Howie Goldstein

From: "Michael Payne" <Michael.Payne@noaa.gov>
To: "Howard Goldstein" <Howard.Goldstein@noaa.gov>
Sent: Wednesday, January 14, 2009 9:37 AM
Subject: [Fwd: Fw: Geophysical seismic surveys in SE Asia]

for the record

-------- Original Message --------
Subject: Fw: Geophysical seismic surveys in SE Asia
Date: Sat, 10 Jan 2009 23:01:28 +0800
From:APEX Environmental <bkahn@apex-environmental.com>
Reply-To:APEX Environmental <bkahn@apex-environmental.com>
Organization:APEX Environmental
To: Michael Payne <Michael.Payne@noaa.gov>

resend as pr1 address bounced, may have something to do with internet connection on board.
regards benjamin
----- Original Message -----
From: APEX Environmental
To: Michael Payne
Cc: PR1.0648 XL89@noaa.gov
Sent: Saturday, January 10, 2009 10:30 PM
Subject: Geophysical seismic surveys in SE Asia

To:

Mr. Michael Payne
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910–3225
USA

Regrading: Geophysical seismic surveys in SE Asia.

Dear Dr. Payne,

I would like to request a 30-day extension on the comment period for the Lamont-Doherty Earth Observatory to harass marine mammals during their planned geophysical seismic surveys in SE Asia.

We have worked in the offshore waters of Indonesia for over 10 years and to a lesser extend in Papua New Guinea and the Solomon Islands. The region's exceptional oceanic cetacean diversity and abundance - combined with the extreme coastal to deep-sea habitat proximity - warrant a most careful approach to this endeavour by LDEO. As such more time is needed to properly assess this complex program.

I appreciate your understanding in this matter.

Yours sincerely,

Benjamin Kahn

(As I am at sea till the 15th I may not be able to respond ASAP to your reply.)

Letters should be e-mailed to both of these addresses: and

Benjamin Kahn
Director
APEX Environmental
Coral Triangle Oceanic Cetacean Program
IUCN Species Survival Commission - Cetacean Specialist Group

Indonesia office:
Suite 104, Jl. Bypass Ngurah Rai No. 379
Sanur - 80228, Bali
INDONESIA

Australia office:
PO Box 59 Clifton Beach - Cairns
4879 Queensland
AUSTRALIA

From Lindy Weilgart <lweilgar@dal.ca>

Sent Friday, January 9, 2009 1:50 pm

To PR1.0648-XL89@noaa.gov

Cc

Bcc

Subject extension of public comment period

I believe an extension of the public comment period is warranted for Lamont-Doherty's geophysical seismic survey around SE Asia March-July 2009. There are several sensitive, little known cetaceans in the region which could be seriously impacted. The timing around the Christmas holidays is poor, and the notice and application are lengthy documents to read. I believe the application is controversial, especially given the unfortunate record Lamont-Doherty has had in the past with the RV Maurice Ewing (though I understand the Langseth has replaced the Ewing).

Sincerely,

Lindy Weilgart, Ph.D. (specialist in underwater noise impacts)

Lindy Weilgart, Ph.D.
Research Associate
Department of Biology
Dalhousie University
Halifax, Nova Scotia B3H 4J1 Canada
Ph.: (902) 494-3723
Fax: (902) 494-3736
E-mail: lweilgar@dal.ca

From Naomi Rose <NRose@hsus.org>
Sent Tuesday, January 6, 2009 4:07 pm
To PR1.0648-XL89@noaa.gov
Cc
Bcc
Subject Re: 73 FR 78294
Attachments image001.jpg 5K image002.png 6K

January 6, 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910–3225

RE: *73 FR 78294*

Dear Mr. Payne:

On behalf of the more than 10 million members and constituents of The Humane Society of the United States and its international arm, Humane Society International (HSUS/HSI), I am writing to request a 30-day extension of the comment period on the request by Lamont-Doherty Earth Observatory (L-DEO) for an incidental harassment authorization under the Marine Mammal Protection Act to harass small numbers of marine mammals during geophysical seismic surveys in southeast Asia, as published in *73 FR 78294*. The current 30-day comment period closes on January 21, 2009.

While 30 days would ordinarily be sufficient for a research permit request, the issues raised by this permit request are not ordinary. The notice was published just before the Christmas holidays (December 22, 2008), meaning many interested parties have still to see it, while others did not see it until at least a week after its publication date (and most people are seeing it only now, two weeks after the publication date, as this is the first full business week after the holidays). The notice alone is 24 pages in the *Federal Register*, while the application is 92 pages and the Environmental Assessment is 215 pages; most interested parties (many of whom live in the affected region, increasing communication difficulties) would need to review and comment on this lengthy documentation in less than three weeks.

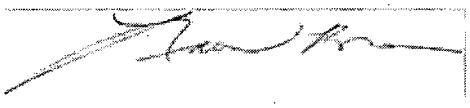
Finally, while L-DEO has conducted this type of seismic survey in the past, it has not always done so

without controversy. Similar surveys in Mexico some years ago were halted due to local controversy and similar concerns are now being expressed by activists and researchers working in Taiwan and surrounding areas. A similar notice, for seismic surveys in the southwest Pacific near Tonga, was published in late November. This notice went by without much attention being paid by the conservation community, but this also may have been a function of the timing of the notice's release (during the Thanksgiving holidays). It is certain that the SE Asia notice is getting considerably more attention, despite its publication date.

At a minimum, we urge a comment period extension of 15 days, but to be truly fair to interested parties and compensate for the holiday disruption of normal working schedules within the conservation and scientific communities, we strongly recommend an extension of 30 days.

Thank you for your consideration of this urgent matter.

Sincerely,



Naomi A. Rose, Ph.D.
Senior Scientist
Humane Society International

Naomi A. Rose, Ph.D.
Senior Scientist
International Policy
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700 Professional Drive
Gaithersburg, MD 20879 USA
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Eml nrose@hsi.org
http://www.hsi.org
http://www.hsus.org

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Electronic Mail

January 7, 2009

Michael Payne, Chief
Permits, Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225
PR1.0648-XL89@noaa.gov

Re: Request to Extend the Public Comment Period on Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March-July 2009

Dear Mr. Payne:

I am writing to petition the National Marine Fisheries Service ("NMFS") to extend the public comment period on its proposed Incidental Harassment Authorization ("IAH") for the taking of marine mammals incidental to a seismic survey conducted by the Lamont-Doherty Earth Observatory ("L-DEO") in Southeast Asia from March through July, 2009. See 73 Fed. Reg. 78294 (Dec. 22, 2008). Despite the dense information provided in L-DEO's application as well as NMFS' proposed IAH, NMFS limited the time in which the public may submit comments to only a 30-day period. NMFS also issued its proposal right before the holidays, further limiting the public's time to respond. A large number of marine mammals, some endangered, reside in this region and yet little is known about them.

In light the dense information provided by L-DEO and NMFS, the timing of the publication, and the need for further evaluation, I respectfully request an extension to submit written comments of at least 30 days, until February 20, 2009. Such an extension will fully protect the public interest by giving citizens the time to thoroughly analyze NMFS' proposal and submit comments on this critical issue. Thank you.

Very truly yours,

Taryn Kiekow
Staff Attorney

www.nrdc.org

1314 Second Street
Santa Monica, CA 90401
TEL 310-434-2300 FAX 310-434-2399

NEW YORK · WASHINGTON D.C. · SAN FRANCISCO · CHICAGO · BEIJING

From Michael Stocker <mstocker@OCR.org>
Sent Tuesday, January 6, 2009 4:54 pm
To PR1.0648-XL89@noaa.gov
Cc
Bcc
Subject 2008 L-DEO Taiger Southeast Asia Seismic Survey
Attachments image002.jpg 1K

Cc: 'Lynn_Abramson@boxer.senate.gov'

Michael Payne, Chief, Permits,
Conservation and Education Division,
Office of Protected Resources,
National Marine Fisheries Service

Re: **Federal Register** / Vol. 73, No. 246 / Monday, December 22, 2008

Dear Mr. Payne,

It has been brought to my attention that a notice of action and request for comments on a Lamont Doherty Earth Observatory seismic survey project in Southeast Asia was submitted into the Federal register on December 22, with a comment closing period ending on January 21. Given that the notice and much of the comment period has been eclipsed by traditional year-end holidays, we would like to request that the comment period be extended an additional 30 days until February 25.

References:

http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications

Federal Register notice

Thank-you

Michael Stocker, Director
Ocean Conservation Research
P.O. Box 559
Lagunitas, CA 94938
V. 415-488-0553
www.OCR.org

Howie Goldstein

From: "Michael Payne" <Michael.Payne@noaa.gov>
To: "Howard Goldstein" <Howard.Goldstein@noaa.gov>
Sent: Friday, January 09, 2009 8:16 AM
Subject: [Fwd: Re: Incidental Harassment Authorization - Taiwan/South East Asia]

fyi

-------- Original Message --------
Subject: Re: Incidental Harassment Authorization - Taiwan/South East Asia
Date: Fri, 09 Jan 2009 09:43:10 +0800
From: Robin Winkler <rwinkler@wildatheart.org.tw>
To: Michael.Payne@noaa.gov
CC:chiau@ntou.edu.tw <chiau@ntou.edu.tw>, Chang, David C <ChangDC@state.gov>, ait yunping <yunping.chang@gmail.com>, mike.payne@noaa.gov
References:<5be028ba0901081727l5d7b3062i7b207cfa0dfe5af6@mail.gmail.com>

On Fri, Jan 9, 2009 at 9:27 AM, Robin Winkler <rwinkler@wildatheart.org.tw> wrote:

> 9 January 2009
>
> Michael Payne
> Chief, Permits
> Conservation and Education Division
> Office of Protected Resources
> National Marine Fisheries Service
> 1315 East-West Highway
> Silver Spring, MD 20910¡V3225
>
> **RE: L-DEO application for IHA for southeast Asia**
>
> Dear Mr. Payne
>
> I am writing to you concerning the application by the Lamont-Doherty Earth Observatory to NMFS for an Incidental Harassment Authorization to harass marine mammals during seismic surveys in southeast Asia from March-July 2009.
>
> This application was only brought to our attention during the first week of January 2009, more than a week after the notice was published in the Federal Register, and not by those responsible for proposing or reviewing the application. We are extremely concerned both by the indirect manner in which we and others have learned of the application and also by the fact that the comment period will end as soon as 21 January, leaving interested and affected parties insufficient time to review and comment on the twenty-four page notice in the Federal Register, let alone the lengthy application and the Environmental Assessment.
>
> While a 30 day comment period for such applications may be the norm according to NMFS procedure

and may be considered acceptable to those whose native language is English, it is however not sufficient to allow any reasonable level of scrutiny by people in the affected regions whose native language is not English, some of whom are scientists intimately involved in researching the very species Lamont-Doherty proposes to harass.

While we would welcome more active, direct and fair soliciting of input from local stakeholders in general, given the pressing nature of the present L-DEO application and the significant delay already experienced, we would merely ask at this point for an extension of a minimum of 30 days on the comment period for this case.

We look forward to hearing from you soon about this matter and thank you for your consideration.

Wild at Heart Legal Defense Association is a Taiwanese non profit organization established in 2003 registered with the Taiwan government. Our staff and consultants include scientists, lawyers and economists and we frequently associate with other organizations in Taiwan and abroad sharing similar interests. More information can be found in English and Kanji (complex Chinese characters) at http://www.wildatheart.org.tw/ and with regards to one of the animals that is proposed to be harrassed we also maintain bilingual websites in English and Kanji.

I am copying the Science and Technology Officer of the United States quasi embassy here and his assistant as well as Professor Chiau Wenyan who is currently serving as the Deputy Minister of Taiwan's Environmental Protection Administration and we have raised concerns about this matter through a number of channels to the Taiwan government, including the Council of Agriculture, Ministry of Defense, Coast Guard and Control Yuan.

Sincerely yours,

Robin Winkler
Director

Taiwan Wld at Heart Legal Defense Association

--
¤å¾|±l Robin J. Winkler
¥xÆWÆZ³¥¤ß¨¬¥Í°A¨ó·|
Wild at Heart Legal Defense Association , Taiwan
12F, 86 Chongcing South Road Section 1 Taipei, Taiwan 100
Tel 886-2-2382-5789;2311-2345x111
Fax 886-2-2382-5810;2311-2688
http://zh.wildatheart.org.tw/
Skype Account:rwinkler111

Subject: [Fwd: RE: 73 FR 78294 - Lamont-Doherty Earth Observatory Application to NMFS for an authorization to harass marine mammals during seismic surveys in southeast Asia from March-July 2009]
From: Michael Payne <Michael.Payne@noaa.gov>
Date: Fri, 09 Jan 2009 08:27:36 -0500
To: Howard Goldstein <Howard.Goldstein@noaa.gov>

fyi

-------- Original Message --------
Subject: RE: 73 FR 78294 - Lamont-Doherty Earth Observatory Application to NMFS for an authorization to harass marine mammals during seismic surveys in southeast Asia from March-July 2009
Date: Fri, 09 Jan 2009 08:50:22 +0800
From: Jose Maria Lorenzo Tan <lorytan@wwf.org.ph>
To: Michael.Payne@noaa.gov

Michael Payne

Conservation and Education Division

Office of Protected Resources

National Marine Fisheries Service

1315 East-West Highway

Silver Spring, MD 20910–3225

RE: 73 FR 78294

Dear Mr. Payne,

I am writing to you concerning the application by the Lamont-Doherty Earth Observatory to NMFS for an Incidental Harassment Authorization to harass marine mammals during seismic surveys in southeast Asia from March-July 2009. WWF Philippines is particularly concerned

about their intention to work very close to the Babuyan / Batanes Islands in northern Philippines.

Aside from containing some of the highest cetacean biodiversity in the Philippines – that include some uncommon and rarely studied species, these islands are also the southwestern-most calving areas for a migratory population of humpback whales that come here from the Bering Sea, passing through Japan and Okinawa.

The application indicates that the project intends to operate around the Babuyan – Batanes Islands during the migratory / calving season here in the Philippines. This is a matter of grave concern to WWF.

When we heard of the application, I immediately contacted the State Department science officer at the US Embassy here in Manila, with whom we work very closely. If any US surveys are conducted within Philippine waters, it is the Embassy that normally serves as the facilitator for all permits required by law. She had never heard of the plan,nor the application.

This application was only brought to our attention during the first week of January 2009, more than a week after the notice was published in the Federal Register, through scientific sources that were in no way connected to the project.

I am writing to urge you to consider extending the period for comment appropriately, to allow scientists from the Region sufficient time to study it, understand its repercussions and send in their studied comments. Much for the area covered by the Pacific and Southeast Asian surveys will cover tracts within the Coral Triangle.

This is a global marine conservation initiative to which the US government, through USAID, has already made a significant catalytic investment of $32 Million. Many other nations and aid agencies, including the GEF, the Asian Development Bank, the UNDP, Australia and Japan are involved in mobilizing resources for this program. In addition, the Philippines, Indonesia, Malaysia, the Solomons, Papaua New Guinea and Timor Leste form the core countries of the Coral Triangle. Many players have made commitments to this conservation program and will surely have something to say about the proposed survey. Much work is being done to weave together a viable and sustainable multi-country effort for the Coral Triangle. All of this will culminate in May at the World Oceans Conference in Manado. The proposed timing of this survey could not be worse, especially since it will involve activities that may be perceived to run counter to regional conservation efforts.

Coming at the heels of President Bush's decision to create the largest marine protected area in the world around the Marianas, WWF Philippines believes it is going to be very important that potentially contentious activities covering key biodiversity areas such as the proposed survey be handled with a higher level of rigor and scrutiny, and should not simply follow prescribed rules.

I look forward to receiving a response from you, or your office, acknowledging receipt of this

letter. I also hope to receive a subsequent communication informing us that the survey will be postponed, allowing more time for comment. In the interest of transparency, I am forwarding copies of this note to WWF US, the US Embassy in Manila, as well as the Bureau of Fisheries and Aquatic Resources and the Department of Environment and Natural Resources of the Republic of the Philippines.

Sincerely yours,

JOSE MA. LORENZO TAN

CEO / Vice-Chairman, Board of Trustees

WWF Philippines

Coral Triangle - nursery of the seas

www.panda.org/coraltriangle

Animal Welfare Institute
900 Pennsylvania Avenue SE, Washington, DC 20003 www.awionline.org
telephone: (202) 337-2332 facsimile: (202) 446-2131

January 7, 2009

Michael Payne, Chief
Permits, Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, Silver Spring, MD 20910
PR1.0648–XL89@noaa.gov

Re: Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March–July 2009 (Federal Register Pages 78294-78317)

Dear Mr. Payne:

The Animal Welfare Institute (AWI) requests an extension of the comment period on the Incidental Harassment Authorization (IHA) request made by the Lamont-Doherty Earth Observatory (L-DEO).

The Federal Register notice soliciting comments was published shortly before the holiday season on December 22 - a time when many people are on vacation and away from the office. We are therefore requesting that the current deadline of January 21 be extended by 30 days (or 15 days at a minimum). The proposed activities to take place in the waters of Taiwan, the Philippines, south China, and Japan could potentially impact a large number of cetaceans, some of which are endangered. The extension would serve to provide more time for concerned parties returning from vacation to read the 24 page Federal Register notice and submit comments.

Thank you for considering our request.

Sincerely,

Susan Millward
Executive Director

P.O. Box 953
Georgetown, CT 06829 USA
Ph: 203.770.8615
Fax: 860.561.0187
rossiter@csiwhalesalive.org
www.csiwhalesalive.org

January 7, 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910–3225

RE: ***73 FR 78294***

Dear Mr. Payne:

Cetacean Society International (CSI) respectfully petitions for an extension to the 30-day comment period applying to the request by Lamont-Doherty Earth Observatory for an incidental harassment authorization under the Marine Mammal Protection Act to harass small numbers of marine mammals during geophysical seismic surveys in Southeast Asia, as published in *73 FR 78294*.

CSI has just become aware of the notice, perhaps because it was published just before Christmas. The holiday timing was unintentional, but the reality is that most interested parties may not have seen this notice until now. In fact, only in the last two days have we learned of a growing number of professionals, some within the affected region, who are concerned with this authorization. They are frustrated with the short response time currently required. CSI has a history of concern for such issues, but we would be very hard pressed to provide useful and appropriate comments or to engage interested stakeholders in this process before the comment period closes on January 21, 2009. The remaining time will limit responses, and therefore does not serve NMFS well.

Previous requests from the Lamont-Doherty Earth Observatory have been controversial. The onus of a short response time will add to the controversy inherent in the current proposal. Given the situation and significance, CSI urges you to grant a 30 day extension for the public comment period. If there is some over-riding reason not to grant such an extension please be kind enough to provide it to us.

Thank you for considering this request.

William W. Rossiter
President

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
NMFS
1315 East-West Highway
Silver Spring, MD 20910–3225
USA

WDCS Moray Firth Wildlife Centre
Spey Bay, Moray
Scotland
Phone 44 (0) 1343 820 339
078 3449 8275
sarah.dolman@wdcs.org

www.wdcs.org

12th January 2009

Dear Mr. Payne,

RE: *73 FR 78294* - Lamont-Doherty Earth Observatory seismic surveys in northeast Asia

I am writing on behalf of the Whale and Dolphin Conservation Society (WDCS) to request a 30-day extension of the comment period on the request by Lamont-Doherty Earth Observatory (L-DEO) for an incidental harassment authorization under the Marine Mammal Protection Act (MMPA) to harass small numbers of marine mammals during geophysical seismic surveys in southeast Asia, as published in *73 FR 78294*. The 30-day comment period currently closes on 21st January 2009.

The issues raised by this permit request are considerable. Seismic surveys conducted by L-DEO are controversial and of concern to members of the environmental and scientific communities. Further, the notice was published in the lead up to Christmas (22nd December 2008) and so it's likely that a number of interested parties already have considerably less time to respond within the comment period. Therefore, we strongly request an extension of 30 days to the comment period.

Thank you for your consideration of this urgent matter.

Yours sincerely,

Sarah Dolman

Sarah Dolman

WDCS Noise campaign Manager

08 January 6, 2009

Michael Payne (Chief, Permits)
Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225

RE: Federal Register #78294

Dear Mr. Payne,

I have been conducting cetacean research in SE Asia waters (mainly on cetaceans in Taiwanese waters) since the early 1990s and represent a small research-focused conservation group called *FormosaCetus* Research and Conservation Group. The notice of a proposal by Lamont-Doherty Earth Observatory (Columbia University) to conduct geophysical surveys in SE Asian waters with a specific focus on the waters around Taiwan just came to my attention recently. Because the proposed surveys are to be in waters that are inhabited by species or populations of marine mammals that are highly endangered (e.g, the eastern Taiwan Strait population of *Sousa chinensis*) or apparently very sensitive to loud noises (e.g., beaked whales and other deep-diving cetaceans) and during a time of the year when large concentrations of cetaceans are known in Taiwanese waters, our group is very concerned with this additional threat to the myriad that already exist in these waters for cetaceans. The notice itself is a large document and the application and environmental assessments are also formidable documents for anyone to review in any scientific detail.

The present closing date for comments is January 21. However, I would like to request that an extension of at least a month be allowed so that there is a reasonable amount of time to review these documents adequately.

Thank you for your attention to this matter and happy new year

Sincerely

John Y. Wang, Ph.D.
FormosaCetus Research and Conservation Group
310-7250 Yonge Street, Thornhill, Ontario, Canada, L4J-7X1

TO:
Ms Christina McFarquhar
Wild at Heart Legal Defense Association
12F, 86 Chongcing South Road
Section 1
Taipei, Taiwan 100

Eastern Taiwan Strait
Sousa Technical Advisory Working Group

Dr Peter S. Ross
Chairman, ETSSTAWG
PO Box 2429

January 29, 2009

Dear Ms MacFarquahar:

Further to your request of the Eastern Taiwan Strait Technical Advisory Working Group (ETSSTAWG), I am pleased to provide you with a scientific review of the proposed Lamont-Doherty Earth Laboratory (L-DEO) seismic survey and its request for an Incidental Harassment Authorization from the US government.

The ETSSTAWG was formed in 2008 to provide expert advice in support of the conservation of the Critically Endangered population of <100 Indo-Pacific Humpback Dolphins (*Sousa chinensis*) along the west coast of Taiwan. This population will not survive without mitigation measures to address the following threats: fisheries by-catch, pollution, habitat destruction (reclamation), water diversions, and noise/disturbance.

I have solicited feedback from two international experts on the issue, with their feedback based on the content of the US Federal Register 73 (246) Dec 22 2008 p. 78294. Their comprehensive reviews are attached and reflect detailed scrutiny of the Federal Register notice.

Please note that the ETSSTAWG is a science-based committee and refrains from taking positions on policy unless the weight of evidence indicates that a danger exists to the ETS Sousa population. In this context, it is worth noting that the death of one individual from this population, and/or reduced recruitment or reproduction, would be regarded by the ETSSTAWG as an unacceptable outcome. In this particular case, our reviewers expressed grave misgivings about the magnitude of the risks to the dolphin population and about the incomplete or deficient nature of the scientific documentation used by the project proponents.

In summary, it is our opinion that:

- the L-DEO project, as presently described in the US Federal Register, poses an unacceptable risk to the Critically Endangered population of Eastern Taiwan Strait *Sousa*;

- The project description does not adequately consider the relevant scientific literature on risks of seismic activities to cetaceans;
- The project description must adopt a 'precautionary approach' when extrapolating from the literature to the particular acoustic environment of the study area, and when considering 'unknowns' ('absence of evidence is not evidence of absence');
- Proposed mitigation practices are inadequate to prevent injury to cetaceans;
- Beaked whales can be expected to be at heightened risk from the L-DEO project, in part because their extended dives make it exceedingly difficult for even trained personnel to spot them.

We recommend a series of measures that would reduce the risks to cetaceans, and in particular to ETS *Sousa*, from the L-DEO project:

- The section of Leg # 4 running along the western coast of Taiwan should be removed from the L-DEO survey as this represents core habitat for the Critically Endangered population of ETS *Sousa*;
- Survey effort should be suspended at night as night-time observations are of insufficient acuity to detect cetaceans;
- Survey effort should be suspended when adverse weather conditions prevail that would preclude effective spotting (e.g. in fog, rain, heavy seas > Beaufort 3);
- Two cetacean observers, not just one, should be on watch at the same time;
- Duration of watch times should be reduced from 4 to 2 hours to prevent compromised efficiency as a result of fatigue;
- Observers should be familiar with the cetaceans expected in the area, the nature of the local environment (i.e. a locally trained person), operation of the PAM system, and the observation methods required;
- Changes in bottom topography during the survey must be better incorporated into the designation of 'safety zones', and the cruise should be adapted accordingly.

Please use the attached reviews to provide more detailed guidance on the above (and additional) points. I trust that this ETSSTAWG review provides you with some of the answers that you seek. You are, of course, free to circulate this review to any interested party.

Sincerely,

Dr Peter S. Ross
Chair
Eastern Taiwan Strait *Sousa* Technical Advisory Working Group

Cc/ETSSTAWG membership

February 5, 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225
Eml: PR1.0648-XL89@noaa.gov

RE: ***73 FR 78294***

Dear Mr. Payne:

On behalf of Dr. Peter Ross, chairman, and the other members of the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG), I am submitting the attached reviews of the notice of a proposed incidental take authorization by Lamont-Doherty Earth Observatory (L-DEO) at Columbia University, for a request under the Marine Mammal Protection Act (MMPA) to take small numbers of marine mammals, by Level B harassment, incidental to conducting a marine seismic survey in Southeast Asia during March-July 2009, as published in *73 FR 78294*. The reviews were prepared at the request of Wild at Heart Legal Defense Association of Taiwan (see attached cover letter), but reflect the independent views of the ETSSTAWG reviewers. We are aware that the public comment period closes today and we are submitting these reviews directly to the National Marine Fisheries Service in order to ensure they are included in the administrative record. Thank you for your consideration.

Yours sincerely,

E.C.M. Parsons **BA MA PhD CBiol MIBiol FRGS**
Vice Chair, ETSSTAWG

Associate Professor
Department of Environmental Science & Policy,
George Mason University
4400 University Drive
Fairfax, VA 22030-4444 USA.

Marine Section President: *Society for Conservation Biology*
Deputy Director: *Mason Center for Conservation Studies*

February 5, 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225
Eml: PR1.0648-XL89@noaa.gov

RE: *73 FR 78294*

Dear Mr. Payne:

I am submitting these comments on behalf of the millions of members and constituents of The Humane Society of the United States, its international arm, Humane Society International (HSUS/HSI), and the groups and individuals listed below. This letter is in response to the notice of a proposed incidental take authorization by Lamont-Doherty Earth Observatory (L-DEO) at Columbia University, for a request under the Marine Mammal Protection Act (MMPA) to take small numbers of marine mammals, by Level B harassment, incidental to conducting a marine geophysical seismic survey in Southeast (SE) Asia during March-July 2009, as published in *73 FR 78294*. While we appreciate L-DEO's efforts to comply with the MMPA and the National Environmental Policy Act, we are concerned that this request for an incidental harassment authorization is premature and that in fact a letter of authorization for incidental take may be required. **HSUS/HSI strongly urges the National Marine Fisheries Service (NMFS) to deny this request as submitted and at a minimum to require L-DEO to resubmit its request with an updated review of the region's marine mammals, a more complete review of relevant literature, modified survey track lines and schedules, and additional mitigation measures.**

HSUS/HSI's comments are based largely on the *Federal Register* notice alone, although some information found in the L-DEO application was reviewed as well. We are aware that comments on the application and the Environmental Assessment (EA) have been submitted by others and we wish to endorse the comments submitted by the Natural Resources Defense Council, Dr. John Wang, and the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group.

General concerns

The notice in the *Federal Register* states in several places that scientific information on marine mammal species in the SE Asia survey area is minimal or even non-existent. It also notes that

data on the impacts of seismic airgun sounds on marine mammals are minimal or lacking. Nevertheless, the NMFS and L-DEO inexplicably and without basis or precaution conclude that the surveys will have negligible impacts on marine mammals. This is unacceptable.

When it suits the agency and the applicant to focus on specific results from the limited number of scientific studies on acoustic impacts on marine mammals (when, for example, results show some marine mammal species do not avoid vessels conducting seismic surveys), they do so in great detail, in order to support their conclusion that impacts from the proposed surveys will be negligible. When specific study results do *not* support their conclusion of negligible impacts (when, for example, results show that some marine mammal species cease vocalizing when exposed to seismic airguns), they pass over them quickly with little discussion. Similarly, the *Federal Register* notice frequently emphasizes the lack of evidence for impacts, in what seems to be an effort to make the classic (and inappropriate) argument that absence of evidence is evidence of absence. At no time does the notice take the position that a lack of information should be treated as grounds for a precautionary approach.

For example, the notice states that "There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns" (p. 78304). Such a statement is misleading on many levels. For one, marine mammal science has yet to develop ways to measure or identify PTS (permanent threshold shift or permanent hearing loss) in the field. For another, it is known that exposure to loud impulsive sounds such as are produced by airguns can deafen terrestrial species, including people. To state that no *specific* evidence exists of PTS in marine mammals exposed to airguns when science cannot yet identify such evidence is both specious and disingenuous.

The notice also draws conclusions that are heavily biased in favor of a finding of "no impact." For example, the notice states that "many cetaceans…are likely to show some avoidance of the area with high received levels of airgun sound…[and] the avoidance responses of the animals themselves will reduce or *(most likely) avoid any possibility* of hearing impairment" (emphasis added, p. 78303). Setting aside the lack of scientific substantiation for the degree of certainty displayed by this claim, there is no presentation or discussion of the opposing (and equally likely) possibility that many cetaceans might *not* show avoidance of an area ensonified by airguns because it is important habitat.

The notice states that "if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals or on the stock or species could potentially be significant" (p. 78301). It does not, however, consider the reverse; that the failure of a sound source to displace animals from important feeding or breeding habitat may indicate that the area is so important that the animals are willing/forced to tolerate a level of noise exposure that is in fact harmful (see, e.g., the discussion of this concept in Richardson et al. 1995).

For example, the notice states that "during the summer feeding season, bowheads are not *as sensitive* to seismic sources" (emphasis added, p. 78302). Yet another perfectly legitimate interpretation of the failure of bowheads to move away from seismic sources when feeding is that feeding bowheads are *just as sensitive* to airgun noise as migrating bowheads (disturbance of

migrating whales exposed to airgun noise is discussed earlier in the paragraph), but do not react because leaving a prime feeding spot is more costly than moving laterally along a migration pathway. The failure of the notice to consider this possibility is an example of the bias permeating the entire analysis and has contributed to an unacceptably incomplete level of evaluation and discussion regarding impacts and mitigation.

This strong bias in the *Federal Register* notice is disturbing. The notice should be an objective discussion that leaves open whether the agency should issue the authorization or not. As published, however, the notice's language leads inevitably to a decision to issue the authorization, despite the applicant's failure to argue convincingly, as required by law, that the surveys will not result in serious injury or death or even, in this case, Level A harassment. In fact, **there is an insufficient scientific basis for concluding that no serious injury, death, or Level A harassment of any marine mammal species will occur. Accordingly, the NMFS must deny this request as submitted and at a minimum request the applicant to submit a revised application** with a more realistic and conservative analysis of potential impacts. If a compelling argument to support the conclusion that only harassment (Level B *or* Level A) will occur is not forthcoming, then the NMFS must deny the request outright and require the applicant to seek a letter of authorization for incidental take under Section 101(a)(5)(A-C) of the MMPA.

Review of the region's marine mammals

The application and the *Federal Register* notice never indicate that the Eastern Taiwan Strait (ETS) population of the Indo-Pacific humpback dolphin, *Sousa chinensis*, is listed as "critically endangered" on the International Union for Conservation of Nature (IUCN) Red List. Instead these two documents lump the entire region's *Sousa* populations together. While the IUCN did list the larger regional *Sousa* population as "near threatened," it specifically identified the ETS population as separate and "critically endangered." This designation was made well before the December publication of the *Federal Register* notice. The failure to note this, to address the fact that two-thirds of this population (the maximum proportion the notice indicates could be taken – see p. 78311) cannot be considered a "small number," or to address the fact that the survey track lines cover the entire length of this imperiled population's home range is unacceptable and must be rectified by a resubmission of the application.

The discussion of the critically endangered western gray whale (*Eschrichtius robustus*) is similarly problematic and does not adequately consider that the surveys will occur in waters presumed to include the population's breeding grounds and migration pathways (which are currently unknown but are placed by expert opinion in the South China Sea). Any resubmission of this application must do a far better job of evaluating the region's marine mammal populations, especially those that are critically endangered.

In its discussion of disturbance reactions, we also note the notice's use of the eastern gray whale's status as an example of a species experiencing "no impact" despite living in a noisy environment. The notice states that the whales "continued to migrate annually...with substantial increases in the population over recent years, despite intermittent seismic exploration and much ship traffic" (p. 78302). However, the notice ignores the drastic drop in eastern gray whale

numbers between 1998 and 2000, by perhaps as many as 9000 animals (Angliss and Outlaw 2007). While it is certainly debatable to what (if any) degree exposure to various noise sources contributed to this population's decline, to ignore the decline when using the population as an example of a population's *increase* in the face of exposure to various noise sources is simply bad science.

Relevant literature

The *Federal Register* notice and application have failed to consider some key papers in the recent acoustics literature, at least one of which is a significant and telling omission. Madsen et al. (2006) is not cited by L-DEO in its application and although it is cited in the EA, the discussion there about its implications for marine mammals with high frequency hearing and the propagation of seismic airgun sounds is shallow. This is unacceptable. Clearly seismic airguns have the capacity to propagate well beyond the exclusion zones proposed by L-DEO and to affect marine mammals with higher frequency hearing, yet the mitigation measures discussed do not address this at all.

The NMFS and L-DEO also ignore the growing body of literature addressing the possible infliction of stress on animals, including marine mammals, due to exposure to noise and how this stress can have significant impacts on individuals and populations (e.g., Wright and Kuczaj 2007). The discussion in the notice and application (and no doubt the EA) still relies overmuch on observable behavioral reactions, when in fact research (also not cited in the L-DEO documentation) is available that suggests already stressed animals or animals in poor condition may *not* observably react in the face of human disturbance when more robust animals will (e.g., Beale and Monaghan 2004). Any resubmission of this request for authorization must expand and improve its discussion of the relevant scientific literature.

Survey track lines and timing

It is unclear why the surveys must take place during the proposed time period (March 21-July 14, 2009). The applicant acknowledges that the best available science shows the "highest number of marine mammal sightings and species occur during April and June" (p. 78298) in the region – the overlap with the survey dates is obvious. This also happens to be the calving season for many species in the region. The NMFS should require at a minimum that L-DEO provide clear and substantive justification for the proposed survey schedule. The most effective mitigation measure known is to avoid species spatially and/or temporally; L-DEO has ignored this and must offer a strong rationale for doing so in any application resubmission. (The rationale that resources have already been committed to conducting these surveys during this time period is of course not only unacceptable as a justification, it is also illegal under the National Environmental Policy Act.)

The same can be said of the track lines. Based on the map of the proposed survey track lines found in the L-DEO application (see Figure 1, p. 3 of the application), the survey vessel R/V *Marcus G. Langseth* will be operating in the known and suspected habitat of at least two critically endangered cetacean species, the western gray whale and the ETS *Sousa*. L-DEO must provide better justification for the track lines – if these are the only track lines that will accomplish the goals of the research, then L-DEO must explain why and offer a rationale that

justifies exposing critically endangered marine mammal populations to Level B harassment and, despite the applicant's assurances to the contrary, potentially Level A harassment and serious injury.

Mitigation measures

Although the *Federal Register* notice and the application note that the root mean square (rms) received level distances are potentially very large for shallow water, there is no effort to address the short-comings of the proposed mitigation measures under those circumstances. As an example, the most vulnerable cetacean population to be affected by these surveys (i.e., ETS *Sousa*) could be routinely exposed to sound pressure levels of 180 dB re 1µPa (rms) or greater (the level beyond which Level A harassment might occur), given the track lines proposed. Individual *Sousa* could be at risk of Level A harassment (or worse) at a distance as far from the *Langseth* as 4km (see Table 1, p. 78297). This is well beyond visual (and probably acoustic) detection range, yet there is little effort in the application (or the *Federal Register* notice) to address this short-coming. The proposal to come no nearer to the west coast of Taiwan than 2km (and to remain "when possible" – p. 78315 – at least 8-10km offshore) is not sufficient.

Recent research examining the propagation of airgun noise has shown that, contrary to predictions, received levels can decrease between 5 km and 9 km, but then increase at distances between 9 km and 13 km (Madsen et al. 2006). The researchers stated that received levels "can be just as high…at 12 km as at a range of 2 km from the array" (Madsen et al. 2006, p. 2374), "beyond where visual observers on the source vessel can monitor effectively" (Madsen et al. 2006, p. 2376). Arguably, this suggests that if the goal is to avoid subjecting animals to Level A harassment or worse, seismic surveys should be conducted at a minimum greater than 12km from the offshore boundary of a coastal species' home range.

Applying this logic, the only way to avoid exposing these critically endangered dolphins to Level A harassment (or serious injury) – and also to avoid Level B harassment, to which this fragile population should arguably not be exposed either – is to move the proposed track line considerably farther offshore than 10km. There is no way to avoid them on the proposed track line seasonally, as they are year-round residents. It is unacceptable that L-DEO proposes to run the *Langseth* directly through the only known habitat for this critically endangered population, employing mitigation measures that will clearly be ineffective at preventing Level A harassment and serious injury, let alone Level B harassment.

HSUS/HSI is also concerned about other aspects of the proposed mitigation measures, including the use of only one Marine Mammal Visual Observer (two will be used only "when practical" – p. 78314); visual detection as the primary mitigation measure, when several vulnerable species are extremely difficult to see even under the best of circumstances (e.g., beaked whales); the use of any mitigation measure(s) at night (there has yet to be designed any suite of nighttime mitigation measures that is even remotely as effective as daytime mitigation measures when it comes to detecting and avoiding marine mammals); the heavy reliance on ramp-up of the airgun arrays (even though there is little if any independent field testing of the assumption that ramp-up causes animals to move away from a sound source); and the failure to consider alternate

schedules to avoid the overlap of the surveys with the calving season for several cetacean species in the region.

The assumption (repeated several times in the *Federal Register* notice) that animals will move away from the approaching *Langseth* is simply wishful thinking – there is no evidence that this will occur for most species and in some cases (again, e.g., ETS *Sousa*), this is not even an option, as there is essentially nowhere for the animals to move to that will allow them to escape exposure to high levels of seismic sound. These issues are all discussed at greater length by other parties submitting comments and we urge the NMFS to require L-DEO to address these concerns in any resubmission of the application.

Conclusion

The NMFS must deny this authorization request as submitted. The unsubstantiated, biased, and non-precautionary assumptions found through the *Federal Register* notice are unacceptable and must be discarded in any subsequent re-analysis of this proposal. L-DEO must resubmit its request, providing an expanded and improved discussion of the region's marine mammals, relevant literature, proposed survey track lines and schedules, and mitigation measures.

Three final points: first, the NMFS must verify that L-DEO has complied with all relevant laws and regulations of the countries within whose EEZs it will be conducting surveys. It cannot take at face value the assurances of L-DEO that such compliance will occur. It is a long-standing concern of HSUS/HSI (and other NGOs, both domestic and international) that U.S. agencies issue environmental permits and authorizations for activities that will in part be conducted within foreign jurisdictions without first verifying that the applicant has complied or even initiated compliance with local laws and regulations.

In this case, L-DEO has stated that it will "coordinate with Taiwan, China, Japan, and the Philippines, as well as applicable U.S. agencies (e.g., NMFS) and will comply with their requirements" (p. 78316). This is a promise of action, but there is no indication in the *Federal Register* notice how fulfillment of this promise will be verified. *Before* the NMFS issues an authorization, it must verify, by requesting *and receiving* the relevant paperwork from the applicant, that L-DEO has at a minimum initiated and preferably completed compliance with all relevant laws and regulations of these four nations.

Second, the applicant and the agency must improve their consultation with regional experts on the protected species in the region(s) of interest. Many of the omissions and inaccuracies of the application (and, quite frankly, much of the local resistance to this proposed research) could have been avoided if the applicants had sought out and consulted with regional scientific experts and regional NGOs with relevant expertise. Far too often, applicants for MMPA incidental harassment authorizations, who are working on geophysical and other projects that do not directly concern marine mammals but result in their incidental harassment and that will occur at least partially within foreign jurisdictions, fail to consult much or at all with regional entities who can be considered stakeholders in the decisions to authorize such projects. The authorizing agency compounds this failing by accepting the applicant's assurances at face value that

sufficient consultation has occurred or will occur. We strongly advise the NMFS (and applicants such as L-DEO) to rectify this problem in the future.

Third, we note that the *Federal Register* notice states (p. 78306):

> NMFS believes that to avoid the potential for *permanent physiological damage (Level A harassment)*, cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). The precautionary nature of these criteria is discussed in Appendix B (6) of L-DEO's application, including the fact that the minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces barely-detectable TTS and the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. [emphasis added].

The language (see emphasis) functionally defining Level A harassment is not found in the MMPA or in its implementing regulations. We advise the NMFS against inserting "unofficial" definitions of harassment into notices, regardless of the context (here, it could be argued only hearing impairment was in question, but these words could be taken out of context). This wording could be seen to encompass a broad range of "damage" – from a wound that heals into a scar (clearly minor) to a crippling injury that leads to death (so clearly *not* Level A harassment but rather serious injury). It also could be seen to exclude reversible injuries that should be categorized as Level A, not Level B, harassment (such as, for example, broken bones that, until healed, could result in lost mating opportunities). We strongly recommend that this language be expunged from any subsequent rule on this application and not used again in any future notices.

Thank you for the opportunity to comment on this important matter.

Sincerely,

Naomi A. Rose, Ph.D.
Senior Scientist
International Policy

On behalf of:
Mark Berman, Earth Island Institute
Alan Godley, Blue Dolphin Alliance
Ellen Hines, Ph.D., Associate Professor, Department of Geography and Human Environmental Studies, San Francisco State University
Samuel K. Hung, Ph.D., Chairman, Hong Kong Cetacean Research Project
Mark Jones, Animal Welfare Director, Animals Asia Foundation

Benjamin Kahn, Director, APEX Environmental, Coral Triangle Oceanic Cetacean Program
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Cc: Tim Ragen, Ph.D., Executive Director, Marine Mammal Commission

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February 5th, 2009

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Chief, Permits
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RE: 73 FR 78294

Dear Mr. Payne:

I am writing to you on the behalf of Linking Individuals for Nature Conservation (LINC); a Hong Kong based non-profit organization dedicated to the protection of marine and coastal environments in SE Asia.

According to the application of the Lamont-Doherty Earth Observatory (L-DEO) at Columbia University, for the request to take small numbers of marine mammals, by Level B harassment, in SE Asia during March – July 2009; The L-DEO will "coordinate with Taiwan, China, Japan and the Philippines, as well as applicable U.S. agencies." We are fortunate to be able to respond and particularly object to the application, as we are well aware of other local NGOs that have not had to time to do so due to lack of sufficient notice.

