). One role of the Committee is to advise both the National Science Foundation (NSF) and the ship operator Lamont-Doherty Earth Observatory (L-DEO) on safe, efficient, cost-effective, and scientifically compelling operations of *R/V Langseth*.

As a U.S. research vessel, *R/V Langseth* operates entirely within the U.S. regulatory process, and, when appropriate, international laws, including for mitigating any potential impacts of sound on the environment. NEPA, and Executive Order 12114, requires agencies, in this case NSF, to consider the potential environmental impacts of their proposed actions. The Draft Environmental Assessment (EA), the associated application for an IHA, and NMFS's request for comments on the proposed IHA for this seismic investigation of Santorini Volcano describe the proposed research program, its potential

consequences, possible alternatives, the rationale for why the proposed action is the most efficient and safe program, monitoring plan, and mitigation measures that would minimize any potential adverse impacts. Among the factors considered in developing the research plan were:

a. Minimum energy source size to accomplish scientific objectives;
b. Mitigation and shut down procedures for marine species;
c. Protected Species Visual Observers (PSVO) observations for a standard amount of time, generally 30 minutes prior to the start of the survey to clear a specified area around the vessel, and to monitor marine species occurrence, abundance, and behavior during seismic operations;
d. Startup of the energy source includes ramp-up procedures over a standard amount of time (generally 30 mins) that serves to alert animals of the activity and allows them to vacate the area if disturbed;
e. No start-up of the seismic source during poor visibility or at night unless at least one airgun has been operating;
f. PSVOs, independently contracted biologists, have authority to shut down the seismic source when marine mammals, sea turtles, and diving and foraging endangered/threatened seabirds are detected in or about to enter designated exclusion zones;
g. Passive Acoustic Monitoring (PAM) and infrared sensors during day and night to complement visual monitoring; and
h. As a specific requirement for this project, the airguns would be shut down if a Mediterranean monk seal were seen at any distance from the vessel.

These factors are similar to and sometimes more stringent than guidelines that are implemented by countries such as:

U.K. (*http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Seismic%20Guidelines_Aug%202010.pdf*),
Canada (*http://www.dfo-mpo.gc.ca/oceans/management-gestion/integratedmanagement-gestionintegree/seismic-sismique/index-eng.asp*),
Brazil(*http://www.oceanwatchmmos.com/resources/IBAMA_document_Guide%20for%20monitoring%20marine%20biota%20translated_2005_04.pdf*),
Australia (*http://www.environment.gov.au/resource/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales*),
New Zealand (*http://www.doc.govt.nz/our-work/seismic-surveys-code-of-conduct/*),
Denmark(*http://www.govmin.gl/images/stories/petroleum/environmental_reports/EIA_Guidelines_to_environmental_impact_assessment_of_seismic_activities_in_Greenland_waters.pdf*),
Norway (*http://www.npd.no/global/engelsk/5-rules-and-regulations/guidelines/guidelines-seismic-surveys.pdf*),

The monitoring and mitigation strategies proposed for the Santorini Volcano are reasonable, and are consistent with, or more conservative than, these internationally accepted standards. The proposed monitoring and mitigation measures are based on standards set in the *Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey* (NSF/USGS PEIS – link provided below), which included public input, expert review, and are precautionary because of the uncertainties associated with impacts of man-made sound on animals and unknowns about the behavior, abundances, and distributions of marine animals.

There is often public confusion regarding the potential impacts to marine mammals from seismic surveys, in particular, the distinction between injury and disturbance because the U.S MMPA uses the term “take”

to describe both situations. The IHA application for the Santorini Volcano research program is an application only to "incidentally" disturb animals, not to injure animals. The proposed monitoring and mitigation described in a – h above is designed to minimize potential disturbance to marine mammals, as well as to avoid the possibility of injury. While NMFS may issue Level A take for the proposed activity, we do not believe that the activity, combined with the proposed monitoring and mitigation measures, would result in Level A injuries to marine species.

As required by NMFS, this IHA was prepared using the current NOAA acoustic guidance. Though NOAA published new draft guidelines in December 2013 and again in July, 2015 for assessing the effects of anthropogenic sound on marine mammals (http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm), these have not yet been finalized and implemented. Specifically, scientists at Lamont-Doherty Earth Observatory (L-DEO) have analyzed actual received sound levels from the *R/V Langseth* acoustic source collected via hydrophone streamers in shallow water depths at two different sites, similar to water depths that occur in the Santorini study area. Their results showed that the mitigation radii based on the L-DEO model (i.e., the radii generally used in establishing exclusion and mitigation zones in the IHA permit) were 2-3 times larger than the radii measured in situ (Crone et al., 2014 and Crone, *pers comm* 2015). Consistent with the NSF/USGS PEIS, NSF uses the larger and more conservative radii from their models for shallow water rather than the significantly smaller radii demonstrated by actual measurements. This conservative approach should allay alarmist concerns raised by groups such as the Marine Mammal Commission that uncertainties in sound propagation in shallow water are reason to deny issuing the permit or require the use of even larger exclusion zone radii than those predicted by the L-DEO model.

The problem, however, with using conservative radii is summarized by Crone et al. (2014): "Conservative mitigation radii are preferred to those that are underestimated; however, excessively conservative radii can result [*in*] the over-counting of takes, and may cause unnecessary power-downs and shutdowns like those that plagued the 2012 COAST project on the *R/V Langseth*, and lead to large unnecessary losses of survey data" (Crone et al., 2014, p. 3805). As more data similar to that published by Crone et al. (2014) are acquired, analyzed, and published, NSF will work with NMFS to incorporate these results into estimates of mitigation radii based on the best available scientific information.

Part of the rationale for mitigation and monitoring, including ramp-ups, is that animals are given the opportunity and will move away from a sound that might disturb them. During the 2014 *R/V Langseth* program conducted by the U.S. Geological Survey along the U.S. Atlantic margin to survey natural hazards and the extended continental shelf, the IHA permit authorized 11,367 takes to "incidentally" disturb individual animals protected under the Marine Mammals Protection Act and the Endangered Species Act. Only three unidentified dolphins were observed as potentially exposed to airgun sounds within the mitigation zone (> 160 dB) during the survey, resulting in a power down for 12 minutes out of 357.2 hours that the source was active. This very small number is evidence that mitigation and monitoring do work to minimize exposure and potential harm. Additionally, it demonstrates conservative, precautionary approaches to estimating take calculations can result in significantly overestimating potential impacts to marine species and can instead mislead the public as to the level of impacts that may result from acoustic sources. While MLSOC applauds NMFS' proactive efforts to protect precious marine species and the marine environment through the IHA process, we also encourage NMFS to take into consideration documented PVSO observations, such as those noted above, when assessing future *R/V Langseth* and academic seismic survey IHA applications.

Acoustic sources are essential and irreplaceable tools for the collection of data for scientific research in the oceans. Seismic methods are the only tool available for peering directly into the seafloor and acquiring the data necessary to advance understanding of volcanic, earthquake, and tsunami hazards. The proposed Santorini Volcano seismic program fits wholly within this framework and will provide invaluable data on the deep structure and current state of the magmatic system at Santorini volcano. The

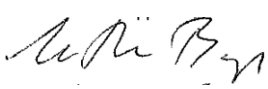
program will also provide detailed images of the deforming uppermost crust at Santorini and of the adjoining volcanic and faulted regions, which are an essential component in assessing volcanic, earthquake and tsunami hazards. Furthermore, the results from this study of the Santorini Volcano will further our understanding of volcanos worldwide.

If seismic research programs such as that proposed for the Santorini Volcano using *R/V Langseth* are not permitted, the future of this unique national asset and the innovative research that it enables will be lost. The U.S. will have no way to investigate and study marine geologic features of critical interest to understand potential volcanic hazards, such as the Santorini Volcano, or other geohazards, such as earthquakes, tsunamis, and submarine landslides. Further, this means government officials will not be able to make informed polices to better protect its citizens, for example from earthquake or tsunami hazards, especially along populated coastline areas. If the *R/V Langseth* cannot conduct these programs that are relevant to U.S. national interests, what role will science play in policies that safeguard public safety, resilience, and stability?

