

**Supplemental Environmental Assessment of a
Marine Geophysical Survey by the R/V *Marcus G. Langseth*
in Southeast Asia, March–July 2009**

Prepared for

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TABLE OF CONTENTS

	Page
LIST OF ACRONYMS	IV
I. INTRODUCTION.....	1
II. SUMMARY OF PUBLIC COMMENTS	1
III. RESPONSE TO PUBLIC COMMENTS	1
Location or Timing of Survey Lines	2
1. <i>Eastern Taiwan Strait Subpopulation of the Indo-Pacific Humpback Dolphin</i>	2
2. <i>Shallow Waters of the South China Sea and Western Taiwan Strait</i>	2
3. <i>Coastal and Slope Waters off the East Coast of Taiwan</i>	2
4. <i>Timing of Surveys near Humpback Whale Breeding Areas</i>	4
Other Monitoring and Mitigation Measures	4
1. <i>Number and Qualifications of Marine Mammal Observers</i>	4
2. <i>Nighttime Operations</i>	4
IV. REVISED TAKE ESTIMATES.....	5
V. LITERATURE CITED	7
APPENDIX 1	9

LIST OF ACRONYMS

~	approximately
dB	decibel
EA	Environmental Assessment
ETSSTAWG	Eastern Taiwan Strait Technical Advisory Working Group
h	hour
HKDCS	Hong Kong Dolphin and Conservation Society
HIS	Humane Society International
IHA	Incidental Harassment Authorization (under U.S. MMPA)
IUCN	International Union for the Conservation of Nature
JW	Dr. John Wang
L-DEO	Lamont-Doherty Earth Observatory of Columbia University
<i>Langseth</i>	<i>R/V Marcus G. Langseth</i>
m	meter
MMO	Marine Mammal Observer
MMVO	Marine Mammal Visual Observer
ms	millisecond
NEPA	(U.S.) National Environmental Policy Act
NMFS	(U.S.) National Marine Fisheries Service
NRDC	Natural Resources Defense Council
NSF	(U.S.) National Science Foundation
NVD	Night Vision Device
OBS	Ocean Bottom Seismometer
PAM	Passive Acoustic Monitoring
R/V	Research Vessel
rms	root-mean-square
s	second
SE	southeast
SEL	Sound Exposure Level (a measure of acoustic energy)
SPL	sound pressure level
TAIGER	Taiwan Integrated Geodynamics Research
μPa	micropascal
WAH	Wild at Heart

I. INTRODUCTION

Lamont-Doherty Earth Observatory (L-DEO), a part of Columbia University, operates the oceanographic research vessel *Marcus G. Langseth* under a cooperative agreement with the U.S. National Science Foundation (NSF). L-DEO plans to conduct a seismic survey in Southeast (SE) Asia from ~31 March–20 July 2009, as part of the Taiwan Integrated Geodynamics Research (TAIGER) program.

NSF, as the funding and action agency, has a mission to “promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”. The proposed seismic survey is part of a research proposal recommended for funding by an expert review panel. The proposed survey will provide data integral to advancing scientific understanding of the process of large-scale mountain building. The study is designed to characterize the birth and evolution of a mountain belt, which in turn can provide information on locations and source properties of regional earthquakes. The information is vital to understanding plate tectonic processes and their effects on earthquake occurrence and distribution.

An Environmental Assessment (EA) was prepared to provide the information needed to assess the potential environmental impacts associated with the use of a 36-airgun array during the proposed study. The EA was prepared under the U.S. National Environmental Policy Act (NEPA) and Executive Order 12114, “Environmental Effects Abroad of Major Federal Actions”. The EA addresses potential impacts of the proposed seismic survey on marine mammals, as well as other species of concern in and near the study area, including sea turtles, fish, and invertebrates. The EA also provides useful information in support of the application to the National Marine Fisheries Service (NMFS) for an Incidental Harassment Authorization (IHA). An Application for that IHA was posted by NMFS in the Federal Register on 22 December 2008 (NMFS 2008), requesting comments by 21 January 2009, subsequently (on 16 January) extended to 5 February because “unique circumstances of the timing of the publication of the Federal Register notice relative to several Federal holidays” (NMFS 2009).