In response to the Federal Register notice (*73 FR 78294*), (p. 78316), "As a result of these preliminary determinations, NMFS proposes to issue an IHA to L-DEO for conducting a marine geophysical survey in Southeast Asia from March-July, 2009, provided that previous mentioned, mitigation, monitoring and reporting requirements are incorporated." (p. 78316 – 78317), it is out of expectation that the NMFS would be so eager to approve the L-DEO application without verifying that L-DEO has first complied with relevant local laws and regulations. It is of our greatest concern that the NMFS does not facilitate the violation of local conservation laws by issuing permits and authorizations for destructive activities in our region without verifying that the applicant has been granted the required permits by the relevant local government agencies.

LINC strongly urges the NMFS to reject the application of L-DEO until it can be proven that they have; (1) complied with local laws and regulations and, (2) have completed a comprehensive consultation with local government, scientists, researchers and NGOs based in this region. Approval of the current L-DEO application, as is, would demonstrate a clear lack of concern for the conservation laws, threats and environmental protection efforts in this region.

Sincerely,

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2 February 2009

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RE: FR742995: Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March–July 2009

Dear Dr. Payne:

The National Marine Fisheries Service (NMFS) should be pleased with the comments and counsel offered by so many regional and species experts regarding the Lamont-Doherty Earth Observatory (L-DEO) / Columbia University Incidental Harassment Authorization (IHA) Request. This request has stimulated documented facts and expert opinions not equaled by any other acoustical impact request that Cetacean Society International (CSI) is aware of. The resources provided to NMFS by these experts should stimulate appropriate and necessary research, and enable more accurate and useful assessments of appropriate mitigations for the entire seismic research community and commercial seismic industry.

CSI has had opportunity to review the "Request by Lamont-Doherty Earth Observatory 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 Southeast Asia, March–July 2009" (Request) and the "Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in Southeast Asia, March–July 2009, prepared by LGL Limited" (EA).

CSI is not opposed to seismic surveys, whether for research or commercial purposes. CSI is opposed to such surveys being authorized and undertaken without adequate scientific research or consultation on the potential impacts on, and adequate mitigations for, cetaceans, other marine organisms and the marine habitat. Both the Request and the EA are deficient in this respect.

The Request and EA are similar in many respects to previous L-DEO EA's. The response, however, is not. The response to this authorization request will prove to be unique, a potential watershed in the manner all future seismic surveys should be critiqued by the scientific community. To be helpful, CSI has attached some relevant expert reviews to our comments, even if they are duplicated by others, to ensure that NMFS has the opportunity to include them in the deliberative process. The expert level of opinion and proof stimulated by the Request and EA challenges previous assumption and, we hope, will stimulate adequate, directed research to enable appropriate mitigations to satisfy various laws, including the Marine Mammal Protection Act (MMPA).

However, the MMPA only authorizes the lethal taking of marine mammals under extraordinary circumstances that do not apply to the scientific research proposed by this project. In the opinion of experts, as expressed in the attachments, mortalities are likely. How can NMFS believe that all these experts are wrong, or that associated mortalities would not violate the MMPA? We urge NMFS to apply these expert comments to the EA and Request deficiencies, and to require that the L-DEO proposal address them in the only legal format available to them, an application for a letter of authorization under MMPA Section 101(a)(5)(A-C).

It is a relief to find so many experts willing to contribute their knowledge and experience to this process. They do a far better job than CSI or any NGO could of addressing the specific flaws found in this L-DEO authorization request. While some of these same flaws in previous L-DEO requests have been addressed, they may have been more easily dismissed by NMFS because very few were from world authorities and scientific experts. This time the experts have participated directly, and cannot be dismissed.

Previous L-DEO authorizations have proceeded on the assumption that there was no proof of significant impact, without supporting adequate, directed research to validate that claim. The attached expert reviews declare several significant research questions that need to be answered to judge the potential impacts from this proposal. Will L-DEO, the National Science Foundation (NSF), and other supporters work with the experts to enable adequately mitigated seismic research?

This increased expert participation will help NMFS to meet the Administrative Procedures Act (APA) requirement that the best available science be incorporated into deliberations, science which is not evident in the current EA. In addition, because anthropogenic acoustical impact research has progressed beyond the references in the L-DEO proposal (for several significant examples see the Journal of Comparative Psychology 20 (2007)), NMFS must require an adequate review of the recent references given in the attached documents.

For just one example, assumptions or assertions in the EA that a lack of behavioral response means that there is no significant impact are not supported by the best current science. A panel of experts recently addressed the issue, concluding that animals may suffer severe or chronic stress from a stimulus, even while showing no observable behavioral response. The scientific evidence for the affects of stress becoming significant to survival is increasing, and the EA should be revised to take these modern views into account.

The EA violates the National Environmental Protection Act (NEPA). NEPA requires that resources should not be committed until the EA/EIS process is complete. But resources already have been committed and scheduled, according to LGL's declaration that "If the IHA is issued for another period, it could result in significant delay and disruption not only of the proposed cruise, but of subsequent geophysical studies that are planned by L-DEO for 2009 and beyond." If more time is required to comply with federal law so be it.

The intent of LGL's comment is to manipulate NMFS into a fast and uncritical decision. By law, the schedules, as well as the scientific and economic values of this project, remain irrelevant to the scope of NMFS' deliberations on the fitness of the proposal.

CSI is well aware that the L-DEO, National Science Foundation and other project supporters represent powerful influences that NMFS must respect. However, we trust that these rational influences also recognize the overwhelming need to define and mitigate anthropogenic affects on the marine environment, with their rapidly accelerating influences on the planet and eventually human societies. Is it necessary to do significant, irrevocable damage to marine life in order to understand geo-physical processes?

In lieu of such lofty concerns economic efficiency is an excellent rationale for increased support of appropriate science to determine adequate mitigations. Without better science this and future proposals will face further challenges that will cause delays in the L-DEO schedule that are likely to have economic consequence. The time and financial loss is neither the fault of the process or the responsibility of NMFS. Why not do the job responsibly?

The current EA is deficient, but its critique will provide stakeholders with resources to define what truly adequate mitigations are possible, while meeting the project's goals. Not only that, but by example, the world's increasingly active but unregulated seismic industry will benefit from learning what mitigations are most effective.

The fundamental point of CSI's comment and many others, is that this L-DEO project does not qualify for an IHA, according to the criteria at www.nmfs.noaa.gov/pr/permits/incidental.htm. The fact that previous L-DEO projects received IHA's does not provide a precedent under which this proposal also should receive an IHA, because no matter how NMFS rationalized those past IHA's this proposal is different, different in the scale, scope and expertise represented by the formal comments and less public complaints it has generated from scientific world authorities and regional and species experts. If these people had been consulted by LGL the inadequate EA and request would never have been submitted for an IHA. The original intent of the IHA process was to expedite some requests, not all requests. Not this request.

Because the L-DEO's geophysical research will have an incidental impact on marine mammals that experts predict will include mortalities and even extirpation it must apply for a letter of authorization under MMPA Section 101(a)(5)(A-C).

Thank you for the opportunity to present these comments, and the attached expert reviews.

Sincerely,

William W. Rossiter
President

Attachment 1: Review of proposed L-DEO seismic surveys in SE Asia (FR 78294)
Attachment 2: ETSSTAWG Peer review 09-01

Review of proposed L-DEO seismic surveys in SE Asia (FR 78294)
28.1.09

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7. References

Note 1. Focus on marine mammals in this review

The concerns raised here specifically focuses on marine mammals but do not imply that impacts on other marine organisms such as marine reptiles, fish, etc. are insignificant but rather that the expertise of this reviewer is with marine mammals. Sincere consultation with experts on other marine organisms of the region is needed as there are also considerable socio-economic issues with fisheries and aquaculture.

Note 2. Noise impacts on cetaceans

- according to NMFS, to avoid permanent physiological damage, cetaceans should not be exposed to received pulsed underwater noise levels of 180 dB re 1μPam (rms) or more.
- This would be 'Level A Harassment' whereas received levels above 160 but lower than 180 dB re 1μPam (rms) would be considered 'Level B Harassment'.
- The predicted distances of where 180 dB re 1μPam (rms) will be received varied between 710m and 3,694m from the source (36-airgun array) depending on the depth at which the array will be towed and the depth of water.
- A deeper tow depth and over shallower water will increase the distance of exposure.
- For the 160 dB re 1μPam (rms) level, the distances varied from 4,670 to 8,000m from source.

1. Lack of data but numerous threats for marine mammal species and populations in SE Asian waters

- There is little knowledge available for most of the species that inhabit the waters of SE Asia. Even the most basic knowledge about the presence/absence of species is incomplete.
- Only a small proportion of the large expanse of sea in the region (and mostly coastal waters) has been surveyed systematically for marine mammals.
- Few estimates of abundance or distribution exists for SE Asian marine mammals and in most cases, this information is for a limited region, often bounded by political rather than biological borders.
- What little is known clearly shows the region to be an area with a high diversity of marine mammal (and other marine) species.
- However, it is also a region where marine mammals are facing a myriad of serious threats that have made the continued existence of several marine mammal populations and possibly some species uncertain (note: some of the same threats and activities have resulted in the recent 'functional extinction' of the baiji (Turvey et al., 2007), which is endemic to the Yangtze River of China).
- All small cetaceans in Taiwanese waters are threatened by fishermen using hand-harpoons, bycatch in fishing gear and noise. Those that inhabit coastal waters of western Taiwan also face habitat degradation, pollution and possibly prey reduction.
- Some marine mammals have been reduced to numbers so low that even minimal 'takes'

will have a large impact on the remaining population.

- A number of marine mammals are discussed below based on what is known about their biology, conservation status and threats in the region. This does not imply other marine mammals that are not specifically discussed in detail are 'safer' from the seismic surveys; in most cases, too little information is available to understand the impacts, which may be as great as or greater than the marine mammals discussed in detail below.

2. Threats to particular species and populations- odontocetes

2.1 Certain overlap of survey tracklines with distribution of critically endangered Eastern Taiwan Strait (ETS) Indo-Pacific humpback dolphins (*Sousa chinensis*) (west coast of Taiwan)

2.1.1 Potential threat from LDEO seismic surveys:

With the exception of a very small area where the proposed tracks take the *Langseth* to the mainland Chinese coast and back to western Taiwan, the *Langseth* will operate in waters within 1 km from the shore of Taiwan and right through the middle (longitudinally) of almost the entire linear coastal distribution of the ETS population, i.e. the proposed trackline almost completely overlaps with entire distribution of the ETS population. At this distance from shore, the *Langseth* will subject the entire population to noise levels >>180dB.

2.1.2 Background

- STATUS: The species *Sousa chinensis* is listed as 'near threatened' under the IUCN red list and is listed under CITES Appendix I. The ETS population is listed as Critically Endangered under the IUCN red list. The species is given the highest level of legislative protection by Taiwan's Wildlife Conservation Act (WCA); distinct (Wang et al., 2008a)
- ABUNDANCE: Population size <100 (Wang et al., 2007a)
- DISTRIBUTION: Thus far, the ETS humpback dolphin population has been recorded in waters from shore out to about 3 km and in water depths that vary from 1.4 to about 25m deep (see Wang et al., 2007a; Chou 2006). The species has not been reported in waters greater than about 25-30m (Jefferson and Karczmarski, 2001) but can be found much further offshore if shallow water exists (Corkeron et al., 1997). Jefferson (2000) showed that humpback dolphin sightings drop off considerably beyond a perpendicular distance of about 400-500m and none were observed beyond a perpendicular distance of about 1500m.
- The ETS population is resident year-round (J.Y. Wang, unpublished data) in a very restricted (<200km) stretch of shallow coastal waters (to about 3km from shore) along western Taiwan (=eastern Taiwan Strait) (Wang et al., 2007b).
- THREATS: noise, bycatch in fisheries, loss of habitat due to land reclamation, decrease of freshwater to river estuaries, pollution (Wang et al., 2007b).
- HUMPBACK DOLPHINS AND BOAT NOISE: In general the species are usually indifferent towards boats but can be curious and approach boats occasionally. Noise from boat traffic (being much lower in intensity than airguns) can affect the acoustic behaviour of humpback dolphins, with mother-calf pairs being the most disturbed (van Parijs and Corkeron, 2001); Boat

traffic can also affect the diving and swimming behaviour of humpback dolphins (Ng and Leung, 2003).

-

2.1.3 No escape from noise

Sousa chinensis is considered a slow swimmer and unlikely to sustain high speed swimming for more than a few minutes, and therefore unlikely to be able to outrun the *Langseth* (while towing airguns) for extended periods. Even if they were able to outrun the *Langseth*, there would be no escape within their distribution because:

a) the tracklines covers nearly the entire longitudinal length of the ETS population's total distribution and beyond; and
b) no safe acoustic shelters DEFINE exist.

2.1.4 Poor/no tolerance of additional stress

Mortality (by human causes) of even a single individual per year from this population may not be sustainable, and unless effective mitigation measures are taken immediately to reduce the threats to this population, it is unlikely that the population will continue to exist (Wang et al., 2004, 2007b). Any single threat has the potential to be the final cause of extinction for this small population of dolphins.

2.1.5 Unacceptably high proportion of ETS humpback dolphin population to be impacted

68.7% of the ETS population was predicted to be impacted by the proposed surveys. This high proportion in itself is a severe underestimation of the population being impacted as the *Langseth* will transect the entire distribution of the ETS population, which has no acoustic shelters in these waters and the dolphins can not escape to other waters. Therefore, nearly the entire population will be exposed regardless of where the dolphins are in their distribution. Even at 68.7%, the proportion of this critically endangered population to be impacted is unquestionably far too high.

2.1.6 Proposed impact mitigation measures

Predicted RMS distances

- Even staying >= 2km from the coastline (a proposed mitigation measure to reduce the impact on the ETS humpback dolphin population) does absolutely nothing to reduce the noise exposure to these critically endangered dolphins.
- Even at 8-10km from shore will still expose all animals to >160dB and an unknown number would still be exposed to >180dB.
- The above statements are conservative because they are based on the predicted RMS distances for different levels of exposure (Table 1 in the Federal Register (FR) notice), which
  a) underestimates actual exposure levels in shallow waters* (FR) and
  b) does not consider
     - reverberations that are likely to occur as a result of the solid concrete sea walls that are found along much of the central western coast of Taiwan,

- the very shallow water depths of western Taiwan (also, tidal fluctuation is up to about 5-6m and can affect the depth in which the dolphins are found during exposure); or
- the many sandbars that may force animals to be further offshore from the solid shoreline during lower tides.

* The grouping of exposures into the very broad category of 'shallow' water (being <100m) is not sufficient to understand the exposure level for a species that occupies water depths at the lowest end of the 'shallow' water category. It is expected that the exposure levels will be much higher at any given distance from source than the predicted values in the tables. The distance to reduce exposure to noise levels of 160dB or greater is unknown for dolphins in water depths less than 25m and could be much greater.

2.1.7 Previous recommendation for buffer zone for ETS humpback dolphins
In December 2008, the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG, an international working group established in early 2008 to provide scientific guidance and advice to all interest groups) recommended that a buffer for noise threats to be out to at least 5km from shore for the ETS population after reviewing a proposal for designation of Major Wildlife Habitat for the ETS population (review letter to Wild At Heart Legal Defense Association – dated 29 December 2008).

Calculations of how far the *Langseth* should be to prevent the ETS population from being exposed to levels >160dB should be based at least on the recommended 5km buffer boundary (i.e., the waters from shore to 5km offshore should not be exposed to levels >160dB). However, given the population's critical status and the fact that table 1 underestimates the actual exposure levels in shallow water, the recommended distance should be even more precautionary, i.e. greater than 13 km from shore based on the values presented in table 1 of the FR notice.

Consideration of cumulative noise impacts
The exposure of these dolphins to total cumulative noise has not been considered. The ETS dolphins live in an environment which is already very noisy (e.g., pile driving and other noise-generating activities during coastal construction, shipping, other seismic surveys (oil and gas, local researchers, etc.). The cumulative impact of all noise sources needs to be examined in context of the contributions by the intense sounds source of the airguns.

2.2 Overlap of survey tracklines with distribution of Jiulong River estuary (JRE) Indo-Pacific humpback dolphins (*Sousa chinensis*) (east coast of China)

2.2.1 Potential threat from LDEO seismic surveys
If the *Langseth* approaches to within 10km from shore, dolphins using waters east of the Chinmen islands may be exposed to levels greater than 160dB and some may be be exposed to 180 dB or

more depending on where the dolphins are found in their distribution and how close the *Langseth* is to the 25-30m isobath.

2.2.2 Background

- STATUS: The species *Sousa chinensis* is listed as 'near threatened' under the IUCN red list and listed under CITES Appendix I. The JRE population likely to meet the IUCN Red List criteria for "critically endangered". *Sousa chinensis* is afforded the highest level of legal protection in China and Hong Kong. JRE humpback dolphins are distinct from ETS humpback dolphins (Wang et al., 2008a); the level of exchange (if any) with other provisional populations along the mainland Chinese coast is uncertain. The JRE population is less well understood than ETS population
- ABUNDANCE: Population size <90 (Chen et al., 2008a)
- DISTRIBUTION The shallow water which *Sousa chinensis* inhabit is more expansive on the western side (i.e. JRE side) of the Taiwan Strait than on the eastern side (ETS side) with the 25-30m isobath which likely marks the boundary of their distribution being further offshore.
- THREATS: main threats are bycatch, habitat degradation, reduction of freshwater to the Jiulong River estuary, increasing pollution, prey reduction and noise. Some JRE dolphins were also killed recently by blasting during coastal construction activities (Wang et al., 2003).

2.2.3 Note on lack of data

Although the JRE dolphins' distribution near Xiamen, PRC has been studied, their distribution in the adjacent waters of the Chinmen islands and further east are completely unknown and were not surveyed by Chen et al. (2008) due to political border issues. Not enough is known about this population to estimate what proportion of dolphins in this small population will be impacted but it is clear that some will be impacted and with such a small population size, even minimal disturbance can have a large impact on the population.

Note on other provisional populations of *Sousa chinensis* along the coast of China:

Far less is known about *Sousa chinensis* in other regions so the impact on these dolphins can not be estimated. However, given the proposed trackline which meets the mainland Chinese coast perpendicularly and closest near the area of Xiamen/Chinmen Islands and near Pingtan (where records of *Sousa chinensis* also exist – see Wang, 1999; Zhou, 2004), dolphins of these coastal waters would be expected to be impacted most.

2.2.5 Summary for populations of Indo-Pacific humpback dolphins in the EEZs of Taiwan and China:

The proposed tracklines for the LDEO survey

a) overlap completely with the distribution of the ETS population, and

b) are directly in line with the heart of the JRE population's distribution at their closest approach to the mainland Chinese coast

The tracklines proposed have the maximum possible impact on these two very small populations, one of which is listed critically endangered, while the other has an even lower abundance.

Given the confirmed critically endangered status of the ETS population and the small population size of the JRE provisional population, a higher level of precaution must be given to avoid negative impacts of human activities on these dolphins. Until the affects of seismic surveys on these shallow water dolphins and in the context of the cumulative impacts of all threats already present can be better understood, a 'safe' exposure level cannot be estimated as all contributions have the potential to be the 'final straw'.

2.2.6 Threats of lower noise levels

Even lower thresholds of exposure than those discussed above may increase the risks to these dolphins by altering dolphin behaviour. Increasing ambient noise levels that can 'mask' biologically important sounds as well as sounds that allow the detection of other threats (e.g., the sound of water flowing past gillnets, approaching boats, etc.).

2.2.7 Reviewer's recommendations for mitigation for *Sousa chinensis*

It is recommended that activities that would increase the risk of extinction of these populations, including physiological and behavioural impacts, not be permitted. {add specifics}

2.3 Beaked Whales, Ziphiidae

2.3.1 Potential threat of LDEO seismic surveys

- The tracklines of proposed seismic survey overlap much of the waters that are known or suspected to be important habitat for beaked whales.
- Waters along the edge of the continental shelf (especially where the strong Kuroshio Current meets the shelf edge) are particularly productive and appear to attract cetaceans, including beaked whales.
- Tracklines that run near and parallel to the edge of the continental shelf around Taiwan will have the greatest impact on cetaceans, being particularly damaging to beaked whales.

2.3.2 Background on beaked whales in SE Asian waters

- Beaked whales are given level two protection under the Wildlife Conservation Act of Taiwan and are listed under CITES Appendix II
- Three species of beaked whales occurring in this area are listed as "data deficient" in the IUCN Red List while Cuvier's beaked whale is 'least concern'.
- Threats to beaked whales in Taiwanese waters include large-mesh pelagic driftnet entanglement (Perrin et al., 2005), direct hunting, vessel collisions (large volume of commercial shipping occurs all around Taiwan) and noise from vessels, live-fire military exercises, naval sonar and seismic surveys (research and commercial).

- Four species of three genera of beaked whales are known from Taiwanese waters:
    - Cuvier's beaked whale (*Ziphius cavirostris*),
    - Longman's beaked whale (*Indopacetus pacificus*),
    - Blainville's beaked whale (*Mesoplodon densirostris*) and
    - ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*);
- Taiwan qualifies as a 'key area' for beaked whales based on the criteria of MacLeod and Mitchell (2006).
- Abundance: Almost nothing is known about the abundance of any species of beaked whales in SE Asian waters; however, recent systematic surveys of the waters of SE Taiwan (J.Y. Wang, unpublished data) revealed much higher beaked whale sightings per unit effort than in Hawaiian waters (Baird et al., 2006), a recognized beaked whale 'key area' (MacLeod and Mitchell, 2006). Beaked whales have been recorded in the waters off the entire eastern coast of Taiwan and strandings have also been recorded in SW Taiwan and several places along western Taiwan (see Wang et al., 1995; Wang, 1999; Zhou, 2004; Wang and Yang, 2006; Yang et al., 2007).
- Although the waters off western Taiwan are usually considered shallow and not the preferred habitat of beaked whales, in NW and SW Taiwan, adjacent deep water is present.
- Of note, *M. ginkgodens* has not been observed alive at sea and <25 specimens are known (see MacLeod et al., 2006).
- There are at least 10 (likely more) stranding and catch records of this species from Taiwan (J.Y. Wang, unpublished data) since the early 1990s.
- Recent surveys off SE Taiwan resulted in multiple sightings (and many photographs) of an unknown species of mesoplodont, which almost certainly was *M. ginkgodens* (the only other species recorded from this region is *M. densirostris*, which clearly was not the species observed). It was the most frequently encountered species in the waters surveyed (J.Y. Wang, unpublished data) and probably not as rare as once believed.
- There is evidence that at least some species of beaked whales exhibit strong site fidelity (e.g., Gowans et al., 2000; McSweeney et al., 2007)

2.3.3 Note on military exercises in waters near Taiwan and unusual stranding events

Military exercises of all forms and by many nations are common in and around Taiwanese waters and recently the Taiwan navy purchased four US-made Kidd-class destroyers that possess the 53-C mid-frequency active sonar, which has been implicated in the mortality of beaked whales in the Bahamas (Balcomb and Claridge, 2001; Evans and England, 2001). The waters around Taiwan are also one of the few places in the world where the US Navy can use their powerful low frequency active (LFA) sonar.

In 2004 and 2005, unusual multiple stranding events of several deep-diving species were recorded (Wang and Yang, 2006; Yang et al., 2008). Shattered tympanic bones and massive injuries to internal structures associated with diving and acoustics were reported for a *M. ginkdogens* that stranded in SW Taiwan (Wang and Yang, 2006). Yang et al. (2008) also reported finding "bubble

lesions" in two beaked whale carcasses that stranded in NE Taiwan.

2.3.4 Need for cetacean surveys before seismic surveys

- Clearly, all tracklines over or near the shelf edge will likely impact many cetaceans. However, without more cetacean survey information, it is uncertain if
  a) just moving tracklines away from the shelf edge would be effective in reducing impacts on beaked whales; or
  b) if the relocation of tracklines would harm different species in waters further offshore.
- Recent multiple sightings of *M. ginkgodens* during dedicated cetacean surveys of waters off SE Taiwan demonstrate the importance of such studies.
- Cetacean surveys in the waters off SW Taiwan where the important deep Penghu Channel exists are limited. This channel has a steep eastern wall that borders against the SW shores of Taiwan and helps to funnel a branch of the Kuroshio Current or the South China Sea Current to the northern tip of the channel ending in an important area of complex seasonal mixing with the cold China Coastal Current (Jan et al., 2002).

2.3.5 Reviewer's recommendations

- Systematic cetacean surveys of the waters of the Penghu Channel are needed before seismic surveys are conducted, to help reduce the impact on beaked whales and other cetaceans.
- Cetacean surveys are needed in the waters off eastern Taiwan (particularly in waters beyond 20km from shore where almost no cetacean survey effort exists) to determine if and what concentrations of beaked whales exist.

2.4 Sperm Whale, *Physeter macrocephalus*

2.4.1 Background on sperm whales in Taiwanese waters

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I
- The sperm whale is listed as "vulnerable" in the IUCN Red List
- DATA: Little is known about the sperm whales in Taiwanese waters.
- ABUNDANCE: The population size is unknown
- DISTRIBUTION: It is the most frequently sighted large cetacean in Taiwanese waters and is not 'uncommon' as stated in table 2 of the Federal Register notice. Most sightings occur in eastern Taiwanese waters (they have been observed along most of eastern Taiwan) but strandings have also occurred along the shores of the Taiwan Strait. Past whaling indicates that the deeper waters off SW Taiwan were also inhabited by sperm whales and sightings are still reported by fishermen.
- THREATS: Sperm whales in Taiwanese waters are threatened by the same human activities that harm beaked whales (see above) with the possible exception of direct hunting.

2.5 Finless Porpoises, *Neophocaena* spp.

2.5.1 Potential threat from LDEO seismic surveys

- During the period of proposed seismic surveys, many female finless porpoises in the region will be accompanied by neonatal calves. These will be most vulnerable individuals as they will be less able to maintain swimming speeds that will allow them to escape the range of the airguns.

2.5.2 Background on finless porpoises

- STATUS: The species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I. Finless porpoises are listed as "vulnerable" in the IUCN Red List but some populations are being threatened more seriously (e.g., the Yangtze River population is listed as 'endangered')
- There is recent evidence that more than one species exists (Wang et al., 2008b)
- ABUNDANCE: the population size is unknown but as a group, finless porpoises are probably the most abundant coastal cetaceans

2.5.3 Comments on detection by MMVOs as mitigation measure

- This is one of the most difficult species to detect at sea even in calm conditions because of its small size, lack of dorsal fin, brief surface time and usually occurring individually or in small groups. Depending on the behaviour of the animal, it can be near impossible to detect.
- Jefferson et al. (2002) reported that during calm sighting conditions, finless porpoises were observed primarily within 300m from the trackline (perpendicular distance) and none were observed beyond about 700m.
- In low light conditions or even slight seas, detecting finless porpoises is challenging even for researchers experienced with the species.
- MMVOs will be ineffective at detecting animals within the predicted distance where exposure in shallow waters can be greater than 190dB.

2.5.4 Comments on PAM as mitigation measure

- In shallow water, PAM is unlikely to be effective in detecting finless porpoises.
- Finless porpoises are not always vocalizing and the high frequency sounds produced by finless porpoises attenuate quickly.

2.5.5 Swimming speed

- Finless porpoises are generally slow-swimmers but are capable of high-speed bursts.
- However, it is unlikely that such speeds can be maintained for more than a few minutes.

2.6 Other Odontocetes

2.6.1 Melon-headed whale

Recent mass strandings of melon-headed whales (*Peponocephala electra*) may have been related to the use of naval sonar (Hawaiian waters) and seismic surveys (Madagascan waters) so there is

concern about the potential impact such activities may have on this species as well. Melon-headed whales, although not a commonly-observed species, have been sighted on several occasions in the waters of eastern Taiwan and SW Taiwan and harpoon captures and two mass stranding events have been recorded from NE Taiwan and western and southern Taiwan, respectively (Wang et al., 2001a).

2.6.2 Short-finned pilot whale

Although the short-finned pilot whale (*Globicephala macrorhynchus*) has not been a species of concern in other parts of the world, four unusual stranding events (with two being mass strandings) involving short-finned pilot whales occurred at several places in and near Taiwan over a short period and coincided spatially (accounting for the direction and strength of local currents) and temporally with large-scale military exercises in the region (Wang and Yang, 2006).

2.6.3 Deep diving cetaceans

Deep diving cetaceans such as Risso's dolphins (*Grampus griseus*), dwarf and pygmy sperm whales (*Kogia sima* and *K. breviceps*, respectively) are also species of concern. Risso's dolphins are very common in all waters off eastern Taiwan (Yang et al., 1999; Wang et al., 2001b; Chen, 2001; Yeh, 2001) and SW Taiwan (Huang, 1996) and appear to be concentrated along and near the steep slope of the continental shelf. Dwarf sperm whales are also seen quite often at sea (Wang et al., 2001b) and appear to have a similar distribution to Risso's dolphins. Nothing is known about the distribution of the pygmy sperm whale in Taiwanese waters as none have ever been seen at sea; the only records are from strandings but comparisons of stomach contents of both *Kogia* spp., Wang et al., (2002) suggested the pygmy sperm whale had a more offshore distribution than that of the dwarf sperm whale. Many *Kogia* (both species) were involved in unusual mass stranding events of multiple species in Taiwan that were linked to intense energy sources (Wang and Yang, 2006; Yang et al., 2008).

Very little is known about most cetacean species in SE Asia. Studies in other regions suggest that some populations of species such as the false (*Pseudorca crassidens*) and pygmy killer (*Feresa attenuata*) whales, common bottlenose dolphin (*Tursiops truncatus*) and spinner dolphin (*Stenella longirostris*) may comprise small isolated groups that are associated with oceanic islands (see Karczmarski et al., 2005; Baird et al., 2008a,b; Baird et al., in press; McSweeney et al., in press).The conditions along eastern Taiwan may have similar characteristics (i.e., oligotrophic waters with considerable nutrient input from land sources and is distant from other such sources of nutrients) that encourages such populations with high site fidelity. Small isolated populations are more vulnerable to local extirpation. These species have been seen throughout the waters of eastern Taiwan and parts of the Taiwan Strait but nothing is known about population structuring of these species in Taiwanese and nearby waters. Several mass stranding events of pygmy killer whales have occurred in SW Taiwan and at least one individual exhibited internal haemorrhage deep in the melon (Wang and Yang, 2006).

3. Threats to particular species and populations - mysticetes

3.1 Background

Little is known about baleen whales in this region. The western gray (*Eschrichtius robustus*), north Pacific right (*Eubalaena japonica*) and western north Pacific blue (*Balaenoptera musculus*) whales have been depleted to such low numbers that their future is precarious. The humpback whale (*Megaptera novaeangliae*) in the western north Pacific is also not as numerous as before commercial whaling with at least one wintering population (southern Taiwan) being extirpated and a small population that over-winter in the northern waters of the Philippines, particularly the Babuyan Islands. Little is known about the other species that have been recorded from these waters: minke whale (*Balaenoptera acutorostrata*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), Bryde's whale (*Balaenoptera brydei*)and the newly described Omura's whale (*Balaenoptera omurai*).

3.2 Western Gray Whale, *Eschrichtius robustus*

3.2.1 Potential threat of LDEO seismic surveys

- The proposed L-DEO surveys from March 21 to July 14, which overlaps with the period during which western gray whales are expected to be either in their wintering grounds or are undergoing their northward migration through the Taiwan Strait, are an additional threat to these highly threatened gray whales. The shallow water preference of gray whales also increases the distance greatly for exposure thresholds. Even the take of a few individuals is projected to cause a continuing decline in the population towards extinction (Cooke et al., 2006).

3.2.2 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan, is listed under CITES Appendix I, and is listed as "critically endangered" under the IUCN Red List
- ABUNDANCE: ~100 individuals (Cooke et al., 2006)
- DISTRIBUION: Generally found in fairly shallow (i.e., continental shelf) waters
- summers in the Okhotsk Sea (mainly off northeastern Sakhalin Island), off eastern Kamchatka, Russia (Weller et al., 1999); wintering grounds (yet undiscovered) are believed to be somewhere in the waters of southern China, possibly around Hainan Island (northern part of the South China Sea) (Wang, 1984). Migration between summering and wintering grounds is unknown but records exist along more or less the entire Chinese coast (Omura, 1988; Zhu and Yue, 1998) so is likely through the Taiwan Strait; migration likely occurs as with other baleen whales during the spring (northwards) and autumn/winter (southwards) periods.
- THREATS: The western Gray whale faces many threats including: direct hunting, incidental mortality caused by fishing gear, coastal industrialization and shipping and activities associated with oil and gas development (for a review, see Weller et al., 2002).

3.2.3 Reviewer's recommendations

- Only with more dedicated cetacean surveys of the region's waters can this population be better understood. Better coverage of the region's waters by cetacean surveys can also allow fine tuning of spatial and temporal avoidance of gray whales by seismic surveys.
- Simple strategic scheduling of seismic surveys can eliminate or at least greatly reduce the impacts on this population.

North Pacific Right Whale, *Eubalaena japonica*

3.3.1 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I, and is listed as "endangered" in the IUCN Red List.
- ABUNDANCE: No more than a few hundred
- DISTRIBUTION: The distribution of this species is unknown, especially the wintering grounds where calving and nursing occurs; the wintering grounds may be as far south as the East China Sea.
- NOTES: Very little is known of the species.

3.4 Western North Pacific Blue Whale, *Balaenoptera musculus*

3.4.1 Potential threat of LDEO seismic surveys

- If small numbers of western north Pacific blue whales still exist in the region's waters, seismic surveys can have a large impact on the few remaining individuals (even if only a very few whales are disturbed).

3.4.2 Background

- STATUS: The species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan, is listed under CITES Appendix I; the blue whale is listed as "endangered" in the IUCN Red List. The north Pacific stock was listed as 'lower risk/conservation dependent' by the 1996 IUCN Red List based mainly on the numbers and evidence of increase from a small part of the stock's distribution (i.e., in Californian waters); a reassessment of this stock using the revised criteria (version 3.1) is needed as the 'lower risk/conservation dependent' category no longer exists and the western north Pacific stock should probably be assessed as a separate entity. There is evidence that supports the western north Pacific stock of blue whales being separate from blue whales elsewhere (for review, see NMFS, 1998).
- ABUNDANCE: The population size is unknown but none has been seen in recent times from Taiwan to southern Japan where hunting once occurred (Clapham et al., 2008); this suggests that the population maybe greatly depleted or possibly extirpated (see NMFS, 1998; Clapham et al., 2008).

3.5 Western North Pacific Humpback Whale, *Megaptera novaeangliae*

3.5.1 Potential threat of LDEO seismic surveys:

The timing of the L-DEO surveys overlaps greatly in space and time with the whales wintering in the Babuyan Islands and coincides spatially and temporally with the northward migration of mothers with neonatal and other young calves from the calving/nursing grounds of the Babuyan waters.

3.5.2 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I. Although the humpback whale is listed as "least concern" in the IUCN Red List (mainly because many populations have recovered greatly from past commercial whaling), there are still great concerns about some stocks of humpback whales, including the western North Pacific stock which has shown no signs of recovery contrasting greatly with the eastern North Pacific stock.
- ABUNDANCE: The population size for the western North Pacific is estimated to be about 1000 (Calambokidis et al., 2008), which is low and does not indicate recovery from past hunting.
- DISTRIBUTION: There are several wintering populations of humpback whales in the north Pacific Ocean. One population found in the waters of southern Taiwan was decimated (Darling and Mori, 1993) and almost certainly extinct as there have been no sightings of the species in these waters in recent years (Wang and Yang, 2007) even though past records show whales were observable from shore and the waters are fairly extensively utilized by fishing boats presently. Another small wintering population was recently discovered in the waters of the Babuyan Islands in the northern Philippines (Yaptinchay, 1999; Acebes et al., 2007). The sightings data indicates that the humpback whales are present in Babuyan waters from November to May/June but peaking from February to March/April (Acebes et al., 2007). These waters are a calving and nursing area. Records of humpback whales exist for the waters of almost the entire eastern Taiwan and a few records also exist for the Taiwan Strait. At least for some individuals, migration between summering and wintering grounds is through Taiwanese waters, mainly along the east coast of Taiwan (=Philippine Sea) but also some records from the shallow waters of the Taiwan Strait also exist (J.Y. Wang, unpublished data). Records of humpback whales exist for the waters of almost the entire east coast of Taiwan.
- THREATS: Mother-calf pairs of humpback whales appear to be more sensitive to loud noises and have reacted to impulsive noise levels of as low as 140dB (McCauley et al., 2000). The wintering population of the Babuyan Islands is small and vulnerable to threats faced by the whales along their migration route. Incidental mortality of whales in net fisheries along the east coast of Taiwan has been recorded. In the waters of both the west and east coasts of Taiwan, the volume of commercial shipping is a threat to whales because of increased risks of vessel collisions, oil and chemical spills and increased noise. The additional threat of loud noises from seismic surveys has the potential to mask other important sounds or displace humpback whales from their migration routes, which in turn, may increase the risk of other threats (e.g., increase

entanglement as a result of a reduced ability to detect nets in the water; increased vessel collisions because of reduced ability to detect and avoid approaching vessels; movement into waters with a larger amount of net fisheries, etc.). The lack of recovery, the extirpation of the southern Taiwan wintering population and the small size of the Babuyan population are indicative of the need for better protection from impacts caused by human activities.

3.5.3 Reviewer's recommendations

- Better coverage of the region's waters by cetacean surveys can also allow fine tuning of spatial and temporal avoidance of humpback whales by seismic surveys.
- Simple strategic scheduling of seismic surveys can eliminate or at least greatly reduce the impacts on this population.

3.6 Other mysticetes

3.6.1 Background

- STATUS: All other baleen whales species are given the highest level of legislative protection under the Wildlife Conservation Act of Taiwan and listed under CITES Appendix I. Both the sei (*Balaenoptera borealis*) and fin (*B. physalus*) whales are listed as 'endangered' under the IUCN Red List. Little is known of both species in this region but it is believed that a distinct population of fin whales exists in the East China Sea (Fujino, 1960). The common minke whale (*B. acutorostrata*) is under the 'least concern' category of the IUCN Red List. However, the 'J-stock', which inhabits waters that include the East China Sea, is believed to be distinct from other minke whales (evidenced by a reproductive cycle that is out of phase with the others) and has been reduced by >50% by whaling (Reeves et al., 2003). The J-stock of minke whales continues to be hunted or caught by nets by Japanese and Korean whalers/fishermen and is of conservation concern. Furthermore, bycatch of minke whales appear to be common in Chinese waters but this has not been quantified. Although both Omura's (*B. omurai*) and Bryde's (*B. brydei*) whales are listed as 'data deficient' by the IUCN Red List, considerable confusion with regards to taxonomy and nomenclature remains amongst whales that resemble the Bryde's whale. Very little is known about the biology of these whales in the region including how many species exists.
- ABUNDANCE: An estimate of 137 was reported for the East China Sea stock (IWC, 1996). These whales were also captured in Taiwanese waters but none have been seen in recent years. Bryde's whales of the East China Sea stock may have been depleted by whaling (Omura, 1977).

4. Regions of Particular Importance

4.1 Western Taiwan (inshore of about 5km)

- There are three main coastal small cetaceans that inhabit these waters:
  - the endemic and critically endangered ETS population of humpback dolphin
  - Indo-Pacific bottlenose dolphin and the

- finless porpoise.

- Only the waters inshore of about 5km have been surveyed extensively. Most of the Taiwan Strait remains unstudied for cetaceans.
- These waters are effectively a large river delta that is formed by complex of many river systems and are highly productive as there is considerable nutrient input from several of the largest river systems in Taiwan. These coastal waters comprise many estuaries, wetlands, salt marshes, mangrove forests and extensive mud flat areas (resulting from large tidal fluctuations). Intrusions of the warm, clear oceanic waters of the Kuroshio Current also occur fairly regularly.

4.2 Southwestern Taiwan and the Penghu Archipelago

- The Penghu Channel and adjacent waters are important structures that funnel both the South China Sea and strong Kuroshio currents into a narrow area where an important productive upwelling results between the Penghu Islands and Taiwan's west coast.
- There are reports of oceanic cetaceans along and near the steep walls/shelf edge of the channel (Huang, 1996) and deep-diving cetaceans are known to exist in an around the mouth (southern portion) of the Penghu Channel where deeper water exists (as evidenced by past sperm whale whaling records).
- The waters around the Penghu Islands are rich in marine diversity and have substantial coral reefs. There are important fishing grounds to the north and east of the islands that are likely due to the complex bathymetry and mixing of water in this region (Jan et al., 2002).

4.3 Southern Taiwan

- There is great complexity in ocean bathymetry in southern Taiwan and a
- great diversity of cetacean species (>20 species) have been found (see Wang et al., 2001b).
- Wang et al. (2001) also found that the highest occurrence of cetaceans occurred in April and June (the proposed seismic surveys span these months).
- Several sensitive species have been recorded in these waters: Cuvier's beaked whale,Longman's beaked whale (although reported as 'tropical bottlenose whale' in Wang et al. (2001b)), ginkgo-toothed beaked whale, sperm whale, humpback whale (migrants), other baleen whales, dwarf sperm whale, short-finned pilot whale, melon-headed whale, Risso's dolphin and Indo-Pacific bottlenose dolphin.

4.4 Southeastern Taiwan

- This region is mainly occupied by oceanic and deep-diving species (Yeh, 2001; J.Y. Wang, unpublished data). There are minimal shelf waters and the edge of the shelf is very close to shore. The bathymetry is very complex with three small oceanic islands being located more than 30km from Taiwan: Green Island, Orchid Island and Little Orchid Island.

Green and Orchid islands are inhabited and there have been several reports of beaked whale strandings.

- There is a deep water canyon between Green Island and Orchid Island and several upwelling areas between Green Island and Taiwan that is the result of the Kuroshio Current flowing past areas where the water depth decreases quickly. These upwelling areas are important waters for local fisheries targeting large oceanic fish. These islands, being in the path of the Kuroshio Current, also generate areas where deeper water is brought to the surface.
- Recent surveys of some of waters showed high diversity of cetaceans but relatively low abundance of each. Of note is that all four beaked whale species known from Taiwan have been recorded from these waters. There are also frequent sightings of large whales (sperm and humpback). Other oceanic species such as pygmy killer, false killer and killer whales, short-finned pilot whale, dwarf sperm whale, Risso's dolphin, common bottlenose dolphin, striped dolphin, Fraser's dolphin, spinner dolphin and pantropical dolphin have also been recorded.
- In these waters, bycatch mortality by large-mesh, pelagic driftnets are suspected to be very large, on the order of several thousand cetaceans per year and >100 beaked whales per year maybe captured (Perrin et al., 2005).