NSF and L-DEO have followed the appropriate IHA process and have conformed to the associated requirements. Based on the information and analysis provided by NSF and L-DEO, the proposed activities meet the criteria established for issuance of an IHA, particularly because the mitigation radii are in all likelihood considerably larger than they need to be and take estimates appear conservative. Therefore, the MLSOC urges NMFS to approve this application for an IHA.

R/V Langseth, and its predecessor, *R/V Ewing*, completed more than a decade's worth of academic/government seismic programs with the highest standards of mitigation and monitoring and without the dire, unfounded results purported by opponents of the activities (e.g., no marine mammal mass strandings or disruption to fishing). This letter is to affirm that there is significant support from the scientific community and other members of the public, for the IHA to be issued for the proposed activity and for the survey to be conducted. As a consequence of past seismic research activities, academic scientists have provided significant contributions to society through results which have enhanced our understanding of the Earth, Earth processes, and geohazards. Additionally, observations made by the PSVOs aboard seismic expeditions are contributing to better understanding of the distribution and behavior of marine mammals and sea turtles. We encourage NMFS – as a science based agency – to use science to make informed decisions, perform its regulatory duties, and issue IHAs in an appropriate and timely manner.

Respectfully submitted,



Dr. Nathan Bangs, Chair MLSOC
University of Texas at Austin, Institute for Geophysics

Members:
Donna Blackman, Scripps Institution of Oceanography
Deborah Hutchinson, U.S. Geological Survey
Dan Lizarralde, Woods Hole Oceanographic Institution
Beatrice Magnani, Southern Methodist University
Greg Mountain, Rutgers University
Dale Sawyer, Rice University
David Scholl, University of Alaska
Alexander Shor, University of Hawaii

Ex-officio:
Maya Tolstoy, Lamont-Doherty Earth Observatory
Suzanne Carbotte, Lamont-Doherty Earth Observatory

Crone, T.J., Tolstoy, M., and Carton, H., 2014, Estimating shallow water sound power levels and mitigation radii for the R/V Marcus G. Langseth using an 8 km long MCS streamer: Geochemistry, Geophysics, Geosystems, 15, 3793-3807, 10.1002/2014GC005420, (http://onlinelibrary.wiley.com/doi/10.1002/2014GC005420/epdf).

NSF/USGS PEIS can be found at https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf

MARINE MAMMAL COMMISSION

28 September 2015

Ms. Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Ms. Harrison:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by Lamont-Doherty Earth Observatory (LDEO), in collaboration with the National Science Foundation (NSF), seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act (the MMPA) to take small numbers of marine mammals by harassment. The taking would be incidental to a marine geophysical survey to be conducted in the eastern Mediterranean Sea in November–December 2015. The Commission also has reviewed the National Marine Fisheries Service's (NMFS) 4 September 2015 notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (80 Fed. Reg. 53624).

Background

LDEO proposes to conduct a 2D geophysical survey off Crete and a 3D geophysical survey within the territorial waters[1] and exclusive economic zone of Greece. The purpose of the 2D survey is to investigate the megathrust fault between Peloponnesus and Crete in the Hellenic subduction zone off southwestern Crete and the 3D survey is to collect and analyze seismic refraction data on and around the island of Santorini to examine the crustal magma plumbing of the Santorini volcanic system. The surveys would be conducted in waters estimated to be 20 to 3,000 m in depth along approximately 2,344 km of tracklines. LDEO would use the R/V *Marcus G. Langseth* to operate a 36-airgun array at a tow depth of either 9 or 12 m. The *Langseth* also would (1) tow a hydrophone streamer (8,000 m in length) or (2) use 93 ocean-bottom seismometers to collect data during the survey. In addition, LDEO would operate a 10.5- to 13-kHz multibeam echosounder and a 3.5-kHz sub-bottom profiler continuously during the survey. The survey is expected to last for 30 days.

NMFS preliminarily has determined that, at most, the proposed activities would result in the incidental taking of small numbers of up to 22 species of marine mammals by Level B harassment

[1] NMFS does not authorize the taking of marine mammals within the territorial waters (in this case within 6 nmi) of a foreign country but does consider such taking when determining whether the activity would have a negligible impact on the affected species or stocks.

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and 4 species of marine mammals by Level A harassment[2] and that any impact on the affected species would be negligible. NMFS does not anticipate any take of marine mammals by death or serious injury. It also believes that the potential for temporary or permanent hearing impairment will be at the least practicable level because of the proposed mitigation measures. Those measures include (1) refraining from operating the multibeam echosounder and sub-bottom profiler in transit to and from the survey area, (2) monitoring the exclusion[3] and buffer zones (based on Level A and B harassment, respectively), and (3) using power-down, shut-down, and ramp-up procedures. To reduce impacts on Mediterranean monk seals during the peak pupping season (September through November), LDEO would survey the three tracklines closest to Anafi Island[4] as late as possible (i.e., late November to early December). LDEO also would shut down the airguns immediately if and when a pinniped is sighted, regardless of the distance from the *Langseth*. Ramp-up procedures would not be initiated until the pinniped has not been seen at any distance for 30 minutes. In addition, LDEO would power down the array, if possible, when concentrations of gray, humpback, sei, fin, and/or sperm whales (six or more individuals that do not appear to be traveling and are feeding, socializing, etc.) are observed within the Level B harassment zone. Further, LDEO would (1) implement speed and course alterations if those alterations do not compromise operational safety and (2) conduct the survey starting from the coast and proceeding offshore to avoid trapping marine mammals in shallow water.

Species-specific densities[5] or group sizes[6] were used to estimate the numbers of takes for the majority of marine mammal species. However, NMFS based the number of Mediterranean monk seal takes on the number of individuals in the monk seal subpopulations on Anafi Island and the Kimolos–Polyaigos Island complex[7] and from stranding data from Santorini Island, which represent the maximum number of seals that could be harassed during the survey rather than the number of takes. The Commission understands that NMFS is increasing the number of total takes based on the extent of the ensonified area and number of days of activities to inform its negligible impact determination for monk seals—the Commission supports that approach. NMFS's small numbers analysis would not change.

However, the Commission has recommended numerous times that NMFS adjust density estimates used to estimate the numbers of takes by incorporating some measure of uncertainty when available density data originate from other geographical areas and temporal scales[8]. In this instance,

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[2] The Commission understands that NMFS proposed to authorize taking by Level A harassment to account for situations in which marine mammals may enter the Level A harassment zone before the airguns can be either powered or shut down, namely because standard mitigation measures included in incidental take authorizations rely on visual monitoring and implementation may not occur until an animal is observed within the specified zone. This is especially true for seismic surveys that have Level A harassment zones of greater than 2 km.

[3] The Commission understands that NMFS plans to require LDEO to use an exclusion zone of 100 m for both pinnipeds and cetaceans for all water depths when the mitigation gun is in use, rather than the proposed 27 and 96 m for pinnipeds and cetaceans, respectively, in shallow water (< 100 m). The exclusion zone for both pinnipeds and cetaceans in both intermediate (100–1,000 m) and deep (> 1,000 m) water was already proposed to be 100 m.

[4] A known haul-out and pupping area.

[5] And the total ensonified area in a given day for the two different types of surveys and the numbers of days those surveys would occur.

[6] Some group sizes were multiplied by the number of days of activities for those species that have a greater likelihood of occurrence and hooded seal takes were based on a single stranding record from the western Mediterranean.

[7] Which included only the adult females that can travel up to 70 km.

[8] Including the age of the data.

in the absence of applicable density data off Santorini and Crete, NMFS used various extrapolations[9] and adjustments based on numerous assumptions. It would be very useful if NMFS had guidance available that would set forth a consistent approach for how applicants should incorporate uncertainty in density estimates. In addition, NMFS has yet to develop a clear policy setting forth more explicit criteria and/or thresholds for making small numbers and negligible impact determinations. The Commission understands that NMFS is in the process of developing policies and guidance to address these concerns and would welcome the opportunity to work with NMFS as it develops them.