This Supplemental EA is in response to the comments received by NOAA through the public comment periods associated with the IHA process. NSF received no direct public comments on the draft EA during (or after) the open comment period of 14 November 2008 through 15 December 2008. Included are a number of changes to the survey design that were made by L-DEO to address specific comments, some received by a number of individuals and agencies, and to enhance measures already included in the original documents to mitigate effects of the proposed survey on marine mammals

II. SUMMARY OF PUBLIC COMMENTS

Comments received by NMFS in response to the IHA Application published in the Federal Register, as of the extended deadline for comments (5 February 2009), were summarized by NMFS and are given in Appendix 1.

III. RESPONSE TO PUBLIC COMMENTS

Some comments provided to NMFS were too general to allow meaningful responses, or were detailed and informed, but were phrased such that the only response could be a counter comment. A number of other comments pointed out shortcomings in the EA that do not alter the overall conclusions, e.g., particular publications that were not cited; we are grateful for those comments and have taken note of them for future reference. In the following sections, we provide responses to detailed comments that

made recommendations about project activities that will be changed to better protect certain species or groups of marine mammals.

Location or Timing of Survey Lines

1. *Eastern Taiwan Strait Subpopulation of the Indo-Pacific Humpback Dolphin*

Many of the comments, including some of those from the Eastern Taiwan Strait Technical Advisory Working Group (ETSSTAWG), the Hong Kong Dolphin and Conservation Society (HKDCS), Humane Society International (HSI), Dr. John Wang (JW), the Natural Resources Defense Council (NRDC), and Wild at Heart (WAH), concerned possible effects of the seismic surveys on the small population of ~100 Indo-Pacific humpback dolphins (*Sousa chinensis*) that occurs along a ~100 km stretch of the west coast of Taiwan, from Taixi to Tongshiao (Wang et al. 2007). That population, the Eastern Taiwan Strait subpopulation, is considered Critically Endangered on the IUCN Red List of Threatened Species (IUCN 2008). The shallow waters off the west coast of Taiwan are also inhabited by the finless porpoise (*Neophocaena phocaenoides*), considered Vulnerable by IUCN (2008).

L-DEO has negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. Off Taiwan's west coast, the cruise tracks have been re-routed offshore by ~20 km to protect the critically endangered *Sousa* population and the finless porpoise, as well as ease potential pressure on other coastal species (Fig. 1). Thus, it is now planned to maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, "at least 13 km and perhaps a more precautionary 15 km of the ETS *Sousa* population—meaning up to around 20 km from shore".

2. *Shallow Waters of the South China Sea and Western Taiwan Strait*

Other comments expressed concern about the mainland side of Taiwan Strait and shallow waters of the South China Sea. The Jiulong River Estuary, on the mainland side of Taiwan Strait at ~24.5°N, is habitat for another subpopulation of ~90 *Indo-Pacific humpbacked dolphins* (Chen et al. 2008 in JW comments). Winter breeding grounds of the *western gray whale* are not known, but are thought to be located in the South China Sea, along the coast of Guangdong province and Hainan (Wang 1984 and Zhu 1998 in Weller et al. 2002a; Rice 1998). Also, the migration route of the gray whale is ill defined, but very likely extends through Taiwanese waters, probably through the Taiwan Strait. Their occurrence there is possible from December to April. If migration timing is similar to that of the better-known eastern gray whale through similar latitudes, southbound migration probably occurs mainly in December–January, and northbound migration mainly in February–April, with northbound migration of newborn calves and their mothers probably concentrated toward the end of that period. Even during migration, gray whales are found primarily in shallow coastal waters. Shallow, coastal waters of the South China Sea are also inhabited by one of the three populations of the *finless porpoise*.

Because of these concerns about effects of the proposed surveys on gray whales, Indo-Pacific humpbacked dolphins, and finless porpoises, the proposed survey lines in the South China Sea south of the Taiwan Strait have been re-routed so that they are now located in water depths >200 m, as recommended by NRDC. The seismic lines in western Taiwan Strait have been dropped (Fig. 1).

3. *Coastal and Slope Waters off the East Coast of Taiwan*

Other concerns were expressed about the survey line that was parallel to and within a few km of the east coast of Taiwan because of potential effects on coastal species and those that frequent the shelf break and steep slopes, e.g., beaked and sperm whales. The continental shelf is narrow there (Fig. 1).