4.5 Central Eastern Taiwan

- This region has a very narrow shelf so the shelf edge is very close to shore.
- Large concentrations of cetaceans are found along and near the edge of the shelf (Yang et al., 1999) and are the targets of one of the fastest growing cetacean-based tourism industries in the world. Cetaceans are easy to find quickly (with little search effort) and marine conditions during the summer tourism season are generally calm. Although delphinids comprise the main species observed, beaked, sperm and baleen whales have also been reported from these waters. Humpback whales have been recorded migrating through these waters in both spring and autumn.
- As in SE Taiwan, large-mesh pelagic driftnets are abundant and there is a sizeable bycatch.

4.6 Northeastern Taiwan

- This is the only region along eastern Taiwan where the continental shelf is more than a narrow sliver. The bathymetry is complex with a geo-thermally active oceanic island being located <10km from Taiwan.
- An important upwelling exists in NE Taiwan and is the site of a major fishing ground where large purse-seine boats are used to catch schooling fish such as scads and mackerel, which are also consumed by several cetaceans.
- A large cetacean-based tourism industry exists and focuses mainly on spinner dolphins. However, 11 species have been recorded from these waters (Chen, 2001) including the

long-beaked common dolphin (Delphinus capensis), which has only been recorded from these waters thus far. Most of the species observed were delphinids but sperm whales and *Kogia* were also recorded. Of the delphinids observed, the short-finned pilot and pygmy killer whales are suspected to be impacted most by intense noise generated by activities such as seismic surveys.

- There is still a fairly substantial but illegal take of cetaceans by the hand-harpoon fishery, which should be targeting large pelagic fish and fisheries bycatch (especially in purse-seines and entanglement in longlines) are suspected to be considerable as well.
- With the exception of some inshore (<5km from shore) waters, no marine mammal surveys have been conducted in the waters of northern and northwestern Taiwan. The limited surveys of inshore waters in NW Taiwan revealed a single sighting of Indo-Pacific bottlenose dolphins. However, strandings and near strandings of many species have been recorded from the shores of NW and N Taiwan. There are anecdotal reports that a feeding area for baleen whales exists in the waters off northern Taiwan but there is no information to confirm these reports and it is unknown if it still exists. Research on the cetaceans in these waters is needed.

5. Concerns regarding timing of the proposed seismic surveys

5.1 Survey dates and locations

- 21 March to 19 April: seismic surveys will be conducted mainly in the South China Sea.
- 20 April to 07 June: the *Langseth* will survey the waters of the Luzon Strait and Philippine Sea.
- 21 June to 14 July: seismic surveys of the waters around Taiwan will be conducted.

5.2 Concerns:

5.2.1 Western gray whale

- The route(s) and months when western gray whales may undertake their migration from a suspected wintering ground(s) in the South China Sea are unknown. However, it is likely that the period for the migration is in the spring.
- Scheduling the seismic surveys in the South China Sea to be conducted in March and April will likely coincide with at least some migrating gray whales.
- L-DEO did not address this possibility and have not proposed any mitigation measures to avoid this likely overlap of seismic surveys and migrating gray whales.

5.2.2 Humpback whale

- The schedule for surveying the Luzon Strait and the Philippine Sea overlaps completely with the period when humpback whales are still in the area (and includes the latter portion of the peak period (April) for humpback whale concentrations in the Babuyan Islands). Therefore it is unclear how the timing of the surveys reduces the impacts on humpback whales as claimed by L-DEO.

- A large proportion of this population of humpback whales will also be migrating through the Philippine Sea to northern waters at the same time as the proposed surveys Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan. One of the proposed survey tracklines of the *Langseth* also follows this course.
- Many females undertaking the migration at this time will also be accompanied by neonatal calves and these are the most sensitive individuals of the population (McCauley et al., 2000).

5.2.3 Calving/nursing (general)

- Calving for most cetacean species in this region is likely in the spring to early summer as evidenced by sightings of many females with young calves during cetacean surveys that have been conducted in Taiwan and the examination of hundreds of carcasses (J.Y. Wang, unpublished data).
- The proposed survey schedule overlaps greatly with the calving seasons of many species or will occur as females are accompanied by and nursing young calves.
- This proposed period for the seismic surveys is probably the worst choice of seasons if minimizing the impacts of this activity on marine mammals in this region is a sincere goal.

5.2.4 Timing (ETS humpback dolphins and general)

- The ETS population of humpback dolphins is found in the coastal waters western Taiwan throughout the year. Seismic surveys in June and July (as well as any other time of the year) will have a serious impact on this critically endangered population. Given their year-round residency, there is no season that will reduce the serious impacts of seismic surveys in inshore waters on this population.
- In June and July, large numbers of cetaceans are found along and near the shelf edge of eastern Taiwan. Conducting seismic surveys close to the shores of Taiwan risks greatly impacting on these cetaceans.

6. Concerns regarding particular mitigation measures

The mitigation measures proposed by L-DEO would be ineffective or have limited effectiveness at best; below is a list of concerns regarding these mitigation measures:

6.1 Timing (delay)

- The claim is that surveys will be delayed as late as possible to avoid humpback whales, But the timing of the surveys overlap the presence of humpback whales greatly and during a time when newborn calves will be accompanying mothers. The surveys will also occur during or near the calving season for most species in the region; this is when females and calves are the most vulnerable

The Federal Register notice states that *"The Langseth will attempt to avoid these wintering*

areas at the time of peak occurrence, by surveying the lines near the Ryuku Island and Babuyan Islands as late as possible during each leg of the cruise."

- Given that the entire period of the proposed survey overlaps with humpback whale concentrations in the Babuyan Islands and during the migration period, there is no attempt to avoid this area, and surveying the lines near the Ryuku and Babuyan islands as late as possible within the scheduled period of the surveys does nothing but delay the impact on the animals to a slightly later period because the whales will still be in the area. As such, this measure does not mitigate anything.

6.2 Distance offshore (ETS humpback dolphins)

- The critically endangered ETS population of humpback dolphins will be subjected to >>180dB received levels even if mitigation measures are taken (i.e., to remain offshore of 2km from shore).
- Even if the mitigation measures proposed by L-DEO are fully implemented, there will likely be 'level A harassment' to the ETS population that could have serious and likely irreversible impacts on this population.
- Based on the tabled predicted RMS distances for different received levels and accepting the recommendations of the ETSSTAWG (see above) for this population that for noise issues an additional (i.e., additional to the 3km-from-shore distribution that is known presently for the ETS population) 2km buffer should be considered, the *Langseth* should not be within 13 km of western coast of Taiwan to avoid exposing dolphins to >160dB levels.
- However, the model underestimates the actual levels at different distances.
- Further compounding the underestimation of levels is the fact that the shallow water category is <100m but the ETS population lives in waters less than 25m. Much better predicted RMS distances for different received levels are needed for very shallow waters.

The Federal Register notice states that *"Due to the conservation status of the Indo-Pacific humpback dolphins in Taiwan Strait, seismic operations will not occur in water depths less than 20m and within at least 2 km from the Taiwanese shore. Also, when possible, seismic surveying will only take place at least 8-10km from the Taiwanese coast (approximately from Taixi to Tongshiao), to minimize the potential exposing these threatened dolphins to SPLs greater than 160dB re 1 μPa (rms)."*

- Being 2km from shore puts the *Langseth* in the middle of the distribution of the ETS population and does absolutely nothing to reduce the exposure level to any dolphin.
- The only reduction of noise is possibly with the statement that surveying will only take place 8-10km from shore but the condition of "when possible" is not acceptable because this can be a subjective determination by someone not concerned about the impacts on critically endangered populations of cetaceans.

- Furthermore, as discussed above, 8-10km from shore still may not be sufficient to reduce exposure of the animals to >160dB and the distribution for the ETS population is further south than Taixi (Wang et al., 2007b). Chou (2006) also believes that some of the waters south of Taixi are an important breeding/nursing area for the ETS population.
- These mitigation measures are not effective and still poses unacceptable risks to the dolphins of being exposed to >180dB.

NMFS states that: *"Cetaceans need to be closer than between 950 and 3694m (depending on conditions) to the source to be exposed to levels that can cause PTS (180dB)."*

- The proposed seismic surveys will expose almost the entire ETS population of humpback dolphins to levels >180dB.

NMFS states that: *"Cetaceans need to be closer than between 6000 and 8000m (depending on conditions) to be exposed to levels that may cause TTS (160dB)."*

- As such, all or almost all ETS humpback dolphins will be exposed to >160dB levels even if the *Langseth* remains 8-10km from shore.

6.3 MMVOs

- Based on the table of predicted RMS distances for different received levels, MMVOs may be completely ineffective for detecting small cetaceans in shallow coastal waters because the distance from source will be great even for the 190dB received level (1600 to 2182m); for 180dB, the distances can be 2761 to 3694m from source and for 160dB, the distances are 6227 to 8000m.
- Again, these distances must be considered underestimates because the coastal waters of western Taiwan in which some cetaceans inhabit are much shallower than 100m (e.g., the critically endangered ETS humpback dolphins are in waters from 1.5 to 25m deep; finless porpoises and Indo-Pacific bottlenose dolphins are often commonly observed in waters shallower than about 50m).
- Finless porpoises are difficult to detect even if they are within several hundred metres and sighting is during excellent conditions and by experienced observers (note: excellent weather conditions for sighting cetaceans in the waters around most of Taiwan, especially western Taiwan, are very limited).
- Nighttime visual detection of these coastal species is impossible at the distances shown above even with night-vision equipment.
- MMVOs have limited effectiveness in detecting many deep-diving species such as beaked whales and *Kogia* spp. These are all difficult species to observe and study by experienced researchers. Barlow (1999) reported that very few beaked whales are detected even in prime sighting conditions by cetacean researchers. Barlow and Gisiner (2006) estimated that less than 2% of the beaked whales are likely to be observed by typical mitigation monitoring

(this estimation did not account for observer experience, which will greatly affect detection).

- With such a low detection rate, other mitigation measures dependent upon detection and tracking will be compromised.
- None of the mitigation measures takes into account sighting conditions. This is important as several of the mitigation measures are dependent upon observers sighting marine mammals.

LDEO claims that "Marine mammal detection by MMVOs is high at the short distances from the source [the short distances are the ones mentioned earlier]."

- With the possible exception of 180dB at 950m for deep water, the distances mentioned above (especially for operations in shallow waters) are not short for sighting cetaceans (small or large). Detection of most species drops off beyond 1km from a ship. Even 25x binoculars may have limited use in a region with high humidity and smog in coastal regions (e.g., western Taiwan), which can reduce the clarity of high power optical aids.
- The detection of finless porpoises at distances beyond 1 km is poor. At 3694m, detection of small cetaceans is limited and maybe questionable (especially for finless porpoises) when sighting conditions are sub-optimal.
- In no way can the detection of small cetaceans in shallow water at distances of several kilometers be considered high.
- For beaked whales, only a small proportion of the animals are detected by experienced observers in good sighting conditions (Barlow, 1999). As such, beaked whale detection cannot be considered to be high either.
- Because detection of both shallow water small cetaceans and beaked whales were wrongly concluded to be high, take by injury or death cannot be dismissed and the potential for temporary or permanent hearing impairment is not low and (as discussed above) cannot be avoided by implementing the inadequate mitigation measures proposed.

6.4 PAM

- In shallow water, PAM would be almost completely ineffective at detecting (never mind locating or tracking) cetaceans especially at the predicted RMS distances for the different exposure levels (listed in bullet 3 above).
- Furthermore, PAM is only capable of detecting cetaceans when they are vocalizing. Some species have been known to reduce vocalizations during seismic surveys while other species do not vocalize much at or near the surface (e.g., beaked whales).
-

6.5 Shut down

- Shut down of 30 minutes was proposed. This is clearly not sufficient as several species of concern can stay submerged for more than an hour and remain undetected.

6.6 Ramp up

- There are uncertainties about the effectiveness of ramp-up procedures and no data was presented to show that this was indeed useful in reducing impacts

6.7 Additional concerns: masking; displacement; impact of any level of take on small or vulnerable populations; inappropriate use of data from other areas; impacts on prey; assumption that animals will move away from noise source; variability and uncertainty in TTS threshold information; and need for greater local consultation and research

In all cases, animals can face other issues related to loud noise sources.

6.7.1 Masking

- Masking of not only biologically important sounds but also masking of the noises made by threats, hindering detection of the threats and increasing the impact of the existing threats (e.g., water rushing past a gillnet, commercial shipping) and the chances of mortality.

6.7.2 Displacement

- The impacts on cetaceans due to displacement into other waters may not be trivial for populations with low numbers, restricted distributions and in areas where threats are abundant (e.g., large number of net fisheries).
- Displacement may increase energy expenditures by the animals already compromised energetically (such as mothers with calves, individuals that are thin due to interrupted feeding, etc.) and increase exposure to other threats (e.g., changes in migration routes may result in animals using waters with higher densities of fishing nets or lines and thus increase their risk of mortality due to entanglement). Mothers with calves are most vulnerable.

6.7.3 Impact of any level of take on small or vulnerable populations

- Several cetaceans are in critically low numbers that even minimal 'takes' can contribute greatly to the demise of these populations.
- Most of the values in Table 3 do not make any sense to those who have experience with local marine mammal populations in the region
- (e.g., the take of 64 Cuvier's beaked whales compared with 168 Blainville's beaked whales; a take of 189 killer whales compared with only 68 finless porpoises). These numbers are little better than random guesses.

The Federal Register notice states that: *"...the number of potential harassment takings is estimated to be small, less than a few percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned..."*

- This statement is incorrect. L-DEO estimated that 68.7% of the critically endangered ETS population of humpback dolphins will be impacted.
- Even although this is a serious underestimate (explained earlier), it is already a very high proportion of this distinct population and the mitigation measures proposed do not minimize the exposure level to these dolphins.
- The taking is also expected to include level A harassment rather than just level B as claimed by L-DEO.
- The taking (both level A and B) of such a large proportion of the ETS dolphins could have an irreversible impact on the continued survival of the population.

6.7.4 Inappropriate use of data from other areas

- The use of data from the Eastern Tropical Pacific for estimating the densities and number of individuals impacted by the proposed seismic survey is completely inappropriate as there is no evidence that the two sides of the Pacific Ocean are comparable. Such extrapolation would not be acceptable to most cetacean scientists. This should be re-examined carefully.

6.7.5 Potential impacts on prey (fish)

- The impact on the prey of coastal species such as the ETS population of humpback dolphins, finless porpoises and Indo-Pacific bottlenose dolphin are of concern. A large proportion of the diet of these species consists of sciaenids (croakers, drums, etc.) that are highly acoustic fish. How intense noise from seismic surveys will affect their prey is unknown.
- For the ETS population, this is of particular concern because there are already indications some dolphins are nutritionally stressed (J.Y. Wang, unpublished data).

6.7.6 Assumption that animals will move away from noise source

NMFS states that: *"Animals will move away from noise source that is annoying before it can potentially become injurious."*

This assumption is flawed for slow swimming species and those with restricted distributions.

- This is the case for the ETS population of humpback dolphins, which would be exposed to sound levels >180dB for many pulses and result in PTS
- Finless porpoises and Indo-Pacific bottlenose dolphins may also be as restricted in their movements.
- Furthermore, for cetaceans that inhabit the waters near or on the shelf edge, where the shelf edge is close to shore (e.g., waters of much of Taiwan), it is not clear that cetaceans fleeing an approaching seismic survey vessel will always choose to flee offshore. If an error is made and dolphins flee inshore, they will be trapped and be exposed for a much longer duration and potentially higher levels.

6.7.7 Variability and uncertainty in TTS threshold values

- Furthermore the TTS threshold is based on limited information from only a few species of cetaceans.
- Most of the species of concern (e.g., baleen whales, beaked whales, humpback dolphin, finless porpoises, etc.) have not been examined and there appears to be greatly variability amongst individual cetaceans tested so interspecific extrapolations need to be considered cautiously (for a review, see Weilgart, 2007).

6.7.8 General recommendation for greater local consultation and research

- Extensive consultation with experts on these regions and more studies to better understand the biology of cetaceans in this region can provide expert guidance to greatly reduce the impacts of the seismic surveys.

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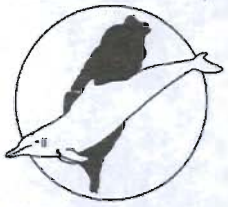
Eastern Taiwan Strait
Sousa Technical Advisory Working Group



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Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG)

Peer review 09-01:

"Does the proposed L-DEO seismic survey (US Federal Register 73(246) Dec 22 2008 p. 78294; planned for March –July 2009), in part to be carried out in the Eastern Taiwan Strait, present a risk to the Critically Endangered ETS Indo-Pacific humpback dolphins or other species?"

Reviewer 1:

Activity in Question

As noted in the FR Notice[1], the National Marine Fisheries Service (NMFS) proposes to authorise, through an Incidental Harassment Authorization (IHA) pursuant to the Marine Mammal Protection Act (MMPA), L-DEO to incidentally take, by Level B harassment only, small numbers of marine mammals during the, incidental to conducting, a marine seismic survey, the Taiwan Integrated Geodynamics Research (TAIGER) survey, in Southeast (SE) Asia during March-July 2009.

The proposed survey will encompass the area 17 30'-26 30' N, 113 30'-126 E within the Exclusive Economic Zones (EEZ) of Taiwan and other nations, as well as on the high seas, between March 21 to July 14, 2009. The fourth leg around Taiwan is scheduled to occur from 21 June 14 July.

Important Note

It should be noted that, while LDEO are applying for the appropriate authorisation under US law, many seismic surveys are conducted in the Taiwan region every year without (to my knowledge) requesting IHAs. The actions of private O&G companies within the EEZ's of other countries is beyond the jusridiction of the MMPA, thus they need no such U.S. authorisations. However, this means that LDEO could become a scapegoat for all survey operation in the region, purely because they have to apply for authorization, as they will clearly be operating partly on the high seas (and thus fall under MMPA jurisdiction) and as they have government funding. This is acknowledged, but until such time as NMFS enforcement confirms the locations and tracks of every survey undertaken globally this situation is unlikely to change.

Questions to Raise

The Langseth will deploy an 8-km long streamer for most transects requiring a streamer; however, a shorter streamer (500 m to 2 km) will be used during surveys in Taiwan (Formosa) Strait (EA[2]). Do the effective source levels offered in the EA (259 dB re 1 μPa – m, with dominant frequencies at 2–188 Hz) pertain to the longer or shorted streamers? There are likely to be differences.

What is the frequency range of the PAM system? Is it suitable for detecting signals produce by all the marine mammals within the area?

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[1] Federal Register Notice dated 22nd Dec 2008 - 2008 FR 73(246): 78294-78317

[2] LGL 2008. Environmental Assessment of a Marine Geophysical Survey by the R/V Marcus G. Langseth in Southeast Asia, March–July 2009

Have LDEO applied for the relevant permits and authorisations under the laws of the various countries where they will be conducting the survey.

General Comments

The lack of separate consideration of the genetically distinct Eastern Taiwan Strait (ETS) population of Sousa is, of course, a concern. One of the most effective ways to protect cetaceans and their habitat from the impacts of noise (and the cumulative and synergistic impacts in combination with other stressors) is through spatio-temporal restrictions, including marine protected areas (Weilgart, 2006).

There are a huge number of other threats facing this population[3], meaning that the potential for cumulative impacts equally huge and making the potential for non-linear synergistic impacts high. Given the above, and the fact that this genetically distinct population (somewhat akin to the Southern Resident killer whales) is small and probably declining, the part of the 4th leg running along the western coast of Taiwan should be removed from the survey.

Recent studies examining airgun noise have shown that, contrary to predictions, received levels can decrease between 5 km and 9 km, but then increase at distances between 9 km and 13 km (Madsen et al., 2006). The researchers stated that received levels "can be just as high at 12 km as they are at 2 km…beyond where visual observers on the source vessel can monitor effectively" (Madsen et al., 2006). Thus, no surveys should be conducted within at least 13 km and perhaps a more precautionary 15 km of the ETS Sousa population – meaning up to around 20 km from shore.

In short – despite a lack of data on the potential cumulative and synergistic impacts, the risk is high and the population is highly at risk, so the most precautionary measures are warranted.

Mitigation

The mitigation procedures offered (especially the use of visual detection at night) are known to be insufficient and ineffective. To make the most of the limited effectiveness, and thus offer the greatest protection, I recommend that:

1) surveys in the Taiwan Strait (and throughout the operation) shut down at night.
2) a minimum of two MMOs be used at all times, with one of those having considerable prior experience as a MMO (preferably within the area of Taiwan).
3) the MMO operating the PAM system (which should be in addition to the other two at all times) should have considerable experience working with the acoustic signals of many of the marine mammal taxa that are likely to be encountered in the survey.
4) the predicted protection ranges (AKA safety zones) should be confirmed in the field at each point in the survey that the bottom geography changes substantially. The results should be reported to NMFS immediately and safety zone sizes should be adjusted accordingly.
5) that the more precautionary 15 dB difference be employed in converting the SEL-based safety zones to SPL-based safety zones. (From the EA: "At the distances where rms levels are 160–190 dB re 1 μPa, the difference between the SEL and SPL values for the same pulse measured at the same location usually average ~10–15 dB, depending on the propagation characteristics of the location (Greene 1997; McCauley et al. 1998, 2000a; Appendix B). In this EA, we assume that rms pressure levels of received seismic pulses will be 10 dB higher than the SEL values predicted by L-DEO's model. Thus, we assume that 170 dB SEL ~ 180 dB re 1 μPa rms.") Thus 180 dB rms SPL would be reached with a SEL of 165 dB.

[3] The EA acknowledges this: "There are numerous threats to cetaceans in SE Asia including vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting."

6) Since empirical data is not available for LDEO operations (and what is available at deep and shallow was from shorter arrays) in intermediate distances, the extrapolation in the EA ("On the expectation that results would be intermediate between those from shallow and deep water, a correction factor of 1.1 to 1.5x was applied to the estimates provided by the model for deep-water situations to obtain estimates for intermediate-depth sites.") should be much more precautionary. Perhaps a mean between the shallow and deep water ranges, rather than adjusted by the apparently arbitrary correction factor. See Table 1.
7) See also Weir & Dolman, 2007. (Note the EA states "However, currently the procedures are based on best practices noted by Pierson et al. (1998) and Weir and Dolman (2007)". However, this is clearly not the case since Weir and Dolman (2007) call for, among other things the avoidance of sensitive areas – e.g., the western Taiwan coastline; suspension of airgun use at night; and additional restrictions in adverse weather conditions. For example, the EA states that "when at all possible, seismic surveying will only take place at least 8–10 km from the Taiwanese coast, particularly the central western coast (~from Taixi to Tongshiao), to minimize the potential of exposing these threatened dolphins to SPLs >160 dB". The use of the term "when at all possible" is not reassuring.

Alternatives

It should be noted that, under the National Environmental Protection Act (NEPA), resources should not be committed until the EA/EIS process is complete. LGL admit that LDEO have done this within the EA "If the IHA is issued for another period, it could result in significant delay and disruption not only of the proposed cruise, but of subsequent geophysical studies that are planned by L-DEO for 2009 and beyond."

Disturbance Reactions, Tolerance and Masking

The idea that behavioural tolerance is a proxy for no impact has no scientific merit. In fact, some fairly sizable impacts have been reported in various species despite a lack of behavioural response. A recent panel of experts also noted that an apparently unresponsive animal may still be undergoing a chronic and/or severe acute stress response, with associated physiological and psychological consequences. These can result from exposure directly, or through masking and other phenomenon indirectly. Thus, taking is entirely possible without observable behavioural disturbance reactions and this needs to be accounted for. For a discussion of this issue and reviews of the available literature, see Beale (2007), Bateson (2007), Wright et al. (2007 a,b) and refs therein).

Hearing Impairment and Other Physical Effects

The EA notes that Southall et al. (2007) stated that TTS is not injury. However I believe that they have overstated their conclusions. It is true that Southall et al. (2007) state: "[impacts resulting in]…TTS rather than a permanent change in hearing sensitivity…are within the nominal bounds of physiological variability and tolerance and do not represent physical injury (Ward, 1997)." However, they also note that "at present, however, there are insufficient data to allow formulation of quantitative criteria for non-auditory injuries" and later acknowledge that, while they believe that "strong behavioral responses to single pulses…are expected to dissipate rapidly enough as to have limited long-term consequence" there are occasions where such responses may "secondarily result in injury or death (e.g., stampeding)" (Southall et al. 2007).

Southall et al. (2007) also add the following caveat with regards to their report:

> *Finally, we emphasize that exposure criteria for single individuals and relatively short-term (not chronic) exposure events, as discussed here, are insufficient to describe the cumulative and ecosystem-level effects likely to result from repeated and/or sustained human input of sound into the marine environment and from potential interactions with other stressors. Also, the injury*

criteria proposed here do not predict what may have been indirect injury from acoustic exposure in several cases where cetaceans of mass stranded following exposure to mid-frequency military sonars.

Thus, since they did not attempt to consider all possible methods of injury in their deliberations and thus their final figures, they should not be directly applied to management decisions that must, by law, consider the full suite of potential impacts. Direct application of their criteria would thus not be precautionary enough to meet the required legal standards.

In any case, it should be noted that repeated TTS can lead eventually lead to PTS, which would not be classed as injury under these criteria. Other potentially injurious impacts have also been shown to occur below levels that would cause TTS in humans. For example, impaired reading comprehension and recognition memory in children is linked to aircraft noise at exposure levels considerably less than 75 dB (Stansfeld et al., 2005), which, according to the U.S. National Institute on Deafness and Other Communication Disorders (NIDCD), are unlikely to cause hearing loss (temporary or otherwise) even after long exposure (NIDCD, 2007).

Similarly, the EA noted that "captive bottlenose dolphins and beluga whales exhibited changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran et al. 2000, 2002, 2005). However, the animals tolerated high received levels of sound before exhibiting aversive behaviors."

It should be noted, however, that the animals in the abovementioned Navy studies (Finneran et al., 2000, 2002, 2005) were reported by Nowacek et al. (2007) to be generally "tested in a context where they were being rewarded for tolerating high levels of noise" and were "usually 'punished' in some way…for failing to return to the experimental station for additional exposures". This was not a problem for their main results as the focus of the work was on to TTS, but the setup does invalidate any conclusions base on the behavioural responses reported in the same studies. For further discussion of the need for precaution in the use of captive studies to set exposure criteria for wild animals, see Parsons et al. (2008) and Wright et al. (In Press).

Non-auditory Physiological Effects

It is strange that an entire special issue devoted to noise-related stress responses in marine mammals resulting from a multi-disciplinary panel of experts does not get a single mention in this section, even though a discussion of likely impacts is offered in Wright et al 2007a, b and the other papers within (all of which are cited therein). The papers are cited in Southall et al., 2007, which the authors have obviously read. I will not repeat the conclusions here, but suggest they are included within the EA (or more likely an EIS) before this survey goes forward.

Numbers of Marine Mammals that Could be "Taken by Harassment"

This will be largely dependent upon abundance and other factors I am not familiar with and so I have decided to leave this to those more familiar with the populations in the area. However, I will mention that, according to the tables within the EA, more Sousa will be impacted than there actually are Sousa in the area. I am unclear on how this meets the 'small number' criteria. This number would, of course, go up further if the distances reported by Madsen et al. (2006 – noted above) were taken into account. Of course, these distances would increase the take numbers for all animals in the area.

Indirect Effects on Marine Mammals, Sea Turtles, and Their Significance
The most comprehensive study undertaken on the impacts of seismic surveys on the fishing industry in Norway in 1996 showed that fishing catches were impacted to as far as 33 km from seismic testing[4]. I can only assume this is also not good for marine mammals who have a limited range, such as Sousa.

Cumulative Effects
The discussion of cumulative impacts in the EA is lacking. It often refers to behavioural tolerance, which has already been dismissed as an inappropriate metric above, and uncertainty in the level of impact. However, the EA does note that "Indo-Pacific humpback dolphin is unknown…may be particularly at risk" from habitat loss/destruction.

After detailing all the treats and outlining the uncertainties, the EA concludes that:

> *Because human activities in the area of the proposed seismic survey are high, additional impacts on marine mammals by the TAIGER seismic survey are expected to be no more than minor and short–term. Although the airgun sounds from the seismic survey will have higher source levels than do the sounds from most other human activities in the area, airgun operations will be intermittent during the program. In contrast, sounds from shipping have lower peak pressures but occur continuously over extended periods.*

Although this may appear logical, cumulative impacts do not work in this way. Any additional stressor may be the one that pushes the overall energetic demand beyond the capabilities of the animals involved. Similarly, the more stressors acting, the more likely synergistic impacts are. And finally, short-term stressors can lead to long-term impacts, especially in foetuses and newborns if they are exposed directly or through their mothers. It may well be that the small addition does not reach these physiological thresholds or lead to deleterious impacts as a result of synergism, but the argument that "it's only a little bit more – no-one will notice" is not a valid one.

These effects, and others, are outlined in Wright et al. (2007 a,b and references therein) and I ***strongly*** recommend NMFS consider those effects and the conclusions of the panel before accepting the IHA application and the EA upon which it is based.

Other Species
The impacts of masking (including the physiological and psychological consequences potentially resulting from masking) are likely to be greatest for baleen whales throughout the survey area. Pregnant females and/or newborns will be a greatest risk from exposure to stressors (see Wright et al. 2007a and references therein), so calving grounds at breeding season should be avoided.

According to the EA, the Multibeam Echosounder & Sub-bottom Profiler have outputs up to 204 dB re 1 μPa – m, at the dominant frequency of 3.5 kHz. This is perilously close to the US Navy's AN/SQS-53C tactical mid-frequency sonar system implicated in many of the mass strandings of beaked whales and other cetaceans, which produces 'pings' primarily in the 2.6–3.3 kHz range. Another LDEO survey has been associated with a stranding (as acknowledged in the EA: "…association of mass strandings of beaked whales with naval exercises and, in one case, an L-DEO seismic survey (Malakoff 2002)"). There may thus also be concern for beaked whales and other animals, because, while "[t]here is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys" (EA), there is also no conclusive evidence that seismic surveys *do not* lead to strandings or death either.

[4] The paper can be found in Norwegian at http://www.fiskeribladetfiskaren.no/filarkiv/vedlegg/96.pdf and there is an English summary around page 8.

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		190 dB			180 dB			170 dB			160 dB		
		LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL
Single Bolt airgun	Deep	12			40			120			385		
40 in3	Int	18	81	450%	60	168	280%	180	310	172%	578	718	124%
	Shallow	150			296			500			1050		
36 airguns	Deep	220			710			2100			4670		
6600 in3 6-7 deep	Int	330	910	276%	1065	1736	163%	3150	3877	123%	5189	5449	105%
	Shallow	1600			2761			5654			6227		
36 airguns	Deep	300			950			2900			6000		
6600 in3 6-9 deep	int	450	1241	276%	1425	2322	163%	4350	5354	123%	6667	7000	105%
	Shallow	2182			3694			7808			8000		

Table 1. This illustrates the lack of precaution in the LGL extrapolations for the intermediate depths from their deep-water empirical data. If they were to take a mean of the data-supported ranges at which their signals reach certain dB levels shallow and deep water, the resulting ranges in intermediate depths would be substantially higher in most cases, especially at the higher levels of exposure.

Review 2:

It was with great concern that I read the proposal for extensive seismic survey off the coast of Taiwan by Lamont-Doherty Earth Observatory (**Federal Register** 73 (246) Monday, December 22, 2008 at p. **78294**).

The sounds produced by seismic surveys are the most intense of all anthropogenic sound sources and have been detected more 3000 miles (c. 5000 km) from their source (Nieukirk et al., 2004). Moreover, researchers trying to record cetaceans in the mid-Atlantic found that whale calls were frequently being smothered and "masked" by the high levels of continuous sound produced by these seismic surveys (Nieukirk et al., 2004). Clark and Gagnon (2006) also observed large scale effects, noting that observed that fin whales in the vicinity of seismic surveys cease vocalizing over spatial scales on the order of 10,000 nm^2 or greater. Animals have also been documented reacting to seismic surveys sounds; for example, sperm whales have been observed exhibiting a "startle" reaction 2 km away from a seismic survey vessel (Stone, 2003). McCauley and Duncan (2001) stated that airguns could elicit behavioural changes at a range measured in tens of km in blue whales and probable avoidance at 3-20 km. Miller et al. (1995) describe similar results for beluga whales and McCauley et al. (2000b) also discovered that humpback whales, off Exmouth, Australia, responded to seismic testing in various ways and at distances that were not observable from the survey vessel – females with calves were particularly sensitive and were reported to show aversive reactions at 7 to 12 km from seismic vessels (McCauley et al., 1998). The longest-term study of cetacean and seismic interactions began in the Alaskan Beaufort Sea in the 1980s. Data collected since then have shown that behavioural responses in bowhead whales, have occurred as far away as 30 km from the source (where received levels were 107-126 dB re 1 μPa rms; Richardson et al., 1999). Thus, there are numerous published studies showing impacts of seismic surveys on cetaceans at significanty distances from seismic vessels – greater that the distanced noted by the Federal register notice.

Moreover, recent studies on seismic survey sounds received by tagged whales have, however, altered our understanding of noise transmission in the sea as the received sound levels did not match predictions. (Madsen et al., 2006). In that case, sound levels from a seismic survey decreased between 5 km and 9 km from the sound source, but then *increased* at distances between 9 km and 13 km (Madsen et al., 2006). The researchers stated that sperm whales in the Gulf of Mexico "could be impacted at ranges of more than 10 km from seismic survey vessels" (Madsen et al., 2006, p. 2376.) and impacts would occur "beyond where visual observers on the source vessel can monitor effectively" (Madsen et al., 2006, p. 2376) It was also assumed that the seismic source only emitted low frequency pulses, however evidence demonstrates that air-gun arrays can generate significant sound energy at frequencies many octaves higher than the frequencies of interest for seismic exploration, which increases concern of the potential impact on odontocetes hearing at higher frequencies. (Madsen et al., 2006).

There are substantive populations of beaked whales off the coast of Taiwan, and these animals are known to be particularly susceptible to acoustic disturbance: there have been numerous strandings of these animals associated with high intensity noise events coupled with symptomatic emboli and lesions similar to those produced during decompression sickness (see Parsons et al., 2008 for a review). It is now widely believed that these stranding events are the result of behavioural responses to sound (i.e. surfacing too rapidly, or being forced to stay near the surface; see Cox et al., 2006) that can occur as exposure levels far below those levels that can cause acoustic injury such as temporary and permanent (TTS & PTS) threshold shifts, with strandings in the Bahamas being believed to have been the result of received levels of sound of 145-155 dB (see Parsons et al., 2008 for a review). Thus, at least for beaked whales, 180 or 190 dB exposure levels would be inappropriate safety guideline levels.

Seismic surveys have been linked to several whale stranding events. For example, in 2002, two Cuvier's beaked whales stranded on the Isla San Jose (Gulf of California, Mexico) coincident with seismic surveys from the research vessel Lamont-Doherty Earth Observatory Maurice Ewing (Malakoff, 2002) although there is as yet no scientific confirmation of this. It has also been speculated by scientists that seismic surveys have caused cetacean strandings in other areas, such as the Galápagos Islands (Palacios et al., 2004). Scientists did find, however, that cetacean diversity off the coast of Brazil dropped from 1994 to 2004, with a conspicuous decrease in 2000-2001 when there were a greater number of seismic surveys (Parente et al., 2007). Other oceanographic parameters such seawater temperature, salinity and density, showed no relationship to the decline, and thus weren't considered a factor in the decrease of species; seismic surveys were the most likely factor (Parente et al., 2007).

Marine mammals aren't the only marine life affected by seismic surveys. Norway's Institute of Marine Research showed that trawl catch rates of haddock and cod fell by 45-70% over a 2,000 square mile area, while seismic surveys were being conducted (Engas et al., 1993). Caged squid, fish and turtles have all shown an alarm response, avoidance and altered behaviour in seismic experiments (McCauley et al., 2000). Seismic survey sounds can also cause significant damage to fish hearing structures (McCauley et al., 2003). Furthermore, unusual numbers of giant squid were found dead and stranded on beaches at the same time seismic surveys were being conducted in the Bay of Biscay (MacKenzie, 2004). Thus, the impacts of seismic surveys may ultimately be found to be more extensive than previously thought on potential prey species of cetaceans and commercial fisheries – a major industry off the coast of Taiwan.

Moreover, I believe proposed mitigation measures to be insufficient. For example, for the visual survey methodology proposed, although there will be three marine mammal visual observers on board, at most times there will only be one present. Dedicated cetacean surveys usually use two teams of two to three observers who survey the sea simultaneously – and still animals are not observed (hence the need for the g0 calculation – the likelihood that animals would be observed under a set of environmental conditions when directly in front of a survey vessel, in order to estimate missed animals). Thus, the number of MMOs should be increased and a maximum length for observer shifts should be reduced from 4 to 2 hours to prevent observer fatigue.

There is no consideration of factors which effect visibility and the likelihood of cetacean detection, for example fog, rain or rough seas. Scientific surveys for cetaceans are often not conducted in sea states greater than Beaufort 3 or 5, depending on the study species, as rough weather severely reduces the ability to see cetaceans. Further, there are no prohibitions on conducting seismic surveys at night, when visual surveys are almost completely useless - even the use of night-vision glasses is rendered ineffective by lights on board seismic survey vessels At a minimum, when relying on observers as a mitigation measure in sea states greater than Beaufort 5, during fog or heavy precipitation, or at night, cetaceans may well be in the zone of impact despite having visual observers present, and thus animals cannot be protected from seismic survey noise during these conditions. Moreover, in areas where beaked whales are likely to be encountered (e.g. canyons and continental shelf edges) the likelihood of sighting animals even though they are present is extremely low. US government scientists have noted that the probability of observers actually sighting a beaked whale in the zone of acoustic impact is generally less than 1% (Barlow & Gisiner, 2006), even in the best conditions, with virtually a zero chance of detection beyond 1km or less than perfect conditions. This makes visual surveys for such acoustically vulnerable, deep-diving species largely ineffective. Thus, encroachment of seismic surveys sounds should be avoided in all likely beaked whale habitat.

Appropriate experience is an important criterion in the selection of visual observers, as shown by the British government's own research (Stone, 2003). When marine mammals were detected within the 500

m zone of impact by dedicated, experienced MMOs, the guidelines were followed and the survey was delayed 70% of the time. This figure fell to 0% when non dedicated, inexperienced observers or ship's crew were used (Stone, 2003). Thus, any visual observers should have multiple years of cetacean observation experience, ideally with cetaceans from SE Asia, in conditions similar to those off the coast of Taiwan.

PAM has great potential for detecting cetacean species that vocalise frequently such as sperm whales, which would reduce a number of the concerns noted above for visual surveys. However, PAM can only detect cetaceans when they vocalise and no species vocalises constantly (Gordon & Tyack, 2002). One study on common dolphins in the UK showed that although vocalisation rates were relatively high at night, they decreased for portions of the day (Wakefield, 2001).

Also, anthropogenic sounds have, on occasion, been shown to cause cetaceans to cease vocalising. For example, as noted above, fin whales ceased all vocalisation during seismic surveys and did not resume vocalising for hours or days afterward (Clark & Gagnon, 2006). Sperm whales have also decreased vocalisations or become completely silent in response to seismic surveys (IWC, 2007), as well as in the presence of pinger sounds (Watkins & Schevill, 1975), mid-frequency military sonar signals (Watkins et al., 1985), and low-frequency anthropogenic sounds (Bowles et al., 1994). Nevertheless, real-time PAM should be used in conjunction with visual observation, to maximize the probability of detection.

In summary, based on the best available science, the safety distances and mitigation measures proposed cannot guarantee that cetaceans will not be impacted by seismic surveys, and the number of takes would likely be much greater than those proposed in the Federal Register notice. Several important and key studies related to seismic survey impacts and the impacts of noise on cetaceans have not been mentioned in the FR notice, showing at best incomplete research, and at worst selective use of published scientific data. In particular, beaked whales could likely be impacted more heavily than stated. The most effective mitigation measure for these animals would be spatial exclusion zones in important habitats, which are not esonified by seismic surveys.

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NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Regular and Electronic Mail

February 5, 2009

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Re: **Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March-July 2009**

Dear Mr. Payne:

On behalf of the Natural Resources Defense Council ("NRDC"), International Fund for Animal Welfare, Whale and Dolphin Conservation Society, Cetacean Society International, Animals Asia, New York Whale and Dolphin Action League, Ocean Futures Society, and Jean-Michel Cousteau, and on behalf of our millions of members and activists, I appreciate the opportunity to submit comments regarding the request for authorization to take marine mammals incidental to conducting seismic surveys in Southeast Asia submitted by Lamont-Doherty Earth Observatory ("L-DEO") at Columbia University.[1] *See* 73 Fed. Reg. 78294 (Dec. 22, 2008); *see also* "Request by Lamont-Doherty Earth Observatory 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 Southeast Asia, March July 2009" (October 2008), *available at* http://www.nmfs.noaa.gov/pr/pdfs/permits/taiger_iha.pdf ("IHA Application").

At the outset, we appreciate L-DEO's commitment to request an Incidental Harassment Authorization ("IHA") from the National Marine Fisheries Service ("NMFS") and, with the National Science Foundation ("NSF"), to prepare an Environmental Assessment for these seismic surveys. *See* "Environmental Assessment of a Marine Geophysical

[1] NRDC is aware that comments are being submitted independently by other organizations, scientists, governmental entities, and the public. We hereby incorporate by reference all of these comments, noting in particular the comments submitted by Humane Society International and Dr. John Wang. The comments that follow do not constitute a waiver of any factual or legal issue raised by any of these organizations or individuals that is not specifically discussed herein.

Survey by the R/V Marcus G. Langseth in Southeast Asia, March–July 2009" (October 2008), *available at* http://www.nmfs.noaa.gov/pr/pdfs/permits/taiger_ea.pdf ("L-DEO EA"). We do, however, have serious concerns related to potential adverse impacts to marine mammals from L-DEO's seismic surveys in the South China Sea, Luzon Strait, North Philippine Sea, and waters surrounding coastal Taiwan. These comments are made with particular regard to the effects these surveys may have on threatened and endangered species – including the Eastern Taiwan Strait population of Indo-Pacific humpbacked dolphin, the Jiulong River Estuary population of Indo-Pacific humpbacked dolphin, western Pacific humpback whales, and western Pacific gray whale – and offer suggestions for mitigating those impacts.[2] Our comments are thus aimed at helping NMFS and L-DEO ensure that the potential adverse impacts of the proposed seismic surveys are properly analyzed, avoided, minimized, and mitigated, especially given the acknowledged lack of abundance and distribution data for marine mammal species in the proposed waters.