Uncertainty in modeling exclusion and buffer zones

For more than five years, the Commission has raised concerns about the method used to estimate exclusion and buffer zones (based on Level A and B harassment, respectively) and the numbers of takes incidental to NSF-funded geophysical research. LDEO performs acoustic modeling for geophysical research funded by NSF[10] to estimate exclusion and buffer zones using a simple ray trace–based modeling approach that assumes spherical spreading, a constant sound speed, and no bottom interactions (Diebold et al. 2010). As noted in several Commission letters, numerous studies[11] have emphasized the importance of incorporating site-specific environmental and operational parameters into estimating exclusion and buffer zones. The recent Crone et al. (2014)[12] study indicated that, in shallow and sloped environments, the complexity of local geology and bathymetry and the typical lack of sufficient information regarding this complexity can make it difficult to predict accurately sound levels as a function of distance from the source array.

In keeping with that theme, Crone et al. (2014) used a (1) non-parametric smoothing cubic spline model to estimate the distances to the 180-dB re 1 μPa[13] and the 160-dB re 1 μPa^2-sec thresholds, (2) spherical spreading model with an attenuation term for the 160-dB re 1 μPa threshold, and (3) high-degree polynomial model for the 180-dB re 1 μPa^2-sec threshold for a survey[14] off Washington state. Extrapolation was necessary for both the 160-dB re 1 μPa and 180-dB re 1 μPa^2-sec thresholds due to the isopleths being either beyond the range of the hydrophone streamer or closer to the ship than what the streamer could collect. Conversely, Crone (2015) determined that a simple logarithmic spreading loss model[15] without an attenuation term best characterized the distances to the 180- and 160-dB re 1 μPa thresholds for a survey[16] off New Jersey. Extrapolation also was necessary for the 180-dB re 1 μPa thresholds due to the isopleths being closer to the ship than what the streamer could collect. These recent examples highlight the inherent site-specific and near- and far-field differences in deriving both exclusion and buffer zones—attributes that LDEO does not currently incorporate in its estimates of those zones.

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[9] Including data from the Ligurian, Adriatic and Balearic Seas for estimating densities and data from Atlantic Marine Assessment Program for Protected Species (AMAPPS) surveys in 2010, 2011, and 2013 for estimating group sizes.
[10] Including NSF's Division of Polar Programs and Antarctic Support Contract (ASC) and projects funded by the U.S. Geological Survey (USGS).
[11] Tolstoy et al. (2004), Tolstoy et al. (2009), Diebold et al. (2010), and most recently, Crone et al. (2014).
[12] Crone et al. (2014) used hydrophone data from waters off Washington State to compare empirically derived estimates to model-estimated exclusion and buffer zones for LDEO's 36-airgun array.
[13] Root mean square.
[14] Using a 36-airgun array towed at 9 m with a total volume of 6,600 in^3.
[15] The spreading loss factor/fitting parameters were not specified.
[16] Using a 4-airgun array towed at 4.5 m with a total volume of 700 in^3.

To estimate the proposed exclusion and buffer zones for the survey in the Mediterranean, LDEO (1) used its model for the 36-airgun array in deep water and the mitigation airgun in all water depths, (2) applied a correction factor of 1.5 to the deep-water radii for the 36-airgun array in intermediate water depths, and (3) scaled empirically-derived measurements from the calibration study in the Gulf of Mexico for the 36-airgun array in shallow water (Tolstoy et al. 2009) to account for the differences in tow depths between the calibration study (6 m) and the proposed survey (9 or 12 m). The use of LDEO's simple model, both correction and scaling factors, and measurements from the Gulf of Mexico have yet to be substantiated relative to conditions in the Mediterranean Sea. Specifically, Tolstoy et al. (2009) verified that, in shallow water, sound is expected to reverberate in the water column and upper seafloor and, therefore, sound propagation in shallow water would be highly dependent on local seafloor geology[17]. Further, although calibration experiments for both the R/V *Maurice Ewing* and *Langseth* occurred in the Gulf of Mexico, Tolstoy et al. (2009) indicated that data differences between the two studies at shallow-water depths may have been due to site-specific differences within the Gulf of Mexico itself.

Although LDEO's model does not incorporate environmental characteristics of the specific survey area (including sound speed profiles and refraction within the water column, bathymetry/water depth, sediment properties/bottom loss, or absorption coefficients), the most widely accepted current modeling approaches normally do. Such approaches are used, and historically have been used, by other action proponents that conduct seismic surveys. In addition to incorporating site-specific parameters, those action proponents generally collect empirical sound source and sound propagation measurements as well. None of those action proponents use exclusion or buffer zones derived from measurements obtained in a specific ocean basin as proxies for another environment, nor do they utilize simple spherical spreading models or numerous correction and scaling factors. If such simple models or various extrapolations and scaling factors were considered best available and more representative, it would follow that other action proponents would use similar methods rather than allocating funds to more sophisticated modeling. It is unclear why NSF, which supports research to advance scientific discoveries on the geological intricacies of the earth, continues to base its own modeling approaches on methods that are significantly outdated. LDEO, NSF, and related entities (ASC, USGS, Scripps Institution of Oceanography (Scripps)) should be held to the same standard as other action proponents (i.e., Bureau of Ocean Energy Management, the oil and gas industry, U.S. Navy, U.S. Air Force).

Because empirical measurements are lacking for the Mediterranean Sea and LDEO has failed to verify the applicability of its exclusion and buffer zones to conditions in the Mediterranean, the Commission believes that LDEO should estimate those zones using a model that accounts for the conditions in the proposed survey area. The model should incorporate site-specific environmental[18] and operational[19] parameters. Until such models are used, the Commission believes LDEO's use of a simplistic model, various extrapolations, and correction and scaling factors cannot be considered the best available science. Therefore, <u>the Commission recommends</u> that NMFS (1) require LDEO to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals

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[17] Tolstoy et al. (2009) further indicated that empirical data confirm significantly different propagation loss rates in shallow and deep water as previously observed for the R/V *Ewing* (Tolstoy et al., 2004), with lower propagation loss rates in shallow water.

[18] Such as sound speed profiles, refraction in the water column, bathymetry/water depth, sediment properties/bottom loss, and wind speed.

[19] Such as tow depth, source level, number/spacing of active airguns.

using site-specific environmental (including sound speed profiles, bathymetry, and sediment characteristics at a minimum) and operational (including number/type of airguns, tow depth) parameters for the proposed incidental harassment authorization and (2) impose the same requirements for all future incidental harassment authorizations submitted by LDEO, NSF, ASC, USGS , Scripps, or any other relevant entity.

Monitoring measures

In several previous letters, the Commission has indicated that the monitoring and reporting requirements adopted under section 101(a)(5) of the MMPA need to be sufficient to provide a reasonably accurate assessment of the manner of taking and the numbers of animals taken incidental to the specified activity. A key goal of those requirements should be to verify that the assessments and assumptions underlying the issuance of the authorization were correct and to confirm that only small numbers of marine mammals are being taken and that the impacts are negligible. The Commission continues to believe those assessments need to account for all animals in the survey area, including those animals directly on the trackline that are not detected and how well animals are detected based on the distance from the observer, which are accounted for by g(0) and f(0) values. In the past, NMFS has indicated that those assessments could be qualitative or relative in nature, or they could be more directly quantitative (79 Fed. Reg. 38503). More recently, NMFS indicated that comparing the actual total area ensonified after the survey to the predicted total area ensonified should result in an even more accurate evaluation of exposed animals, which could then be compared to the numbers of animals actually detected to provide some sense of how the estimates compare to real likely exposure (80 Fed. Reg. 4891). The Commission disagrees with both assertions.