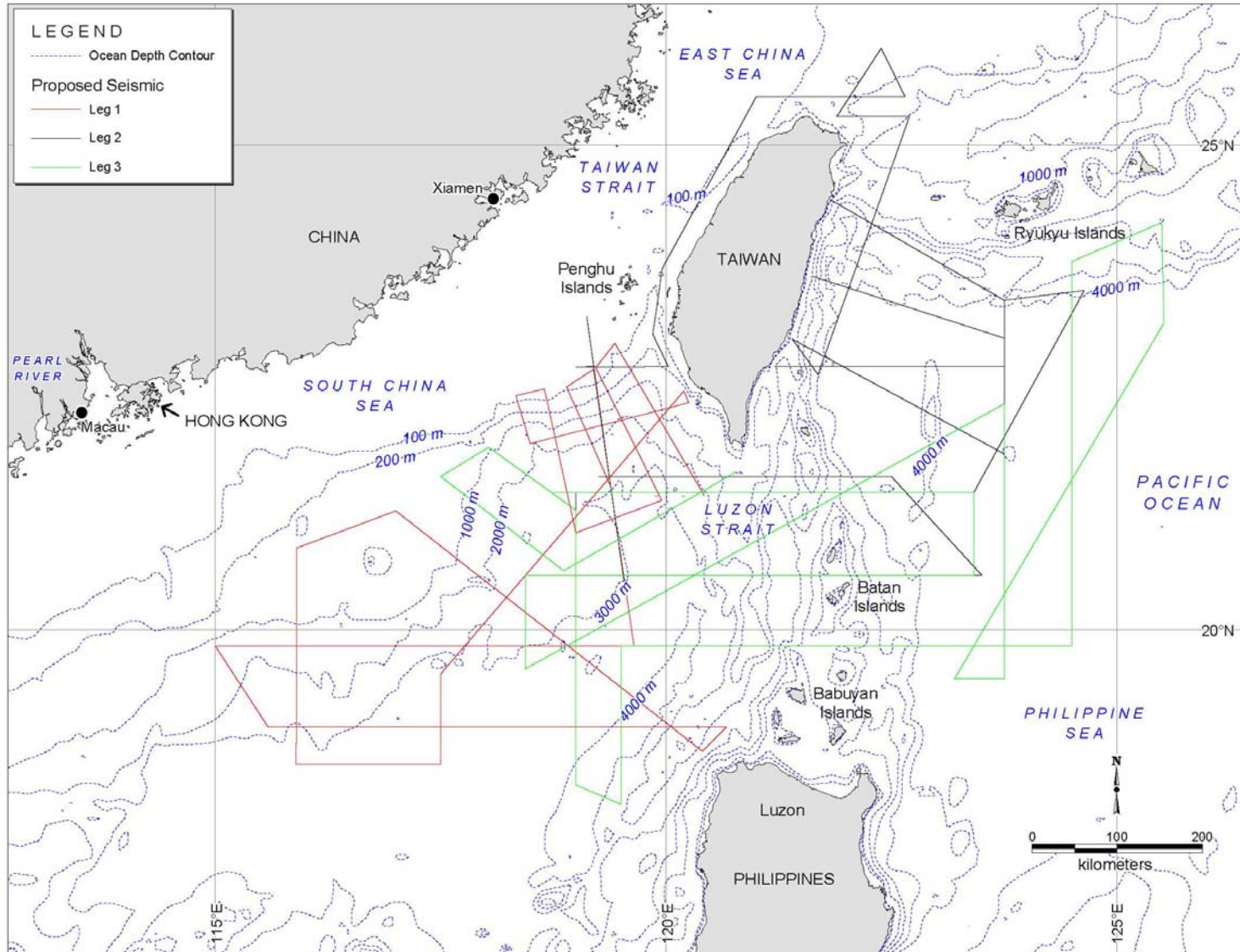


FIGURE 1. Study area and proposed seismic transect lines for the TAIGER survey in SE Asia, revised based on public comments submitted to NMFS. Different colored lines correspond to the various legs of the cruise [see text]. Leg 3 is not shown as it does not involve seismic acquisition.

The proposed survey line paralleling the east coast of Taiwan has also been moved offshore by more than 20 km to decrease potential impacts on species that occur in coastal waters and over the continental slope (Fig. 1).

4. Timing of Surveys near Humpback Whale Breeding Areas

Another concern was raised in several comments (JW, NRDC) about survey lines scheduled for Leg 2 (20 April to 7 June) approaching humpback whale breeding areas in the Babuyan and Ryukyu Islands. In fact, the humpback whales that winter and calve in the Ryukyu Islands are near Okinawa (Nishiwaki 1959; Rice 1989; Darling and Mori 1993), some 400 km north of the most northerly survey. However, a small population of humpbacks does winter and calve in the Babuyan Islands in Luzon Strait (Acebes and Lesaca 2003; Acebes et al. 2007). The whales may arrive in the area as early as November and leave in May or even June, with peak occurrence during February through March or April (Acebes et al. 2007).