Our primary concerns with L-DEO's proposed seismic surveys include the following:

- The proposed survey area overlaps with important breeding, feeding and migratory habitat for several species of threatened and endangered marine mammals. Of particular concern are:
  - The entire range of the critically endangered Eastern Taiwan Strait ("ETS") population of Indo-Pacific humpbacked dolphin
  - The partial range of Jiulong River Estuary ("JRE") population of Indo-Pacific humpbacked dolphin
  - Calving and migratory habitat for western Pacific humpback whales
  - Migratory pathway for the critically endangered western Pacific gray whale
  - Beaked and sperm whale habitat in southeastern and southwestern Taiwan
- The surveys are proposed to occur during the spring and summer months (March through June), coinciding with breeding and calving seasons for many cetaceans, as well as with the months in which the highest marine mammal density has been recorded in this region (Wang et al. 2001).
- Many genetically distinct populations of cetaceans are found within the enclosed seas of the western Pacific, including the ETS population of Indo-Pacific humpbacked dolphin, South China Sea population of finless porpoise, fin whales, gray whales, and humpback whales. Take estimates should use abundance and density estimates for these distinct populations (rather than estimates for the entire North Pacific) where appropriate.
- Baseline information and density data for most species in this region is extremely scarce, making it difficult to assess potential impacts of seismic exploration on these populations. Although both L-DEO and NMFS

[2] As set forth in greater detail in Appendix A, the proposed seismic surveys may have significant effects on these threatened, endangered, and other species of concern. *See* Appendix A, describing the region's marine mammal habitat and diversity.

acknowledge this shortcoming, they nonetheless proceed without sufficient precautions.

- The proposed seismic surveys should adhere to conservation laws and regulations of other nations, including respecting the boundaries of the Marine Protected Areas detailed in Appendix A below.

We are also concerned that L-DEO's EA – and NMFS' proposed IHA – do not meet the rigorous standards of environmental review required by the National Environmental Policy Act and Marine Mammal Protection Act. For example, L-DEO's EA does not properly analyze impacts or adopt adequate mitigation measures. Although the EA notes the lack of scientific information regarding species distribution and acoustic impacts of seismic activities, it nonetheless – and without basis – concludes that the proposed surveys will have only "minor" effects on marine mammal species. NMFS' proposed IHA also notes the lack of density data yet nevertheless concludes – again without basis – that the proposed seismic surveys will have only negligible impacts on marine mammals. And, like L-DEO, NMFS does not propose meaningful mitigation measures.

Additional review of the region's marine mammal population should be undertaken before authorizing incidental takes. *Furthermore, meaningful spatial and temporal restrictions on seismic activities must be adopted, as described in further detail at Appendix A*. In addition to the mitigation measures already proposed, additional spatial and temporal restrictions should include the following:

- All South China Sea from December through May (due to gray whale migration)
- Coastal waters of the South China Sea out to 200m depth, >20 km including islands from April through June (because of the presence of beaked whales and potential gray whale breeding sites)
- Submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat)
- Ryukyu Islands: exclusion to 200 m depth from December through May and year-round coastal exclusion to 20 km (this is important breeding ground for North Pacific humpback whale, particularly December through May, as well as year-round habitat for Indo-Pacific bottlenose dolphin)
- Islands between northern Luzon and Taiwan including Babuyan, Batanes, Calayan Islands: exclusion to 200 m depth from December through May, as well as year-round coastal exclusion to 20 km (these are humpback whale breeding grounds, particularly December through May, and reflect high cetacean diversity year-round)
- Year-round coastal exclusion in the waters surrounding Taiwan to 20 km (because of Indo-Pacific humpback dolphin and finless porpoise habitat)
- Strait of Taiwan from October through May (due to gray whale migration, as well as high cetacean density including endangered population of Indo-Pacific humpback dolphins)
- Submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat)

- Marine Protected Areas.

In sum, we strongly urge NMFS, at a minimum, to impose additional spatial and temporal restrictions before authorizing any incidental takes from this activity. Due to the lack of abundance and distribution data for marine mammal species, we further urge NMFS to require L-DEO to update its EA after consulting with local experts in the affected region (South China Sea, Luzon Strait, North Philippine Sea, and waters surrounding coastal Taiwan), so that the agency's decision is based on a more thorough review of the region's marine mammals. We also recommend further consultation regarding the impacts of seismic sounds on marine mammals.

I. Legal Framework

A. The Marine Mammal Protection Act

The Marine Mammal Protection Act ("MMPA") was adopted more than thirty years ago to ameliorate the consequences of human impacts on marine mammals. Its goal is to protect and promote the growth of marine mammal populations "to the greatest extent feasible commensurate with sound policies of resource management" and to "maintain the health and stability of the marine ecosystem." 16 U.S.C. § 1361(6). A careful approach to management was necessary given the vulnerable status of many of these populations (a substantial percentage of which remain endangered or depleted) as well as the difficulty of measuring the impacts of human activities on marine mammals in the wild. 16 U.S.C. § 1361(l), (3). "[I]t seems elementary common sense," the House Committee on Merchant Marine and Fisheries observed in sending the bill to the floor, "that legislation should be adopted to require that we act conservatively—that no steps should be taken regarding these animals that might prove to be adverse or even irreversible in their effects until more is known. As far as could be done, we have endeavored to build such a conservative bias into the [MMPA]." Report of the House Committee on Merchant Marines and Fisheries, *reprinted in* 1972 U.S. Code Cong. & Admin. News 4148.

At the heart of the MMPA is its so-called "take" provision, a moratorium on the harassing, hunting, or killing of marine mammals. 16 U.S.C. § 1362(13). Under the law, NMFS may grant exceptions to the take prohibition, provided it determines, using the best available scientific evidence, that such take would have only a negligible impact on marine mammal populations or stocks. There are two types of general exemptions available through the MMPA for activities that incidentally "take" marine mammals: permits and incidental harassment authorizations. Until 1994, the only exemptions available under the Act were permits, which require the wildlife agencies to promulgate regulations specifying permissible methods of taking. In 1994, however, the MMPA was amended to provide a streamlined mechanism by which proponents can obtain authorization for projects whose takings are by incidental harassment only. 16 U.S.C. § 1371(a)(5)(D). Regardless of which process is used, NMFS must prescribe "methods" and "means of effecting the least practicable impact" on protected species as

well as "requirements pertaining to the monitoring and reporting of such taking." 16 U.S.C. §§ 1371(a)(5)(A)(ii), (D)(vi).

B. National Environmental Policy Act

The National Environmental Policy Act of 1969 ("NEPA") "declares a broad national commitment to protecting and promoting environmental quality." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348 (1989). NEPA establishes a national policy to "encourage productive and enjoyable harmony between man and his environment" and "promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man." 42 U.S.C. § 4321. In order to achieve its broad goals, NEPA mandates that "to the fullest extent possible" the "policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with [NEPA]." 42 U.S.C. § 4332. To that end, NEPA requires that the potential environmental impacts of any "major Federal actions significantly affecting the quality of the human environment" be considered through the preparation of an environmental assessment ("EA") or an environmental impact statement ("EIS"). *Robertson*, 490 U.S. at 348; 42 U.S.C. § 4332. This directive is known as a "set of action-forcing procedures" that require decision makers to take "a 'hard look' at environmental consequences." *Robertson*, 490 U.S. at 349 (quoting *Kleppe v. Sierra Club*, 427 U.S. 390, 410, n.21 (1976)).

The fundamental purpose of an EA or EIS is to force the decision-maker to take a "hard look" at a particular action – at the need for it, at the environmental consequences it will have, and at more environmentally benign alternatives that may substitute for it – before the decision to proceed is made. 40 C.F.R. §§ 1500.1(b); *Baltimore Gas & Electric v. NRDC*, 462 U.S. 87, 97 (1983). This "hard look" requires decision makers to obtain high-quality information and accurate scientific analysis. 40 C.F.R. § 1500.1(b). "General statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." *Klamath-Siskiyou Wilderness Center v. Bureau of Land Management*, 387 F.3d 989, 994 (9th Cir. 2004) (quoting *Neighbors of Cuddy Mountain v. United States Forest Service*, 137 F.3d 1372, 1380 (9th Cir. 1998)). The law is clear that an EA or EIS must be a pre-decisional, objective, rigorous, and neutral document, not a work of advocacy to justify an outcome that has been foreordained.

NSF, which funds the proposed study, is required to employ rigorous standards of environmental review, including a full analysis of potential impacts of the seismic surveys and a thorough delineation of measures to mitigate harm. Unfortunately, the EA prepared by L-DEO and NSF does not meet the high standards of environmental analysis prescribed by NEPA.

II. NMFS Must Prescribe "Methods" and "Means" of "Effecting the Least Practicable Adverse Impact" on Marine Mammals

NMFS is charged with implementing the MMPA and, to that end, must prescribe methods and means of effecting the least practicable adverse impact on marine mammals. NMFS' proposed IHA falls short of the mark.

NMFS' proposed IHA does not impose meaningful mitigation measures. For instance, it imposes only voluntary spatial and temporal restrictions, introducing caveats such as avoiding humpback winter concentration areas "*if practicable*" and limiting seismic operations to 8-10 km from the Taiwanese coast "*when possible*" to reduce harm to ETS Indo-Pacific humpback dolphins, effectively leaving decisions on habitat avoidance to the project proponent. 73 Fed. Reg. 78315; *see also NRDC v. Gutierrez*, 2008 WL 360852 (N.D. Cal. Feb. 6, 2008)(noting that it is improper for NMFS, as the agency tasked with implementing the MMPA, to shift its burden). Nor, given the distribution of species and the propagation of air gun pulses, would the proposed 2 km coastal avoidance do much to mitigate the harm to the ETS Indo-Pacific humpback dolphin population, whose entire distribution falls within the proposed survey areas. *See* comment letter submitted by Dr. John Wang. Such measures neither meet the agency's statutory burden nor satisfy the strong interest in marine mammal protection that is embodied in the MMPA.

NMFS' proposed mitigation measures focus primarily on visual monitoring. However, research has cast doubt on the ability of ship-board observers to detect whales or for vessels to avoid collisions through visual monitoring, particularly as the size of the vessel increases or visibility decreases. (Clyne and Leaper 1999). Notably, detection rates for marine mammals generally approach only 5 percent. It has been estimated that in anything stronger than a light breeze, only one in fifty beaked whales surfacing in the direct track line of a ship would be sighted; as the distance approaches 1 kilometer, that number drops to zero. (Barlow and Gisiner 2006). Further, L-DEO's ability to monitor the exclusion zone ("EZ") proposed by NMFS cannot be properly evaluated because the EZ has not yet been established and awaits further data from L-DEO's 2007/2008 calibration study. *See* 73 Fed. Reg. at 78297.

In order to meet its obligations under the MMPA, NMFS must prescribe additional spatial and temporal restrictions. Such exclusions are summarized above (*supra* pp. 3-4) and described in greater detail and with supporting references at Appendix A.

III. L-DEO Must Properly Analyze Potential Impacts and Propose Meaningful Alternatives and Mitigation Measures

To comply with NEPA, a decision-maker must analyze marine mammal distribution, habitat abundance, population structure and ecology to estimate impacts on species as well as to consider reasonable alternatives and mitigation measures. Unfortunately, L-

DEO's EA did not fully analyze impacts on marine mammals. Nor did the EA properly assess cumulative impacts, reasonable alternatives, or mitigation measures.

A. Impacts on Marine Mammals

A core element of an EA is its assessment of the distribution and abundance of marine mammal species. Careful assessment is essential, not only for meeting L-DEO's responsibility under NEPA to objectively describe the environment affected by the surveys, but also for evaluating the impacts of the proposed activity on marine mammals and for determining reasonable alternatives. However, L-DEO's EA lacks abundance and distribution data for marine mammal species in the proposed waters. It is not enough for NEPA purposes to claim that insufficient information is available. Unless the costs of obtaining the information are exorbitant, NEPA requires that it be obtained. *See, e.g.,* 40 C.F.R. § 1502.22(a). Here, further research and, at the very least, regional consultation is needed to establish baseline information in order to properly assess potential impacts of seismic exploration on marine mammal populations. Furthermore, many genetically distinct populations of cetaceans are found within the enclosed seas of the western Pacific, including the ETS population of Indo-Pacific humpbacked dolphin, South China Sea population of finless porpoise, fin whales, gray whales, and humpback whales. Take estimates should use abundance and density estimates for these distinct populations, rather than estimates for the entire North Pacific.

L-DEO must also fully analyze the impacts of stress, masking and displacement on marine mammals. For example, the impact of "stress" on marine mammals is not analyzed at all, despite its serious problem for animals exposed even to moderate levels of sound for extended periods. Stress from ocean noise—alone or in combination with other stressors—may weaken a cetacean's immune system, making it more vulnerable to parasites and diseases that normally would not be fatal. (Wright et al. 2007; Romano et al. 2004). Moreover, according to studies on terrestrial mammals, chronic noise can interfere with brain development, increase the risk of myocardial infarctions, depress reproductive rates, and cause malformations and other defects in young – and all at moderate levels of exposure. (Willich et al. 2005; Chang and Merzenich 2003; Harrington and Veitch 1992). Likewise, L-DEO must properly analyze the impacts of displacement – which can lead to abandonment of habitat or migratory pathways – and masking – such as the masking of calls of predators or potential mates.

B. Cumulative Impacts

An EA must also include a full and fair discussion of cumulative environmental impacts. It is not enough, for purposes of this discussion, to consider the proposed action in isolation, divorced from other public and private activities that impinge on the same resource. Rather, it is incumbent on L-DEO to assess cumulative impacts as well, including the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future significant actions." 40 C.F.R. § 1508.7. Thus, L-DEO "cannot treat the identified

environmental concern in a vacuum." *TOMAC v. Norton*, 433 F.3d 852, 863 (D.C. Cir. 2006) (*quoting Grand Canyon Trust v. FAA*, 290 F.3d 339, 345 (D.C. Cir. 2002).

L-DEO's cumulative impact analysis fails to meet these basic requirements. It provides no support for its conclusion that "[b]ecause human activities in the area of the proposed seismic survey are high, additional impacts on marine mammals by the TAIGER seismic survey are expected to be no more than minor and short-term." L-DEO EA at 79. L-DEO's analysis cannot provide such support because it fails to explain what the sum of these impacts is expected to be. For example, the EA does not assess the cumulative impacts of multiple sources of noise. Further, L-DEO does not properly consider the potential for acute synergistic effects. Although the EA discussed the potential for ship strikes in the proposed survey areas, it does not consider the greater susceptibility to vessel strike of animals that have been temporarily harassed or disoriented by seismic noise sources. (Nowacek et al. 2004.) Nor does L-DEO consider the synergistic effects of noise with other stressors in producing or magnifying a stress-response. Although L-DEO acknowledges that the proposed survey areas are crowded with shipping, oil and gas, and fishing activities, many of which introduce noise, pollution, debris, and vessel traffic into the habitat of threatened and endangered species, it nonetheless concludes that only "minor" cumulative effects are anticipated. *See* L-DEO EA at 71-79. The idea that all of these events, when taken as a whole, are having at most "minor" or "short-term" effects is improbable and, at the very least, requires further analysis.

C. Alternatives Analysis

NEPA requires decision-makers to consider alternatives to their proposed actions. Thus, L-DEO must evaluate reasonable alternatives that would avoid or minimize adverse impacts to the proposed seismic surveys. *See, e.g.*, 40 C.F.R. § 1502.1. Yet L-DEO's alternatives analysis analyzes only the specified dates and does not even consider conducting the proposed study during an alternate season, such as winter and fall, which would avoid breeding, calving and migration for many marine mammal species in the proposed survey areas. As discussed in Section II and Appendix A, temporal and spatial avoidance is necessary in order to minimize impacts on marine mammals and therefore must be considered by NMFS and L-DEO.

D. Mitigation Measures

Under NEPA, a decision-maker must discuss measures designed to mitigate the proposed action's impact on the environment. *See, e.g.*, 40 C.F.R. § 1502.14(f). As discussed in Section II above, the mitigation measures proposed by L-DEO and NMFS are insufficient and ineffective. Consideration of spatial and temporal restrictions is minimally necessary to satisfy the requirements of NEPA.

IV. Conclusion

Our groups are committed to minimizing the impact of high-intensity seismic surveys on the marine environment, particularly on marine mammals. We therefore urge NMFS to satisfy its obligations under the MMPA, and particularly to prescribe meaningful spatial and temporal mitigation for the proposed surveys and to properly consult regional experts on the distribution and abundance of marine mammals in the region.

Thank you for your consideration of our comments on this important matter. We welcome the opportunity to discuss the matter with you at any time.

Sincerely,

Taryn Kiekow
Staff Attorney, Marine Mammal Project

APPENDIX A

TAIGER SURVEY AND MARINE MAMMAL HABITAT IN THE WESTERN NORTH PACIFIC

The following paragraphs summarize some of the available scientific literature pertaining to marine mammal habitat and population density in the western North and tropical Pacific, with particular attention to endangered or threatened species or populations. This summary presents a review of marine mammal habitat and diversity in areas specifically mentioned as areas to be used by L-DEO.

1. Marine mammal habitat and diversity in the South China Sea

General features. The first trackline of the TAIGER survey is proposed to occur primarily in the South China Sea, a large marine ecosystem (LME) that that includes roughly 3.5 million km2, including the Asian mainland coast to the western coasts of the Philippines and the island of Borneo. Because the SCS is semi-enclosed and oceanographic conditions differ from the Pacific Ocean, there may be barriers to biological exchange between the two bodies of water. Productivity is generally high in coastal areas and lower in areas of deeper bathymetry. Deep-water canyons and high-relief bathymetry off the coast of Taiwan leading to the Penghu Channel are generally characterized by high marine productivity, resulting in a high concentration of fishing activities. Numerous reports of deep-water cetaceans have been made from this area (Huang 1996) as well as records of whaling ships targeting sperm whales. Additional notable features of the South China Sea are the narrow continental shelf in several areas and the relatively high density of seamounts in the abyssal plain. There are also regions with considerable coral reefs. Despite intensive coastal development, overfishing and pollution in many areas of the South China Sea, cetacean diversity is high.

Part of the first trackline will approach eastern coast of the Philippines, which supports a diverse array of cetaceans. Information from whale-watching boats was gathered from 1997 through 2001 from southern Tanon Strait, indicating the presence of spinner, pantropical spotted, Risso's, common and Indo-Pacific bottlenose, and Fraser's dolphins, as well as pilot, melon-headed, pygmy killer, dwarf sperm, and pygmy sperm whales (Aragones et al. 2005).

Beaked whales. Beaked whales are thought to be particularly sensitive to acoustic disturbance (e.g. Cox et al. 2006). Though no dedicated beaked whale surveys have occurred in the South China Sea, bycatch and stranding records indicate the presence of multiple species. Furthermore, oceanographic and bathymetric patterns indicate that the submarine canyons off the southwestern coast of Taiwan are likely to be particularly good habitat for beaked whales. Four species have been identified from the South China Sea: ginko-toothed, Blainville's, Cuvier's, and Longman's beaked whales. Since 1999 there have been at least 8 records of ginko-toothed beaked whales, including: two specimens taken by local fisheries in the early 1960's around the Penghu Islands and Xiaoliuqiuyu Island, Taiwan (Yang 1964, Yang 1976), a specimen found at fish market

in Kaohsiung Taiwan in 1969 (Yang 1976). There are at least 9 records of Blainville's beaked whales and 15 records of Cuvier's beaked whales (mostly strandings). Blainville's beaked whale has been reported from the coast of Taiwan (Yang et al. 1999). Wang et al (1995) reported on Cuvier's beaked whale records from Taiwan prior to 1995. Additional records include a male Cuvier's beaked whale found stranded on the beach at Lukang, Taiwan in October 1961 (Yang 1976), and records of six strandings from Taiwan, at Miaoli, Hualien, Lu Tao, Lan Yu and Taitung (Chou et al. 1995; Chen et al. 1995). Dolar et al. (1997) report Cuvier's beaked whale in Philippine waters greater than 60 nm from shore at depths greater than 200m. Longman's beaked whale has been observed in southern Taiwan and northeast Philippines (J.Y. Wang, pers comm, Wang et al., 2001) and two individuals live stranded on a beach of Ilan County, NE Taiwan in 2005 (Wang and Yang 2006).

Western Pacific gray whales. The calving grounds of western Pacific gray whales are thought to be located in the South China Sea, though the exact location is unknown (Zhu and Yue 1998; Henderson 1990; Wang 1984). However, based on sighting data it is highly likely that this critically endangered population migrates through the Strait of Taiwan from northerly feeding grounds on its way to calving grounds in the South China Sea, perhaps around Hainan Island (Wang 1984). Furthermore, northward migration when newborn calves are present is likely to occur in the spring (March-April). Because of the extremely small size of this population and the fact that these whales are also exposed to seismic activity on their feeding grounds, any further impact on the population is likely to increase the risk of extinction.

Other baleen whales. Jefferson and Hung (2007) suggest that Bryde's whale (likely the dwarf form B. edeni) may occur with some regularity off of Hong Kong, based on stranding records, and that it may in fact be the only species of baleen whale that occurs with regularity in this area today. Land-based whaling stations in southern Taiwan have also reportedly taken humpback, blue, fin, sei, and Bryde's whales (see Wang et al 2001). Minke whales and Omura's whales have also been reported to occur off of Taiwan (e.g., Chou 1994).

Additional species of conservation concern. Both pygmy and dwarf sperm whales are known to occur in the South China Sea based on numerous stranding records. At least 15 specimens of *K. breviceps* (pygmy sperm whales) and more than 40 specimens of *K. sima* have been recorded from Chinese waters (Yang 1976; Chou et al. 1995; Chen et al. 1995; Wang and Yang 2006; Yang et al. 2008) from throughout Taiwan with fewer animals from western Taiwan, and Hong Kong (Parsons et al. 1995). *Kogia sima* also had the second highest encounter rate of all cetaceans in southern Taiwan (Wang et al., 2001). Several stranded specimens from Hong Kong originally identified as *K. breviceps* were determined to be *K. sima* (dwarf sperm whales) (Porter and Morton 2003). Finless porpoises occur throughout the coastal and estuarine habitats of South China Sea (Parsons and Wang 1998). Though primarily a coastal species, finless porpoises have been sighted 135 km offshore in the South China Sea (De Boer 2000). Both species of *Tursiops* (*T. truncatus* and *T. aduncus*) are present in Chinese waters (Wang and Yang 2007). The deep submarine canyons off of southwest Taiwan may be

important habitat for sperm whales, as indicated by previous whaling records, nearby strandings and sightings by fishermen. Indo-pacific humpback dolphins prefer nearshore habitat but have been sighted up to 55.6 km from the coast where the water remains shallow (Corkeron et al. 1997). Two small, distinct subpopulations of Indo-pacific humpback dolphins are found in and around the Strait of Taiwan and are of particular concern (see Section 3 below).

Additional cetacean species are found off the coasts, islands, and in the straits of the Philippines. Cetacean fauna of the eastern Sulu Sea include Fraser's dolphin, spinner dolphin, pantropical spotted dolphin, dwarf sperm whale and short-finned pilot whale, melon-headed whale, and pygmy killer whale (Dolar and Perrin 2005). Fraser's dolphins in the Philippines show significant morphological differences from those off of Japan (Perrin et al. 2003). A survey in Philippine waters reported by Dolar and Perrin (1996) found spinner and pantropical spotted dolphins in waters of various depths (<200 to 4000m), and Risso's dolphins in shallow water adjacent to deeper waters. Additional species reported from the southern Sulu Sea include common bottlenose dolphin, Indo-Pacific bottlenose dolphin, pantropical spotted dolphin, spinner dolphin (including the dwarf or *roseiventris* subspecies) and dwarf sperm whale (Dolar et al. 1997). In and around the waters of Taiwan, there may also exist different populations or subspecies of pantropical spotted dolphins (Huang 1996). There are also several short-finned pilot whale records from the region (e.g., Moore and Lien 2007).

Recommended spatial and temporal exclusions:

- All South China Sea from December through May (due to gray whale migration)
- Coastal waters of the South China Sea out to 200m depth, >20 km including islands from April through June (because of the presence of beaked whales and potential gray whale breeding sites)
- Submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat)

2. Marine mammal habitat and diversity in the North Philippine Sea

General features. The second trackline of the TAIGER cruise is proposed to take place north of the Philippines in the Luzon Strait and north near the Ryuku Islands. The northern part of the Philippine Sea is characterized by complex bathymetric relief and oceanography, and bounded by a series of extended ridges that enclose the sea to the north, south and east. On the eastern border, the Bonin and Mariana Island Archipelagos extend in a north-south direction. The Kyushu-Palau Ridge is considered to be a remnant of the Bonin-Mariana Island arc. The North Equatorial Current flows through the Philippine Sea from the east. The warm Kuroshio Current originates in the northeast region of the sea and moves north to Japan. In addition to providing breeding habitat for marine mammals, the Philippine Sea also is used as a spawning ground by albacore tuna and the only known spawning area for the Japanese eel in the vicinity of the salinity front in the North Equatorial Current (Kimura and Tsukamoto 2006). Coastal ecosystems in this area are characterized by extremely high diversity and species endemism. The Ryukyu and Ogasawara (Bonin) Island chain represents

particularly important habitat for marine mammals (including roughly 20 species of cetaceans) as well as other marine creatures such as sea turtles, and has been called "the Galapagos of the East" (Guo and McCormick 2001).

The coastal marine waters of the Philippines and its islands cover 2.21 million km2 and are characterized by extraordinarily rich concentrations of marine life including coral reefs, mangroves, and seagrass beds (Ong 2002). The rich biodiversity found within these habitats include nearly 500 coral species (of the roughly 800 species known worldwide), more than 2000 species of fishes, and at least 25 species of marine mammals (dolphins and whales). The area around the Babuyan Islands is highly productive, and is considered the most diverse area for cetacean species in the Philippines, with at least 13 species documented and high densities of many of those species (*see* WWF Philippines website). This area is also known to contain a spawning area for Pacific bluefin tuna. Off the eastern coast of Taiwan, the highly productive Kuroshio current flows along the narrow continental shelf and steep continental slope, resulting in density of prey species such as anchovy (*e.g.* Tsai et al. 1997).

Consistent with the idea of the Ogasawara and Ryukyu Islands as biodiversity hotspots, a recent study by Kaschner (2007) shows that the broad area around the Ogasawara and Ryukyu Islands overlap with some of the areas of highest marine mammal species richness in the world. Predicted marine mammal species richness based on a global habitat suitability model shows hotspots of marine mammal diversity in areas overlapping broadly with the Ogasawara and Ryukyu Archipelagos.

Beaked whales. The Philippine Sea includes a region of shelf habitat and trenches (such as the Philippine Trench) which appear to be used by beaked whales. As in the South China Sea, data on densities are lacking as few surveys have been carried out, but this appears to be an area of high diversity for beaked whales. Beaked whale species found in this region include Cuvier's beaked whale (Reeves et al. 2002), ginko-toothed beaked whale, Blainville's beaked whale, Longman's beaked whale and possibly Baird's beaked whale (Wang and Yang, 2006; Yang et al. 2008). Of these species, Blainville's and Cuvier's beaked whales are the most frequently reported. Longman's beaked whales have been observed in southeastern Taiwan (21°55') and the northeastern Philippines (17°,10'N) and northeastern Taiwan (Wang and Yang 2006; Yang et al., 2008). Specimens of Longman's beaked whale have stranded in Davao, Philippines and southern Kyushu, Japan (Acebes et al. 2005).

Humpback whales. The area covered by the second TAIGER trackline will overlap with important winter breeding grounds for North Pacific humpback whales in two areas. First, waters adjacent to the Ryukyu Islands and Ogasawara (Bonin) Islands are well-recognized as high-density breeding grounds for humpback whales (Nishiwaki 1966; Darling and Mori 1993; Salden et al. 1999). Whaling records suggest that this area was heavily used by European and American whalers from about 1820 (Tanaka 1997). Darling and Mori (1993) documented the extensive use of both the Ogasawara archipelago and the Kerama Islands (Okinawa) by humpback whales for mating and

calving activities. Whales were commonly sighted from December to May, and repeat sightings suggested that some individuals were present for extended periods.

Second, the area around Babuyan Islands and northern Luzon represents the southernmost known breeding and calving area for humpback whales in the western North Pacific (Yamaguchi et al. 2005). Although sighting data show this population is linked to breeding grounds in the Ogasawara Islands and Hawaii, detection and analysis of humpback songs from this area indicate that whales around the Babuyan Islands use different songs than those of other western North Pacific breeding grounds, and may thus represent a unique population. Acebes et al. (2007) reports that whales are present from November to May or June, with peak densities in March and April. Cetacean surveys conducted in 2004 suggest that an even more southern breeding ground for humpback whales along eastern Philippines may exist, but the exact area has yet to be located (J Wang pers comm.). In addition, a wintering population of humpback whales in southern Taiwan that is known to have experienced heavy whaling historically is possibly extirpated from this area, as no humpback whales have been observed in southern Taiwan for decades. However, humpback whales have been observed migrating through Taiwanese waters and the eastern coast of Taiwan is probably used as a migration corridor. Other baleen whale species such as blue, fin, sei, Bryde's, Omura's and minke whales have also been reported from this area (e.g., Chou 1994; Wang et al. 2001).

Additional species of conservation concern. Small resident populations of Indo-Pacific bottlenose dolphin (*T. aduncus*) have been extensively studied in the Ogasawara Islands, Tokyo (142°E, 26°N); Mikura Island, Tokyo (139°E, 33°N); and the Amakusa-Shimoshima Islands, Western Kyushu (130°E, 32°N), Japan (e.g. Shirakihara et al. 2003). Roughly 200-300 dolphins reside around the Ogasawara Islands (Shinohara 1998), 138 have been identified around Mikura Island (Kogi et al. 2004), and 218 are known permanent residents around the Amakusa-Shimoshima Islands (Shirakihara et al. 2002). Differences in acoustic signatures have been documented between these resident populations (Morisaka et al. 2005), which may be an adaptive response to difference in ambient noise between the three locations. Spinner dolphins and sperm whales are also common in this area (Ichiki 2003). Sperm whales can be observed throughout the year in waters with maximum depths >1000m (Mori et al. 1995). In 2003, at least fourteen sperm whales were detected during a five-day expedition west and southeast of Chichijima Island (27°N, 142°E) at a depth of roughly 1000m (Ura et al. 2003). The first sightings of live giant squid (thought to be a prey item for sperm whales) in September 2005 also occurred in the waters off of Chichijima Islands.

MPAs. Marine protected areas off the eastern and northern coast of the Philippines include the following: 1) Batanes Islands Protected Land and Seascape (Luzon Strait, 2135.8 sq km; provides habitat for false killer whale, short-finned pilot, humpback whales; 20°38'36"N, 121°54'7"E); 2) Calayan Island Protected Area (Babuyan Islands, 583 sq km; humpback breeding habitat from December through May; provides habitat for sperm whales, dwarf sperm whales, melon-headed whales; short-finned pilot whales, Fraser's dolphin, spinner dolphin, pantropical spotted dolphin, common and

Indo-Pacific bottlenose dolphin, rough-toothed dolphin, false killer whale, Risso's dolphin, and others), and 3) Northern Sierra Madres Natural Park (NE Luzon, southern portion of Babuyan Channel, 3195.1 sq km; provides habitat for same species as above). Additional MPAs in this region include the Palaui Island Marine Reserve (74.15 sq km; 18°32'27" N, 122°7'48" E), Kenting National Park in southern Taiwan, and Dongsha Atoll National Park located on the North Vereker Bank in the South China Sea.

Recommended spatial exclusions:

- Ryukyu Islands: exclusion to 200 m depth from December through May and year-round coastal exclusion to 20 km (this is important breeding ground for North Pacific humpback whale, particularly December through May, as well as year-round habitat for *T. aduncus*)
- Islands between northern Luzon and Taiwan including Babuyan, Batanes, Calayan Islands: exclusion to 200 m depth from December through May, as well as year-round coastal exclusion to 20 km (these are humpback whale breeding grounds, particularly December through May, and reflect high cetacean diversity year-round)

3. Marine mammal habitat and diversity in the waters surrounding coastal Taiwan

General features. The final leg of the TAIGER survey is expected to take place close to the coasts of Taiwan. The marine habitats and marine mammal species of Taiwan face significant conservation problems due to rapid coastal and riverine development in addition to overfishing. At least 30 species have been confirmed from the waters of Taiwan (see Chou 1994, Wang et al. 1995, Wang and Yang 2007) including finless porpoise (at least two subspecies), Risso's dolphin, long-beaked common dolphin (including the *tropicalis* subspecies), Fraser's dolphin, spinner, pantropical spotted dolphin, striped dolphin, common bottlenose dolphin, Indo-Pacific bottlenose dolphin, Indo-Pacific humpback dolphin, rough-toothed dolphin, false killer whale, pygmy killer whale, short-finned pilot whale, melon-headed whale, killer whale, pygmy/dwarf sperm whale, sperm whale, Cuvier's beaked whale, gingko-toothed beaked whale, Blainville's beaked whale, Longman's beaked whale, blue whale, fin whale, sei whale, Bryde's whale, Omura's whale, minke whale and humpback whale.

Of greatest concern among these is the Indo-Pacific humpback dolphin population of the eastern Taiwan Strait, which is facing serious threats to its continued existence (see below). Populations of other coastal species such as the finless porpoise and Indo-Pacific bottlenose dolphin are suspected to have undergone decline but the reductions in abundance have not been quantified. Density of certain species is also high and predictable, particularly for tropical dolphins and small toothed whales: approximately 238,000 tourists join whale watching ventures off of eastern Taiwan each year (Hoyt 2005).

Indo-Pacific humpback dolphin (Eastern Taiwan Strait and Jiulong River Estuary populations. In 2002, a small and unique population of Indo-Pacific humpback dolphin was discovered in the coastal waters of the eastern Taiwan Strait (ETS). With an

estimated population size of less than 100, this population is listed as "Critically Endangered" on the IUCN Red List. This population is thought to be distinct (Wang et al. 2008a) and is likely to reside in the area year-round (J.Y. Wang, unpublished data) in waters from shore to 3 km. Because of its small size and geographic isolation, this population warrants very high conservation concern (Wang et al. 2004a,b; Wang et al, 2007a,b). Additional threats to this population include noise from all sources, loss of habitat from land reclamation, bycatch, and decreasing freshwater input to estuarine habitats. A second small population of Indo-Pacific humpback dolphin exists along the Jiulong River Estuary and faces the same threats as the ETS population – this population numbers roughly 90 dolphins (Chen et al. 2008). In addition to the ETS and JRE populations, populations of Indo-Pacific humpback dolphins in the South China Sea and nearby are also found in the following areas: Hong Kong/Pearl River estuary (~1500 animals), Xiamen (China)/Chinmen Islands (Taiwan) (80-100 animals) and Beibu Gulf (Gulf of Tonkin) (Jefferson and Hung 2004; Wang et al. 2004).

Groups of Pacific humpback dolphins, which contained mother-calf pairs, increased their rate of whistling after a boat had transited the area (Van Parijs and Corkeron 2001). The authors postulated that the noise from vessels disrupted group cohesion, especially between mother-calf pairs, requiring the re-establishment of vocal contact after masking from boat noise.

Beaked whales. As noted above, numerous species of beaked whales are found off the coast of Taiwan including the East China Sea. A specimen of Blainville's beaked whale was found stranded at Changxin Island, Shanghai in 1994 (Kaiya et al. 1995) and two specimens were discovered at fish markets in Peikang and Tungkang, Taiwan in 1968 (Kasuya and Nishiwaki 1971; Yang 1976). Ginkgo-toothed beaked whales are also found in this area: a female specimen was found stranded on the Yellow Sea coast at Zhuanghe County, Liaoning Province in August 1980 (Shi and Wang 1983). Two Longman's beaked whales stranded alive in Ilan County, northeastern Taiwan (J Wang, pers comm.). Additional species of beaked whales that have stranded in Taiwan include Cuvier's beaked whale (16 specimens), ginko-toothed (8 specimens), and at least 2 Blainville's beaked whales. Additional stranding records of unidentified mesoplodonts and beaked whales are reported from this area. At least one ginkgo-toothed beaked whales stranded in southern Taiwan with massive internal injuries (and no external physical trauma) thought to be caused by a powerful energy source (J Wang, pers comm.).

Baleen whales. Species of baleen whales are known from the coast of Taiwan and East China Sea, include the western Pacific gray whale, humpback, minke, Bryde's, sei, and fin whales. A small separate stock of North Pacific fin whales (or "feeding aggregation") has been generally recognized in the East China Sea (Mizroch et al. 1984; Reeves et al. 1998). Minke whales found in the East China Sea belong to a genetically separate stock called the J-stock, which is found only in this area, the Sea of Japan, and the Yellow Sea (Goto and Pastene 1997). It is believed that the J-stock has declined by more than 50% due to intensive whaling by China, Taiwan, Korea and Japan. Yoshida and Kato (1999) found that Bryde's whales in the East China Sea and coastal waters of

Kochi (southern Japan) are also genetically distinct, possibly at the subspecies level, when compared to offshore populations in the western North Pacific. A newly described species, Omura's whale (B. omurai) has been also been recently recorded from these waters (J Wang pers comm.).

Additional species of conservation concern. At least eight records of stranded pygmy sperm whales have been reported in Chinese waters including Keelung, Taiwan and other locations (see below) (Kaiya et al 1995). Finless porpoise in the East China Sea may constitute two to three populations based on "obvious external differences" (Zheng et al. 2005): the Yellow Sea population (found in the northern ECS), the South China Sea population (found in the southern ECS) and the Yangze River population. Though this species is usually found in nearshore waters, Miyashita et al. (1995) sighted finless porpoises in waters up to 240 km from the coast in the East China Sea. Other cetaceans found in this area include: Indo-Pacific bottlenose dolphins, common bottlenose dolphins, false killer whales, long-beaked common dolphins (including the *tropicalis* subspecies), pantropical spotted dolphins, rough-toothed dolphin, Risso's dolphin, spinner dolphin, and striped dolphin.

During a workshop on strandings of dwarf and pygmy killer whales, Taiwan was identified as a "hotspot" for strandings (SMM Greensboro 2003). A wide diversity of small cetaceans are found in the waters of southern and eastern Taiwan including (at a minimum): long-beaked common dolphin, spinner dolphin, pantropical spotted dolphin, striped dolphin, Fraser's dolphin, Indo-Pacific bottlenose dolphin, common bottlenose dolphin, rough-toothed dolphin, Risso's dolphin, melon-headed whale, pygmy killer whale, false killer whale, killer whale, short-finned pilot whale and the dwarf and pygmy sperm whales (*e.g.*, Wang and Yang 2007). Sperm whales are the most commonly observed large cetacean along eastern Taiwan and have also been recorded from the northern waters of the Philippines (J.Y. Wang, unpublished data).

At least three series of unusual mass strandings have been reported from Taiwan that included the following species: short-finned pilot whales, ginkgo-toothed beaked whale, pygmy killer whale, striped dolphin, Longman's beaked whale, Blainville's beaked whale, pygmy sperm whale, and dwarf sperm whale (Wang and Yang 2006; Yang et al. 2008).

Recommended spatial and temporal exclusions:

- Year-round coastal exclusion in the waters surrounding Taiwan to 20 km (because of Indo-Pacific humpback dolphin and finless porpoise habitat)
- Strait of Taiwan from October through May (due to gray whale migration, as well as high cetacean density including endangered population of Indo-Pacific humpback dolphins)
- Submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat)

APPENDIX B

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-------- Original Message --------

Subject: Comment of L-DEO permit applicaqtion
Date: Mon, 19 Jan 2009 08:37:23 -0500
From:rlbcetacea@aol.com
To: Michael.Payne@noaa.gov, Howard.Goldstein@noaa.gov
CC:chouls@ntu.edu.tw

We would like to comment on the FR notice dealing with the incidental takes of marine mammals during the marine geophysical survey in southeast Asia, March-July 2009 by the Lamont-Doherty Earth Observatory, Columbia University. The permit application is only requesting permission for the incidental harassment of marine mammals (Level B) while conducting the above survey.

The survey area includes the west coast of Taiwan, which is a hot spot for small cetacean mass stranding events (MSEs) or near mass stranding events (NMSEs). Since 1990, at least 16 MSEs or NMSEs involving six species of small cetaceans (pygmy killer whales, rough-toothed dolphins, striped dolphins, pantropical spotted dolphins, melon-headed whales and Ginko-toothed beaked whales) have occurred during all months of the year except May, August, October and December. Taiwan has the highest numbers of pygmy killer whales MSE compared to any other location in the world (Brownell *et al.* 2009). It is possible that at least some of these MSEs may be related to anthropogenic noise. While "NMSF has preliminarily determined that the impact of conducting the seismic survey in SE Asia may result, at worst, in temporary modification in behavior (Level B harassment) of small number of marine mammals", there is no conclusive evidence that the proposed seismic survey will not cause some small cetaceans to strand. Therefore, some mitigation and monitoring plan needs to be developed in case any strandings or near mass stranding events occur.

In addition to the above noted MSEs for Taiwan, one unusual cetacean mortality event occurred in Taiwan between 19 July and 13 August 2005 that involved 23 small cetaceans of seven species. Most of the strandings (74%) were beaked and dwarf sperm whales Yang *et al.* 2008).& nbsp;

R. L. Brownell, Jr.
L.-S. Chou
Institute of Ecology and Evolutionary Biology
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.
Taipei 106, Taiwan
19 January 2009

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Howie Goldstein

From: "Lemnuel Aragones" <lemdva2001@yahoo.com>
To: "Howard Goldstein" <Howard.Goldstein@noaa.gov>; "Howard Goldstein" <howieg12@hotmail.com>
Sent: Wednesday, January 07, 2009 4:30 AM
Subject: Greetings! (concern re incidental mm takes in SE Asia)

Hi Howard

It has been a while since last communicated. Well, I have been back here in the Philippines for two (2) years already, and have been very busy doing lots of stuffs with marine mammals.

I have been to the attention re the proposed 'Incidental takes of marine mammals during the specified activities; marine geophysical surveys in SE Asia, March-July 2009.

Hey, man most of the information used are outdated and most of the literature are from ETP and not really relevant to SE Asia. I hope you this email of mine sooner than later.

I need your help here. Please get in touch with me ASAP.
Mabuhay (cheers in Filipino)
Lem
++++++++++++++++++++++
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The proposed survey will operate in the western North Pacific within the EEZs of Taiwan, China, and the Philippines. Table 3 of the FR notice for this application provides estimates for the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 DB during the proposed seismic survey between March-July 2009. These numbers are based on the regional population sized provided in Table 2. These population sizes are based mainly two sources: (1) the eastern Tropical Pacific (ETP) or (2) the entire North Pacific from Jefferson *et al.* (2008). However, almost all of the regional population estimates in Table 2 are erroneous. Of the 37 cetacean populations listed in Table 2, 22 are from the ETP and have no relationship at all the region to be surveyed in the western North Pacific. For baleen whales, the estimates for western gray whales and western North Pacific humpback whales are correct. The minke whale and Bryde's whale estimates are generally correct. Omura's whale may be common in some parts of the survey area. Sei, fin and blue whales are likely to be rare at best in the survey area. For the small cetacean, 15 of the 28 population estimates are from the ETP and these can not be used for the proposed survey area. Sperm whales may be common as opposed to "uncommon" in deeper waters off the eastern side of Taiwan and in some parts of the Philippines. The estimate for Pacific white-sided dolphins is for the entire North Pacific and this species as noted is rare or does not occur in most of the proposed survey area. Most of the estimated 5,220 – 10,220 finless porpoise occur in the coastal waters of Japan, not in Taiwan or along the coast of China. In the case of Indo-Pacific humpback dolphins, the estimate of 1,680 animals includes about100 from Taiwan. The IUCN has listed the subpopulation [their term] of these dolphins along the a limited part of the western coast of Taiwan as "critically endangered" and the subpopulation is estimated at 100 individuals. Based of the problems of the population estimates noted above, the estimates of the possible number of cetaceans exposed in Table 3 are unrealistic either as the best estimate or the maximum.