First, the Commission is unsure how a qualitative assessment could provide information regarding the numbers of marine mammals taken and whether those are considered small numbers. Second, in regards to comparing ensonified areas, in-situ sound measurements would have to be collected to compare accurately the actual total ensonified area to that which was predicted. However, very few action proponents conduct such measurements and analyses. Rather, NMFS may have been suggesting that the actual total ensonified area be compared to the predicted total ensonified area based on the length of tracklines surveyed and the associated ensonified area. In either instance, NMFS would be assuming that the uniform species-specific densities used to predict the numbers of animals to be taken would equate directly to those animals actually taken during the survey. That assumption is not supported by NMFS's own acknowledgement that marine mammals are distributed patchily—based on species-specific group sizes and behavior states. Furthermore, NMFS indicated that the number of marine mammals detected during geophysical surveys is a small percentage of those predicted to be taken, which is to be expected since marine mammals spend a large portion of their time underwater (80 Fed. Reg. 4891). The Commission has repeatedly recommended that NMFS and LDEO incorporate this latter factor via g(0) and f(0) values into their monitoring efforts.

The Commission continues to believe that g(0) and f(0) values[20] should be based on the ability of protected species observers to detect marine mammals rather than on hypothetically

[20] These values vary based on platform characteristics, observer skill, environmental conditions, and sightability and detectability of the species.

optimal estimates derived from scientific surveys[21] (e.g., from NMFS's shipboard abundance surveys). The Commission also understands that LDEO (and relevant entities) collects, and has been collecting for many years, sightings data during periods both when the airguns are active and when they are not. Those data could be pooled amongst similar survey types (e.g., based on geographical location, array configuration, airgun activity status, vessel-specific observational parameters) to determine rudimentary g(0) and f(0) values—an analysis that was discussed with NMFS, LDEO, and relevant entities in 2013. Although NMFS has indicated it is unlikely that the information gathered from those surveys would result in any statistically robust conclusions for any particular species because of the small number of animals typically observed, the Commission believes that pooling the data and adjusting by those rudimentary values would be preferable to assuming that the number of animals detected during the survey equates to the total numbers taken. This approach, which is LDEO's current method, clearly underestimates the numbers of marine mammals taken.

Therefore, the Commission again recommends that NMFS consult with LDEO and other relevant entities (e.g., NSF, ASC, USGS, Scripps) to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal takes and reliable estimates of the numbers of marine mammals taken by incorporating appropriate estimates of g(0) and f(0) values derived from protected species observer data collected during geophysical surveys. The Commission believes those values are essential for assessing more accurately the numbers of marine mammals taken during geophysical surveys, especially given the extent of the Level B harassment zones that routinely extend to 10 km and can extend to more than 27 km in some instances, including the proposed survey. The Commission notes that it has made this recommendation in numerous previous letters, but has some concern that NMFS may have misinterpreted it. NMFS recently stated that it does not believe it is appropriate to require NSF to collect information in the field to support the development of survey-specific correction factors (80 Fed. Reg. 4862). The Commission never suggested that separate[22] correction factors be developed for every survey. Rather, it is important for LDEO, NSF, and other relevant entities to continue to collect appropriate sightings data in the field to be pooled to determine g(0) and f(0) values relevant to the various geophysical survey types and platforms.

The Commission looks forward to collaborating with NMFS on the various issues raised in this letter. Please contact me if you have questions concerning the Commission's recommendations.

Sincerely,

Rebecca J. Lent, Ph.D.
Executive Director

[21] Values that the Commission understands LDEO and relevant entities incorporated in past monitoring reports.
[22] Survey-specific.

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Wädenswil/Switzerland, October 1st, 2015

OceanCare Statement of Concern:

Proposed Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November–December 2015

Summary of concerns:

- The proposal does not consider the decisions of the ACCOBAMS Resolution 4.17 and Resolution 5.15
- The levels of 'take' are unacceptable.
- The assumptions of impact to Mediterranean monk seals is questionable
- The proponent offers no consideration of the impacts of reduced prey availability, harassment forcing animals to cease feeding or harassment forcing the abandonment of pups.
- We strongly disagree that "the exposures are unlikely to result in any long-term negative consequences for the individuals or their populations"
- We believe there is a very strong likelihood that there will be significant impacts on cetaceans and pinnipeds.

For more than a decade OceanCare has raised concerns about marine noise pollution through intergovernmental meetings, urging governments and the United Nations to take action to reduce marine noise.

OceanCare has been active in this regard through the United Nations General Assembly, the Convention on Migratory Species of Wild Animals (CMS), the Food and Agriculture Organization Committee on Fisheries (FAO/COFI), the International Whaling Commission (IWC) and the European Union. We have also focused our advocacy voice with technical information in the two regional Agreements on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS).

The following Statement of Concern is in response to the proposal for an ***Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November–December 2015***

While we respect that the proposal is applying to the U.S. Endangered Species Act (ESA) process, we remind the proponents that in April 2014 the ACCOBAMS Scientific Committee recommended that all seismic explorations in the ACCOBAMS area, including the Central Aegean Sea and Hellenic Trench, should comply with Resolution 4.17 and Resolution 5.15.

ACCOBAMS Resolution 4.17: 'Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)' specifically "*[r]ecogniz[es] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death*".

Marine wildlife rely on sound for their vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings.[1, 2] While the ocean is certainly a sound-filled environment and many natural (or biological) sounds are very loud, wildlife are not adapted to anthropogenic noise.

Animals exposed to elevated or prolonged anthropogenic noise levels can suffer permanent or temporary hearing threshold shifts, compromising their communication and ability to detect threats.[3, 4] Noise can mask important natural sounds, such as the call of a mate, the sound made by prey or the noise made by a predator. These mechanisms, as well as factors such as stress, distraction, confusion, and panic, can affect vital rates such as reproduction, death, and growth rates, in turn affecting the long-term welfare of the population.[4-6] The most commonly measured wildlife responses to noise fall into three main categories: behavioral, acoustic and physiological.

1. **Behavioural** responses that include changes in surfacing, diving and heading patterns and changes in feeding behaviour.
2. **Acoustic** responses that include changes in type or timing of vocalisation and communication relative to the noise source.
3. **Physiological** responses or impacts that include physical damage, hearing threshold shifts and 'stress' in some species. Noise can also mask natural sounds the animal relies on.

These impacts are experienced by a wide range of species including fish, crustaceans and cephalopods,[7-14] pinnipeds (seals, sea lions and walrus),[3, 5, 15-18] sirenians (dugong and manatee),[19] sea turtles[20-22] and cetaceans (whales, dolphins and porpoises)–the most studied group of marine species when considering the impact of marine noise. [4, 23-29]

Mediterranean monk seals

The estimated total population of Mediterranean monk seals (*Monachus monachus*) is only 350-450 animals, with 250-300 of these in the eastern Mediterranean. (See map1) The closed and genetically isolated population in the Cabo Blanco area (Western Sahara-Mauritania) may have slightly increased.[30, 31] Monk seal critical habitats are well known. The species is listed by the IUCN as 'Critically Endangered' and is included on CMS Appendix I. Mediterranean monk seals are known to remain close to their haul out and pupping grounds, but like all pinnipeds, regularly travel 100km or more from shore to feed.[32]

Cuvier's beaked whales

The Mediterranean population of the Cuvier's beaked whales (*Ziphius cavirostris*) is genetically distinct, containing fewer than 10,000 mature individuals. Cuvier's beaked whales are regular inhabitants of the Hellenic Trench, the southern Adriatic Sea based on frequency of strandings, the northern Thyrrenian Sea and the eastern section of the Alboran Sea. (See map 2) A recent regional assessment by the IUCN has provisionally classified the Mediterranean population as Vulnerable.[33] This population is also included on CMS Appendix I as an endangered species.

Ecologically or Biologically Significant Marine Areas

In 2008, the Conference of the Parties to the Convention on Biological Diversity (CBD) adopted a list of seven scientific criteria for to identify Ecologically or Biologically Significant Marine Areas (EBSAs) in need of protection in open-ocean waters and deep-sea habitats.