The Permit Office appears to have preliminarily determined that the proposed seismic surveys will not cause any death or serious injury to cetaceans in the survey area. This is not a precautionary approach and some consideration should be given to the possibility that some beaked whales or schools of other small cetaceans may mass strand in response to the surveys. Brownell *et al.* (2008) reviewed the numerous fisheries that have used sounds to hunt cetaceans. The success of these fisheries shows that numerous species of small cetaceans avoid and move away from a wide variety of anthropogenic sounds, some as simple as hitting two rocks together underwater. Therefore, some advance plan must be made to respond to any stranding of live animals during the proposed seismic surveys. Attached is a pdf of the Brownell *et al.* (2008) paper.

05 February 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources, National Marine Fisheries Service
1315 East-West Highway, Silver Spring, MD 20910-3225
Eml: PR1.0648-XL89@noaa.gov; michael.payne@noaa.gov

RE: Concerns about the impacts on marine mammals by the proposed L-DEO seismic surveys in SE Asia (FR 78294)

Dear Mr. Payne,

Thank you for the 15 day extension of the commenting period and I appreciate the opportunity to comment on the geophysical survey proposal submitted by Lamont-Doherty Earth Observatory to NMFS for an Incidental Harassment Authorization (IHA) to take a small number of marine mammals, by level B harassment only, in SE Asian waters.

Because of my knowledge of the marine mammals in SE Asia, I was asked by several interest groups to review the merits of the claims made in this proposal from a scientific perspective. And on behalf of the interests of *FormosaCetus* Research and Conservation Group and other groups in the conservation of marine mammals in SE Asia, I am providing my scientific review of the L-DEO's proposal (included at the end of this letter). I apologize for the lengthiness of the review. However, it is a reflection of the number of serious issues with the information provided and my attempts to explain the issues (some of which were complex). I have also included suggestions to help reduce or eliminate (in some cases) impacts on marine mammals by seismic surveys in the future. At best, this proposal appeared to have been hastily prepared without adequate information from local publications or sufficient consultation of experts in marine mammals of the region, contained faulty reasoning (e.g., using the lack of evidence as evidence of absence), did not provide scientific data to support several claims, and failed to provide confidence that the mitigation measures proposed would have even minimal effectiveness. As such, I found it extremely difficult (*if* science was the basis) to understand how NMFS can propose to approve the request of L-DEO. Such a decision would not only reflect poorly on the scientific ability of this US agency but also would be damaging to the reputation of both the agency and applicant (L-DEO, Columbia University). Finally, given that several critically endangered cetaceans inhabit the region and recent studies showing sound levels can be dangerously unpredictable to marine mammals, the only rational decision is to deny the request until the applicant can adequately address the serious shortcomings of their proposal.

Again, I appreciate and thank you for the opportunity to comment on this matter.

Sincerely,

John Y. Wang, Ph.D.
Principal Biologist and Co-Founder
FormosaCetus Research and Conservation Group

Concerns about the impacts on marine mammals by the proposed L-DEO seismic surveys in SE Asia (Federal Register notice 78294)

John Y. Wang, Ph.D.
FormosaCetus Research and Conservation Group

AUTHOR'S BACKGROUND

I have conducted research on marine mammals for over 20 years with more than 15 years of that time focused on marine mammals in SE Asian waters. My work has included collaborations with local researchers from Taiwan, China, Hong Kong, Japan and the Philippines. Most recently, since my research team discovered the highly threatened and distinct population of humpback dolphins in the eastern Taiwan Strait (= off western Taiwan) in 2002, the focus of my team has been to understand the biology and conservation status and needs of this population. Our studies have been crucial in allowing the IUCN Red List to determine this population is "critically endangered". I am the principal biologist and a co-founder of the *FormosaCetus* Research and Conservation Group, which is a non-governmental organization whose mission is to provide an independent and objective voice on cetacean conservation in Taiwan based on, and by conducting, scientifically credible research. I am also a member of the IUCN Cetacean Specialist Group, an adjunct researcher at the National Museum of Marine Biology and Aquarium (Taiwan), an adjunct professor at Trent University (Canada) and affiliate professor at George Mason University (USA).

SUMMARY

The recent proposal by Lamont-Doherty Earth Observatory (L-DEO) to NMFS for an Incidental Harassment Authorization (IHA) to 'take' small numbers of marine mammals by Level B Harassment only, during geophysical surveys in the waters of SE Asia as part of the TAIGER project came to my attention in early 2009. After reviewing the proposal in detail, I am very concerned about the impacts that the proposed survey, using a massive airgun array, will have on local marine life. What is even more troubling is that NMFS has determined that the proposed activity "*may result, at worst, in a temporary modification in behaviour (Level B Harassment) of small numbers of marine mammals*" and proposes to issue an IHA, which demonstrates that either the reviewers of the proposal lacked knowledge of SE Asian marine mammals or chose to ignore the potential damage such seismic surveys can have on small and critically endangered populations of marine mammals in the region. The issues raised here specifically focus on marine mammals but should not be seen to imply that impacts on other marine organisms such as marine reptiles, fish, and other marine taxa are insignificant but rather that my expertise is with marine mammal science.

There is little knowledge available for most of the marine mammal species that inhabit the waters of SE Asia and what little information exists is only for a small proportion (mostly coastal waters) of the expansive region. Few estimates of abundance or distribution exist. However, it is clear that this region has a high diversity of marine mammals, many of which are in serious danger of extinction. Marine mammals are facing a myriad of serious threats and new threats such as the present seismic survey are taxing the populations further but to an unknown extent. Some marine mammals have already been reduced to numbers so low that even minimal 'takes' can have a devastating and possibly irreversible impact on the remaining population. The risks of the potential impacts of additional threats on seriously threatened cetaceans are too high, especially because there are too many uncertainties about the threat and the potential victims in the region, which need to be studied and understood well before potentially harmful levels of noise are transmitted into the oceans around Taiwan (e.g., how sound propagates in various kinds of bathymetry and oceanic

conditions where the seismic surveys are to be conducted). With a lack of knowledge about even the most basic biology of marine mammals in the region, any determination of the level of impact of the seismic surveys would be little more than a random guess. The fundamental unknowns include: species composition, population structure, distribution, abundance and population trends.

Nevertheless, L-DEO has declared that the impacts of its proposed seismic surveys on local marine mammals will be minimal. However, it needs to be made clear that experts in local marine mammal science are far from sharing this same trivialized perspective. For example, in terms of timing and track lines, it would be difficult to design a survey to have a greater potential of damaging local marine mammal populations than that proposed by L-DEO. This survey is to be conducted when many local marine mammal populations are most vulnerable (during or shortly after their calving periods) and in waters that are important to local marine mammals that include critically endangered populations and species (e.g., tracks pass through almost the entire distribution of the critically endangered population of humpback dolphins, follows closely the edge of the continental shelf where marine mammals concentrate, passes through waters when humpback whales are in wintering/calving grounds and during migration).

After reviewing the proposal, I cannot agree that the applicant has attempted to minimize the impacts of its survey, taken a precautionary approach in addressing potential impacts or adopted mitigation measures that are effective. Wherever uncertainties in impacts and knowledge exist, the applicant consistently interpreted the uncertainties as supporting its position of little or no impact. Not only are such interpretations biased, misleading and contradictory to the applicant's recognition of the need for precaution but also, most importantly, scientifically incorrect. Absence of evidence is NOT evidence of absence.

Furthermore, I cannot agree with L-DEO and NMFS that the proposed survey will have a negligible impact on local species or stocks of marine mammals. The estimated number of individuals affected (>50,000 and with 68.7% of one critically endangered population of dolphins being affected) cannot be considered 'small' ("less than a few percent of any of the estimated population sizes"). There is also a high likelihood that many individuals will be exposed to sound levels that qualify as Level A harassment. Any additional threats (especially those where many uncertainties exist about their impacts and that have the potential to cause serious harm or even death) to cetaceans on the brink of extinction are not 'negligible' for the affected species or stocks.

The request for an IHA should be rejected until L-DEO is able to demonstrate convincingly that it has a good understanding of the region's marine mammals and other taxonomic groups that can be impacted and has the ability to eliminate or reduce (to negligible levels) the impacts on local marine mammals (especially those that are seriously threatened with extinction or are known or suspected to be particularly sensitive).

MAIN CONCERNS

1) There are several cetaceans in this region that are particularly sensitive or are highly vulnerable given their low remaining numbers
2) Many of the tracklines proposed appear to maximize risk to cetacean populations in the waters of Taiwan, some of which are critically endangered under the 2008 IUCN Red List
3) The period of the proposed survey also overlaps greatly with the presence of the most vulnerable members of marine mammal population (females with young calves) some of which may be found in aggregations or following certain migration routes during this time
4) The effectiveness of the mitigation measures proposed by L-DEO for reducing threats range between having questionable effectiveness and being entirely inadequate

Details of the main concerns follow.

1) SPECIES OF CONCERN

In Taiwan, all cetaceans are "Protected Wildlife" under the Wildlife Conservation Act of Taiwan (see http://eng.coa.gov.tw/./content.php?catid=9005&hot_new=8870). Article 18 (1) states that, "protected wildlife should be conserved and shall not be disturbed, abused, hunted, killed or otherwise utilized, except...for academic research or educational purposes and with proper approval from the NPA" [NPA – National Principal Authority] and disturbance and abuse were defined as, "any behavior involving the use of drugs, tools or any other means so as to interfere with wildlife" and "the use of violence, unsuitable drugs or other methods to harm wildlife so they cannot maintain their normal physiological condition".

Several seriously threatened species and stocks of cetaceans exist in these waters, including: eastern Taiwan Strait population of Indo-Pacific humpback dolphins, western gray whale, North Pacific right whale, western North Pacific humpback whale and western North Pacific blue whale. All of these cetaceans have been brought to the brink of extinction and exist at critically low numbers so that even minimal impacts can cause irreversible damage to the population. Also, at least four species (and three genera) of beaked whales, known to be highly sensitive to intense noise, occur in these waters. Although there are no abundance estimates for any beaked whales in Taiwanese waters, the numbers are suspected to be fairly high given the number of stranding records, reports of fisheries interactions and recent sightings. Finally, there is strong evidence that finless porpoises comprise two species so each species needs to be considered separately. Finless porpoises are also arguably the most difficult cetacean to detect at sea by observers so many will be missed by MMVOs during seismic operations. Therefore, an unknown (potentially large) number of finless porpoises will be exposed to much greater noise levels than suggested by L-DEO (especially since detection is effectively zero beyond about 1 km yet the predicted distance for received levels >190dB is more than 2km from the source).

Indo-Pacific Humpback Dolphin, *Sousa chinensis*, eastern Taiwan Strait population

This distinct (Wang et al., 2008a) population is very small at <100 (Wang et al., 2007a) and a year-round resident (J.Y. Wang, unpublished data) of a very restricted (~200km) stretch of shallow coastal waters along western Taiwan (=eastern Taiwan Strait) (Wang et al., 2007b). These dolphins have been found in waters from shore out to about 3 km and in water depths that vary from 1.4m to about 25m deep (see Wang et al., 2007a; Chou 2006). The ETS population is experiencing many threats; the five most serious threats are (in no particular order): loss of habitat due to land reclamation, decrease of freshwater to river estuaries upon which the dolphins are dependent, pollution, bycatch in fisheries and noise (see Wang et al., 2007b). Unless effective mitigation measures are taken immediately to reduce these threats, it is unlikely that the population will continue to exist (Wang et al., 2004, 2007b). Any single threat has the potential to be the final cause of extinction. Mortality (by human causes) of even a single individual per year from this population is not sustainable.

An international panel of experts, the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG), was established in early 2008 to provide scientific guidance and advice on the conservation of this population to all interest groups. In 2008, this population was listed in the IUCN Red List as "Critically Endangered", the category with the greatest risk of extinction. This species is under the highest level of legislative protection of the Wildlife Conservation Act of Taiwan

The survey being proposed will bring the *Langseth* to waters within 1 km from the shores of Taiwan and right through the middle (longitudinally) of almost the entire linear coastal distribution

of the ETS population (with the exception of a very small area where the proposed tracks takes the *Langseth* to the mainland Chinese coast before returning to western Taiwan). At this distance from shore, the *Langseth* will inevitably subject the entire population to noise levels >>180dB. According to NMFS, to prevent permanent physiological damage (which the Federal Register notice (FR) considers Level A harassment), cetaceans should not be exposed to pulsed underwater noise at received levels of 180dB or greater. Even staying at least 2km from the coastline (the proposed mitigation measure for reducing the impact on the ETS population) does absolutely nothing to reduce the noise exposure for these critically endangered dolphins. And based on the values in Table 1 of the FR, even at 8-10km from shore, all dolphins will still be exposed to at least 160dB with an unknown number that may be exposed to >180dB (see below for explanation).

The above statements are based on the predicted rms distances for different levels of exposure (Table 1 of the FR), which *underestimates* actual exposure levels in shallow waters and does not consider the issues with: reflection, reverberation, rarefaction, superposition and constructive interference (see Shapiro et al., 2009) of sound waves in waters that abut concrete sea walls found along much of the central western coast of Taiwan; the very shallow water depths of western Taiwan (with a tidal fluctuation up to about 5-6m that can affect the depth in which the dolphins are found during exposure); and the many sandbars and some extensive mudflats that can force animals to be further 'offshore' during lower tides. The water depths in the very broad category of 'shallow' water (being <100m in the FR) are not sufficient to understand the exposure level for a species that occupies water depths at the lowest end of the 'shallow' water category. It is expected that the exposure levels will be much higher at any given distance from the source than the predicted values suggested.

Furthermore, the difficulty in predicting sound levels underwater must be taken into account. Madsen et al. (2006) reported that seismic sounds did not always attenuate predictably and sound levels can be the same at 2 km as well as at 12km. The same unpredictability was found for sounds from acoustic harassment and deterrent devices, where increasing distance from the sound source did not always result in a reduction of exposure levels (Shapiro et al., 2009). Even within a fraction of a meter, sound level differences may be several orders of magnitude (Wahlberg (2006) as cited in Shapiro et al., 2009). These studies are inconsistent with classic ideas of sound propagation and attenuation (see Richardson et al., 1995) and are very concerning because the very dynamic nature of the waters of western Taiwan and the concrete walls lining the shoreline may result in the sounds the airguns to reach unexpectedly dangerous exposure levels within the distribution of the ETS population.

The cumulative exposure of these dolphins to noise was not considered by L-DEO. The ETS dolphins live in an environment which is already very noisy (e.g., pile driving and other noise-generating activities during coastal construction, shipping, other seismic surveys (oil and gas, local researchers, etc.). The cumulative impact of all noise sources needs to be examined in the context of the contributions from these airguns. Percussive pile driving has been shown to disturb and increase swimming speeds of humpback dolphins (Wursig et al., 1999; Jefferson, 2000) and noise from boat traffic can affect the acoustic behaviour of humpback dolphins, with mother-calf pairs being the most disturbed (van Parijs and Corkeron, 2001). Boat traffic can also affect the diving and swimming behaviour of humpback dolphins (Ng and Leung, 2003). It is reasonable that the more intense noise from airguns will affect these dolphins causing physiological stress (see Wright et al., 2007a, b) and possibly permanent damage if the exposure is large and long enough. Low level exposures may not kill or injure animals directly but can cause mortality, worsen injuries or increase stress greatly for already compromised individuals. Based on photo-identification, about 30% of the ETS dolphins bear serious injuries from other threats (e.g., entanglement in nets and ropes; vessel collision) that likely affect their abilities to swim, forage and otherwise behave

'naturally'. In 2008, a dolphin was seen with a rope wrapped around its torso (J.Y. Wang, unpublished data). These compromised dolphins would be highly vulnerable to other threats because of their reduced ability to flee the intense noise. Therefore, the most vulnerable members (including mothers with young calves) are likely to be exposed to the greatest levels and for the longest duration. Furthermore, seismic surveys can also 'mask' important sounds and increase the risk of other existing threats (e.g., increased entanglement in nets and collisions with ships as a result of distraction from or a reduced ability to detect these threats).

Given the threat of noise on the health of the ETS dolphins, the ETSSTAWG recommended a buffer for noise threats out to at least 5km from shore (note: for an area with an expansive littoral zone such as western Taiwan, 'shore' can vary greatly with tides; for clarity, 'shore' is defined here to include the littoral zone at the lowest tide of the year) after reviewing a proposal for designation of Major Wildlife Habitat for the population (review letter to Taiwan Wild At Heart Legal Defense Association – dated 29 December 2008 - available upon request). Calculations of how far out the *Langseth* should be to prevent exposure of ETS dolphins to received levels >160dB should be based on at least the recommended 5km buffer boundary (i.e., the waters from shore, as defined above, to 5km offshore should not be exposed to levels >160dB). Based on the values presented in Table 1 (of the FR) the source should not be closer than 13 km from shore. However, given the population's critical status and the underestimated predicted distances for each exposure threshold level (especially for shallow water; see above), greater precaution is needed (i.e., the airguns should be even further from shore).

L-DEO's estimation of the number of critically endangered ETS humpback dolphins that might be exposed to greater than or equal to160dB was a staggering 68.7% of the population. This is by far the largest proportion of any cetacean in the region to be affected. Also, given the proposed tracklines, a likely large but unknown number of ETS dolphins will be exposed to levels >>180dB, which may result not only in level A harassment but also permanent injuries or even death. Furthermore, I contend that L-DEO severely underestimated the number of affected dolphins. The *Langseth* will transect almost the entire distribution of the ETS population. These waters have no acoustic shelters so the dolphins are not capable of escaping to quieter waters and are completely exposed for the duration of the survey. *Sousa chinensis* is also a slow swimming species with average speeds between 3.6 and 7.2 km/hr (Saayman and Tayler, 1979l; Jefferson, 2000) but much slower during resting periods (Saayman and Tayler, 1979) - observations of the ETS population (unpublished data) are consistent. As such, the ETS dolphins will not be able to outrun the *Langseth* (even while towing airguns, the operating speed is reported to be between 7.4-9.3 km/hr). Therefore, nearly the entire population (especially the most vulnerable members: mothers with young calves and other compromised individuals) will be affected by the seismic surveys along western Taiwan regardless of where the dolphins are in their distribution and an unknown but substantial number will be exposed to levels >180dB. Clearly, the proportion of the ETS population to be impacted by the seismic survey (and at dangerous exposure levels) is far too high for any cetaceans let alone one that is critically endangered.

In light of the recent IUCN Red List assessment and the many issues discussed above, the proposal to conduct seismic surveys in the coastal waters off western Taiwan needs to be reconsidered with much more precaution. Consultation with local experts and the ETSSTAWG is recommended.

Jiulong River Estuary (JRE) Humpback Dolphins, *Sousa chinensis*

The JRE population has been estimated at less than 90 dolphins (Chen et al., 2008). The JRE population is distinct from the ETS population (Wang et al., 2008a) but the level of exchange (if any) with other provisional populations along the mainland Chinese coast is unknown. With

such low abundance, this population is also likely to meet the IUCN Red List criteria for "critically endangered". The population is facing the same threats as those faced by the ETS population: bycatch in the numerous net fisheries, habitat degradation, reduction of freshwater to the Jiulong River estuary, increasing pollution, prey reduction and noise. Some dolphins were killed by blasting during coastal construction activities (Wang et al., 2003). Less is known about this population than that of the ETS. The distribution of the JRE population near Xiamen (China) has been studied but their distribution in adjacent waters around the Chinmen islands and further east are completely unknown and were not surveyed by Chen et al. (2008).

The shallow water habitat of *Sousa chinensis* is more expansive on the western side than eastern side of the Taiwan Strait. One of the *Langseth's* approaches to the mainland Chinese coast is directly in line with the heart of the JRE population. At a distance of 10km from shore, dolphins using waters east of the Chinmen islands may be exposed to levels greater than 160dB and some may be exposed to >180 dB depending on where the dolphins are found in their distribution and how close the *Langseth* is to the 25-30m isobath (which appears to be the depth limit for the species – see Jefferson and Karczmarski, 2001). Not enough is known about this population to estimate the numbers of dolphins that will be impacted. Given such a small population size, even minimal disturbance can have a large impact on the population.

Other *Sousa chinensis* along the coast of China

The other of two proposed approaches to the mainland Chinese coast by the *Langseth* will be in the waters near Pingtan (where records of *Sousa chinensis* also exist – see Wang, 1999; Zhou, 2004). However, almost nothing is known about *Sousa chinensis* in these waters so the impact of the seismic survey cannot be estimated. *Sousa chinensis* is listed as 'near threatened' under the IUCN Red List and is afforded the highest level of protection in China and Hong Kong.

Given the serious conservation status of the ETS population and the small population size of the JRE provisional population, there must be a higher level of precaution to avoid negative impacts of additional threats on these dolphins. Because even low level noise may increase risks to these dolphins by altering dolphin behaviour, increasing ambient noise levels that can 'mask' biologically important sounds as well as 'mask' sounds that allow the detection of other threats (e.g., the sound of water flowing past gillnets, approaching boats, etc.) should be avoided. Until the effects of seismic surveys on these shallow water dolphins and the combined and cumulative impacts of all threats can be better understood, a 'safe' exposure level cannot be determined. Finally, a large proportion of the prey of *Sousa chinensis* is bottom-dwelling fish (Barros et al., 2004), some of which are highly acoustic such as species of the family Sciaenidae (known as drums and croakers because of the sounds made by members of this large group of fishes) (e.g., see Sadovy and Cheung, 2003). Many sciaenids spawn during the spring. How seismic surveys will impact these important prey species and in turn affect these coastal small cetaceans was not addressed in the proposal. The long and short-term impacts on these important prey species of humpback dolphins (and other cetaceans – see below) have not been addressed by L-DEO. Because there is evidence that ETS dolphins may be showing signs of nutritional stress (J.Y. Wang, unpublished data), changes to the availability of their main prey may have a large impact on these dolphins, especially pregnant or lactating females.

Finally, although large pink/white animals are highly visible within 1 km in calm conditions, younger grey and spotted animals can be easily missed. However, beyond 1 km, high atmospheric humidity and smog that is often present along the west coast of Taiwan can reduce visibility of these animals by a considerable but unquantified amount (personal observation) even with optical aids. Furthermore, because these dolphins are often swimming along the shoreline next to the surf,

even pink/white dolphins can be easily missed by offshore observers looking inshore towards the surf. Jefferson (2000) showed that humpback dolphin sightings dropped off considerably beyond a perpendicular distance of about 400-500m and none were observed beyond about 1500m. Within the predicted (but underestimated) distances for exposure to >180dB, many dolphins can go undetected by MMVOs.

Western Gray Whale (*Eschrichtius robustus*)

This is a very small (~100 individuals) population (Cooke et al., 2006) that is generally found in fairly shallow (i.e., continental shelf) waters of the Okhotsk Sea (mainly off northeastern Sakhalin Island) and off eastern Kamchatka, Russia (Weller et al., 1999) during the summer. The wintering ground is unknown but believed to be somewhere in the waters of southern China, possibly around Hainan Island (northern part of the South China Sea) (Wang, 1984). Migration between summering and wintering grounds is unknown but records exist along more or less the entire Chinese coast (Omura, 1988; Zhu and Yue, 1998) so is likely through the Taiwan Strait (most of the Taiwan Strait has never been studied for cetaceans, with the exception of coastal waters very close to shore). Migration likely occurs as with other baleen whales during the spring (northwards) and autumn/winter (southwards) seasons. This species is afforded the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed as "critically endangered" in the IUCN Red List. Even the take of a few individuals was projected to cause a continuing decline in the population towards extinction (Cooke et al., 2006).

North Pacific Right Whale (*Eubalaena japonica*)

This small population numbers no more than a few hundred. Its distribution poorly known, especially the wintering grounds where calving and nursing occurs; the wintering grounds may be as far south as the East China Sea. This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed as "endangered" in the IUCN Red List.

Very little is known of the species. But in the EA, there is mention that right whales were taken in the Taiwan Strait in early times. Therefore, it is highly possible that some right whales still use the Taiwan Strait.

Western North Pacific Humpback Whale (*Megaptera novaeangliae*)

There are several wintering populations of humpback whales in the North Pacific. In the western North Pacific, humpback whales were greatly reduced by past whaling and only about 1000 remain (Calambokidis et al., 2008). One wintering population found in the waters of southern Taiwan was decimated (Darling and Mori, 1993) and almost certainly extinct as there have been no sightings in these waters in recent decades (Wang and Yang, 2007) even though, these waters are fairly extensively utilized by fishing boats and recreational activities. Past records showed whales were observable from shore. Another small wintering (calving and nursing) ground was recently discovered in the waters of the Babuyan Islands in the northern Philippines (Yaptinchay, 1999; Acebes et al., 2007). Humpback whales are present in these waters from November to May/June but peak from February to March/April (Acebes et al., 2007). These whales migrate between summering and wintering grounds through Taiwanese waters, mainly along the east coast of Taiwan (=Philippine Sea) but there are also records from the shallow waters of the Taiwan Strait (J.Y. Wang, unpublished data).

Although the humpback whale is listed as "least concern" in the IUCN Red List (mainly because populations elsewhere have recovered greatly from past commercial whaling), there are still great concerns about some stocks of humpback whales, including the western North Pacific stock, which has shown no signs of recovery and contrasts greatly with the eastern North Pacific

stock. Separate IUCN Red List assessments for these different stocks are required. This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan. The small size of the Babuyan wintering population, lack of recovery of western North Pacific humpback whales and the extirpation of the southern Taiwan wintering population all reflect the vulnerability the western North Pacific stock.

For gray, right and humpback whales some common issues arise from the seismic surveys. The timing of the L-DEO surveys overlaps, spatially and temporally, with whales wintering (calving and nursing) in the region's waters (see above) and during the northward migrations of mothers with neonatal or other young calves from these calving/nursing grounds. Mother-calf pairs of humpback whales appear to be more sensitive to loud noises and have reacted to impulsive noise levels of as low as 140dB (McCauley et al., 2000). No data exist for the gray and right whales of the region but it is reasonable to expect that mother and calf pairs of these species would also be the most sensitive.

For whales that are using the shallow waters (e.g., Taiwan Strait), the predicted distance for exposure levels to be >160dB was 6227 to 8000m and for 180dB the distances 2761 and 3694m. At these distances, detection of whales by observers can be difficult to impossible depending on sighting conditions. Therefore, some whales may be exposed to >180dB without being detected by observers.

Noise from seismic surveys can also 'mask' important sounds and increase the risk of other existing threats (e.g., increased entanglement in nets and collisions with ships as a result of distraction from or a reduced ability to detect these threats). Displacement of whales from their 'normal' migration routes may also increase the risk of encountering other threats.

Simple strategic scheduling of the seismic survey can eliminate or at least greatly reduce the impacts on this population. Only with better coverage of the region's waters by dedicated cetacean surveys can our understanding of these species in the region increase and allow the fine tuning of seismic surveys to avoid whales.

Western North Pacific Blue Whale (*Balaenoptera musculus*)

There is evidence that supports a separate western North Pacific stock of blue whales (NMFS, 1998). Its abundance is unknown but none has been seen in recent times from Taiwan to southern Japan where hunting once occurred (Clapham et al., 2008). The population is likely greatly depleted and possibly extirpated (see NMFS, 1998; Clapham et al., 2008).

The blue whale is listed as "endangered" in the 2008 IUCN Red List. The North Pacific stock was listed as 'lower risk/conservation dependent' by the 1996 IUCN Red List based mainly on the numbers and evidence of increase from a small part of the stock's distribution (i.e., in Californian waters). Reassessments of stocks of blue whales using the revised criteria (version 3.1) are needed as the 'lower risk/conservation dependent' category no longer exists and the western North Pacific stock is recognized as a separate entity (NMFS, 1998). The species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan.

If small numbers of western North Pacific blue whales still exist, seismic surveys can have a large impact on the few remaining individuals.

Beaked whales (family Ziphiidae)

At least four species of three genera of beaked whales, which appear to be especially sensitive to intense noise, are known from Taiwanese waters: Cuvier's beaked whale (*Ziphius cavirostris*), Longman's beaked whale (*Indopacetus pacificus*), Blainville's beaked whale (*Mesoplodon densirostris*) and ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*). Based on

the criteria of MacLeod and Mitchell (2006), Taiwan is a 'key area' for beaked whales. Although there are no abundance estimates for any of these species in Taiwanese waters, the numbers are suspected to be fairly high given the many stranding records, reports of fisheries interactions and sightings. Recent systematic surveys of the waters of SE Taiwan (J.Y. Wang, unpublished data) revealed much higher sightings per unit effort of beaked whales than reported for Hawaiian waters (Baird et al., 2006), which have already been identified as a 'key area' for beaked whales (MacLeod and Mitchell, 2006).

Beaked whales have been recorded in the waters off the entire eastern coast of Taiwan and strandings have also been recorded in SW Taiwan and several places along western Taiwan (see Wang et al., 1995; Wang, 1999; Zhou, 2004; Wang and Yang, 2006; Yang et al., 2007). Although the waters off western Taiwan are usually considered shallow and not preferred habitat of beaked whales, they can occur in waters off NW and SW Taiwan where deep water is present or nearby.

Of note, *M. ginkgodens* has not been observed alive at sea and <25 specimens are known (see MacLeod et al., 2006). There have been at least 10 (likely more) stranding and catch records of this species from Taiwan (J.Y. Wang, unpublished data) since the early 1990s and recent surveys off SE Taiwan resulted in sightings (and photographs) of a species of mesoplodont, which has not been seen before and almost certainly *M. ginkgodens* (note: the only other mesoplodont recorded from Taiwan is *M. densirostris*, which clearly was not the species observed); it was the most frequently encountered species in the waters surveyed near Green Island (J.Y. Wang, unpublished data) and probably not as rare as once believed (at least for Taiwanese waters). There is evidence that at least some species of beaked whales may exhibit strong site fidelity (e.g., Gowans et al., 2000; McSweeney et al., 2007) but this has not been studied for beaked whales in Taiwanese waters.

Beaked whales in Taiwanese waters are threatened by large-mesh pelagic driftnet entanglement (Perrin et al., 2005), direct hunting, vessel collisions (large volume of commercial shipping occurs all around Taiwan) and noise from vessels, live-fire military exercises, naval sonar and seismic surveys (research and commercial). Military exercises of all forms and by many nations are common in and around Taiwanese waters and recently the Taiwan navy purchased four US-made Kidd-class destroyers, which possess the 53-C mid-frequency active sonar implicated in the mortality of beaked whales in the Bahamas (Balcomb and Claridge, 2001; Evans and England, 2001). The waters around Taiwan are also one of the few places in the world where the US Navy can use their powerful low frequency active sonar (LFAS). In 2004 and 2005, unusual multiple stranding events occurred and involved several deep-diving species including beaked whales (Wang and Yang, 2006; Yang et al., 2008). Shattered ear bones and massive injuries to internal structures associated with diving and acoustics were reported for a *M. ginkgodens* that stranded in SW Taiwan (Wang and Yang, 2006). Yang et al. (2008) also reported finding "bubble lesions" in two beaked whale carcasses that stranded in NE Taiwan in 2005.

Three species of beaked whales occurring in this area are listed as "data deficient" by the IUCN Red List while Cuvier's beaked whale is "least concern". Beaked whales are protected under the Wildlife Conservation Act of Taiwan.

The tracklines of the proposed seismic survey overlap much of the waters that are known or suspected to be important habitat for beaked whales. Waters along the edge of the continental shelf (especially where the strong, warm and oligotrophic Kuroshio Current meets the shelf edge and nutrient input from terrestrial sources) are particularly productive and appear to attract cetaceans, including beaked whales. Tracklines that run near and parallel to the edge of the continental shelf around Taiwan will have the greatest impact on cetaceans, being possibly most damaging to beaked whales. However, without more cetacean survey information, it is uncertain if just moving

tracklines offshore from the shelf edge would be effective in reducing impacts on beaked whales or if the relocation of tracklines would harm different species or other populations offshore.

Recent multiple sightings of *M. ginkgodens* during dedicated cetacean surveys of waters off SE Taiwan demonstrate the importance of such studies. Cetacean surveys are needed in the waters off eastern Taiwan (particularly in waters beyond 20km from shore where almost no cetacean survey effort exists) to determine if and what concentrations of beaked whales exist in those waters. Cetacean surveys in the waters off SW Taiwan where the important deep Penghu Channel exists are limited. This channel has a steep eastern wall that borders against the SW shores of Taiwan and helps to funnel a branch of the Kuroshio Current and the South China Sea Current to the northern tip of the channel ending in an important area of complex seasonal mixing with the cold China Coastal Current (Jan et al., 2002). Systematic cetacean surveys of the waters of these waters are needed before seismic surveys are conducted so that better planning with adequate information can reduce impacts on beaked whales and other cetaceans.

Finless porpoises (genus *Neophocaena*)

There is strong evidence that finless porpoises comprise two species (Wang et al, 2008b) that need to be considered separately. The population size is unknown but as a group, finless porpoises are probably the most abundant coastal cetaceans in Chinese waters. Finless porpoises (of either species) are also arguably the most difficult species to detect at sea even during ideal sighting conditions (i.e., good lighting, decent weather and calm seas) and by experienced observers. They are small in size, lack a dorsal fin, have brief surface times and usually occur individually or in small groups. Depending on the behaviour of the animals, they can be near impossible to detect. Jefferson et al. (2002) reported that during calm sighting conditions, finless porpoises were observed primarily within 300m from the trackline (perpendicular distance) and none were observed beyond about 700m. Finless porpoises are generally slow swimmers and avoid boats but short high-speed bursts have been observed.

This species is afforded the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and are listed as "vulnerable" in the IUCN Red List. However, some populations are being threatened more seriously (e.g., the Yangtze River population is listed as 'endangered').

In shallow waters (Taiwan Strait), the predicted distance for exposure levels of 180dB and 190dB was estimated by L-DEO to be 2761 to 3694m and 1600 to 2182m, respectively. At these distances (which are underestimated – see above) and under ideal sighting conditions, detection of finless porpoises by observers is of limited ineffectiveness at the closest range and very ineffective at the greater distances. Even in slight seas, sighting effectiveness will drop dramatically even for highly experienced observers. Under conditions where white caps are present, sightings of finless porpoises are rarely made and researchers generally stop observations. At several kilometers distance in shallow water, PAM would not be able to detect finless porpoises adequately because finless porpoises are not always actively vocalizing and the very high frequency sounds emitted by porpoises (Akamatsu et al., 1998) attenuate quickly so the PAM's detection range will be limited. Therefore, finless porpoises can and will likely be exposed to >>180dB without being detected especially if sighting conditions are not ideal. For finless porpoises, L-DEO's airguns have the potential to inflict serious permanent injuries or even cause death, directly or indirectly.

Noise from seismic surveys can also 'mask' important sounds and increase the risk of other existing threats (e.g., increased entanglement in nets and collisions with ships as a result of distraction from or a reduced ability to detect these threats). There is a serious net entanglement

threat to finless porpoises in all coastal waters throughout Chinese waters (Reeves et al., 1997) and evidence of vessel strikes have also been observed (J.Y. Wang, unpublished data).

Finless porpoises appear to go undergo inshore-offshore migrations seasonally (see Jefferson and Hung, 2004) but this is not well understood. During the timing of the proposed seismic surveys, many finless porpoises will be in the Taiwan Strait (as evidenced by bycatch records and some sighting data – J.Y. Wang, unpublished data) and an unknown (but potentially large) number will be exposed to the airgun sounds. Furthermore, the timing also coincides with the presence of many female with newborn calves in these waters. These will be the most vulnerable individuals as they will be less able to escape the wide range of the airguns in shallow waters. The potential impact on finless porpoises is far from negligible and none of the mitigation measures proposed would be effective in reducing the harm.

Several other baleen whales have been recorded from Taiwanese waters. However, due to almost no survey effort in the waters beyond about 20km from shore and surveys being most in summer months, little is known about these species, which include: fin, sei, minke, Bryde's and Omura's whales. There are reports of several distinct stocks of some of these species. As a minimum, the impact on each stock of each species should be assessed rather than just at the species level and more work is needed on understanding stock structure before impacts can be understood.

All baleen whales species are given the highest level of legislative protection under the Wildlife Conservation Act of Taiwan. Both the sei (*Balaenoptera borealis*) and fin (*B. physalus*) whales are listed as 'endangered' under the IUCN Red List. Little is known of both species in this region but a distinct population of fin whales is believed to exist in the East China Sea (Fujino, 1960). The common minke whale (*B. acutorostrata*) is under the "least concern" category of the IUCN Red List. However, the 'J-stock', which inhabits waters that include the East China Sea, is believed to be distinct from other minke whales (evidenced by a reproductive cycle that is asynchronous with others) and has been reduced by >50% by whaling (Reeves et al., 2003). The J-stock of minke whales continues to be hunted or net-caught by Japanese and Korean whalers/fishermen and is of conservation concern. Furthermore, bycatch of minke whales appears to be common in Chinese waters but this has not been quantified. Although both Omura's (*B. omurai*) and Bryde's (*B. brydei*) whales are listed as "data deficient" by the IUCN Red List, considerable confusion with regards to taxonomy and nomenclature remains amongst whales that resemble the Bryde's whale. Very little is known about the biology of these whales in the region including how many species exist but there is evidence of distinct populations of Bryde's whales (Yoshida and Kato, 1999) in the East China Sea. An estimate of 137 was reported for the East China Sea stock of Bryde's whales (IWC, 1996), which may have been depleted by whaling (Omura, 1977). These whales were also captured in Taiwanese waters but none have been seen in recent years. The impact of loud intense noise on individuals of these species is likely to be similar to the other baleen whales but the impact on populations is unknown.

Loud intense noises have also been suspected to disturb or harm other odontocete species that are found in the waters of Taiwan including (but not limited to): sperm, (*Physeter macrocephalus*), melon-headed (*Peponocephala electra*), short-finned pilot (*Globicephala macrorhynchus*), dwarf and pygmy sperm (*Kogia sima* and *K. breviceps*) and pygmy killer (*Feresa attenuata*) whales (see Wang et al. 2001; Wang and Yang, 2006; Wang and Yang 2007) and spinner (*Stenella longirostris*), striped (*Stenella coeruleoalba*) and coastal Indo-Pacific bottlenose (*Tursiops aduncus*) dolphins (see Wang et al., 1999; 2000a,b; Perrin et al., 2005; Wang and Yang, 2007). Most of these species are poorly known in the area but it would be scientifically incorrect to

interpret the lack of knowledge as meaning the impacts are likely to be less – we may find these species to be just as vulnerable when our knowledge improves.

It has been suggested that recent mass strandings of melon-headed whales were related to the use of naval sonar (in Hawaiian waters – Southall et al., 2006) and seismic surveys (in Madagascan waters) so there is growing concerns about the potential impact of such activities on this species. Although melon-headed whales are not commonly-observed, they have been sighted on several occasions in the waters of eastern Taiwan and SW Taiwan and harpoon captures and two mass stranding events have been recorded from NE Taiwan and western and southern Taiwan, respectively (Wang et al., 2001a). Although the short-finned pilot whale has not been a major species of concern in other parts of the world, four unusual stranding events (with two being mass strandings) involving short-finned pilot whales occurred at several places in and near Taiwan over a short period and coincided spatially and temporally (accounting for the direction and strength of local currents) with large-scale military exercises in the region (Wang and Yang, 2006). Several mass strandings of pygmy killer whales have occurred in SW Taiwan with at least one individual exhibited unusual internal haemorrhage deep in the melon (Wang and Yang, 2006) and they have been seen along the entire east coast of Taiwan (Wang and Yang, 2007). Many *Kogia* (both species) were involved in unusual mass stranding events of multiple species in Taiwan that were linked to an intense energy source (Wang and Yang, 2006; Yang et al., 2008). Strandings have been reported from almost all coasts of Taiwan and dwarf sperm whales have been sighted fairly frequently in southern and eastern Taiwan (Wang et al., 2001). Striped dolphins are rarely seen at sea possibly because this species may be found further offshore (sightings have all been fairly far from Taiwan in eastern waters). Striped dolphins were involved in unusual stranding events of multiple species (Wang and Yang, 2006). Spinner dolphins are often found resting during the daytime very near the shelf edge in the waters of eastern Taiwan (probably because the shelf is very narrow along eastern Taiwan). Seismic surveys along the shelf edge of eastern Taiwan during the daytime will likely have an impact. Indo-Pacific bottlenose dolphins have been shown to alter vocal behaviour as a result of noise (Morisaka et al., 2005) but the short and long-term impact of such changes in behaviour are unknown. In Western Australia, even disturbance from low impact human activities such as dolphin-watching (by only two operators), have resulted in a detectable decline in abundance of Indo-Pacific bottlenose dolphins (Bejder et al., 2006).

Small isolated populations are more vulnerable to local extirpation. In other regions, species such as the false killer whale (*Pseudorca crassidens*), pygmy killer whale, common bottlenose dolphin (*Tursiops truncatus*) and spinner dolphin appear to comprise small isolated groups that are associated with oceanic islands (see Karczmarski et al., 2005; Baird et al., 2008a,b; Baird et al., in press; McSweeney et al., in press). The conditions along eastern Taiwan may have similar characteristics (i.e., oligotrophic waters with considerable nutrient input from land sources and is distant from other such sources of nutrients) that would encourage such populations to exhibit high site fidelity so there may be isolated populations of the above species in Taiwanese waters. More needs to known about population structuring in this region.

2) PROPOSED SURVEY TRACKLINES

Several tracklines of the proposed seismic survey immediately standout as being very likely to cause great risk to marine mammals in the region. For the waters covered by most of the other tracklines, very little is known about marine mammals. Some of the problematic tracklines have been mentioned above under species of concern and include:

1) Coastal waters of western Taiwan (ETS humpback dolphin population, finless porpoises, Indo-Pacific bottlenose dolphin)

2) Approaches to the mainland of China (JRE and other humpback dolphin populations, finless porpoises, Indo-Pacific bottlenose dolphin)
3) The shelf edge along eastern Taiwan and oceanic islands off eastern and northern Taiwan, northern Philippines and the Ryuku archipelago (beaked whales, sperm whale, humpback whale, melon-headed whale, pygmy killer whale, short-finned pilot whale, spinner dolphin, striped dolphin and many other cetacean species)
4) The shelf edge along the eastern side of the Penghu Channel (beaked whales, sperm whale, pygmy killer whale, melon-headed whale, short-finned pilot whale, striped dolphin, many other cetacean species)
5) All waters of the Taiwan Strait (gray, right and humpback whales, finless porpoises, Indo-Pacific bottlenose dolphin and many other cetacean species)

3. TIMING OF PROPOSED SURVEY

The survey period (from 21 March to 14 July) proposed by L-DEO is probably the worst choice of seasons if minimizing impacts to marine mammals is sought. The above scheduling overlaps almost entirely with the confirmed presence of humpback whales, likely presence of gray whales and possible presence of right whales in the region. Calving for most cetacean species (including those that are critically endangered – see above) in this region appear to be in the spring to early summer as evidenced by sightings of many females with neonates and other young calves during cetacean surveys and the examination of hundreds of carcasses (J.Y. Wang, unpublished data).

L-DEO claimed that when conducting the Luzon Strait/Philippine sea leg of their survey, they will "attempt to avoid these [for humpback whale] wintering areas at the time of peak occurrence by surveying...as late as possible during each leg of the cruise". However, the proposed survey schedule overlaps with the peak period of humpback whales in the Babuyan waters (the latter portion of the peak period being April) and a considerable number of humpback whales will still be in the survey area throughout the survey period (many will also be migrating through the waters at the same time the seismic surveys are planned). Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan which is the same path of one of the proposed survey tracklines of the *Langseth*. Some females undertaking the migration at this time will be accompanied by neonatal calves, which are the most sensitive individuals of the population (McCauley et al., 2000). Such a frivolous and empty statement by L-DEO of attempting to mitigate its impact is concerning and raises questions about the sincerity of its mitigation measures proposed.

From at least April to September (Wang et al., 2001b; J.Y. Wang, unpublished data), large numbers of cetaceans are found along and near the shelf edge of eastern Taiwan. Conducting seismic surveys close to the shores of Taiwan during this time will have a large impact on these cetaceans.

4. INEFFECTIVENESS OF MITIGATION MEASURES

Table of predicted RMS distances

Many of the mitigation measures hinge directly or indirectly on the values shown in Table 1 (of the FR) of predicted RMS distances for three different sound level thresholds. However, these values are underestimated, especially for shallow water, as was correctly identified in the FR (p. 78307), "Empirical measurements near the Ewing indicated that in shallow water (<100m; 328 ft), the L-DEO model underestimates actual levels airgun arrays" with measured values ranging wildly

"from 1.3-15 times greater than the modeled values". The studies of Madsen et al. (2006) and Shapiro et al. (2009) also supported that sound levels can be highly unpredictable even several kilometers and be orders of magnitude different even within a meter apart. Furthermore, Shapio et al. (2009) reasoned that animals can become disoriented by received sounds, which may interfere or confuse avoidance responses (this may lead to increased exposure duration or levels). Moreover and very critically, there needs to be a better understanding of how sea floor substrates, sea surface conditions, coastline topography (e.g., concrete sea walls), depth, temperature and salinity alter sound in shallow water. Constructive interference can result in levels several times higher than predicted while cancellation can result in silent zones that can be very stressful and elicit strong behavioural changes in dolphins. The waters of western Taiwan are highly dynamic with seasonal, monthly, daily and diel changes in water salinity, tidal fluctuations, water temperature and surface conditions that can not be explained by the simple model for predicting levels that was used in the L-DEO proposal. Given that a critically endangered population (the ETS population of *Sousa chinensis*), two vulnerable and very difficult species to detect (i.e., finless porpoises) and the Indo-Pacific bottlenose dolphin are found in very shallow waters it is crucial that sound levels under differing conditions in shallow waters be better understood before impacts to cetaceans are trivialized. Similarly, the lack of attention given to constructive interference and cancellation in waters where a steep slope ('wall') exists, and can reflect sound, was very troubling given the studies of Madsen et al. (2006) and Shapiro et al., (2009). It is clear that one of the most critical pieces of information of the foundation for proposed mitigation measures and claims of minimal impact by L-DEO, was also one of the weakest and not addressed in sufficient detail. Overlooking this important issue is clearly far from being precautionary.

Marine Mammal Detection

There are many issues that need to be addressed by the applicant regarding the detection of local marine mammals:

1) ineffectiveness of MMVOs at detecting cetaceans, especially small cetaceans, under non-ideal sighting conditions (low light, rough seas, rain)
2) ineffectiveness of MMVOs at detecting cetaceans, especially small cetaceans, at distances beyond about 1 km but well within the waters ensonified by levels >180dB in shallow waters (potentially farther than 3.7km)
3) ineffectiveness at detecting finless porpoise at distances beyond 1 km under any conditions but well within the waters ensonified by levels >180dB (possibly >190dB) in shallow waters (potentially farther than 3.7km)
4) ineffectiveness of MMVOs with little experience with local marine mammal species and conditions (species identification can be problematic even for experienced researchers in this region due to the large number of species)
5) inadequacy if MMVO coverage with "at least one MMVO and when practical two" monitoring (this would be wholly inadequate even for small-scale marine mammal surveys where the consequences of failing to detect animals are much less serious)
6) MMVO fatigue and lack of vigilance during search (on-duty search times of up to 4 hours is far too long; should be reduced to rotations of between 30 and 60 minutes at most)
7) ineffectiveness of night vision equipment for small cetaceans, especially at distances beyond about 1 km but well within the waters ensonified by levels >180dB in shallow waters (potentially farther than 3.7km)
8) ineffectiveness of MMVOs at detecting beaked whales (detection is known to be very low even for experienced observers in good conditions)

9) ineffectiveness of MMVOs at detecting, tracking and following animals entering and exiting the area being ensonified by sounds greater than the thresholds stated (in shallow waters >180dB can be farther than 3.7km)
10) effectiveness of PAM for detecting very high frequency vocalizations of small cetaceans in shallow waters several kilometers away (due to rapid attenuation of high frequency sounds)
11) ineffectiveness at detecting beaked whales when they are very quiet near the surface
12) ineffectiveness of PAM at determining the location and direction of travel of cetaceans

Other issues

L-DEO did not provide any supporting evidence that ramp-up procedures are effective in reducing impacts on cetaceans. Given that it appears to be an important proposed mitigation measures, effectiveness of such a procedure should be convincing.

The effectiveness of any shut-downs would depend on: the ability to detect cetaceans, communication of the detection, amount of time for a decision to shut down and how quickly a shut-down can be executed. No time frame as to how long such a procedure would take after a cetacean is detected was given. Clearly, timing is important for determining the effectiveness of this mitigation measure.

It is unclear how it can be visually observed that an animal has left the EZ if the EZ is more distant than 1 km and during poor sighting conditions. Not detecting an animal within the EZ boundary may be determined erroneously as the animal having left the area rather than observers failing to see the animal. Such situations are likely to occur very frequently when sightings conditions are not ideal and the EZ's distance from source extends beyond 1km. Obviously, this can have serious consequences.

The resumption of airgun operations after not observing a small odontocete and 'large' (following FR) odontocetes (i.e., sperm, dwarf and pygmy sperm whales and beaked whales) for 15 and 30 minutes is baseless. These periods are far too short for species that can stay submerged for >60 minutes. For many species in the region, submergence maximum time is not known. To be precautionary, this shut-down and search time needs to be at least 60 minutes for small cetaceans with not information on submergence time and at least 90 minutes for the 'large' odontocetes (listed above) to ensure animals have at least one chance of surfacing before power-up.

The limited ability to detect cetaceans (especially small cetaceans) at distances greater than 1km will result in many going undetected; in shallow water the exposure level >>180dB is well beyond 1 km and can be beyond the effective sighting distance of even experienced observers.

Noise from seismic surveys can also 'mask' important sounds and increase the risk of other existing threats (e.g., increased entanglement in nets and collisions with ships as a result of distraction from or a reduced ability to detect these threats). Displacement of whales from their 'normal' migration routes may also increase the risk of encountering other threats.

L-DEO completely overlooked physiological impacts on cetaceans (see Wright et al. 2007a,b). This must be addressed.

Recognizing the sensitivity of beaked whales, L-DEO proposed that as a 'special mitigation procedure' for beaked whales, "approach to slopes and submarine canyons, if possible, during the

proposed survey." It is unclear what is meant by 'if possible'. With this condition it is not convincing that the procedure will actually be implemented. Furthermore, the tracklines proposed by LDEO transit several slope and canyon areas (e.g., the east slope of the Penghu Channel; the nearly the ENTIRE slope waters off eastern Taiwan; off NW Philippines). As with a similar empty attempt to mitigate impacts due to poor timing of the survey (see TIMING OF PROPOSED SURVEY above), L-DEO offers another similarly frivolous and meaningless 'special mitigation procedure'. As such, the sincerity of L-DEO in attempting to mitigate its impacts is even more doubtful.

CONCLUSIONS

1) L-DEO failed to demonstrate its ability to minimize or mitigate the impacts of their proposed activity on local cetacean, especially those that are critically endangered.
2) L-DEO demonstrated their lack of knowledge of the vulnerability of several marine mammals in SE Asia, mainly because it has chosen to not consult local and international expertise or information published locally.
3) L-DEO's proposal lacked scientific rigor and information in determining its potential impact.
4) L-DEO demonstrated serious logical flaws in its reasoning many times in the proposal by using the lack of evidence to be supporting evidence for absence. This is poor and incorrect scientific logic. This is needs to be addressed. For examples, L-DEO claimed that PTS would be unlikely. However, the only support presented was the lack of evidence demonstrating 'definitively' that PTS in marine mammals can be caused by seismic surveys. Also, L-DEO claimed that 'masking' is expected to be limited with no evidence to support this claim except that there was no evidence demonstrating 'definitively' that masking occurs. It is irrational to claim that 'masking' at least at some level will not be expected for highly acoustic animals – it's a matter of the level of impact.

Comments on the 'support' considered by NMFS' determination to approve an IHA (4 points – FR, p. 78316):

1) animals will and can move away from annoying noise source before damage can occur

This claim is unsubstantiated and there is no reason to believe this will occur for all marine mammals. One very obvious example is the critically endangered ETS population, which is found only in a restrict area off western Taiwan. The animals are slow swimming (slower than the *Langseth* during airgun operations) and have no other waters to which to escape. Their important habitat is small and limits them from even temporary displacement. Furthermore, vulnerable and compromised cetaceans such as females with calves and those already injured or ill from other cause are unlikely to escape the annoying noise source before damage occurs.

2) *need to be within 950-3694m for chance of PTS (note: this was stated incorrectly in the FR as being TTS)*
3) *need to be within 6000-8000m for chance of TTS*
4) *MMVOs have high detection ability of marine mammals within the distances in 2 & 3*

These distances are not considered short for detecting small cetaceans even by highly experienced observers under ideal conditions. In fact, for TTS, most small cetaceans at these distances will be beyond visual range (even with optical aids given the typical atmospheric conditions in Taiwan); only a small proportion of small cetaceans and probably only those in large energetic groups (note: none of the coastal species are known to occur in very large groups) can be observed at these distances. For PTS, distances can be almost 3.7km. This is very far for detecting small cetaceans; even experienced observers would have difficulties beyond 1 km, especially for finless porpoises.

Finally, these distances are underestimated (see above) and actual distances for PTS and TTS will undoubtedly be even further and beyond effective detection by any observer.

The reasons that were used by NMFS to support its determination are wrong, unscientific and not based on best available information, and as such not precautionary.

SOME RECOMMENDATIONS TO MOVE FORWARD

Conduct a consultation workshop with scientists who have expertise in local marine mammals, reptiles, fish and invertebrates to understand better the local sensitive species and waters. Much more information exists in publications in local languages that have not been considered by this proposal. Consultation with the ETSSTAWG is needed.

A safe distance from shore to operate airguns needs to be determined in consultation with the ETSSTAWG and other marine mammal experts.

Seismic surveys should not be conducted in poor cetacean sighting conditions (low light, SS>4, rain, heavy fog or haze) until a proven (acceptable to most marine mammal scientists) method for detecting cetaceans is developed for such conditions. Low light and night time seismic surveys should not be permitted at this time.

Seismic surveys should not be conducted within at least 10 km from areas where a steep shelf wall exists (e.g., east coast of Taiwan) until the effects of reflection and constructive interference on sound levels are better understood.

MMVOs that are highly experienced with the fauna and conditions of the region need to be involved; observation periods should be reduced to between 30 and 60 minutes to prevent observer fatigue and loss of vigilance; and secondary support vessels should be used to search for cetaceans with MMVOs to cover a sufficient amount of water to reduce the number of marine mammals being exposed to >160dB. Detection of marine mammals as part of a mitigation measure has to be at least as effective, but preferably better, at detecting cetaceans as cetacean survey projects because the consequences are more serious if cetaceans are not detected.

Seismic surveys should not be conducted in the spring (when many species give birth). Seismic surveys should not be conducted in the autumn and winter until more information about marine mammals in these waters during these seasons is available.

A better understanding of the many uncertainties that exist about the issues (e.g., understanding the propagation of airgun sounds and sound levels in shallow water (including constructive interference and cancellation), under differing conditions of water depth, salinities, water temperature, etc.) and the animals in the region is needed.

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Re: RIN 0648-XL89 Incidental takes of marine mammals during specified activities; Marine geophysical survey in Southeast Asia, March-July 2009

Dear Mr. Payne:

Our group of scientific proponents involved in the planned geophysical survey in the Taiwan vicinity and South China Sea has become aware of concerns of marine biologists regarding possible impacts of our program on marine mammals. Here we make some comments about the nature and significance of our project and also try to allay some of the expressed concerns. As an introductory statement, the research we plan targets fundamental Earth processes that remain inadequately understood; this includes topics such as the growth and composition of continents and the fundamental processes of building mountains. We choose to do this research in the Taiwan region because it is the best location, of only a few places globally, where we can study the collision of an oceanic island chain with a continent. As for marine mammal safety, the community of marine mammal biologists can be assured that our project is not a reckless intrusion into the marine habitat of endangered species. In fact, detailed studies have been conducted regarding the possible impacts of this project on marine mammal populations. Furthermore, a mitigation plan has been developed that will insure the safety of marine mammals that may be present in the survey areas. With this mitigation plan and lack of documented historical impacts, we deem that injury to marine mammals is exceedingly unlikely and disturbance, if any, would be minimal, local, and short-term. In contrast, the impact of this research on our understanding of fundamental Earth processes is likely to be significant.

Scientific Significance of the Project

Oceanic island chains, or arcs, along convergent tectonic plate boundaries result from a process known as subduction where one of Earth's tectonic plates slides beneath another as they move toward each other. As the lower plate slides beneath the upper plate, its trajectory usually steepens with depth and eventually reaches depths of several hundred (to greater than 700) km. The arc is made up of a chain of volcanoes on the upper plate, and is typically situated above the point where the lower plate is at about 100 km depth. As this process of subduction and volcanism continues through time (millions of years) the crust of the upper plate becomes thicker, and develops properties more like continental crust, which is much thicker and less dense than ocean crust and allows for land surface above sea level. The results of many studies indicates that much of the crust that forms Earth's continents was accumulated through time by island arcs colliding with continents leaving remnants of the arcs attached to the edge of the continents. Despite this general interpretation, the actual processes of how this happens, including growth of collisional mountain belts and deformation of arc and continental crust, is poorly understood and poorly documented. Ancient collision zones have been studied, but they have typically undergone many stages of deformation and erosion, leaving them difficult to interpret. Currently active arc-continent collision zones include Taiwan, Papua New

Guinea, and Timor. Of these active collisions, Taiwan is currently the most active. Taiwan is also the most favorable of these to examine the full spectrum of processes as a plate boundary changes from oceanic subduction to arc-continent collision. This transition is a major target of the TAIGER project requiring that we obtain a series of crustal-scale seismic transects from south of Taiwan, where subduction is active, to northern Taiwan, where the collision has reached mature steady state.

One of the by-products of the collision in Taiwan is the generation of frequent small earthquakes and less frequent, large, destructive earthquakes. By using the the relatively small signals from the R/V Langseth source array (compared to those generated by nature) we can tomographically image the mountains and thereby localize the major breaks or faults underneath the mountains and assess their seismic potential. In addition to linear arrays of seismographs, the Langseth signals will also be recorded, as an integrated TAIGER acquisition program, on over 200 land seismographs across the island and 20 ocean bottom seismographs, all of which have been recording earthquakes. We expect to produce the most comprehensive subsurface images of the rapidly rising Taiwan mountains with our data. These images, along with seismicity recorded by our arrays, will form a greatly enhanced basis for evaluating earthquake and tsunami potentials of Taiwan and can thus be used to improve the safety and security of the human population at risk to these phenomena.

A previous US-Taiwan project (the 1995 TAICRUST project) demonstrated the feasibility of the approach to be used in the TAIGER project, but this project did not include significant seismic data acquisition in the Taiwan Strait. Subsequent analysis showed that seismic profiles across the Taiwan, recorded by seismographs in the strait and on land in Taiwan, are necessary to determine the crustal structure of the Taiwan collisional mountain belt. Thus, our plans in the Taiwan Strait are one of the key elements required for the success of the TAIGER project.

Marine Mammal Safety

The R/V Marcus Langseth is operated in strict compliance with requirements mandated by the U.S. National Marine Fisheries Service. The underlying guidelines are based on requirements of the U.S. Endangered Species Act and the Marine Mammal Protection Act. The R/V Langseth will have on board five marine mammal observers for visual and acoustic monitoring during all seismic operations. These operations will be ramped-down or shut down if marine mammals or sea turtles enter into the NMFS-approved safety zone. This mitigation plan is similar to those used during previous R/V Langseth projects and previous seismic projects on the R/V Maurice Ewing, the Langseth predecessor. Based on past post-cruise reports, this plan has successfully avoided takes of marine mammals during numerous seismic projects.

A specific concern expressed by Dr. John Wang is with the safety of the Eastern Taiwan Strait Humpback dolphin; this species is considered critically endangered. We share Dr. Wang's desire to protect this species and plan to avoid seismic work in or near its

habitat. This species is known to live in very shallow water environments, primarily in water depths less than 25 meters and typically close to the coast. We expect seismic operations to occur nearly exclusively in water depths of 50 m or greater, especially along Taiwan's west coast. With the generally shallow slope of the seafloor in this area this means that our work will typically be farther than 10 km from the coast. Furthermore, we are willing to adjust line positions to provide an adequate buffer zone for the coastal habitat of these humpback dolphins.

We have already contacted marine biologists highly knowledgeable and very concerned about the ecology of all marine mammals in the National Taiwan University, Academia Sinica and the National Taiwan Ocean University. They will continue to provide guidance to our planning.

As noted above, our seismic operations will be in strict compliance with the mitigation practices developed by the National Marine Fisheries Service, and we will avoid the sensitive near-coastal habitat. This type of seismic project has been undertaken many times in the past, with marine biological observers present, and has not resulted in any observed impacts. Unlike many sources of marine noise, which emit continuous sound, seismic work involves a short pulse of acoustic energy followed by a significant period of quiet. In addition, the seismic program will pass through any one area at a speed of about 8 km/hr, so any impact will be very limited in time, generally much less than one hour. Furthermore, the planned transects are very widely spaced, so most parts of the Taiwan Strait will be completely unaffected by the project. Finally, we would like to point out that the bulk of the energy produced by the R/V Langseth sound source is below a frequency of 200 Hz. Odontocetes communicate in a much higher band of frequencies, typically in the range of 10,000 Hz to several 100,000 Hz. Thus there is very little, if any, overlap in the frequency bands of acoustic energy used by these marine mammals and that of the seismic system. In summary, we agree with the environmental assessment that this work is not likely to result in any significant impact on marine life in the area.

Sincerely,

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On behalf of the TAIGER project principal investigators

^^^

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Feb. 5, 2009

Michael Payne
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RE: *73 FR 78294*
Dear Mr. Payne:

I am a cetacean bioacoustician who has worked on underwater noise issues for the past 15 years. I am very familiar with the literature in this area, and the studies done to date. It is my professional opinion that the proposed geophysical seismic survey by Lamont-Doherty Earth Observatory (L-DEO) at Columbia University constitutes a high risk to marine mammals. This is a powerful array of airguns, and the permit application does not seriously consider the possibility of irreversible harm to marine mammals and the marine environment.

The treatment of possible impact is very superficial, and does not take into account that ecological and population-level consequences may result. Especially where many depleted species in the area are faced with a myriad of threats and stressors already, the addition of noise may prove to be the final straw. In nature, cumulative stressors often interact synergistically, particularly if there are several stressors. Noise impacts should not be reduced to merely hearing impairment, though that is certainly possible and serious. Even TTS can compromise an animal's survival, in that its feeding, predator avoidance, and social behavior are impacted. Other behavioral responses such as permanent avoidance of an area that is associated with a frightening, loud noise are also possible.

Unfortunately, cetaceans are difficult to observe, and many cetaceans in this area are poorly known and little studied. In even the better studied populations, population impacts are hard to discern. Thus, a large seismic survey such as this one could easily impact a local population, yet that effect could go unnoticed until it is too late and the

population is past the point of recovery. Paradoxically, the less reaction some individuals show to noise (or other perturbations), the more they are often impacted. This is because the most vulnerable individuals have the least energy reserves and thus cannot afford to react or flee. Similarly, population impacts have been shown for well-studied local populations of Australian dolphins, yet these showed no observable response on the surface. Thus, we cannot rely on observations to tell us whether cetaceans are harmed or not.

Seismic airgun noise has been shown to impact a variety of species from cetaceans, to fish species, to squid, to even invertebrates. The fact that this noise covers a large area at high levels makes this survey potentially dangerous to marine life. There are indications that similar surveys have caused fatal giant squid and beaked whale strandings. While I understand that the *Langseth* probably has a better airgun configuration (safer for marine life) than its predecessor, the *Ewing*, it appears very little was learned from past experience.

The possibility of trophic cascades was also unaddressed. Most marine animals are acoustically sensitive. Since components in the marine ecosystem are particularly interlinked, such effects cannot be discounted. It is time serious consideration be given to (possibly) subtle, long-term impacts at the level of the population and ecosystem. These are the effects we should be most concerned about, yet they barely merit any attention in this application.

Thus, I urge NMFS to reject this application for an IHA.

Sincerely,

Linda S. Weilgart, Ph.D.
Research Associate

Please acknowledge receipt of this eMAIL ASAP.

February 5, 2009

Michael Payne

Chief, Permits

Conservation and Education Division

Office of Protected Resources

National Marine Fisheries Service

1315 East-West Highway

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Eml: PR1.0648-XL89@noaa.gov <mailto:PR1.0648-XL89@noaa.gov>

RE: /73 FR 78294/

Dear Mr. Payne:

This letter is in response to the "notice of a proposed incidental take authorization by Lamont-Doherty Earth Observatory (L-DEO) at Columbia University for a request under the Marine Mammal Protection Act (MMPA) to take small (sic) numbers of marine mammals, by Level B harassment, incidental to conducting a marine geophysical seismic survey in Southeast (SE) Asia during March-July 2009, as published in /73 FR 78294"/. We request that a permit to "take" these cetaceans not be granted.

We are all U.S. citizens currently residing in Canada.

Our objections to the proposed undertaking are numerous, and begin with what we feel is a lack of balance and objectivity in the submitted documentation. To start, the summary in the federal register listing says the proposal is to take "SMALL" numbers of marine mammals. However, the actual proposed "take authorization" by LDEO is for 71,669 cetaceans. We propose that a reasonable upper bound for a SMALL number is what can be counted on our fingers and toes. We have conducted a careful survey and have found that number to be 80. Since the requested take is 895 times (89,586%) higher than the biggest SMALL number, we feel that the use of the word "small" in the federal register summary is misleading with respect to the proposed undertaking. Rather than using the words "small numbers" in the summary TWICE, space could have been saved and accuracy improved if the actual number had been used instead. Even though the federal register listing is 23 pages long, there was apparently not room to include the "requested take authorization" column from the "*Request by Lamont-Doherty Earth Observatory for an Incidental Harassment Authorization" *document.* *The federal registry summary that

twice used the word "small" to describe the number 71,669, while failing to mention the actual number, so misinformed the public that the resulting public consultation process is clearly invalid.

We have read the "*Request by Lamont-Doherty Earth Observatory for an Incidental Harassment Authorization" *and are disappointed about the lack of balance in its presentation. At first glance the document looks substantial, with pages of graphs and tables. There is a rather Nazi-like attempt to sanitize the torture this activity will inflict on thousands and thousands of marine mammals by using bureaucratic language like "temporary threshold shift (TTS)", "permanent threshold shift (PTS)", and "Level B harassment". Upon further examination it is clear that the numerous graphs and tables that supposedly document the levels of sound and "take" are not really well supported with data. "Little is known about" is a common refrain concerning biological effects, and the document notes that models used underestimate the actual sound levels by as much as 15x (that is a 1500% modeling error).

An example of the numerous attempts to gloss over the lack of substance in this report can be seen in the following statement (page 38): "However, there has been no specific documentation of TTS let alone permanent hearing damage, i.e., permanent threshold shift (PTS), in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions."

While this may sound "sciency", it is actually a very stupid statement couched in jargon. Yes, it is very difficult to capture a whale. It is even harder to give it a hearing test. And since whales aren't stupid, capturing the exact same whale again after conducting a field test of the airguns for a follow up exam is getting pretty unlikely. And repeating this activity often enough to get statistically valid results, well that's not likely to happen either. The problem that permeates the EA and IHA documents (and the federal register listing) is the silly assumption that since nobody has done this (impossible) task that there is no reason to suspect that sending 170dB pulses out for 7,808m either side of a boat traveling for 1,113km through the shallow water critical habitat of several endangered species is wrong.

We think that the model's deviations from reality are the highest in shallow waters. The IHA document notes that the model UNDERESTIMATES actual sound levels in shallow waters by up to 15x (1500%). It is possible that part of this reason may be due to lensing from an uneven bottom. This raises the possibility that there are spots of even higher sound levels that are not captured in the models. The EA and IHA fail to address the probability that exposure levels under these circumstances could result in "injuries" (Level A harassment).

The EA and IHA documents also fail to deal with the reality of the strandings that have been associated with previous airgun operations (including one stranding associated with a previous survey conducted by the proponent, LDEO). We think that these strandings clearly constitute something greater than "Level B harassment".

Finally, we are greatly saddened to see the high proportion of cetaceans that are endangered in the proposed study area. Some of the species have population levels that are so low that the loss of a single individual could significantly increase the chances of extinction. We do not feel that chasing these animals around with a boat that produces seismic "bangs" that are still 170dB at a distance of 7808m from the boat will be anything other than harmful to these endangered animals.

Two of us are trained scientists (PhDs in biology and astronomy from Caltech). As scientists, it greatly saddens us to see government funding being used to cause the "Level B harassment" of 71,669 cetaceans. We also doubt that the data that might gained from this proposed "taking" is worth the harm that it will do.

We are concerned about what the proposed undertaking will do to the reputation of U.S. science. Recently, one species of cetacean was declared extinct in this region. As clearly documented in the submitted materials, there are several more endangered species in the proposed study area. To have a U.S. flagged ship, owned by the National Science Foundation, cruising around in the critical habitat of multiple endangered species conducting SEISMIC testing is clearly poor public relations. And if another of these species goes extinct soon, the U.S. National Science Foundation will find itself trying to "sell" the notion that its contribution to the extinction was insignificant. The NMFS could make a positive contribution to the long term reputation of U.S. science if it could show some backbone and talk the NSF out of this idiocy.

To repeat, we request that a permit to "take" these cetaceans not be granted.

Sincerely,

Joseph E. Minor (PhD, Biology)

Christine D. Wilson (PhD, Astronomy)

James C. Minor

Susan L. Wilson

Michael Payne
Chief
Permits, Conservation and Education Division,
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Comments by the Center for Regulatory Effectiveness ("CRE") on RIN 0648-XL89; 73 FR 78294 (Dec. 22, 2008), comment period extended 74 FR 2995 (Jan. 16, 2009); Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Surveys in Southeast Asia, March-July 2009; filed by email *PR1.0648-XK83@noaa.gov,* on February 5, 2009

Dear Mr. Payne,

We appreciate this opportunity to submit comments on behalf of CRE. We do not object to the proposed IHA for the Langseth that is referenced above. We do, however, object to the following statement by NMFS in the Federal Register notice of the proposed IHA:

> *"However, controlled exposure experiments in the Gulf of Mexico indicate that foraging effort is somewhat altered upon exposure to airgun sounds (Jochens et al., 2006)."*

73 FR 78303 (Dec. 22, 2008)

This statement is misleading. It does not accurately reflect the underlying data, and it is not based on the most recent assessment of those data.

The above-quoted NMFS statement about foraging cites for support a 2006 Report that summarizes the years 2002 to 2004 of the Sperm Whale Seismic Study in the Gulf of Mexico ("SWSS").[1] The Report discusses data on foraging behavior and avoidance movements of 7 tagged sperm whales in the Gulf of Mexico during exposure to airguns.

[1] The 2006 SWSS Report is available online at http://www.gomr.mms.gov/PI/PDFImages/ESPIS/3/3599.pdf

The NMFS statement quoted above does not cite the final 2008 *Synthesis Report* on SWSS, which also discusses these foraging data. The final 2008 *Synthesis Report* does not support NMFS' statement that seismic affects sperm whale foraging. In fact, the *Synthesis Report* found

> *"no evidence for a concerted reduction in foraging rate during airgun exposure by all seven whales (p=0.19, rotation test)."*[2]

These foraging data from the seven whales have never been published in a peer reviewed journal, and the *Synthesis Report* includes many caveats and disclaimers about them. For example, the *Synthesis Report* cautions that the

> *"sample size of 7 animals that conducted dives during exposure was too small to provide definitive results....The power of the test to detect small changes in foraging success was low, and no conclusions on the biological significance of these effects for an individual animal or for the population can be made from the data sets available."*[3]

For these reasons, NMFS' statement *"that foraging behavior was altered upon exposure to airgun sound"* violates the Objectivity standard in NMFS' Information Quality Act Guidelines ("IQA") because the information it disseminates is not "presented in an accurate, clear, complete and unbiased manner and in a proper context."[4]

This statement also violates the Objectivity standard in NMFS' IQA Guidelines because the information it disseminates is not "accurate, reliable and unbiased."

We request that this statement be deleted in NMFS' Federal Register notice of the final Langseth IHA for the voyage identified above.

In the alternative, we request that NMFS state in its Federal Register notice of the final Langseth IHA that there is no accurate, reliable or useful evidence that seismic causes any foraging effects in sperm whales that are of biological significance for any individual animal or for the population.

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[2] Page 263 of 2008 *Synthesis Report* available online at http://www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4444.pdf

[3] Page 13 of *Synthesis Report.*

[4] The NOAA/NMFS Information Quality Act Guidelines are available online at http://www.cio.noaa.gov/Policy_Programs/IQ_Guidelines_110606.html

We once again thank you for the opportunity to submit these comments, and we look forward to NMFS' response to them.

Respectfully submitted,

Scott Slaughter
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Hong Kong Dolphin Conservation Society
香港海豚保育學會

February 4, 2009

Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
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1315 East-West Highway
Silver Spring, MD 20910–3225

RE: 73 FR 78294

Dear Mr. Payne:

On behalf of the Hong Kong Dolphin Conservation Society, I am writing to express our grave concerns over the request by Lamont-Doherty Earth Observatory (L-DEO) for an incidental harassment authorization under the Marine Mammal Protection Act to take small numbers of marine mammals by harassment during a series of marine geophysical seismic surveys in Southeast Asia during March-July 2009, as published in 73 FR 78294.

On top of the various cetacean species that may be affected in the area by these seismic surveys in the region, we are especially worried the acoustic disturbance that can seriously affect several coastal populations of Indo-Pacific humpback dolphins (*Sousa chinensis*), notably the ones at the Pearl River Estuary in Guangdong Province, the Jiulong River Estuary in Fujian Province, and along the coastal waters of Eastern Taiwan Strait; as well as the finless porpoise populations inhabiting the coastal waters of South China Sea. The proposed tracklines of these seismic surveys will traverse through areas that will overlap or are in close proximity to these resident dolphin and porpoise populations, posing serious threats to the livelihood of their daily lives. Our society have been heavily involved in the long-term research and conservation effort on these coastal dolphin populations in the past decade, and from our knowledge these small dolphin and porpoise populations are already facing

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various threats in their habitats including acoustic disturbance from coastal development activities and shipping traffic. The additional acoustic disturbance from the proposed seismic surveys will certainly pose further stress on these populations. From the NMFS notice, it appears that the cumulative noise impacts have not been properly assessed and addressed, and therefore we strongly oppose these seismic surveys to be conducted in Southeast Asia unless further studies are conducted to fully investigate the potential impacts, and full set of mitigation measures are proposed to the satisfaction of local conservation authorities and NGOs.

Thank you for your consideration of this matter.

Sincerely,

Samuel K. Hung, Ph.D.
Chairman
Hong Kong Dolphin Conservation Society

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MARINE MAMMAL COMMISSION
4340 EAST-WEST HIGHWAY, ROOM 700
BETHESDA, MD 20814-4447

22 January 2009

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by the Lamont-Doherty Earth Observatory seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act to take small numbers of marine mammals by harassment. The taking would be incidental to conducting a marine seismic survey in the South and East China Seas and the Philippines from late March to mid-July 2009. The Commission also has reviewed the National Marine Fisheries Service's 22 December 2008 *Federal Register* notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (73 Fed. Reg. 78294).

The National Science Foundation is funding the planned survey as part of the Taiwan Integrated Geodynamics Research program. The survey would consist of four legs and would be conducted in the Exclusive Economic Zones of Taiwan, China, Japan, and the Philippines (between 17°30' to 26°30'N and 113°30' to 126°E). The applicant would conduct the survey using the R/V *Marcus G. Langseth*, which would deploy a 36-airgun array (6,600 in^3) as an energy source. The array output is 265 dB re 1μPa-m (peak-to-peak). In addition, the applicant would operate an 11.25–12.6 kHz multibeam echo sounder during airgun operations and a sub-bottom profiler continuously throughout the cruise. The applicant also would tow a passive acoustic monitoring hydrophone array up to 8 km in length and deploy 100 ocean-bottom seismometers.

RECOMMENDATIONS

The Marine Mammal Commission recommends that, before issuing the requested authorization, the National Marine Fisheries Service—

- provide additional justification for its preliminary determination that the planned monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified safety zones. At a minimum, such justification should (1) identify those species that it believes can be detected with a high degree of confidence using visual monitoring only, (2) describe detection probability as a function of distance from the observer, (3) describe changes in detection probability at night, and (4) explain how close to the vessel marine mammals must be for observers to achieve the anticipated high nighttime detection rate;

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- clarify the qualifiers "when practical" and "when feasible" with respect to (1) using two marine mammal observers to monitor the exclusion zone for marine mammals during daytime operations and nighttime start-ups of the airguns, and (2) using marine mammal observers during daytime periods to compare sighting rates and animal behavior when the seismic airguns are operating and when they are not;
- consult with the applicant to clarify and describe the potential conditions that would render the use of passive acoustic monitoring impracticable for complementing the visual monitoring program;
- extend the monitoring period to at least one hour before initiation of seismic activities and at least one hour before the resumption of airgun activities after a power-down because of a marine mammal sighting within the safety zone;
- require that observations be made during all ramp-up procedures to gather the data needed to analyze and provide a report on their effectiveness as a mitigation measure;
- require the applicant to take all measures necessary to ensure that the proposed activities are not conducted near the Ryukyu Islands and Babuyan Islands during peak occurrence of the humpback whales in those areas (i.e., February through April);
- describe the reasons why and the conditions under which the applicant would need to conduct surveys closer than 8 to 10 km off the coast of Taiwan where threatened Indo-Pacific humpback dolphins are more likely to be exposed to sound pressure levels greater than 160 dB re 1 μPa (rms);

RATIONALE

The Service has preliminarily determined that the proposed activities would result at most in a temporary modification in the behavior of small numbers of up to 34 species of marine mammals and that any impact on the affected species is expected to be negligible. The Service also has preliminarily determined that no take of marine mammals by death or serious injury is anticipated and that the potential for temporary or permanent hearing impairment will be avoided through the incorporation of the proposed mitigation measures. The Service believes that these determinations are reasonable because, among other things, (1) marine mammals are expected to move away from a noise source that is annoying before it becomes potentially injurious; (2) temporary threshold shift is unlikely to occur, especially in odontocetes, at levels below 180 dB re 1μPa (rms); (3) injurious levels of sound are likely to occur only very close to the vessel; and (4) the monitoring program (visual detection and passive acoustic monitoring) developed to avoid injury would be sufficient to detect with reasonable certainty all marine mammals within or entering the identified safety zones.

Monitoring

The Marine Mammal Commission recommends that, prior to granting the requested authorization, the National Marine Fisheries Service provide additional justification for its preliminary determination that the planned monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified safety zones. At a minimum, such justification should (1) identify those species that it believes can be detected with a

high degree of confidence using visual monitoring only, (2) describe detection probability as a function of distance from the observer, (3) describe changes in detection probability at night, and (4) explain how close to the vessel marine mammals must be for observers to achieve the anticipated high nighttime detection rate. If such information is not available, the Service should undertake the studies needed to verify that the proposed monitoring program is likely to detect most marine mammals in or near those zones and/or to encourage development of alternative means of detecting marine mammals within the specified safety zones. Specifically, we note the following concerns.

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conservationists, and others generally are unfamiliar with the procedures for permit review and authorization in the United States but may have a good understanding of the natural history and vulnerability of potentially affected species. The Commission believes that they should be provided with opportunities to contribute to the evaluation of the potential effects of seismic studies in the context of all other factors that may be affecting these species. If U.S. scientists and institutions are to engage in research activities in the waters of other countries, it stands to reason that our system of review should include sufficient opportunities for foreign parties to comment on potential effects. This might be accomplished in a number of ways, such as extending the comment period to give them additional time to comment and promoting interaction between the research organization and concerned parties from other countries. We recognize that such accommodations may complicate research efforts and that various mechanisms might have to be explored before suitable ones are found. Nonetheless, we believe such participation is appropriate and, in the long run, will facilitate international cooperation on conservation issues, more informed comments, and more risk-averse research methods and mitigation procedures.

With these concerns in mind, the Commission will send a separate letter of invitation to the National Marine Fisheries Service, the National Science Foundation, and the Lamont-Doherty Earth Observatory to discuss (1) existing research plans and needs regarding monitoring and mitigation measures and mechanisms to ensure that the essential research is conducted, and (2) possible procedural improvements (e.g., outreach) to ensure that potentially valuable comments from expertise outside the United States are considered when research supported by the United States is conducted in foreign waters.

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Sincerely,

Timothy J. Ragen

Timothy J. Ragen, Ph.D.
Executive Director

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MARINE MAMMAL COMMISSION
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BETHESDA, MD 20814

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Date: 22 Jan. 2009

Total pages including cover 8

To: Mike Payne

Facsimile Phone #: 301-427-2521

Telephone #: _____

From: Tim Ragen

Subject: _____

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Comments: _____

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MARINE MAMMAL COMMISSION
4340 EAST-WEST HIGHWAY, ROOM 700
BETHESDA, MD 20814-4447

22 January 2009

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by the Lamont-Doherty Earth Observatory seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act to take small numbers of marine mammals by harassment. The taking would be incidental to conducting a marine seismic survey in the South and East China Seas and the Philippines from late March to mid-July 2009. The Commission also has reviewed the National Marine Fisheries Service's 22 December 2008 *Federal Register* notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (73 Fed. Reg. 78294).

The National Science Foundation is funding the planned survey as part of the Taiwan Integrated Geodynamics Research program. The survey would consist of four legs and would be conducted in the Exclusive Economic Zones of Taiwan, China, Japan, and the Philippines (between 17°30' to 26°30'N and 113°30' to 126°E). The applicant would conduct the survey using the R/V *Marcus G. Langseth*, which would deploy a 36-airgun array (6,600 in^3) as an energy source. The array output is 265 dB re 1µPa-m (peak-to-peak). In addition, the applicant would operate an 11.25–12.6 kHz multibeam echo sounder during airgun operations and a sub-bottom profiler continuously throughout the cruise. The applicant also would tow a passive acoustic monitoring hydrophone array up to 8 km in length and deploy 100 ocean-bottom seismometers.

RECOMMENDATIONS

The Marine Mammal Commission recommends that, before issuing the requested authorization, the National Marine Fisheries Service—

- provide additional justification for its preliminary determination that the planned monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified safety zones. At a minimum, such justification should (1) identify those species that it believes can be detected with a high degree of confidence using visual monitoring only, (2) describe detection probability as a function of distance from the observer, (3) describe changes in detection probability at night, and (4) explain how close to the vessel marine mammals must be for observers to achieve the anticipated high nighttime detection rate;

- clarify the qualifiers "when practical" and "when feasible" with respect to (1) using two marine mammal observers to monitor the exclusion zone for marine mammals during daytime operations and nighttime start-ups of the airguns, and (2) using marine mammal observers during daytime periods to compare sighting rates and animal behavior when the seismic airguns are operating and when they are not;
- consult with the applicant to clarify and describe the potential conditions that would render the use of passive acoustic monitoring impracticable for complementing the visual monitoring program;
- extend the monitoring period to at least one hour before initiation of seismic activities and at least one hour before the resumption of airgun activities after a power-down because of a marine mammal sighting within the safety zone;
- require that observations be made during all ramp-up procedures to gather the data needed to analyze and provide a report on their effectiveness as a mitigation measure;
- require the applicant to take all measures necessary to ensure that the proposed activities are not conducted near the Ryukyu Islands and Babuyan Islands during peak occurrence of the humpback whales in those areas (i.e., February through April);
- describe the reasons why and the conditions under which the applicant would need to conduct surveys closer than 8 to 10 km off the coast of Taiwan where threatened Indo-Pacific humpback dolphins are more likely to be exposed to sound pressure levels greater than 160 dB re 1 μPa (rms);

RATIONALE

The Service has preliminarily determined that the proposed activities would result at most in a temporary modification in the behavior of small numbers of up to 34 species of marine mammals and that any impact on the affected species is expected to be negligible. The Service also has preliminarily determined that no take of marine mammals by death or serious injury is anticipated and that the potential for temporary or permanent hearing impairment will be avoided through the incorporation of the proposed mitigation measures. The Service believes that these determinations are reasonable because, among other things, (1) marine mammals are expected to move away from a noise source that is annoying before it becomes potentially injurious; (2) temporary threshold shift is unlikely to occur, especially in odontocetes, at levels below 180 dB re 1μPa (rms); (3) injurious levels of sound are likely to occur only very close to the vessel; and (4) the monitoring program (visual detection and passive acoustic monitoring) developed to avoid injury would be sufficient to detect with reasonable certainty all marine mammals within or entering the identified safety zones.

Monitoring

The Marine Mammal Commission recommends that, prior to granting the requested authorization, the National Marine Fisheries Service provide additional justification for its preliminary determination that the planned monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified safety zones. At a minimum, such justification should (1) identify those species that it believes can be detected with a

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AnimalsAsia Foundation
亞 洲 動 物 基 金

Michael Payne,
Chief, Permits,
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service,
1315 East-West Highway,
Silver Spring, MD, 20910-3225, USA

Copy to: the US Consul General, Hong Kong

2/2/2009

Dear Mr Payne,

My name is Mark Jones, I am a British veterinarian and animal welfare director at Animals Asia Foundation, a Hong Kong based NGO dedicated to improving the welfare of all animals across Asia. In 2008 I completed a Master of Science degree in Wild Animal Health in London, which included a research project on threats to cetaceans.