These criteria were completed, in 2010 and are: uniqueness or rarity; special importance for life history of species; importance for threatened, endangered or declining species and/or habitats; vulnerability, fragility, sensitivity, slow recovery; biological productivity, biological diversity and naturalness.[34]

In paragraph 3 of '*Decision XII/22: Marine and coastal biodiversity: ecologically or biologically significant marine areas (EBSAs)*', CBD Parties commit that EBSAs may require strengthened conservation and management measures, and that this can be achieved through marine protected areas and impact assessments. In paragraph 9 they are encouraged to:

> *"… make use, as appropriate, of the scientific information regarding the description of areas meeting EBSA criteria … when carrying out marine spatial planning, development of representative networks of marine protected areas … and application of other area-based management measures in marine and coastal*

> *areas, with a view to contributing to national efforts to achieve the Aichi Biodiversity Targets;"*

The Central Aegean Sea is characterized by an extensive archipelago of hundreds of small islands and bays that form a variety of habitats hosting a rich biodiversity and important reproduction areas for Mediterranean monk seals.

The North Aegean Sea highly productive due to the input of trans-frontal river waters, upwellings and the input of nutrient-rich water from the Black Sea. Rare species of cetaceans and corals are found in the area, as well as one of the largest marine parks of the Mediterranean, which supports an important Mediterranean monk seal population.

The Hellenic Trench is the area is contained in part in the Central Mediterranean sub-region (Eastern Ionian Sea), and in part in the Eastern Mediterranean sub-region (Levantine Sea). The area is a major feature of the seafloor connecting the Central to the Eastern Mediterranean. Due to its geomorphological conditions, it is important for the survival of threatened, deep-diving marine mammals in the Eastern Mediterranean Sea, including as Cuvier's beaked whales and sperm whales.

The CBD Conference of the Parties agreed that Central Aegean Sea rates high for the following EBSA Criteria

1. Special importance for life-history stages of species
2. Importance for threatened, endangered or declining species and/or habitats
3. Biological diversity

The Hellenic Trench rates high for the following EBSA Criteria

1. Uniqueness or rarity
2. Special importance for life-history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, or slow recovery
5. Biological productivity

Without question the Central Aegean Sea and Hellenic Trench are critical habitat for Mediterranean monk seal – the most endangered pinniped species in the world – and a distinct population of Cuvier's beaked whales among many other cetacean species. The proposed activities covered under the ***Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea*** are unacceptable.

We find the levels of 'take' to be unacceptable. We question the assumptions of impact to Mediterranean monk seals, believing the numbers could be dramatically higher. The proponent offers no consideration of the impacts of reduced prey availability, harassment forcing animals to cease feeding or harassment forcing the abandonment of pups.

We strongly disagree that "the exposures are unlikely to result in any long-term negative consequences for the individuals or their populations". We believe there is a very strong likelihood that there will be significant impacts on cetaceans and pinnipeds.

Regulating anthropogenic marine noise

A series of important intergovernmental decisions have already determined the direction for regulating anthropogenic marine noise. The most recent of these are the following:

European Union Directive

The *2014/52/EU Directive* introduction now directs European Union Member States:

> *"[w]ith a view to ensuring a high level of protection of the marine environment, especially species and*

> *habitats, environmental impact assessment and screening procedures for projects in the marine environment should take into account the characteristics of those projects with particular regard to the technologies used (for example seismic surveys using active sonars).*"[35]

ACCOBAMS

The Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) '*Resolution 5.13: Conservation of Cuvier's beaked whales in the Mediterranean*'[36] and '*Resolution 5.15: Addressing the impact of anthropogenic noise*'[37] reinforces the commitments made in '*Resolution 4.17: Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)*' that urges ACCOBAMS Parties to:

> *"[r]ecogniz[e] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death".*[38]

This Resolution also encourages ACCOBAMS Parties to:

> *" ... address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities".*[38]

The ACCOBAMS Noise Guidelines provide further comprehensive detail relating to each of the marine noise producing activities.

Espoo (EIA) Convention

Principle 17 of the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo (EIA) Convention) states that:

> *"Environmental impact assessment[s], as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.*"[39]

CBD

The Convention on Biological Diversity (CBD) '*Decision XII/23: Marine and coastal biodiversity: Impacts on marine and coastal biodiversity of anthropogenic underwater noise*' encourages CBD Parties:

> *"… to take appropriate measures… to avoid, minimize and mitigate the potential significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity".*[40]

In Decision XII/23, CBD Parties have agreed to a significant list of technical commitments, including gathering additional data about noise intensity and noise types; and building capacity in developing regions where scientific ability can be strengthened.

Decision XII/23 urges the transfer to quieter technologies and applying the best available practice in all relevant activities. The CBD Parties advocate for mapping spatial and temporal distribution of sound through EIAs and combining this acoustic mapping with habitat mapping of sound-sensitive species with regard to spatial risk assessments to identify areas where species may be exposed to noise impacts. They also advocate the use of spatio-temporal management of activities.

CMS

The Convention on Migratory Species (CMS) '*Resolution 10.24: Further Steps to Abate Underwater Noise Pollution for the Protection of Cetaceans and Other Migratory Species*' encourages CMS Parties to:

> *"... prevent adverse effects on cetaceans and on other migratory marine species by restricting the emission of*

> *underwater noise, understood as keeping it to the lowest necessary level with particular priority given to situations where the impacts on cetaceans are known to be heavy" and "[u]rges Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on cetaceans and to consider potential impacts on marine biota and their migration routes ..."*[41]

Resolution 10.24 further articulates that CMS Parties should ensure that EIAs take full account of the impact of anthropogenic marine noise on marine species; apply Best Available Techniques (BAT) and Best Environmental Practice (BEP); and to integrate the issue of anthropogenic noise into the management plans of marine protected areas.

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Rome, Italy, October 2nd 2015

Oceanomare Delphis Onlus Statement of Concern:

Proposed Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November–December 2015

Summary of concerns:

- The proposal does not consider the decisions of the ACCOBAMS Resolution 4.17 and Resolution 5.15
- The levels of 'take' are unacceptable.
- The assumptions of impact to Mediterranean monk seals is questionable
- The proponent offers no consideration of the impacts of reduced prey availability, harassment forcing animals to cease feeding or harassment forcing the abandonment of pups.
- We strongly disagree that "the exposures are unlikely to result in any long-term negative consequences for the individuals or their populations"
- We believe there is a very strong likelihood that there will be significant impacts on cetaceans and pinnipeds.

For several years Oceanomare Delphis Onlus has raised concern about marine noise pollution through monitoring noise -relate impacts on marine mammals.
Oceanomare Delphis Onlus has been active in this issue through the Costa Concordia wreck removal (Giglio Island, Italy) supported by the University of Rome "La Sapienza" and the "building of offshore platforms Fauzia and Elettra and relative sealine" conducted upon request by CNR-ISMAr in Ancona. We have also given our technical and scientific support to the Commission EIA (Environmental Impact Assessment) of the Italian Ministry of Environment in developing new protocols that related to the monitoring of the noise impact during geophysical prospecting with compressed air devices (air guns).

The following Statement of Concern is in response to the proposal for an *Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea, November–December 2015*
While we respect that the proposal is applying to the the U.S. Endangered Species Act (ESA) process, we remind the proponents that in April 2014 the ACCOBAMS Scientific Committee recommended that all seismic explorations in the ACCOBAMS area, including

the Central Aegean Sea and Hellenic Trench, should comply with Resolution 4.17 and Resolution 5.15.
ACCOBAMS Resolution 4.17: 'Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)' specifically "*[r]ecogniz[es] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death*".
Marine wildlife rely on sound for their vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings.[1, 2] While the ocean is certainly a sound-filled environment and many natural (or biological) sounds are very loud, wildlife are not adapted to anthropogenic noise.
Animals exposed to elevated or prolonged anthropogenic noise levels can suffer permanent or temporary hearing threshold shifts, compromising their communication and ability to detect threats.[3, 4] Noise can mask important natural sounds, such as the call of a mate, the sound made by prey or the noise made by a predator. These mechanisms, as well as factors such as stress, distraction, confusion, and panic, can affect vital rates such as reproduction, death, and growth rates, in turn affecting the long-term welfare of the population.[4-6] The most commonly measured wildlife responses to noise fall into three main categories: behavioral, acoustic and physiological.