We were disturbed to learn of the proposals from the Lamont-Doherty Earth Observatory (L-DEO) to carry out extensive seismic surveys in South East Asia from March-July 2009 (ref RIN 0648-XL89, Federal Register vol. 73 No. 246, page 4) . We understand that the period for comment on these proposals has been extended to February 5th 2009.

The type and extent of the proposed surveys risks disturbing cetaceans of a number of species, many of which are poorly understood, and one sub-population of which (the Indo-Pacific humpback dolphin *Sousa chinensis*) is listed as "critically endangered" by the International Union for the Conservation of Nature (IUCN), in the seas around the Philippines, China, Taiwan, and Japan.

Mass strandings involving live and dead beaked whales (family Ziphidae) and other cetaceans in a wide variety of locations, including the Taiwanese coast, have been associated spatially and temporally with naval exercises and seismic surveys (Frantzis 1998, Engel *et al.* 2004, Cox *et al*. 2006).

The impacts of seismic air gun noise on cetaceans and other marine species are poorly understood, but may include direct physical damage to auditory and other structures, disruption of behaviour leading to decompression anomalies, and indirect effects on prey species behaviour (Gordon *et al.* 2004). Effects may potentially occur over distances of tens or even hundreds of kilometers (Gordon *et al.* 2004), and the real impact of such activities may never be accurately predicted or known (Marine Mammal Commission 2007).

The concern over anthropogenic noise and its potential effect on cetaceans has led to repeated resolutions by multinational groups and organizations including the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS 2006), the Agreement on the Conservation of Cetaceans of the Black and Mediterranean Seas (ACCOBAMS 2004), and the European Commission (2004), for member countries to take precautionary mitigating measures, although to date there has been a continuing failure of most countries to do so (Parsons et al 2008).

Given the large volume of evidence for the association between anthropogenic noise and disturbance in cetaceans and other marine mammals, a precautionary approach is surely required (as recommended by Gordon *et al.* 2004). We urge you to consider the application from L-DEO with this, and the findings and recommendations of the independent reviews of the Eastern Taiwan Strait Sousa Technical Advisory Working Group (ETSSTAWG) and others, in mind.

Sincerely

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Eastern Taiwan Strait
Sousa Technical Advisory Working Group

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Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG)

Peer review 09-01:

"Does the proposed L-DEO seismic survey (US Federal Register 73(246) Dec 22 2008 p. 78294; planned for March –July 2009), in part to be carried out in the Eastern Taiwan Strait, present a risk to the Critically Endangered ETS Indo-Pacific humpback dolphins or other species?"

***Reviewer 1*:**

Activity in Question

As noted in the FR Notice[1], the National Marine Fisheries Service (NMFS) proposes to authorise, through an Incidental Harassment Authorization (IHA) pursuant to the Marine Mammal Protection Act (MMPA), L-DEO to incidentally take, by Level B harassment only, small numbers of marine mammals during the, incidental to conducting, a marine seismic survey, the Taiwan Integrated Geodynamics Research (TAIGER) survey, in Southeast (SE) Asia during March-July 2009.

The proposed survey will encompass the area 17 30'-26 30' N, 113 30'-126 E within the Exclusive Economic Zones (EEZ) of Taiwan and other nations, as well as on the high seas, between March 21 to July 14, 2009. The fourth leg around Taiwan is scheduled to occur from 21 June 14 July.

Important Note

It should be noted that, while LDEO are applying for the appropriate authorisation under US law, many seismic surveys are conducted in the Taiwan region every year without (to my knowledge) requesting IHAs. The actions of private O&G companies within the EEZ's of other countries is beyond the jusridiction of the MMPA, thus they need no such U.S. authorisations. However, this means that LDEO could become a scapegoat for all survey operation in the region, purely because they have to apply for authorization, as they will clearly be operating partly on the high seas (and thus fall under MMPA jurisdiction) and as they have government funding. This is acknowledged, but until such time as NMFS enforcement confirms the locations and tracks of every survey undertaken globally this situation is unlikely to change.

Questions to Raise

The Langseth will deploy an 8-km long streamer for most transects requiring a streamer; however, a shorter streamer (500 m to 2 km) will be used during surveys in Taiwan (Formosa) Strait (EA[2]). Do the effective source levels offered in the EA (259 dB re 1 μPa – m, with dominant frequencies at 2–188 Hz) pertain to the longer or shorted streamers? There are likely to be differences.

What is the frequency range of the PAM system? Is it suitable for detecting signals produce by all the marine mammals within the area?

[1] Federal Register Notice dated 22nd Dec 2008 - 2008 FR 73(246): 78294-78317
[2] LGL 2008. Environmental Assessment of a Marine Geophysical Survey by the R/V Marcus G. Langseth in Southeast Asia, March–July 2009

Have LDEO applied for the relevant permits and authorisations under the laws of the various countries where they will be conducting the survey.

General Comments

The lack of separate consideration of the genetically distinct Eastern Taiwan Strait (ETS) population of Sousa is, of course, a concern. One of the most effective ways to protect cetaceans and their habitat from the impacts of noise (and the cumulative and synergistic impacts in combination with other stressors) is through spatio-temporal restrictions, including marine protected areas (Weilgart, 2006).

There are a huge number of other threats facing this population[3], meaning that the potential for cumulative impacts equally huge and making the potential for non-linear synergistic impacts high. Given the above, and the fact that this genetically distinct population (somewhat akin to the Southern Resident killer whales) is small and probably declining, the part of the 4th leg running along the western coast of Taiwan should be removed from the survey.

Recent studies examining airgun noise have shown that, contrary to predictions, received levels can decrease between 5 km and 9 km, but then increase at distances between 9 km and 13 km (Madsen et al., 2006). The researchers stated that received levels "can be just as high at 12 km as they are at 2 km…beyond where visual observers on the source vessel can monitor effectively" (Madsen et al., 2006). Thus, no surveys should be conducted within at least 13 km and perhaps a more precautionary 15 km of the ETS Sousa population – meaning up to around 20 km from shore.

In short – despite a lack of data on the potential cumulative and synergistic impacts, the risk is high and the population is highly at risk, so the most precautionary measures are warranted.

Mitigation

The mitigation procedures offered (especially the use of visual detection at night) are known to be insufficient and ineffective. To make the most of the limited effectiveness, and thus offer the greatest protection, I recommend that:

1) surveys in the Taiwan Strait (and throughout the operation) shut down at night.
2) a minimum of two MMOs be used at all times, with one of those having considerable prior experience as a MMO (preferably within the area of Taiwan).
3) the MMO operating the PAM system (which should be in addition to the other two at all times) should have considerable experience working with the acoustic signals of many of the marine mammal taxa that are likely to be encountered in the survey.
4) the predicted protection ranges (AKA safety zones) should be confirmed in the field at each point in the survey that the bottom geography changes substantially. The results should be reported to NMFS immediately and safety zone sizes should be adjusted accordingly.
5) that the more precautionary 15 dB difference be employed in converting the SEL-based safety zones to SPL-based safety zones. (From the EA: "At the distances where rms levels are 160–190 dB re 1 µPa, the difference between the SEL and SPL values for the same pulse measured at the same location usually average ~10–15 dB, depending on the propagation characteristics of the location (Greene 1997; McCauley et al. 1998, 2000a; Appendix B). In this EA, we assume that rms pressure levels of received seismic pulses will be 10 dB higher than the SEL values predicted by L-DEO's model. Thus, we assume that 170 dB SEL ~ 180 dB re 1 µPa rms.") Thus 180 dB rms SPL would be reached with a SEL of 165 dB.

[3] The EA acknowledges this: "There are numerous threats to cetaceans in SE Asia including vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting."

6) Since empirical data is not available for LDEO operations (and what is available at deep and shallow was from shorter arrays) in intermediate distances, the extrapolation in the EA ("On the expectation that results would be intermediate between those from shallow and deep water, a correction factor of 1.1 to 1.5x was applied to the estimates provided by the model for deep-water situations to obtain estimates for intermediate-depth sites.") should be much more precautionary. Perhaps a mean between the shallow and deep water ranges, rather than adjusted by the apparently arbitrary correction factor. See Table 1.
7) See also Weir & Dolman, 2007. (Note the EA states "However, currently the procedures are based on best practices noted by Pierson et al. (1998) and Weir and Dolman (2007)". However, this is clearly not the case since Weir and Dolman (2007) call for, among other things the avoidance of sensitive areas – e.g., the western Taiwan coastline; suspension of airgun use at night; and additional restrictions in adverse weather conditions. For example, the EA states that "when at all possible, seismic surveying will only take place at least 8–10 km from the Taiwanese coast, particularly the central western coast (~from Taixi to Tongshiao), to minimize the potential of exposing these threatened dolphins to SPLs >160 dB". The use of the term "when at all possible" is not reassuring.

Alternatives

It should be noted that, under the National Environmental Protection Act (NEPA), resources should not be committed until the EA/EIS process is complete. LGL admit that LDEO have done this within the EA "If the IHA is issued for another period, it could result in significant delay and disruption not only of the proposed cruise, but of subsequent geophysical studies that are planned by L-DEO for 2009 and beyond."

Disturbance Reactions, Tolerance and Masking

The idea that behavioural tolerance is a proxy for no impact has no scientific merit. In fact, some fairly sizable impacts have been reported in various species despite a lack of behavioural response. A recent panel of experts also noted that an apparently unresponsive animal may still be undergoing a chronic and/or severe acute stress response, with associated physiological and psychological consequences. These can result from exposure directly, or through masking and other phenomenon indirectly. Thus, taking is entirely possible without observable behavioural disturbance reactions and this needs to be accounted for. For a discussion of this issue and reviews of the available literature, see Beale (2007), Bateson (2007), Wright et al. (2007 a,b) and refs therein).

Hearing Impairment and Other Physical Effects

The EA notes that Southall et al. (2007) stated that TTS is not injury. However I believe that they have overstated their conclusions. It is true that Southall et al. (2007) state: "[impacts resulting in]…TTS rather than a permanent change in hearing sensitivity…are within the nominal bounds of physiological variability and tolerance and do not represent physical injury (Ward, 1997)." However, they also note that "at present, however, there are insufficient data to allow formulation of quantitative criteria for non-auditory injuries" and later acknowledge that, while they believe that "strong behavioral responses to single pulses…are expected to dissipate rapidly enough as to have limited long-term consequence" there are occasions where such responses may "secondarily result in injury or death (e.g., stampeding)" (Southall et al. 2007).

Southall et al. (2007) also add the following caveat with regards to their report:

> *Finally, we emphasize that exposure criteria for single individuals and relatively short-term (not chronic) exposure events, as discussed here, are insufficient to describe the cumulative and ecosystem-level effects likely to result from repeated and/or sustained human input of sound into the marine environment and from potential interactions with other stressors. Also, the injury*

criteria proposed here do not predict what may have been indirect injury from acoustic exposure in several cases where cetaceans of mass stranded following exposure to mid-frequency military sonars.

Thus, since they did not attempt to consider all possible methods of injury in their deliberations and thus their final figures, they should not be directly applied to management decisions that must, by law, consider the full suite of potential impacts. Direct application of their criteria would thus not be precautionary enough to meet the required legal standards.

In any case, it should be noted that repeated TTS can lead eventually lead to PTS, which would not be classed as injury under these criteria. Other potentially injurious impacts have also been shown to occur below levels that would cause TTS in humans. For example, impaired reading comprehension and recognition memory in children is linked to aircraft noise at exposure levels considerably less than 75 dB (Stansfeld et al., 2005), which, according to the U.S. National Institute on Deafness and Other Communication Disorders (NIDCD), are unlikely to cause hearing loss (temporary or otherwise) even after long exposure (NIDCD, 2007).

Similarly, the EA noted that "captive bottlenose dolphins and beluga whales exhibited changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran et al. 2000, 2002, 2005). However, the animals tolerated high received levels of sound before exhibiting aversive behaviors."

It should be noted, however, that the animals in the abovementioned Navy studies (Finneran et al., 2000, 2002, 2005) were reported by Nowacek et al. (2007) to be generally "tested in a context where they were being rewarded for tolerating high levels of noise" and were "usually 'punished' in some way…for failing to return to the experimental station for additional exposures". This was not a problem for their main results as the focus of the work was on to TTS, but the setup does invalidate any conclusions base on the behavioural responses reported in the same studies. For further discussion of the need for precaution in the use of captive studies to set exposure criteria for wild animals, see Parsons et al. (2008) and Wright et al. (In Press).

Non-auditory Physiological Effects

It is strange that an entire special issue devoted to noise-related stress responses in marine mammals resulting from a multi-disciplinary panel of experts does not get a single mention in this section, even though a discussion of likely impacts is offered in Wright et al 2007a, b and the other papers within (all of which are cited therein). The papers are cited in Southall et al., 2007, which the authors have obviously read. I will not repeat the conclusions here, but suggest they are included within the EA (or more likely an EIS) before this survey goes forward.

Numbers of Marine Mammals that Could be "Taken by Harassment"

This will be largely dependent upon abundance and other factors I am not familiar with and so I have decided to leave this to those more familiar with the populations in the area. However, I will mention that, according to the tables within the EA, more Sousa will be impacted than there actually are Sousa in the area. I am unclear on how this meets the 'small number' criteria. This number would, of course, go up further if the distances reported by Madsen et al. (2006 – noted above) were taken into account. Of course, these distances would increase the take numbers for all animals in the area.

Indirect Effects on Marine Mammals, Sea Turtles, and Their Significance
The most comprehensive study undertaken on the impacts of seismic surveys on the fishing industry in Norway in 1996 showed that fishing catches were impacted to as far as 33 km from seismic testing[4]. I can only assume this is also not good for marine mammals who have a limited range, such as Sousa.

Cumulative Effects
The discussion of cumulative impacts in the EA is lacking. It often refers to behavioural tolerance, which has already been dismissed as an inappropriate metric above, and uncertainty in the level of impact. However, the EA does note that "Indo-Pacific humpback dolphin is unknown…may be particularly at risk" from habitat loss/destruction.

After detailing all the treats and outlining the uncertainties, the EA concludes that:

> *Because human activities in the area of the proposed seismic survey are high, additional impacts on marine mammals by the TAIGER seismic survey are expected to be no more than minor and short–term. Although the airgun sounds from the seismic survey will have higher source levels than do the sounds from most other human activities in the area, airgun operations will be intermittent during the program. In contrast, sounds from shipping have lower peak pressures but occur continuously over extended periods.*

Although this may appear logical, cumulative impacts do not work in this way. Any additional stressor may be the one that pushes the overall energetic demand beyond the capabilities of the animals involved. Similarly, the more stressors acting, the more likely synergistic impacts are. And finally, short-term stressors can lead to long-term impacts, especially in foetuses and newborns if they are exposed directly or through their mothers. It may well be that the small addition does not reach these physiological thresholds or lead to deleterious impacts as a result of synergism, but the argument that "it's only a little bit more – no-one will notice" is not a valid one.

These effects, and others, are outlined in Wright et al. (2007 a,b and references therein) and I ***strongly*** recommend NMFS consider those effects and the conclusions of the panel before accepting the IHA application and the EA upon which it is based.

Other Species
The impacts of masking (including the physiological and psychological consequences potentially resulting from masking) are likely to be greatest for baleen whales throughout the survey area. Pregnant females and/or newborns will be a greatest risk from exposure to stressors (see Wright et al. 2007a and references therein), so calving grounds at breeding season should be avoided.

According to the EA, the Multibeam Echosounder & Sub-bottom Profiler have outputs up to 204 dB re 1 µPa – m, at the dominant frequency of 3.5 kHz. This is perilously close to the US Navy's AN/SQS-53C tactical mid-frequency sonar system implicated in many of the mass strandings of beaked whales and other cetaceans, which produces 'pings' primarily in the 2.6–3.3 kHz range. Another LDEO survey has been associated with a stranding (as acknowledged in the EA: "…association of mass strandings of beaked whales with naval exercises and, in one case, an L-DEO seismic survey (Malakoff 2002)"). There may thus also be concern for beaked whales and other animals, because, while "[t]here is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys" (EA), there is also no conclusive evidence that seismic surveys *do not* lead to strandings or death either.

[4] The paper can be found in Norwegian at http://www.fiskeribladetfiskaren.no/filarkiv/vedlegg/96.pdf and there is an English summary around page 8.

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		190 dB			180 dB			170 dB			160 dB		
		LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL	LGL	Mean	% Mean larger than LGL
Single Bolt airgun	Deep	12			40			120			385		
40 in3	Int	18	81	450%	60	168	280%	180	310	172%	578	718	124%
	Shallow	150			296			500			1050		
36 airguns	Deep	220			710			2100			4670		
6600 in3 6-7 deep	Int	330	910	276%	1065	1736	163%	3150	3877	123%	5189	5449	105%
	Shallow	1600			2761			5654			6227		
36 airguns	Deep	300			950			2900			6000		
6600 in3 6-9 deep	int	450	1241	276%	1425	2322	163%	4350	5354	123%	6667	7000	105%
	Shallow	2182			3694			7808			8000		

Table 1. This illustrates the lack of precaution in the LGL extrapolations for the intermediate depths from their deep-water empirical data. If they were to take a mean of the data-supported ranges at which their signals reach certain dB levels shallow and deep water, the resulting ranges in intermediate depths would be substantially higher in most cases, especially at the higher levels of exposure.

Review 2:

It was with great concern that I read the proposal for extensive seismic survey off the coast of Taiwan by Lamont-Doherty Earth Observatory (**Federal Register** 73 (246) Monday, December 22, 2008 at p. **78294**).

The sounds produced by seismic surveys are the most intense of all anthropogenic sound sources and have been detected more 3000 miles (c. 5000 km) from their source (Nieukirk et al., 2004). Moreover, researchers trying to record cetaceans in the mid-Atlantic found that whale calls were frequently being smothered and "masked" by the high levels of continuous sound produced by these seismic surveys (Nieukirk et al., 2004). Clark and Gagnon (2006) also observed large scale effects, noting that observed that fin whales in the vicinity of seismic surveys cease vocalizing over spatial scales on the order of 10,000 nm^2 or greater. Animals have also been documented reacting to seismic surveys sounds; for example, sperm whales have been observed exhibiting a "startle" reaction 2 km away from a seismic survey vessel (Stone, 2003). McCauley and Duncan (2001) stated that airguns could elicit behavioural changes at a range measured in tens of km in blue whales and probable avoidance at 3-20 km. Miller et al. (1995) describe similar results for beluga whales and McCauley et al. (2000b) also discovered that humpback whales, off Exmouth, Australia, responded to seismic testing in various ways and at distances that were not observable from the survey vessel – females with calves were particularly sensitive and were reported to show aversive reactions at 7 to 12 km from seismic vessels (McCauley et al., 1998). The longest-term study of cetacean and seismic interactions began in the Alaskan Beaufort Sea in the 1980s. Data collected since then have shown that behavioural responses in bowhead whales, have occurred as far away as 30 km from the source (where received levels were 107-126 dB re 1 μPa rms; Richardson et al., 1999). Thus, there are numerous published studies showing impacts of seismic surveys on cetaceans at significanty distances from seismic vessels – greater that the distanced noted by the Federal register notice.

Moreover, recent studies on seismic survey sounds received by tagged whales have, however, altered our understanding of noise transmission in the sea as the received sound levels did not match predictions. (Madsen et al., 2006). In that case, sound levels from a seismic survey decreased between 5 km and 9 km from the sound source, but then *increased* at distances between 9 km and 13 km (Madsen et al., 2006). The researchers stated that sperm whales in the Gulf of Mexico "could be impacted at ranges of more than 10 km from seismic survey vessels" (Madsen et al., 2006, p. 2376.) and impacts would occur "beyond where visual observers on the source vessel can monitor effectively" (Madsen et al., 2006, p. 2376) It was also assumed that the seismic source only emitted low frequency pulses, however evidence demonstrates that air-gun arrays can generate significant sound energy at frequencies many octaves higher than the frequencies of interest for seismic exploration, which increases concern of the potential impact on odontocetes hearing at higher frequencies. (Madsen et al., 2006).

There are substantive populations of beaked whales off the coast of Taiwan, and these animals are known to be particularly susceptible to acoustic disturbance: there have been numerous strandings of these animals associated with high intensity noise events coupled with symptomatic emboli and lesions similar to those produced during decompression sickness (see Parsons et al., 2008 for a review). It is now widely believed that these stranding events are the result of behavioural responses to sound (i.e. surfacing too rapidly, or being forced to stay near the surface; see Cox et al., 2006) that can occur as exposure levels far below those levels that can cause acoustic injury such as temporary and permanent (TTS & PTS) threshold shifts, with strandings in the Bahamas being believed to have been the result of received levels of sound of 145-155 dB (see Parsons et al., 2008 for a review). Thus, at least for beaked whales, 180 or 190 dB exposure levels would be inappropriate safety guideline levels.

Seismic surveys have been linked to several whale stranding events. For example, in 2002, two Cuvier's beaked whales stranded on the Isla San Jose (Gulf of California, Mexico) coincident with seismic surveys from the research vessel Lamont-Doherty Earth Observatory Maurice Ewing (Malakoff, 2002) although there is as yet no scientific confirmation of this. It has also been speculated by scientists that seismic surveys have caused cetacean strandings in other areas, such as the Galápagos Islands (Palacios et al., 2004). Scientists did find, however, that cetacean diversity off the coast of Brazil dropped from 1994 to 2004, with a conspicuous decrease in 2000-2001 when there were a greater number of seismic surveys (Parente et al., 2007). Other oceanographic parameters such seawater temperature, salinity and density, showed no relationship to the decline, and thus weren't considered a factor in the decrease of species; seismic surveys were the most likely factor (Parente et al., 2007).

Marine mammals aren't the only marine life affected by seismic surveys. Norway's Institute of Marine Research showed that trawl catch rates of haddock and cod fell by 45-70% over a 2,000 square mile area, while seismic surveys were being conducted (Engas et al., 1993). Caged squid, fish and turtles have all shown an alarm response, avoidance and altered behaviour in seismic experiments (McCauley et al., 2000). Seismic survey sounds can also cause significant damage to fish hearing structures (McCauley et al., 2003). Furthermore, unusual numbers of giant squid were found dead and stranded on beaches at the same time seismic surveys were being conducted in the Bay of Biscay (MacKenzie, 2004). Thus, the impacts of seismic surveys may ultimately be found to be more extensive than previously thought on potential prey species of cetaceans and commercial fisheries – a major industry off the coast of Taiwan.

Moreover, I believe proposed mitigation measures to be insufficient. For example, for the visual survey methodology proposed, although there will be three marine mammal visual observers on board, at most times there will only be one present. Dedicated cetacean surveys usually use two teams of two to three observers who survey the sea simultaneously – and still animals are not observed (hence the need for the g0 calculation – the likelihood that animals would be observed under a set of environmental conditions when directly in front of a survey vessel, in order to estimate missed animals). Thus, the number of MMOs should be increased and a maximum length for observer shifts should be reduced from 4 to 2 hours to prevent observer fatigue.

There is no consideration of factors which effect visibility and the likelihood of cetacean detection, for example fog, rain or rough seas. Scientific surveys for cetaceans are often not conducted in sea states greater than Beaufort 3 or 5, depending on the study species, as rough weather severely reduces the ability to see cetaceans. Further, there are no prohibitions on conducting seismic surveys at night, when visual surveys are almost completely useless - even the use of night-vision glasses is rendered ineffective by lights on board seismic survey vessels At a minimum, when relying on observers as a mitigation measure in sea states greater than Beaufort 5, during fog or heavy precipitation, or at night, cetaceans may well be in the zone of impact despite having visual observers present, and thus animals cannot be protected from seismic survey noise during these conditions. Moreover, in areas where beaked whales are likely to be encountered (e.g. canyons and continental shelf edges) the likelihood of sighting animals even though they are present is extremely low. US government scientists have noted that the probability of observers actually sighting a beaked whale in the zone of acoustic impact is generally less than 1% (Barlow & Gisiner, 2006), even in the best conditions, with virtually a zero chance of detection beyond 1km or less than perfect conditions. This makes visual surveys for such acoustically vulnerable, deep-diving species largely ineffective. Thus, encroachment of seismic surveys sounds should be avoided in all likely beaked whale habitat.

Appropriate experience is an important criterion in the selection of visual observers, as shown by the British government's own research (Stone, 2003). When marine mammals were detected within the 500

m zone of impact by dedicated, experienced MMOs, the guidelines were followed and the survey was delayed 70% of the time. This figure fell to 0% when non dedicated, inexperienced observers or ship's crew were used (Stone, 2003). Thus, any visual observers should have multiple years of cetacean observation experience, ideally with cetaceans from SE Asia, in conditions similar to those off the coast of Taiwan.

PAM has great potential for detecting cetacean species that vocalise frequently such as sperm whales, which would reduce a number of the concerns noted above for visual surveys. However, PAM can only detect cetaceans when they vocalise and no species vocalises constantly (Gordon & Tyack, 2002). One study on common dolphins in the UK showed that although vocalisation rates were relatively high at night, they decreased for portions of the day (Wakefield, 2001).

Also, anthropogenic sounds have, on occasion, been shown to cause cetaceans to cease vocalising. For example, as noted above, fin whales ceased all vocalisation during seismic surveys and did not resume vocalising for hours or days afterward (Clark & Gagnon, 2006). Sperm whales have also decreased vocalisations or become completely silent in response to seismic surveys (IWC, 2007), as well as in the presence of pinger sounds (Watkins & Schevill, 1975), mid-frequency military sonar signals (Watkins et al., 1985), and low-frequency anthropogenic sounds (Bowles et al., 1994). Nevertheless, real-time PAM should be used in conjunction with visual observation, to maximize the probability of detection.

In summary, based on the best available science, the safety distances and mitigation measures proposed cannot guarantee that cetaceans will not be impacted by seismic surveys, and the number of takes would likely be much greater than those proposed in the Federal Register notice. Several important and key studies related to seismic survey impacts and the impacts of noise on cetaceans have not been mentioned in the FR notice, showing at best incomplete research, and at worst selective use of published scientific data. In particular, beaked whales could likely be impacted more heavily than stated. The most effective mitigation measure for these animals would be spatial exclusion zones in important habitats, which are not esonified by seismic surveys.

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Review of proposed L-DEO seismic surveys in SE Asia (FR 78294) 28.1.09

Contents

Note 1. Focus on marine mammals in this review

The concerns raised here specifically focuses on marine mammals but do not imply that impacts on other marine organisms such as marine reptiles, fish, etc. are insignificant but rather that the expertise of this reviewer is with marine mammals. Sincere consultation with experts on other marine organisms of the region is needed as there are also considerable socio-economic issues with fisheries and aquaculture.

Note 2. Noise impacts on cetaceans

- according to NMFS, to avoid permanent physiological damage, cetaceans should not be exposed to received pulsed underwater noise levels of 180 dB re 1µPam (rms) or more.
- This would be 'Level A Harassment' whereas received levels above 160 but lower than 180 dB re 1µPam (rms) would be considered 'Level B Harassment'.
- The predicted distances of where 180 dB re 1µPam (rms) will be received varied between 710m and 3,694m from the source (36-airgun array) depending on the depth at which the array will be towed and the depth of water.
- A deeper tow depth and over shallower water will increase the distance of exposure.
- For the 160 dB re 1µPam (rms) level, the distances varied from 4,670 to 8,000m from source.

1. Lack of data but numerous threats for marine mammal species and populations in SE Asian waters

- There is little knowledge available for most of the species that inhabit the waters of SE Asia. Even the most basic knowledge about the presence/absence of species is incomplete.
- Only a small proportion of the large expanse of sea in the region (and mostly coastal waters) has been surveyed systematically for marine mammals.
- Few estimates of abundance or distribution exists for SE Asian marine mammals and in most cases, this information is for a limited region, often bounded by political rather than biological borders.
- What little is known clearly shows the region to be an area with a high diversity of marine mammal (and other marine) species.
- However, it is also a region where marine mammals are facing a myriad of serious threats that have made the continued existence of several marine mammal populations and possibly some species uncertain (note: some of the same threats and activities have resulted in the recent 'functional extinction' of the baiji (Turvey et al., 2007), which is endemic to the Yangtze River of China).
- All small cetaceans in Taiwanese waters are threatened by fishermen using hand-harpoons, bycatch in fishing gear and noise. Those that inhabit coastal waters of western Taiwan also face habitat degradation, pollution and possibly prey reduction.
- Some marine mammals have been reduced to numbers so low that even minimal 'takes'

will have a large impact on the remaining population.

- A number of marine mammals are discussed below based on what is known about their biology, conservation status and threats in the region. This does not imply other marine mammals that are not specifically discussed in detail are 'safer' from the seismic surveys; in most cases, too little information is available to understand the impacts, which may be as great as or greater than the marine mammals discussed in detail below.

2. Threats to particular species and populations- odontocetes

2.1 Certain overlap of survey tracklines with distribution of critically endangered Eastern Taiwan Strait (ETS) Indo-Pacific humpback dolphins (*Sousa chinensis*) (west coast of Taiwan)

2.1.1 Potential threat from LDEO seismic surveys:

With the exception of a very small area where the proposed tracks take the *Langseth* to the mainland Chinese coast and back to western Taiwan, the *Langseth* will operate in waters within 1 km from the shore of Taiwan and right through the middle (longitudinally) of almost the entire linear coastal distribution of the ETS population, i.e. the proposed trackline almost completely overlaps with entire distribution of the ETS population. At this distance from shore, the *Langseth* will subject the entire population to noise levels >>180dB.

2.1.2 Background

- STATUS: The species *Sousa chinensis* is listed as 'near threatened' under the IUCN red list and is listed under CITES Appendix I. The ETS population is listed as Critically Endangered under the IUCN red list. The species is given the highest level of legislative protection by Taiwan's Wildlife Conservation Act (WCA); distinct (Wang et al., 2008a)
- ABUNDANCE: Population size <100 (Wang et al., 2007a)
- DISTRIBUTION: Thus far, the ETS humpback dolphin population has been recorded in waters from shore out to about 3 km and in water depths that vary from 1.4 to about 25m deep (see Wang et al., 2007a; Chou 2006). The species has not been reported in waters greater than about 25-30m (Jefferson and Karczmarski, 2001) but can be found much further offshore if shallow water exists (Corkeron et al., 1997). Jefferson (2000) showed that humpback dolphin sightings drop off considerably beyond a perpendicular distance of about 400-500m and none were observed beyond a perpendicular distance of about 1500m.
- The ETS population is resident year-round (J.Y. Wang, unpublished data) in a very restricted (<200km) stretch of shallow coastal waters (to about 3km from shore) along western Taiwan (=eastern Taiwan Strait) (Wang et al., 2007b).
- THREATS: noise, bycatch in fisheries, loss of habitat due to land reclamation, decrease of freshwater to river estuaries, pollution (Wang et al., 2007b).
- HUMPBACK DOLPHINS AND BOAT NOISE: In general the species are usually indifferent towards boats but can be curious and approach boats occasionally. Noise from boat traffic (being much lower in intensity than airguns) can affect the acoustic behaviour of humpback dolphins, with mother-calf pairs being the most disturbed (van Parijs and Corkeron, 2001); Boat

traffic can also affect the diving and swimming behaviour of humpback dolphins (Ng and Leung, 2003).

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2.1.3 No escape from noise

Sousa chinensis is considered a slow swimmer and unlikely to sustain high speed swimming for more than a few minutes, and therefore unlikely to be able to outrun the *Langseth* (while towing airguns) for extended periods. Even if they were able to outrun the *Langseth*, there would be no escape within their distribution because:

a) the tracklines covers nearly the entire longitudinal length of the ETS population's total distribution and beyond; and
b) no safe acoustic shelters DEFINE exist.

2.1.4 Poor/no tolerance of additional stress

Mortality (by human causes) of even a single individual per year from this population may not be sustainable, and unless effective mitigation measures are taken immediately to reduce the threats to this population, it is unlikely that the population will continue to exist (Wang et al., 2004, 2007b). Any single threat has the potential to be the final cause of extinction for this small population of dolphins.

2.1.5 Unacceptably high proportion of ETS humpback dolphin population to be impacted

68.7% of the ETS population was predicted to be impacted by the proposed surveys. This high proportion in itself is a severe underestimation of the population being impacted as the *Langseth* will transect the entire distribution of the ETS population, which has no acoustic shelters in these waters and the dolphins can not escape to other waters. Therefore, nearly the entire population will be exposed regardless of where the dolphins are in their distribution. Even at 68.7%, the proportion of this critically endangered population to be impacted is unquestionably far too high.

2.1.6 Proposed impact mitigation measures

Predicted RMS distances

- Even staying >= 2km from the coastline (a proposed mitigation measure to reduce the impact on the ETS humpback dolphin population) does absolutely nothing to reduce the noise exposure to these critically endangered dolphins.
- Even at 8-10km from shore will still expose all animals to >160dB and an unknown number would still be exposed to >180dB.
- The above statements are conservative because they are based on the predicted RMS distances for different levels of exposure (Table 1 in the Federal Register (FR) notice), which
  a) underestimates actual exposure levels in shallow waters* (FR) and
  b) does not consider
     - ◆ reverberations that are likely to occur as a result of the solid concrete sea walls that are found along much of the central western coast of Taiwan,

- the very shallow water depths of western Taiwan (also, tidal fluctuation is up to about 5-6m and can affect the depth in which the dolphins are found during exposure); or
- the many sandbars that may force animals to be further offshore from the solid shoreline during lower tides.

* The grouping of exposures into the very broad category of 'shallow' water (being <100m) is not sufficient to understand the exposure level for a species that occupies water depths at the lowest end of the 'shallow' water category. It is expected that the exposure levels will be much higher at any given distance from source than the predicted values in the tables. The distance to reduce exposure to noise levels of 160dB or greater is unknown for dolphins in water depths less than 25m and could be much greater.

2.1.7 Previous recommendation for buffer zone for ETS humpback dolphins

In December 2008, the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG, an international working group established in early 2008 to provide scientific guidance and advice to all interest groups) recommended that a buffer for noise threats to be out to at least 5km from shore for the ETS population after reviewing a proposal for designation of Major Wildlife Habitat for the ETS population (review letter to Wild At Heart Legal Defense Association – dated 29 December 2008).

Calculations of how far the *Langseth* should be to prevent the ETS population from being exposed to levels >160dB should be based at least on the recommended 5km buffer boundary (i.e., the waters from shore to 5km offshore should not be exposed to levels >160dB). However, given the population's critical status and the fact that table 1 underestimates the actual exposure levels in shallow water, the recommended distance should be even more precautionary, i.e. greater than 13 km from shore based on the values presented in table 1 of the FR notice.

Consideration of cumulative noise impacts

The exposure of these dolphins to total cumulative noise has not been considered. The ETS dolphins live in an environment which is already very noisy (e.g., pile driving and other noise-generating activities during coastal construction, shipping, other seismic surveys (oil and gas, local researchers, etc.). The cumulative impact of all noise sources needs to be examined in context of the contributions by the intense sounds source of the airguns.

2.2 Overlap of survey tracklines with distribution of Jiulong River estuary (JRE) Indo-Pacific humpback dolphins (*Sousa chinensis*) (east coast of China)

2.2.1 Potential threat from LDEO seismic surveys

If the *Langseth* approaches to within 10km from shore, dolphins using waters east of the Chinmen islands may be exposed to levels greater than 160dB and some may be be exposed to 180 dB or

more depending on where the dolphins are found in their distribution and how close the *Langseth* is to the 25-30m isobath.

2.2.2 Background

- STATUS: The species *Sousa chinensis* is listed as 'near threatened' under the IUCN red list and listed under CITES Appendix I. The JRE population likely to meet the IUCN Red List criteria for "critically endangered". *Sousa chinensis* is afforded the highest level of legal protection in China and Hong Kong. JRE humpback dolphins are distinct from ETS humpback dolphins (Wang et al., 2008a); the level of exchange (if any) with other provisional populations along the mainland Chinese coast is uncertain. The JRE population is less well understood than ETS population
- ABUNDANCE: Population size <90 (Chen et al., 2008a)
- DISTRIBUTION The shallow water which *Sousa chinensis* inhabit is more expansive on the western side (i.e. JRE side) of the Taiwan Strait than on the eastern side (ETS side) with the 25-30m isobath which likely marks the boundary of their distribution being further offshore.
- THREATS: main threats are bycatch, habitat degradation, reduction of freshwater to the Jiulong River estuary, increasing pollution, prey reduction and noise. Some JRE dolphins were also killed recently by blasting during coastal construction activities (Wang et al., 2003).

2.2.3 Note on lack of data

Although the JRE dolphins' distribution near Xiamen, PRC has been studied, their distribution in the adjacent waters of the Chinmen islands and further east are completely unknown and were not surveyed by Chen et al. (2008) due to political border issues. Not enough is known about this population to estimate what proportion of dolphins in this small population will be impacted but it is clear that some will be impacted and with such a small population size, even minimal disturbance can have a large impact on the population.

Note on other provisional populations of *Sousa chinensis* along the coast of China:

Far less is known about *Sousa chinensis* in other regions so the impact on these dolphins can not be estimated. However, given the proposed trackline which meets the mainland Chinese coast perpendicularly and closest near the area of Xiamen/Chinmen Islands and near Pingtan (where records of *Sousa chinensis* also exist – see Wang, 1999; Zhou, 2004), dolphins of these coastal waters would be expected to be impacted most.

2.2.5 Summary for populations of Indo-Pacific humpback dolphins in the EEZs of Taiwan and China:

The proposed tracklines for the LDEO survey

a) overlap completely with the distribution of the ETS population, and

b) are directly in line with the heart of the JRE population's distribution at their closest approach to the mainland Chinese coast

The tracklines proposed have the maximum possible impact on these two very small populations, one of which is listed critically endangered, while the other has an even lower abundance.

Given the confirmed critically endangered status of the ETS population and the small population size of the JRE provisional population, a higher level of precaution must be given to avoid negative impacts of human activities on these dolphins. Until the affects of seismic surveys on these shallow water dolphins and in the context of the cumulative impacts of all threats already present can be better understood, a 'safe' exposure level cannot be estimated as all contributions have the potential to be the 'final straw'.

2.2.6 Threats of lower noise levels

Even lower thresholds of exposure than those discussed above may increase the risks to these dolphins by altering dolphin behaviour. Increasing ambient noise levels that can 'mask' biologically important sounds as well as sounds that allow the detection of other threats (e.g., the sound of water flowing past gillnets, approaching boats, etc.).

2.2.7 Reviewer's recommendations for mitigation for *Sousa chinensis*

It is recommended that activities that would increase the risk of extinction of these populations, including physiological and behavioural impacts, not be permitted. {add specifics}

2.3 Beaked Whales, Ziphiidae

2.3.1 Potential threat of LDEO seismic surveys

- The tracklines of proposed seismic survey overlap much of the waters that are known or suspected to be important habitat for beaked whales.
- Waters along the edge of the continental shelf (especially where the strong Kuroshio Current meets the shelf edge) are particularly productive and appear to attract cetaceans, including beaked whales.
- Tracklines that run near and parallel to the edge of the continental shelf around Taiwan will have the greatest impact on cetaceans, being particularly damaging to beaked whales.

2.3.2 Background on beaked whales in SE Asian waters

- Beaked whales are given level two protection under the Wildlife Conservation Act of Taiwan and are listed under CITES Appendix II
- Three species of beaked whales occurring in this area are listed as "data deficient" in the IUCN Red List while Cuvier's beaked whale is 'least concern'.
- Threats to beaked whales in Taiwanese waters include large-mesh pelagic driftnet entanglement (Perrin et al., 2005), direct hunting, vessel collisions (large volume of commercial shipping occurs all around Taiwan) and noise from vessels, live-fire military exercises, naval sonar and seismic surveys (research and commercial).

- Four species of three genera of beaked whales are known from Taiwanese waters:
    - Cuvier's beaked whale (*Ziphius cavirostris*),
    - Longman's beaked whale (*Indopacetus pacificus*),
    - Blainville's beaked whale (*Mesoplodon densirostris*) and
    - ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*);
- Taiwan qualifies as a 'key area' for beaked whales based on the criteria of MacLeod and Mitchell (2006).
- Abundance: Almost nothing is known about the abundance of any species of beaked whales in SE Asian waters; however, recent systematic surveys of the waters of SE Taiwan (J.Y. Wang, unpublished data) revealed much higher beaked whale sightings per unit effort than in Hawaiian waters (Baird et al., 2006), a recognized beaked whale 'key area' (MacLeod and Mitchell, 2006). Beaked whales have been recorded in the waters off the entire eastern coast of Taiwan and strandings have also been recorded in SW Taiwan and several places along western Taiwan (see Wang et al., 1995; Wang, 1999; Zhou, 2004; Wang and Yang, 2006; Yang et al., 2007).
- Although the waters off western Taiwan are usually considered shallow and not the preferred habitat of beaked whales, in NW and SW Taiwan, adjacent deep water is present.
- Of note, *M. ginkgodens* has not been observed alive at sea and <25 specimens are known (see MacLeod et al., 2006).
- There are at least 10 (likely more) stranding and catch records of this species from Taiwan (J.Y. Wang, unpublished data) since the early 1990s.
- Recent surveys off SE Taiwan resulted in multiple sightings (and many photographs) of an unknown species of mesoplodont, which almost certainly was *M. ginkgodens* (the only other species recorded from this region is *M. densirostris*, which clearly was not the species observed). It was the most frequently encountered species in the waters surveyed (J.Y. Wang, unpublished data) and probably not as rare as once believed.
- There is evidence that at least some species of beaked whales exhibit strong site fidelity (e.g., Gowans et al., 2000; McSweeney et al., 2007)

2.3.3 Note on military exercises in waters near Taiwan and unusual stranding events

Military exercises of all forms and by many nations are common in and around Taiwanese waters and recently the Taiwan navy purchased four US-made Kidd-class destroyers that possess the 53-C mid-frequency active sonar, which has been implicated in the mortality of beaked whales in the Bahamas (Balcomb and Claridge, 2001; Evans and England, 2001). The waters around Taiwan are also one of the few places in the world where the US Navy can use their powerful low frequency active (LFA) sonar.

In 2004 and 2005, unusual multiple stranding events of several deep-diving species were recorded (Wang and Yang, 2006; Yang et al., 2008). Shattered tympanic bones and massive injuries to internal structures associated with diving and acoustics were reported for a *M. ginkdogens* that stranded in SW Taiwan (Wang and Yang, 2006). Yang et al. (2008) also reported finding "bubble

lesions" in two beaked whale carcasses that stranded in NE Taiwan.

2.3.4 Need for cetacean surveys before seismic surveys

- Clearly, all tracklines over or near the shelf edge will likely impact many cetaceans. However, without more cetacean survey information, it is uncertain if
  a) just moving tracklines away from the shelf edge would be effective in reducing impacts on beaked whales; or
  b) if the relocation of tracklines would harm different species in waters further offshore.
- Recent multiple sightings of *M. ginkgodens* during dedicated cetacean surveys of waters off SE Taiwan demonstrate the importance of such studies.
- Cetacean surveys in the waters off SW Taiwan where the important deep Penghu Channel exists are limited. This channel has a steep eastern wall that borders against the SW shores of Taiwan and helps to funnel a branch of the Kuroshio Current or the South China Sea Current to the northern tip of the channel ending in an important area of complex seasonal mixing with the cold China Coastal Current (Jan et al., 2002).

2.3.5 Reviewer's recommendations

- Systematic cetacean surveys of the waters of the Penghu Channel are needed before seismic surveys are conducted, to help reduce the impact on beaked whales and other cetaceans.
- Cetacean surveys are needed in the waters off eastern Taiwan (particularly in waters beyond 20km from shore where almost no cetacean survey effort exists) to determine if and what concentrations of beaked whales exist.

2.4 Sperm Whale, *Physeter macrocephalus*

2.4.1 Background on sperm whales in Taiwanese waters

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I
- The sperm whale is listed as "vulnerable" in the IUCN Red List
- DATA: Little is known about the sperm whales in Taiwanese waters.
- ABUNDANCE: The population size is unknown
- DISTRIBUTION: It is the most frequently sighted large cetacean in Taiwanese waters and is not 'uncommon' as stated in table 2 of the Federal Register notice. Most sightings occur in eastern Taiwanese waters (they have been observed along most of eastern Taiwan) but strandings have also occurred along the shores of the Taiwan Strait. Past whaling indicates that the deeper waters off SW Taiwan were also inhabited by sperm whales and sightings are still reported by fishermen.
- THREATS: Sperm whales in Taiwanese waters are threatened by the same human activities that harm beaked whales (see above) with the possible exception of direct hunting.

2.5 Finless Porpoises, *Neophocaena* spp.

2.5.1 Potential threat from LDEO seismic surveys

- During the period of proposed seismic surveys, many female finless porpoises in the region will be accompanied by neonatal calves. These will be most vulnerable individuals as they will be less able to maintain swimming speeds that will allow them to escape the range of the airguns.

2.5.2 Background on finless porpoises

- STATUS: The species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I. Finless porpoises are listed as "vulnerable" in the IUCN Red List but some populations are being threatened more seriously (e.g., the Yangtze River population is listed as 'endangered')
- There is recent evidence that more than one species exists (Wang et al., 2008b)
- ABUNDANCE: the population size is unknown but as a group, finless porpoises are probably the most abundant coastal cetaceans

2.5.3 Comments on detection by MMVOs as mitigation measure

- This is one of the most difficult species to detect at sea even in calm conditions because of its small size, lack of dorsal fin, brief surface time and usually occurring individually or in small groups. Depending on the behaviour of the animal, it can be near impossible to detect.
- Jefferson et al. (2002) reported that during calm sighting conditions, finless porpoises were observed primarily within 300m from the trackline (perpendicular distance) and none were observed beyond about 700m.
- In low light conditions or even slight seas, detecting finless porpoises is challenging even for researchers experienced with the species.
- MMVOs will be ineffective at detecting animals within the predicted distance where exposure in shallow waters can be greater than 190dB.

2.5.4 Comments on PAM as mitigation measure

- In shallow water, PAM is unlikely to be effective in detecting finless porpoises.
- Finless porpoises are not always vocalizing and the high frequency sounds produced by finless porpoises attenuate quickly.

2.5.5 Swimming speed

- Finless porpoises are generally slow-swimmers but are capable of high-speed bursts.
- However, it is unlikely that such speeds can be maintained for more than a few minutes.

2.6 Other Odontocetes

2.6.1 Melon-headed whale

Recent mass strandings of melon-headed whales (*Peponocephala electra*) may have been related to the use of naval sonar (Hawaiian waters) and seismic surveys (Madagascan waters) so there is

concern about the potential impact such activities may have on this species as well. Melon-headed whales, although not a commonly-observed species, have been sighted on several occasions in the waters of eastern Taiwan and SW Taiwan and harpoon captures and two mass stranding events have been recorded from NE Taiwan and western and southern Taiwan, respectively (Wang et al., 2001a).

2.6.2 Short-finned pilot whale

Although the short-finned pilot whale (*Globicephala macrorhynchus*) has not been a species of concern in other parts of the world, four unusual stranding events (with two being mass strandings) involving short-finned pilot whales occurred at several places in and near Taiwan over a short period and coincided spatially (accounting for the direction and strength of local currents) and temporally with large-scale military exercises in the region (Wang and Yang, 2006).

2.6.3 Deep diving cetaceans

Deep diving cetaceans such as Risso's dolphins (*Grampus griseus*), dwarf and pygmy sperm whales (*Kogia sima* and *K. breviceps*, respectively) are also species of concern. Risso's dolphins are very common in all waters off eastern Taiwan (Yang et al., 1999; Wang et al., 2001b; Chen, 2001; Yeh, 2001) and SW Taiwan (Huang, 1996) and appear to be concentrated along and near the steep slope of the continental shelf. Dwarf sperm whales are also seen quite often at sea (Wang et al., 2001b) and appear to have a similar distribution to Risso's dolphins. Nothing is known about the distribution of the pygmy sperm whale in Taiwanese waters as none have ever been seen at sea; the only records are from strandings but comparisons of stomach contents of both *Kogia* spp., Wang et al., (2002) suggested the pygmy sperm whale had a more offshore distribution than that of the dwarf sperm whale. Many *Kogia* (both species) were involved in unusual mass stranding events of multiple species in Taiwan that were linked to intense energy sources (Wang and Yang, 2006; Yang et al., 2008).

Very little is known about most cetacean species in SE Asia. Studies in other regions suggest that some populations of species such as the false (*Pseudorca crassidens*) and pygmy killer (*Feresa attenuata*) whales, common bottlenose dolphin (*Tursiops truncatus*) and spinner dolphin (*Stenella longirostris*) may comprise small isolated groups that are associated with oceanic islands (see Karczmarski et al., 2005; Baird et al., 2008a,b; Baird et al., in press; McSweeney et al., in press).The conditions along eastern Taiwan may have similar characteristics (i.e., oligotrophic waters with considerable nutrient input from land sources and is distant from other such sources of nutrients) that encourages such populations with high site fidelity. Small isolated populations are more vulnerable to local extirpation. These species have been seen throughout the waters of eastern Taiwan and parts of the Taiwan Strait but nothing is known about population structuring of these species in Taiwanese and nearby waters. Several mass stranding events of pygmy killer whales have occurred in SW Taiwan and at least one individual exhibited internal haemorrhage deep in the melon (Wang and Yang, 2006).

3. Threats to particular species and populations - mysticetes

3.1 Background

Little is known about baleen whales in this region. The western gray (*Eschrichtius robustus*), north Pacific right (*Eubalaena japonica*) and western north Pacific blue (*Balaenoptera musculus*) whales have been depleted to such low numbers that their future is precarious. The humpback whale (*Megaptera novaeangliae*) in the western north Pacific is also not as numerous as before commercial whaling with at least one wintering population (southern Taiwan) being extirpated and a small population that over-winter in the northern waters of the Philippines, particularly the Babuyan Islands. Little is known about the other species that have been recorded from these waters: minke whale (*Balaenoptera acutorostrata*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), Bryde's whale (*Balaenoptera brydei*)and the newly described Omura's whale (*Balaenoptera omurai*).

3.2 Western Gray Whale, *Eschrichtius robustus*

3.2.1 Potential threat of LDEO seismic surveys

- The proposed L-DEO surveys from March 21 to July 14, which overlaps with the period during which western gray whales are expected to be either in their wintering grounds or are undergoing their northward migration through the Taiwan Strait, are an additional threat to these highly threatened gray whales. The shallow water preference of gray whales also increases the distance greatly for exposure thresholds. Even the take of a few individuals is projected to cause a continuing decline in the population towards extinction (Cooke et al., 2006).

3.2.2 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan, is listed under CITES Appendix I, and is listed as "critically endangered" under the IUCN Red List
- ABUNDANCE: ~100 individuals (Cooke et al., 2006)
- DISTRIBUION: Generally found in fairly shallow (i.e., continental shelf) waters
- summers in the Okhotsk Sea (mainly off northeastern Sakhalin Island), off eastern Kamchatka, Russia (Weller et al., 1999); wintering grounds (yet undiscovered) are believed to be somewhere in the waters of southern China, possibly around Hainan Island (northern part of the South China Sea) (Wang, 1984). Migration between summering and wintering grounds is unknown but records exist along more or less the entire Chinese coast (Omura, 1988; Zhu and Yue, 1998) so is likely through the Taiwan Strait; migration likely occurs as with other baleen whales during the spring (northwards) and autumn/winter (southwards) periods.
- THREATS: The western Gray whale faces many threats including: direct hunting, incidental mortality caused by fishing gear, coastal industrialization and shipping and activities associated with oil and gas development (for a review, see Weller et al., 2002).

3.2.3 Reviewer's recommendations

- Only with more dedicated cetacean surveys of the region's waters can this population be better understood. Better coverage of the region's waters by cetacean surveys can also allow fine tuning of spatial and temporal avoidance of gray whales by seismic surveys.
- Simple strategic scheduling of seismic surveys can eliminate or at least greatly reduce the impacts on this population.

North Pacific Right Whale, *Eubalaena japonica*

3.3.1 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I, and is listed as "endangered" in the IUCN Red List.
- ABUNDANCE: No more than a few hundred
- DISTRIBUTION: The distribution of this species is unknown, especially the wintering grounds where calving and nursing occurs; the wintering grounds may be as far south as the East China Sea.
- NOTES: Very little is known of the species.

3.4 Western North Pacific Blue Whale, *Balaenoptera musculus*

3.4.1 Potential threat of LDEO seismic surveys

- If small numbers of western north Pacific blue whales still exist in the region's waters, seismic surveys can have a large impact on the few remaining individuals (even if only a very few whales are disturbed).

3.4.2 Background

- STATUS: The species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan, is listed under CITES Appendix I; the blue whale is listed as "endangered" in the IUCN Red List. The north Pacific stock was listed as 'lower risk/conservation dependent' by the 1996 IUCN Red List based mainly on the numbers and evidence of increase from a small part of the stock's distribution (i.e., in Californian waters); a reassessment of this stock using the revised criteria (version 3.1) is needed as the 'lower risk/conservation dependent' category no longer exists and the western north Pacific stock should probably be assessed as a separate entity. There is evidence that supports the western north Pacific stock of blue whales being separate from blue whales elsewhere (for review, see NMFS, 1998).
- ABUNDANCE: The population size is unknown but none has been seen in recent times from Taiwan to southern Japan where hunting once occurred (Clapham et al., 2008); this suggests that the population maybe greatly depleted or possibly extirpated (see NMFS, 1998; Clapham et al., 2008).

3.5 Western North Pacific Humpback Whale, *Megaptera novaeangliae*

3.5.1 Potential threat of LDEO seismic surveys:

The timing of the L-DEO surveys overlaps greatly in space and time with the whales wintering in the Babuyan Islands and coincides spatially and temporally with the northward migration of mothers with neonatal and other young calves from the calving/nursing grounds of the Babuyan waters.

3.5.2 Background

- STATUS: This species is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan and is listed under CITES Appendix I. Although the humpback whale is listed as "least concern" in the IUCN Red List (mainly because many populations have recovered greatly from past commercial whaling), there are still great concerns about some stocks of humpback whales, including the western North Pacific stock which has shown no signs of recovery contrasting greatly with the eastern North Pacific stock.
- ABUNDANCE: The population size for the western North Pacific is estimated to be about 1000 (Calambokidis et al., 2008), which is low and does not indicate recovery from past hunting.
- DISTRIBUTION: There are several wintering populations of humpback whales in the north Pacific Ocean. One population found in the waters of southern Taiwan was decimated (Darling and Mori, 1993) and almost certainly extinct as there have been no sightings of the species in these waters in recent years (Wang and Yang, 2007) even though past records show whales were observable from shore and the waters are fairly extensively utilized by fishing boats presently. Another small wintering population was recently discovered in the waters of the Babuyan Islands in the northern Philippines (Yaptinchay, 1999; Acebes et al., 2007). The sightings data indicates that the humpback whales are present in Babuyan waters from November to May/June but peaking from February to March/April (Acebes et al., 2007). These waters are a calving and nursing area. Records of humpback whales exist for the waters of almost the entire eastern Taiwan and a few records also exist for the Taiwan Strait. At least for some individuals, migration between summering and wintering grounds is through Taiwanese waters, mainly along the east coast of Taiwan (=Philippine Sea) but also some records from the shallow waters of the Taiwan Strait also exist (J.Y. Wang, unpublished data). Records of humpback whales exist for the waters of almost the entire east coast of Taiwan.
- THREATS: Mother-calf pairs of humpback whales appear to be more sensitive to loud noises and have reacted to impulsive noise levels of as low as 140dB (McCauley et al., 2000). The wintering population of the Babuyan Islands is small and vulnerable to threats faced by the whales along their migration route. Incidental mortality of whales in net fisheries along the east coast of Taiwan has been recorded. In the waters of both the west and east coasts of Taiwan, the volume of commercial shipping is a threat to whales because of increased risks of vessel collisions, oil and chemical spills and increased noise. The additional threat of loud noises from seismic surveys has the potential to mask other important sounds or displace humpback whales from their migration routes, which in turn, may increase the risk of other threats (e.g., increase

entanglement as a result of a reduced ability to detect nets in the water; increased vessel collisions because of reduced ability to detect and avoid approaching vessels; movement into waters with a larger amount of net fisheries, etc.). The lack of recovery, the extirpation of the southern Taiwan wintering population and the small size of the Babuyan population are indicative of the need for better protection from impacts caused by human activities.

3.5.3 Reviewer's recommendations

- Better coverage of the region's waters by cetacean surveys can also allow fine tuning of spatial and temporal avoidance of humpback whales by seismic surveys.
- Simple strategic scheduling of seismic surveys can eliminate or at least greatly reduce the impacts on this population.

3.6 Other mysticetes

3.6.1 Background

- STATUS: All other baleen whales species are given the highest level of legislative protection under the Wildlife Conservation Act of Taiwan and listed under CITES Appendix I. Both the sei (*Balaenoptera borealis*) and fin (*B. physalus*) whales are listed as 'endangered' under the IUCN Red List. Little is known of both species in this region but it is believed that a distinct population of fin whales exists in the East China Sea (Fujino, 1960). The common minke whale (*B. acutorostrata*) is under the 'least concern' category of the IUCN Red List. However, the 'J-stock', which inhabits waters that include the East China Sea, is believed to be distinct from other minke whales (evidenced by a reproductive cycle that is out of phase with the others) and has been reduced by >50% by whaling (Reeves et al., 2003). The J-stock of minke whales continues to be hunted or caught by nets by Japanese and Korean whalers/fishermen and is of conservation concern. Furthermore, bycatch of minke whales appear to be common in Chinese waters but this has not been quantified. Although both Omura's (*B. omurai*) and Bryde's (*B. brydei*) whales are listed as 'data deficient' by the IUCN Red List, considerable confusion with regards to taxonomy and nomenclature remains amongst whales that resemble the Bryde's whale. Very little is known about the biology of these whales in the region including how many species exists.
- ABUNDANCE: An estimate of 137 was reported for the East China Sea stock (IWC, 1996). These whales were also captured in Taiwanese waters but none have been seen in recent years. Bryde's whales of the East China Sea stock may have been depleted by whaling (Omura, 1977).

4. Regions of Particular Importance

4.1 Western Taiwan (inshore of about 5km)

- There are three main coastal small cetaceans that inhabit these waters:
  - the endemic and critically endangered ETS population of humpback dolphin
  - Indo-Pacific bottlenose dolphin and the

- finless porpoise.

- Only the waters inshore of about 5km have been surveyed extensively. Most of the Taiwan Strait remains unstudied for cetaceans.
- These waters are effectively a large river delta that is formed by complex of many river systems and are highly productive as there is considerable nutrient input from several of the largest river systems in Taiwan. These coastal waters comprise many estuaries, wetlands, salt marshes, mangrove forests and extensive mud flat areas (resulting from large tidal fluctuations). Intrusions of the warm, clear oceanic waters of the Kuroshio Current also occur fairly regularly.

4.2 Southwestern Taiwan and the Penghu Archipelago

- The Penghu Channel and adjacent waters are important structures that funnel both the South China Sea and strong Kuroshio currents into a narrow area where an important productive upwelling results between the Penghu Islands and Taiwan's west coast.
- There are reports of oceanic cetaceans along and near the steep walls/shelf edge of the channel (Huang, 1996) and deep-diving cetaceans are known to exist in an around the mouth (southern portion) of the Penghu Channel where deeper water exists (as evidenced by past sperm whale whaling records).
- The waters around the Penghu Islands are rich in marine diversity and have substantial coral reefs. There are important fishing grounds to the north and east of the islands that are likely due to the complex bathymetry and mixing of water in this region (Jan et al., 2002).

4.3 Southern Taiwan

- There is great complexity in ocean bathymetry in southern Taiwan and a
- great diversity of cetacean species (>20 species) have been found (see Wang et al., 2001b).
- Wang et al. (2001) also found that the highest occurrence of cetaceans occurred in April and June (the proposed seismic surveys span these months).
- Several sensitive species have been recorded in these waters: Cuvier's beaked whale,Longman's beaked whale (although reported as 'tropical bottlenose whale' in Wang et al. (2001b)), ginkgo-toothed beaked whale, sperm whale, humpback whale (migrants), other baleen whales, dwarf sperm whale, short-finned pilot whale, melon-headed whale, Risso's dolphin and Indo-Pacific bottlenose dolphin.

4.4 Southeastern Taiwan

- This region is mainly occupied by oceanic and deep-diving species (Yeh, 2001; J.Y. Wang, unpublished data). There are minimal shelf waters and the edge of the shelf is very close to shore. The bathymetry is very complex with three small oceanic islands being located more than 30km from Taiwan: Green Island, Orchid Island and Little Orchid Island.

Green and Orchid islands are inhabited and there have been several reports of beaked whale strandings.

- There is a deep water canyon between Green Island and Orchid Island and several upwelling areas between Green Island and Taiwan that is the result of the Kuroshio Current flowing past areas where the water depth decreases quickly. These upwelling areas are important waters for local fisheries targeting large oceanic fish. These islands, being in the path of the Kuroshio Current, also generate areas where deeper water is brought to the surface.
- Recent surveys of some of waters showed high diversity of cetaceans but relatively low abundance of each. Of note is that all four beaked whale species known from Taiwan have been recorded from these waters. There are also frequent sightings of large whales (sperm and humpback). Other oceanic species such as pygmy killer, false killer and killer whales, short-finned pilot whale, dwarf sperm whale, Risso's dolphin, common bottlenose dolphin, striped dolphin, Fraser's dolphin, spinner dolphin and pantropical dolphin have also been recorded.
- In these waters, bycatch mortality by large-mesh, pelagic driftnets are suspected to be very large, on the order of several thousand cetaceans per year and >100 beaked whales per year maybe captured (Perrin et al., 2005).

4.5 Central Eastern Taiwan

- This region has a very narrow shelf so the shelf edge is very close to shore.
- Large concentrations of cetaceans are found along and near the edge of the shelf (Yang et al., 1999) and are the targets of one of the fastest growing cetacean-based tourism industries in the world. Cetaceans are easy to find quickly (with little search effort) and marine conditions during the summer tourism season are generally calm. Although delphinids comprise the main species observed, beaked, sperm and baleen whales have also been reported from these waters. Humpback whales have been recorded migrating through these waters in both spring and autumn.
- As in SE Taiwan, large-mesh pelagic driftnets are abundant and there is a sizeable bycatch.

4.6 Northeastern Taiwan

- This is the only region along eastern Taiwan where the continental shelf is more than a narrow sliver. The bathymetry is complex with a geo-thermally active oceanic island being located <10km from Taiwan.
- An important upwelling exists in NE Taiwan and is the site of a major fishing ground where large purse-seine boats are used to catch schooling fish such as scads and mackerel, which are also consumed by several cetaceans.
- A large cetacean-based tourism industry exists and focuses mainly on spinner dolphins. However, 11 species have been recorded from these waters (Chen, 2001) including the

long-beaked common dolphin (Delphinus capensis), which has only been recorded from these waters thus far. Most of the species observed were delphinids but sperm whales and *Kogia* were also recorded. Of the delphinids observed, the short-finned pilot and pygmy killer whales are suspected to be impacted most by intense noise generated by activities such as seismic surveys.

- There is still a fairly substantial but illegal take of cetaceans by the hand-harpoon fishery, which should be targeting large pelagic fish and fisheries bycatch (especially in purse-seines and entanglement in longlines) are suspected to be considerable as well.
- With the exception of some inshore (<5km from shore) waters, no marine mammal surveys have been conducted in the waters of northern and northwestern Taiwan. The limited surveys of inshore waters in NW Taiwan revealed a single sighting of Indo-Pacific bottlenose dolphins. However, strandings and near strandings of many species have been recorded from the shores of NW and N Taiwan. There are anecdotal reports that a feeding area for baleen whales exists in the waters off northern Taiwan but there is no information to confirm these reports and it is unknown if it still exists. Research on the cetaceans in these waters is needed.

5. Concerns regarding timing of the proposed seismic surveys

5.1 Survey dates and locations

- 21 March to 19 April: seismic surveys will be conducted mainly in the South China Sea.
- 20 April to 07 June: the *Langseth* will survey the waters of the Luzon Strait and Philippine Sea.
- 21 June to 14 July: seismic surveys of the waters around Taiwan will be conducted.

5.2 Concerns:

5.2.1 Western gray whale

- The route(s) and months when western gray whales may undertake their migration from a suspected wintering ground(s) in the South China Sea are unknown. However, it is likely that the period for the migration is in the spring.
- Scheduling the seismic surveys in the South China Sea to be conducted in March and April will likely coincide with at least some migrating gray whales.
- L-DEO did not address this possibility and have not proposed any mitigation measures to avoid this likely overlap of seismic surveys and migrating gray whales.

5.2.2 Humpback whale

- The schedule for surveying the Luzon Strait and the Philippine Sea overlaps completely with the period when humpback whales are still in the area (and includes the latter portion of the peak period (April) for humpback whale concentrations in the Babuyan Islands). Therefore it is unclear how the timing of the surveys reduces the impacts on humpback whales as claimed by L-DEO.

- A large proportion of this population of humpback whales will also be migrating through the Philippine Sea to northern waters at the same time as the proposed surveys Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan. One of the proposed survey tracklines of the *Langseth* also follows this course.
- Many females undertaking the migration at this time will also be accompanied by neonatal calves and these are the most sensitive individuals of the population (McCauley et al., 2000).

5.2.3 Calving/nursing (general)

- Calving for most cetacean species in this region is likely in the spring to early summer as evidenced by sightings of many females with young calves during cetacean surveys that have been conducted in Taiwan and the examination of hundreds of carcasses (J.Y. Wang, unpublished data).
- The proposed survey schedule overlaps greatly with the calving seasons of many species or will occur as females are accompanied by and nursing young calves.
- This proposed period for the seismic surveys is probably the worst choice of seasons if minimizing the impacts of this activity on marine mammals in this region is a sincere goal.

5.2.4 Timing (ETS humpback dolphins and general)

- The ETS population of humpback dolphins is found in the coastal waters western Taiwan throughout the year. Seismic surveys in June and July (as well as any other time of the year) will have a serious impact on this critically endangered population. Given their year-round residency, there is no season that will reduce the serious impacts of seismic surveys in inshore waters on this population.
- In June and July, large numbers of cetaceans are found along and near the shelf edge of eastern Taiwan. Conducting seismic surveys close to the shores of Taiwan risks greatly impacting on these cetaceans.

6. Concerns regarding particular mitigation measures

The mitigation measures proposed by L-DEO would be ineffective or have limited effectiveness at best; below is a list of concerns regarding these mitigation measures:

6.1 Timing (delay)

- The claim is that surveys will be delayed as late as possible to avoid humpback whales, But the timing of the surveys overlap the presence of humpback whales greatly and during a time when newborn calves will be accompanying mothers. The surveys will also occur during or near the calving season for most species in the region; this is when females and calves are the most vulnerable

  The Federal Register notice states that *"The Langseth will attempt to avoid these wintering*

areas at the time of peak occurrence, by surveying the lines near the Ryuku Island and Babuyan Islands as late as possible during each leg of the cruise."

- Given that the entire period of the proposed survey overlaps with humpback whale concentrations in the Babuyan Islands and during the migration period, there is no attempt to avoid this area, and surveying the lines near the Ryuku and Babuyan islands as late as possible within the scheduled period of the surveys does nothing but delay the impact on the animals to a slightly later period because the whales will still be in the area. As such, this measure does not mitigate anything.

6.2 Distance offshore (ETS humpback dolphins)

- The critically endangered ETS population of humpback dolphins will be subjected to >>180dB received levels even if mitigation measures are taken (i.e., to remain offshore of 2km from shore).
- Even if the mitigation measures proposed by L-DEO are fully implemented, there will likely be 'level A harassment' to the ETS population that could have serious and likely irreversible impacts on this population.
- Based on the tabled predicted RMS distances for different received levels and accepting the recommendations of the ETSSTAWG (see above) for this population that for noise issues an additional (i.e., additional to the 3km-from-shore distribution that is known presently for the ETS population) 2km buffer should be considered, the *Langseth* should not be within 13 km of western coast of Taiwan to avoid exposing dolphins to >160dB levels.
- However, the model underestimates the actual levels at different distances.
- Further compounding the underestimation of levels is the fact that the shallow water category is <100m but the ETS population lives in waters less than 25m. Much better predicted RMS distances for different received levels are needed for very shallow waters.

The Federal Register notice states that *"Due to the conservation status of the Indo-Pacific humpback dolphins in Taiwan Strait, seismic operations will not occur in water depths less than 20m and within at least 2 km from the Taiwanese shore. Also, when possible, seismic surveying will only take place at least 8-10km from the Taiwanese coast (approximately from Taixi to Tongshiao), to minimize the potential exposing these threatened dolphins to SPLs greater than 160dB re 1 μPa (rms)."*

- Being 2km from shore puts the *Langseth* in the middle of the distribution of the ETS population and does absolutely nothing to reduce the exposure level to any dolphin.
- The only reduction of noise is possibly with the statement that surveying will only take place 8-10km from shore but the condition of "when possible" is not acceptable because this can be a subjective determination by someone not concerned about the impacts on critically endangered populations of cetaceans.

- Furthermore, as discussed above, 8-10km from shore still may not be sufficient to reduce exposure of the animals to >160dB and the distribution for the ETS population is further south than Taixi (Wang et al., 2007b). Chou (2006) also believes that some of the waters south of Taixi are an important breeding/nursing area for the ETS population.
- These mitigation measures are not effective and still poses unacceptable risks to the dolphins of being exposed to >180dB.

NMFS states that: *"Cetaceans need to be closer than between 950 and 3694m (depending on conditions) to the source to be exposed to levels that can cause PTS (180dB)."*

- The proposed seismic surveys will expose almost the entire ETS population of humpback dolphins to levels >180dB.

NMFS states that: *"Cetaceans need to be closer than between 6000 and 8000m (depending on conditions) to be exposed to levels that may cause TTS (160dB)."*

- As such, all or almost all ETS humpback dolphins will be exposed to >160dB levels even if the *Langseth* remains 8-10km from shore.

6.3 MMVOs

- Based on the table of predicted RMS distances for different received levels, MMVOs may be completely ineffective for detecting small cetaceans in shallow coastal waters because the distance from source will be great even for the 190dB received level (1600 to 2182m); for 180dB, the distances can be 2761 to 3694m from source and for 160dB, the distances are 6227 to 8000m.
- Again, these distances must be considered underestimates because the coastal waters of western Taiwan in which some cetaceans inhabit are much shallower than 100m (e.g., the critically endangered ETS humpback dolphins are in waters from 1.5 to 25m deep; finless porpoises and Indo-Pacific bottlenose dolphins are often commonly observed in waters shallower than about 50m).
- Finless porpoises are difficult to detect even if they are within several hundred metres and sighting is during excellent conditions and by experienced observers (note: excellent weather conditions for sighting cetaceans in the waters around most of Taiwan, especially western Taiwan, are very limited).
- Nighttime visual detection of these coastal species is impossible at the distances shown above even with night-vision equipment.
- MMVOs have limited effectiveness in detecting many deep-diving species such as beaked whales and *Kogia* spp. These are all difficult species to observe and study by experienced researchers. Barlow (1999) reported that very few beaked whales are detected even in prime sighting conditions by cetacean researchers. Barlow and Gisiner (2006) estimated that less than 2% of the beaked whales are likely to be observed by typical mitigation monitoring

(this estimation did not account for observer experience, which will greatly affect detection).

- With such a low detection rate, other mitigation measures dependent upon detection and tracking will be compromised.
- None of the mitigation measures takes into account sighting conditions. This is important as several of the mitigation measures are dependent upon observers sighting marine mammals.

LDEO claims that "Marine mammal detection by MMVOs is high at the short distances from the source [the short distances are the ones mentioned earlier]."

- With the possible exception of 180dB at 950m for deep water, the distances mentioned above (especially for operations in shallow waters) are not short for sighting cetaceans (small or large). Detection of most species drops off beyond 1km from a ship. Even 25x binoculars may have limited use in a region with high humidity and smog in coastal regions (e.g., western Taiwan), which can reduce the clarity of high power optical aids.
- The detection of finless porpoises at distances beyond 1 km is poor. At 3694m, detection of small cetaceans is limited and maybe questionable (especially for finless porpoises) when sighting conditions are sub-optimal.
- In no way can the detection of small cetaceans in shallow water at distances of several kilometers be considered high.
- For beaked whales, only a small proportion of the animals are detected by experienced observers in good sighting conditions (Barlow, 1999). As such, beaked whale detection cannot be considered to be high either.
- Because detection of both shallow water small cetaceans and beaked whales were wrongly concluded to be high, take by injury or death cannot be dismissed and the potential for temporary or permanent hearing impairment is not low and (as discussed above) cannot be avoided by implementing the inadequate mitigation measures proposed.

6.4 PAM

- In shallow water, PAM would be almost completely ineffective at detecting (never mind locating or tracking) cetaceans especially at the predicted RMS distances for the different exposure levels (listed in bullet 3 above).
- Furthermore, PAM is only capable of detecting cetaceans when they are vocalizing. Some species have been known to reduce vocalizations during seismic surveys while other species do not vocalize much at or near the surface (e.g., beaked whales).
-

6.5 Shut down

- Shut down of 30 minutes was proposed. This is clearly not sufficient as several species of concern can stay submerged for more than an hour and remain undetected.

6.6 Ramp up

- There are uncertainties about the effectiveness of ramp-up procedures and no data was presented to show that this was indeed useful in reducing impacts

6.7 Additional concerns: masking; displacement; impact of any level of take on small or vulnerable populations; inappropriate use of data from other areas; impacts on prey; assumption that animals will move away from noise source; variability and uncertainty in TTS threshold information; and need for greater local consultation and research

In all cases, animals can face other issues related to loud noise sources.

6.7.1 Masking

- Masking of not only biologically important sounds but also masking of the noises made by threats, hindering detection of the threats and increasing the impact of the existing threats (e.g., water rushing past a gillnet, commercial shipping) and the chances of mortality.

6.7.2 Displacement

- The impacts on cetaceans due to displacement into other waters may not be trivial for populations with low numbers, restricted distributions and in areas where threats are abundant (e.g., large number of net fisheries).
- Displacement may increase energy expenditures by the animals already compromised energetically (such as mothers with calves, individuals that are thin due to interrupted feeding, etc.) and increase exposure to other threats (e.g., changes in migration routes may result in animals using waters with higher densities of fishing nets or lines and thus increase their risk of mortality due to entanglement). Mothers with calves are most vulnerable.

6.7.3 Impact of any level of take on small or vulnerable populations

- Several cetaceans are in critically low numbers that even minimal 'takes' can contribute greatly to the demise of these populations.
- Most of the values in Table 3 do not make any sense to those who have experience with local marine mammal populations in the region
- (e.g., the take of 64 Cuvier's beaked whales compared with 168 Blainville's beaked whales; a take of 189 killer whales compared with only 68 finless porpoises). These numbers are little better than random guesses.

The Federal Register notice states that: *"...the number of potential harassment takings is estimated to be small, less than a few percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned..."*

- This statement is incorrect. L-DEO estimated that 68.7% of the critically endangered ETS population of humpback dolphins will be impacted.
- Even although this is a serious underestimate (explained earlier), it is already a very high proportion of this distinct population and the mitigation measures proposed do not minimize the exposure level to these dolphins.
- The taking is also expected to include level A harassment rather than just level B as claimed by L-DEO.
- The taking (both level A and B) of such a large proportion of the ETS dolphins could have an irreversible impact on the continued survival of the population.

6.7.4 Inappropriate use of data from other areas

- The use of data from the Eastern Tropical Pacific for estimating the densities and number of individuals impacted by the proposed seismic survey is completely inappropriate as there is no evidence that the two sides of the Pacific Ocean are comparable. Such extrapolation would not be acceptable to most cetacean scientists. This should be re-examined carefully.

6.7.5 Potential impacts on prey (fish)

- The impact on the prey of coastal species such as the ETS population of humpback dolphins, finless porpoises and Indo-Pacific bottlenose dolphin are of concern. A large proportion of the diet of these species consists of sciaenids (croakers, drums, etc.) that are highly acoustic fish. How intense noise from seismic surveys will affect their prey is unknown.
- For the ETS population, this is of particular concern because there are already indications some dolphins are nutritionally stressed (J.Y. Wang, unpublished data).

6.7.6 Assumption that animals will move away from noise source

NMFS states that: *"Animals will move away from noise source that is annoying before it can potentially become injurious."*

This assumption is flawed for slow swimming species and those with restricted distributions.

- This is the case for the ETS population of humpback dolphins, which would be exposed to sound levels >180dB for many pulses and result in PTS
- Finless porpoises and Indo-Pacific bottlenose dolphins may also be as restricted in their movements.
- Furthermore, for cetaceans that inhabit the waters near or on the shelf edge, where the shelf edge is close to shore (e.g., waters of much of Taiwan), it is not clear that cetaceans fleeing an approaching seismic survey vessel will always choose to flee offshore. If an error is made and dolphins flee inshore, they will be trapped and be exposed for a much longer duration and potentially higher levels.

6.7.7 Variability and uncertainty in TTS threshold values

- Furthermore the TTS threshold is based on limited information from only a few species of cetaceans.
- Most of the species of concern (e.g., baleen whales, beaked whales, humpback dolphin, finless porpoises, etc.) have not been examined and there appears to be greatly variability amongst individual cetaceans tested so interspecific extrapolations need to be considered cautiously (for a review, see Weilgart, 2007).

6.7.8 General recommendation for greater local consultation and research

- Extensive consultation with experts on these regions and more studies to better understand the biology of cetaceans in this region can provide expert guidance to greatly reduce the impacts of the seismic surveys.

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Comments and recommendations regarding application for Incidental Harassment Authorization for marine seismic surveys in SE Asia from March 21 to July 14 (FR 78294).

Dear Mr. Payne:

Wild at Heart Legal Defense Association and the undersigned individuals and organizations jointly submit the following comments and recommendations regarding the application by Lamont-Doherty Earth Observatory (LDEO) for an Incidental Harassment Authorization (IHA) for a marine seismic survey proposed to be carried out in south-east Asia from March 21 to July 14, and the EA for the project.

COMMENTS AND CONCERNS:

1. **<u>The EA contains several erroneous claims, omissions and unacceptable proposals with regards to the critically endangered ETS population of humpback dolphins (*Sousa chinensis*)</u>**

The distinct, isolated Eastern Taiwan Strait (ETS) population of Indo-Pacific humpback dolphins (*Sousa chinensis*) was listed under the IUCN Red List in August 2008 as "Critically Endangered". This was partly due to its small population size (<100) and the numerous threats present in its limited habitat along the west coast of Taiwan, the main threats being: bycatch; underwater noise; reduction of freshwater flow to estuaries; habitat loss through land reclamation; and air and water pollution. Several international workshops and peer-reviewed reports have highlighted the urgent need to reduce these threats in order to avoid pushing this population closer to extinction, and aid its recovery.

- Sixty-eight point seven percent - the percentage of the ETS humpback dolphin population which LDEO has applied for permission to take - constitutes an indisputably high percentage of the population; **over two-thirds cannot be reasonably argued to constitute a "small number" of dolphins in any context, let alone the context of there being less than 100 in existence**. The requested level of impacts of this survey therefore exceeds the coverage provided by IHAs.
- **Even the high number of dolphins estimated in the EA to be potentially harassed does not accurately reflect the potential impact**, as the entire ETS humpback dolphin habitat could be ensonified at received levels of >160dB re 1μPa (rms), with some dolphins being exposed to received levels of >180dB (rms), given that the survey tracklines pass within 1 km of shore (or 2km if proposed mitigation measures are applied) and therefore directly through the shallow, narrow, linear coastal ETS humpback dolphin habitat which extends to 5km from shore.
- **The level of harassment for which LDEO has applied for permission (level B) is inappropriate for a survey which threatens to expose ETS humpback dolphins to received levels of >180dB** re 1μPa (rms), which can cause permanent physiological damage and would constitute at a minimum level A harassment.
- When considered in the context of a population that is estimated to be unable to sustain an annual loss of one individual, and the fact that noise levels > 180dB (rms) may cause serious injury or even death while noise levels >160dB and indeed <160 dB (rms) may influence behavior or act in combination or synergy with existing threats (e.g. increasing the likelihood of injurious or deadly

interactions with boats and gillnets), **the proposed survey does not merely threaten to cause minor impacts to individuals – it clearly poses a significant threat to the future existence of the population.**

- **The claim in the EA that the impacts of the TAIGER survey will be minor and short-term "[b]ecause human activities in the area of the proposed seismic survey are high" (EA p. 79) is illogical** and reflects a serious misunderstanding or misrepresentation of the nature of cumulative and synergistic effects. Impacts predicted to result from this seismic survey must be viewed with no less seriousness than any other new stress factor, i.e. they should be treated as impacts that could threaten the continued existence of the population.
- Recent estimates of habitat boundaries and noise buffer zones specifically for the ETS humpback dolphins are not referred to yet could have easily been acquired through consultation with the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG). The existence of this expert advisory team dedicated to ETS humpback dolphin matters was brought to the attention of one of the principle preparers of the EA by the director of Wild at Heart Legal Defense Association in an email dated 19 September 2008.

2. <u>The proposed mitigation measures are inadequate and do not sufficiently allow for local marine mammal observation conditions – weaknesses which augment the risk of impacts in a region where cetacean status and distribution are relatively poorly understood</u>

The lack of reliable information from systematic surveys in the relatively poorly-studied SE Asian region, as in other regions, necessitates the highest levels of precaution in estimating and attempting to mitigate potential impacts. Even best practice marine mammal visual observation, shut down and other measures can provide no guarantee against significant impacts on populations in these regions (given, for example, inherently low observation sighting rates for species such as beaked whales and evidence that some species decrease or cease vocalizing in response to seismic surveys). **However, LDEO has not attempted to adopt all available precautionary measures that may help to reduce impacts**.

- With tracklines overlapping known and suspected habitat for beaked whales, which are known to be particularly sensitive to acoustic impacts, extremely difficult to detect visually, and already facing numerous threats (including acoustic) within their habitat *at least* in Taiwanese waters, and with almost no

data on abundance for beaked whales in SE Asia (as reflected by the IUCN Red List status of three species in the region as "Data Deficient"), there is a clear potential for significant impacts on beaked whales, and hence a need for great precaution.

- Similarly, abundance and other data in SE Asia for sperm whales, which are known to 'startle' in response to seismic surveys and to face numerous threats in the SE Asia region (including acoustic), are unknown, justifying precautionary measures.
- There is a risk that dolphins from the Jiulong River Estuary (JRE) population of humpback dolphins, which is of similar size (<90) and faces similar threats to the ETS population, may also be exposed to received levels >180dB, again exceeding the type of take for which LDEO has applied.
- The anticipated presence of female finless porpoises and their calves in the survey region during the surveys is of great concern, particularly given the fact that these animals will likely be difficult if not completely impossible to detect visually at distances at which they may still be exposed to noise levels > 190dB (rms), and do not vocalize at all times.
- The potential impacts on western North Pacific humpback whales in the waters of the Babuyan Islands (believed to be calving and nursing grounds for a small population of humpback whales) and Taiwan (e.g along the east coast and in the Taiwan Strait) and the fact that surveys will occur during the northward migration of mothers and calves is worrying. Mothers and calves may be more sensitive to acoustic disturbance and are probably more susceptible to the impacts of stress responses to disturbance of any kind.

A lack of understanding of the distribution and status of the abovementioned and other species and populations highlights the need for greater precaution and investigation prior to carrying out seismic surveys in this region. However several proposed monitoring and mitigation measures do not reflect the need for precaution, for example:

- **The proposed number of marine mammal visual observers is insufficient** (a minimum of only one observer working during daytime operations, except for 30 minutes before and after ramp up when this will be increased to two observers)
- **Nighttime seismic surveys could be (but are not) prohibited**, meaning impaired effectiveness of MMVOs and greater reliance on PAM, which provides no certainty of detection of animals that are not vocalizing.

RECOMMENDATIONS:

- An IHA should not be granted for the proposed survey because:
  - the number of ETS humpback dolphins that LDEO proposes to harass and the likely level of harassment both exceed the levels for which an IHA should be granted.
  - the number of ETS humpback dolphins to be harassed is likely to exceed a sustainable level of take for this critically endangered population and is therefore unacceptable.
  - the proposed monitoring and mitigation measures are inadequate to detect or avoid impacting several species which are endangered, particularly vulnerable to noise impacts, extremely difficult to detect (e.g. ETS humpback dolphins, beaked whales and finless porpoises) and generally poorly understood.
  - the timing of the surveys shows little or no regard to periods of migration through or near the survey locations for some species (e.g. humpback whales)
  - the EA reflects serious misunderstanding and error in the analysis of potential cumulative impacts where such impacts matter greatly.
- While it may be true that some of the planned monitoring and mitigation measures "would reduce the possibility of injurious effects", the monitoring and mitigation measures cannot be argued to *prevent* the possibility of injurious effects, which are highly likely to occur. The claim in the EA that "[n]o long-term or significant effects are expected on individual marine mammals…the populations to which they belong, or their habitats" is ill-founded and should be reconsidered in light of the above concerns.
- In the event that no attempt was made by LGL to consult with the Eastern Taiwan Strait *Sousa* Technical Advisory Working Group (ETSSTAWG) prior to completion of the EA, we would recommend that this be done immediately with a view to clarifying some of the concerns relating to harassment of Indo-Pacific humpback dolphins, and that similar consultations be held with other experienced researchers throughout the region in question.
- Finally, we are aware that that this LDEO survey proposal is one of a very small number or requests for authorization for geophysical surveys while other user groups, including the oil and gas industry, are not carrying out such environmental assessments or are not subjected to public scrutiny in this way. Rather than allowing the focus to be limited to geological surveys such as LDEO's, we recommend that measures be taken to ensure that all future marine seismic surveys (whether of an academic or commercial nature) are made subject

to the same level of scrutiny and transparency, such as by requiring EAs or EISs to be submitted for professional and public review and with all relevant documents (including post-survey reports and relevant local permits, authorizations and licenses) being made publicly available.

For further information regarding these comments and recommendations, please contact us at the above address.

Sincerely,

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