1. **Behavioural** responses that include changes in surfacing, diving and heading patterns and changes in feeding behaviour.
2. **Acoustic** responses that include changes in type or timing of vocalisation and communication relative to the noise source.
3. **Physiological** responses or impacts that include physical damage, hearing threshold shifts and 'stress' in some species. Noise can also mask natural sounds the animal relies on.

These impacts are experienced by a wide range of species including fish, crustaceans and cephalopods,[7-14] pinnipeds (seals, sea lions and walrus),[3, 5, 15-18] sirenians (dugong and manatee),[19] sea turtles[20-22] and cetaceans (whales, dolphins and porpoises)–the most studied group of marine species when considering the impact of marine noise. [4, 23-29]

Mediterranean monk seals

The estimated total population of Mediterranean monk seals (*Monachus monachus*) is only 350-450 animals, with 250-300 of these in the eastern Mediterranean. (See map1) The closed and genetically isolated population in the Cabo Blanco area (Western Sahara-Mauritania) may have slightly increased.[30, 31] Monk seal critical habitats are well known. The species is listed by the IUCN as 'Critically Endangered' and is included on CMS

Appendix I. Mediterranean monk seals are known to remain close to their haul out and pupping grounds, but like all pinnipeds, regularly travel 100km or more from shore to feed.[32]

Cuvier's beaked whales

The Mediterranean population of the Cuvier's beaked whales (*Ziphius cavirostris*) is genetically distinct, containing fewer than 10,000 mature individuals. Cuvier's beaked whales are regular inhabitants of the Hellenic Trench, the southern Adriatic Sea based on frequency of strandings, the northern Thyrrenian Sea and the eastern section of the Alboran Sea. (See map 2) A recent regional assessment by the IUCN has provisionally classified the Mediterranean population as Vulnerable.[33] This population is also included on CMS Appendix I as an endangered species.

Ecologically or Biologically Significant Marine Areas

In 2008, the Conference of the Parties to the Convention on Biological Diversity (CBD) adopted a list of seven scientific criteria for to identify Ecologically or Biologically Significant Marine Areas (EBSAs) in need of protection in open-ocean waters and deep-sea habitats.
These criteria were completed, in 2010 and are: uniqueness or rarity; special importance for life history of species; importance for threatened, endangered or declining species and/or habitats; vulnerability, fragility, sensitivity, slow recovery; biological productivity, biological diversity and naturalness.[34]
In paragraph 3 of '*Decision XII/22: Marine and coastal biodiversity: ecologically or biologically significant marine areas (EBSAs)*', CBD Parties commit that EBSAs may require strengthened conservation and management measures, and that this can be achieved through marine protected areas and impact assessments. In paragraph 9 they are encouraged to:

> *"… make use, as appropriate, of the scientific information regarding the description of areas meeting EBSA criteria … when carrying out marine spatial planning, development of representative networks of marine protected areas … and application of other area-based management measures in marine and coastal areas, with a view to contributing to national efforts to achieve the Aichi Biodiversity Targets;"*

The Central Aegean Sea is characterized by an extensive archipelago of hundreds of small islands and bays that form a variety of habitats hosting a rich biodiversity and important reproduction areas for Mediterranean monk seals.
The North Aegean Sea highly productive due to the input of trans-frontal river waters, upwellings and the input of nutrient-rich water from the Black Sea. Rare species of

cetaceans and corals are found in the area, as well as one of the largest marine parks of the Mediterranean, which supports an important Mediterranean monk seal population.
The Hellenic Trench is the area is contained in part in the Central Mediterranean sub-region (Eastern Ionian Sea), and in part in the Eastern Mediterranean sub-region (Levantine Sea). The area is a major feature of the seafloor connecting the Central to the Eastern Mediterranean. Due to its geomorphological conditions, it is important for the survival of threatened, deep-diving marine mammals in the Eastern Mediterranean Sea, including as Cuvier's beaked whales and sperm whales.
The CBD Conference of the Parties agreed that Central Aegean Sea rates high for the following EBSA Criteria

1. Special importance for life-history stages of species
2. Importance for threatened, endangered or declining species and/or habitats
3. Biological diversity

The Hellenic Trench rates high for the following EBSA Criteria

1. Uniqueness or rarity
2. Special importance for life-history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, or slow recovery
5. Biological productivity

Without question the Central Aegean Sea and Hellenic Trench are critical habitat for Mediterranean monk seal– the most endangered pinniped species in the world–and a distinct population of Cuvier's beaked whales among many other cetacean species. The proposed activities covered under the *Incidental Harassment Authorization to Allow the Incidental Take of Marine Mammals during a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Eastern Mediterranean Sea* are unacceptable.
We find the levels of 'take' to be unacceptable. We question the assumptions of impact to Mediterranean monks seals, believing the numbers could be dramatically higher. The proponent offers no consideration of the impacts of reduced prey availability, harassment forcing animals to cease feeding or harassment forcing the abandonment of pups.
We strongly disagree that "the exposures are unlikely to result in any long-term negative consequences for the individuals or their populations" We believe there is a very strong likelihood that there will be significant impacts on cetaceans and pinnipeds.

Regulating anthropogenic marine noise

A series of important intergovernmental decisions have already determined the direction for regulating anthropogenic marine noise. The most recent of these are the following:

European Union Directive

The *2014/52/EU Directive* introduction now directs European Union Member States:

> *"[w]ith a view to ensuring a high level of protection of the marine environment, especially species and habitats, environmental impact assessment and screening procedures for projects in the marine environment should take into account the characteristics of those projects with particular regard to the technologies used (for example seismic surveys using active sonars)."*[35]

ACCOBAMS

The Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) '*Resolution 5.13: Conservation of Cuvier's beaked whales in the Mediterranean'*[36] and '*Resolution 5.15: Addressing the impact of anthropogenic noise'*[37] reinforces the commitments made in '*Resolution 4.17: Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)'* that urges ACCOBAMS Parties to:

> *"[r]ecogniz[e] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death".*[38]

This Resolution also encourages ACCOBAMS Parties to:

> *" ... address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities".*[38]

The ACCOBAMS Noise Guidelines provide further comprehensive detail relating to each of the marine noise producing activities.

Espoo (EIA) Convention

Principle 17 of the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo (EIA) Convention) states that:

> *"Environmental impact assessment[s], as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority."*[39]

CBD

The Convention on Biological Diversity (CBD) '*Decision XII/23: Marine and coastal biodiversity: Impacts on marine and coastal biodiversity of anthropogenic underwater noise*' encourages CBD Parties:

> *"… to take appropriate measures… to avoid, minimize and mitigate the potential significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity".*[40]

In Decision XII/23, CBD Parties have agreed to a significant list of technical commitments, including gathering additional data about noise intensity and noise types; and building capacity in developing regions where scientific ability can be strengthened.

Decision XII/23 urges the transfer to quieter technologies and applying the best available practice in all relevant activities. The CBD Parties advocate for mapping spatial and temporal distribution of sound through EIAs and combining this acoustic mapping with habitat mapping of sound-sensitive species with regard to spatial risk assessments to identify areas where species may be exposed to noise impacts. They also advocate the use of spatio-temporal management of activities.

CMS

The Convention on Migratory Species (CMS) '*Resolution 10.24: Further Steps to Abate Underwater Noise Pollution for the Protection of Cetaceans and Other Migratory Species*' encourages CMS Parties to:

> *"… prevent adverse effects on cetaceans and on other migratory marine species by restricting the emission of underwater noise, understood as keeping it to the lowest necessary level with particular priority given to situations where the impacts on cetaceans are known to be heavy" and "[u]rges Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on cetaceans and to consider potential impacts on marine biota and their migration routes …"*[41]

Resolution 10.24 further articulates that CMS Parties should ensure that EIAs take full account of the impact of anthropogenic marine noise on marine species; apply Best Available Techniques (BAT) and Best Environmental Practice (BEP); and to integrate the issue of anthropogenic noise into the management plans of marine protected areas.

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October 2nd, 2015

Jolie Harrison, Chief
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Office of Protected Resources
National Marine Fisheries Service
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Silver Spring, MD 20910

Re: Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Eastern Mediterranean Sea, November to December, 2015

Dear Ms. Harrison,

On behalf of Whale and Dolphin Conservation and the Natural Resources Defense Council ("NRDC), we submit this letter to express our grave concern about the proposed Incidental Harassment Authorization (IHA) to take marine mammals incidental to conducting a marine geophysical (seismic) survey in the eastern Mediterranean Sea, by the Lamont-Doherty Earth Observatory (Lamont-Doherty) in collaboration with the National Science Foundation (NSF).

Marine seismic surveys greatly contribute to overall energy of ocean noise and have large spatiotemporal ranges of influence (Hildebrand, 2009). The output of airgun arrays is usually designed to produce a concentration of low-frequency energy, but the impulsive nature of the bubble collapse inevitably results in a broadband sound characteristic (Richardson *et al.*, 1995), and significant levels of energy have been recorded up to 22 kHz (Gordon and Moscrop, 1996). Signals from airguns can be detected at great distances from survey vessels – having been recorded as far as 4,000 km from their source at levels that can mask baleen whale vocalizations (Nieukirk *et al.*, 2012).

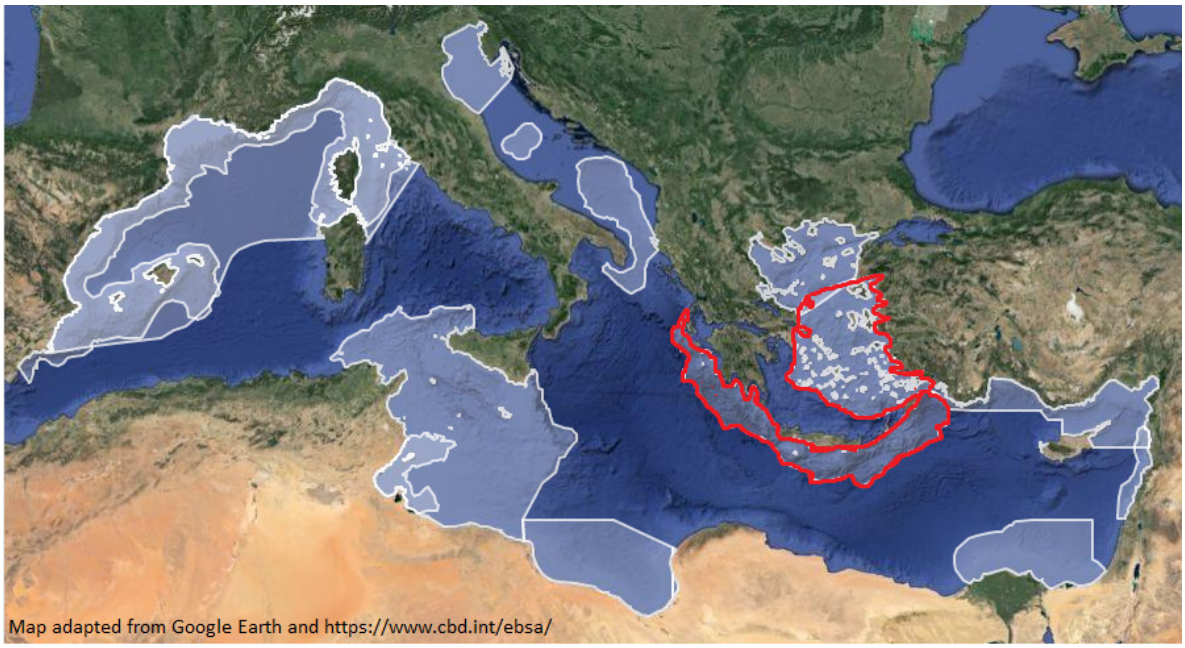
Marine mammals are especially sensitive to increasing levels of ocean noise since they use underwater sounds as a primary method to sense their environment and communicate with each other. Many studies can be cited reporting the wide range of effects of seismic surveys on marine mammals. These include behavioural changes such as displacement (Castellote *et al.*, 2012; Weir, 2008; Bain and Williams 2006; Stone and

Tasker, 2006; McCauley *et al.*, 2000; Richardson *et al.*, 1999), reduced foraging (Pirotta *et al.*, 2014; Miller *et al.*, 2009; Thompson *et al.*, 1998), or an alteration in vocalizations (Blackwell *et al.*, 2015; Di Iorio and Clark, 2010; McDonald *et al.*, 1995), as well as hearing impairment such as temporary (TTS) or permanent threshold shift (PTS) (Mann *et al.*, 2010; Lucke *et al.*, 2009), and physiological alterations such as stress responses (Rolland *et al.*, 2012; Romano *et al.*, 2004). Additionally, many studies have been published showing the adverse impacts on seismic surveys on other marine taxa, such as fishes (Fewtrell and McCauley, 2012; Hassel *et al.*, 2004; Slotte *et al.*, 2004; McCauley *et al.*, 2003; Booman *et al.*, 1996), turtles (DeRuiter and Doukara, 2010; Lenhardt, 2002; McCauley *et al.*, 2000), invertebrates (Aguilar de Soto *et al.*, 2013; Guerra *et al.*, 2004; McCauley *et al.*, 2000).

The Mediterranean is characterized as a sea ''under siege'' (Coll *et al.*, 2011; Galil, 2008) since it has historically been exposed to intense pressure from multiple sources (Micheli *et al.*, 2013; Coll *et al.*, 2011; Lejeusne *et al.*, 2010; Lotze *et al.*, 2008), which have led to major shifts in this ecosystem (Claudet and Fraschetti, 2010; Abdulla *et al.*, 2008; Ferretti *et al.*, 2008; Airoldi *et al.*, 2007). This area is habitat to various marine mammal species, many listed as vulnerable or endangered in the Appendices of the Convention on the Conservation of Migratory Species of Wild Animals (CMS). These include sperm whales (*Physeter microcephalus*), Cuvier's beaked whales (*Ziphius cavirostris*), fin whales (*Balaenoptera physalus*) and Mediterranean monk seals (*Monachus monachus*), the most endangered marine mammal species in Europe, and all of them listed in CMS Appendix I. Cuvier's beaked whale is acknowledged through this listing to be highly sensitive to loud, impulsive marine noise. The Mediterranean population of the Cuvier's beaked whales is genetically distinct with less than 10,000 mature individuals, and a recent regional assessment by the IUCN has provisionally classified this population as Vulnerable.

The past decade has seen a considerable amount of seismic activity overlapping, in the Mediterranean, *with proposed, recognized marine protected areas of importance for cetaceans*, as agreed on by the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS) through its Resolution 4.15 (ACCOBAMS 2010a). Also the Convention on Biological Diversity (CBD) agreed that the Central Aegean Sea and Hellenic Trench meet several of the scientific criteria adopted by the Convention to identify Ecologically or Biologically Significant Marine Areas (EBSA).

The proposed IHA directly contradicts all these conservation priorities. The proposed survey area falls within the two proposed EBSAs mentioned above (map 1) and critical Habitat of monk seals (map 2). High-intensity anthropogenic sound from airguns and mid- and high-frequency sonars are a probable cause of cetacean strandings and deaths. Multiple mass strandings of beaked whales, particularly Cuvier's beaked whales have occurred following high-intensity sound exposure (Hildebrand 2005). Several of such stranding events have thus far occurred due to noise events in the Mediterranean Sea (map 2).



Map 1. Mediterranean Ecologically or Biologically Significant Marine Areas (EBSAs). The proposed survey area is included within the Hellenic Trench and Central Aegean Sea EBSAs (contours shown in red)

Map 2. Overlay of the proposed survey area with the critical Habitat of monk seals (*Monachus monachus*). Also the proposed protected Areas by ACCOBAMS, and Cuvier's beaked whale (*Ziphius cavirostris*) strandings that happened due to naval sonar exercises are shown (Source: OceanCare).

Additionally, NSF proposes to use throughout its operations the successor to the same system, the Kongsberg Simrad EM122 multibeam echosounder, that was the likely cause of the mass stranding of melon-headed whales along the Madagascar coast in 2008 (Southall *et al.*, 2013). As the Madagascar report found, such equipment could still easily propagate noise at levels above 120 dB over a greater than 30 km radius even though MBES pulses are directed downwards towards the seafloor. Given the system's frequent noise output and the findings of the Madagascar report, the Fisheries Service should more appropriately apply its take threshold for continuous noise sources (120 dB) rather than its threshold for impulsive noise sources (160 dB) to this MBES system, assuming that it persists in utilizing these old metrics for take estimation. It is worth noting that a less powerful Kongsberg system, the EM 302, whose peak frequency of 30 kHz would attenuate far more rapidly than that of the proposed system, would cover the entirety of the area the applicant wishes to survey; indeed, that system, according to Kongsberg, is capable of operating to water depths of 7000m. Better still, the EM 710 MKII, which can survey water depths to 2000m, would still cover the majority of the proposed study area. Any meaningful mitigation scheme for this activity would require use of this alternative technology.

ACCOBAMS has adopted through its Resolution 4.17 and 5.15 comprehensive ***Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area*** and recommended that all seismic explorations in the ACCOBAMS area should comply with both regulations. The proposed authorization published by NMFS, along with the Draft Environmental Analysis (DEA) prepared by NFS, fail to fulfill many of those guidelines and are not based on the best available science. For example, they do not abide by the requirement that "e*xtra mitigation measures should be applied in deep water areas if beaked whales have been seen diving on the vessel trackline or if habitats suitable for beaked whales are approached: in such a cases the watch should be at least 120 minutes to increase the probability that deep-diving species are detected"; to "…consider cumulative impacts not just of noise but of all anthropogenic threats over time; consider effects modelling; include consideration of seasonal and historical impacts from other activities (shipping, military, industrial, other seismic) in the specific survey area and nearby region..."; and to "…Determine safe / harmful exposure levels for various species, age classes, contexts, etc. This must be precautionary enough to handle large levels of uncertainty…."*

Modelling of the generated sound field should have considered local propagation features (spherical and cylindrical spreading, depth and type of sea bottom, salinity and temperature profiles, sound channels) in order to predict sound propagation characteristics in the same seasonal conditions and area of the proposed survey, which, remarkably, they did not. That information should be used in the estimation of the proposed exclusion zones (EZ).

EZs and the estimated take by incidental harassment for the proposed survey were calculated using a 160 dB re 1 µPa (RMS) level B threshold and 180 dB re 1 µPa (RMS) level A threshold. However, **scientific evidence supports behavioral disruption of marine mammals well below the 160 dB level B threshold,** and so both EZ and take estimates are inaccurate and non-conservative. Nowacek *et al.* (2015) reviewed the best available science on seismic airgun impacts and concluded that, for a generally applicable threshold, a behavioral risk function centered at 140 dB (RMS) would far better represent the data than the 160 dB threshold used here. A few additional examples beyond those referenced in Nowacek *et al.* (2015) are mentioned here. DeRuiter *et al.* (2013), found that beaked whales changed their behavior in response to mid-frequency naval sonar at received levels of 89-127 dB re 1µPa. Blue whales (*Balaenoptera musculus)* changed their calling behavior after being exposed to mid-frequency naval sonar as low as 80 dB (Melcón *et al*., 2012). Also, Kastelein *et al.* (2012) showed that harbor porpoises (*Phocoena phocoena*) can exhibit temporary hearing impairment at levels as low as 124 dB re 1µPa.

Currently, new auditory threshold levels for onset of permanent (level A harassment) and temporary threshold shifts on marine mammals are under review by the US National Oceanic and Atmospheric Administration (NOAA) and a public comment period has recently closed. The signatory organizations submitted comments noting some methodological and assumption problems that should be addressed. Therefore, NMFS should modify their thresholds as they must be based on the best available science, which would result in a significant increase of the estimated number of marine mammal takes incidental to the proposed survey. Also, given that considerable uncertainty remains about these auditory thresholds we caution NMFS towards conservatism.

Cumulative actions and effects have not been adequately evaluated.

ACCOBAMS' Resolution 4.17 encourages Parties to "*address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities."*

As was noted above, the Mediterranean marine ecosystems have been exposed to numerous activities so repeat exposures of individuals that display a strong fidelity to a particular habitat, as well as migratory species that could find several noise sources along their migratory routes, should be part of cumulative impacts analysis. According to Micheli *et al.* (2013) 65.9% of the Mediterranean and Black Sea are subject to medium cumulative impact and 20% of the Mediterranean Sea and 60–99% of the territorial waters of EU member states are heavily impacted, with high human impact occurring in all ecoregions and territorial waters. Fewer than 1% of these regions are relatively unaffected. The recent paper Nowacek *et al.* (2015) exposed the limitations of current regulation of ocean noise, particularly noise generated during seismic surveys, a growing activity, to account

for the cumulative effects of simultaneous seismic surveys and prolonged, repeated exposures, as well as all the other sources associated with such activities and other anthropogenic stressors.

The agency's DEA does not adequately assess all the possible cumulative effects from past and present sources. Furthermore, NMFS only estimated takes for the airguns but did not consider the other sound-producing sources used in the proposed project such as an acoustic release system for seismometers, a multibeam echosounder and a sub-bottom profiler. All of these sources will introduce substantial noise in the mid-frequency to high-frequency range that could impact several marine mammal species at substantial distances, and their cumulative effects must be considered. As noted above, we are extremely concerned about the use of the multibeam echosounder simultaneously with airgun operations. This echosounder produces sound in the 10.5 to 13.0 kHz frequency range, which is within the optimal hearing spectrum for many odontocete and pinniped species that may occur in the study area. A highly similar 12-kHz multibeam echosounder system operated off the coast of Madagascar and was implicated in the mass-stranding of approximately 100 melon-headed whales (*Peponocephala electra*) in 2008 (Southall *et al.*, 2008). In 2002, beaked whale strandings were observed in the Gulf of California area after a seismic expedition led also by L-DEO where a similar multibeam sonar system was employed (Cox *et al.*, 2006).

NMFS states that estimate of instances of exposures is likely an overestimate of the number of individuals that are taken because it assumes that each new day results in takes of entirely new individuals, with no repeat takes of the same individuals over the survey period, and also considers unlikely any level A harassment. As we mentioned before the acoustic thresholds used by NMFS are patently incorrect and lead to an underestimation of EZ and incidental takes. Additionally, the assumption of 100% turnover in the area every day is wholly unsubstantiated and indeed runs counter to basic assumptions in mammalian ecology, that individuals with a strong biological need to remain in an area will often continue to do so despite the degradation of their habitat and injury risk (Wright *et al.* 2007). The assumption thus fails to account for cumulative impacts on individual animals, including the potential that repeated TTS can lead to PTS (Weilgart 2014), which would increase the probability of level A harassment.

The effectiveness of exclusion zones and Marine Mammal Observers (MMOs)/Passive Acoustic Monitoring (PAM) or ramp up as mitigation measures for underwater noise-producing activities has repeatedly been questioned (Dolman *et al*., 2009; Parsons *et al.*, 2008; Parsons *et al.* 2009; Weir and Dolman, 2007). Several assumptions are made behind such effectiveness (which have also been largely assumed by NMFS in the IHA), including that marine mammals would move away in response to the approaching higher power sources; that they would do it fast enough to escape injury; and that they would not have important reasons to stay in the area, which, again, is totally unrealistic considering that this area has been proposed as an EBSA given its uniqueness or rarity, special importance

for life-history stages of species and importance for threatened, endangered and declining species (Druel 2012).

For all these reasons, we strongly disagree with NMFS's conclusion that given the proposed seismic survey will have a negligible impact on marine mammals. Contrarily, we believe that it's highly probable that there will be significant negative consequences for marine mammals in the area.

We strongly urge NMFS to withdraw the proposed IHA.

Thank you for considering these comments.

Sincerely yours,

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Acoustic and Research Analyst
Whale and Dolphin Conservation

Michael Jasny
Director, Marine Mammal Protection
Natural Resources Defense Council

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