To mitigate against the potential effects of the surveys on humpbacks, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible, to Leg 4 (18 June–20 July).

Other Monitoring and Mitigation Measures

1. Number and Qualifications of Marine Mammal Observers

A number of comments (EESSTAWG, JW, HSI, WAH) concerned the ability (or inability) to detect marine mammals from the seismic vessel. Specific recommendations included that a minimum of 2 marine mammal visual observers (MMVOs) should be present, that MMOs (both visual and acoustic) have proper training and experience, particularly experience in the Taiwan area, and that the duration of watch times should be reduced from 4 to 2 h (or 30–60 min) to prevent compromised efficiency as a result of fatigue.

The R/V *Marcus G. Langseth* carries 5 qualified and experienced marine mammal observers for every seismic study involving use of an airgun system comparable to that planned for this project. MMOs are appointed by L-DEO with NMFS concurrence. L-DEO now plans to employ a regional expert as one of the MMOs, and negotiations are currently underway with experts from National Taiwan University, Academia Sinica, and the National Taiwan Ocean University.

Three observers are typically on watch at a time, two on the observation tower conducting visual observations and the third monitoring the PAM equipment. On the tower, two observers are on watch during all daylight hours except during meal times. Observers typically observe for 1–3 h. Because there are usually two marine mammal observers on the visual watch at a time, they alternate between observing with reticle binoculars (e.g., 7×50 Fujinon), Big-eye binoculars (25×150), and the naked eye to avoid eye fatigue.

2. Nighttime Operations

A number of comments (EESSTAWG, HSI, WAH) concerned the inability to detect marine mammals from the seismic vessel at night, and recommended no nighttime operations.

The scientists conducting the survey have considered this recommendation, and have decided that it is not feasible, as limiting the surveys to daytime only would either result in the loss of half of the data

or would necessitate doubling the duration of the project. Doubling the duration of the surveys is not possible because the *Langseth* has other research commitments after this cruise, and because of weather conditions associated with the typhoon season. It would also incur other potential environmental effects. However, the seismic source will not be started if the observers cannot view the entire safety radius for any reason (darkness, fog, or rough seas). In addition, Passive Acoustic Monitoring (PAM) will be used day and night as practical, which can detect vocalizing marine mammals present in the area.

3. *Shut downs for Species of Special Concern*

In response to concerns about marine mammal species of special concern because of their low population sizes, the airgun array will be shut down immediately if there is a sighting at any distance of the North Pacific right whale, western gray whale, Indo-Pacific humpbacked dolphin, or finless porpoise.

IV. REVISED TAKE ESTIMATES

The number of different individuals that could be exposed to airgun sounds with received levels ≥ 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ on one or more occasions and the number of possible exposures (including repeated exposures of the same individuals) were estimated using the methods described in the EA. In the originally proposed and revised survey, the seismic lines are widely spaced in the survey area, and are further spaced in time because the proposed survey is planned in discrete legs separated by several days. Thus, an average individual mammal would not be exposed during the revised surveys more than 1.1 times. Moreover, some individual animals would not be expected to stay in the area during the entire survey.

The numbers of different individuals potentially exposed to ≥ 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ were calculated by multiplying

- the expected species density, either “mean” (i.e., best estimate) or “maximum”, times
- the anticipated area to be ensonified to that level during airgun operations on the revised transect lines excluding overlap.

Density estimates of large whales were the same after the tracklines were revised, but those of most of the species were different because they were weighted by the estimated lengths of seismic lines over complex bathymetry or slope and over deep, flat or gently sloping bottom. Those lengths differed when the survey lines were revised (revised estimate of 1200 km over complex bottom vs. ~1250 km; 12,934 km over flat bottom vs. 14,652 km). Because densities of most species were higher over complex bottoms, the revised density estimates were somewhat higher (1–5%).

The total length of revised tracklines is 14,515 km, ~9% less than the original 15,902 km. Applying the approach for estimating ensonified areas described in the original EA, ~160,132 km² (~5% less than the original 168,315 km²) would be within the 160-dB isopleth on one or more occasions during the revised survey. Table 1 shows the best and maximum estimates of the number of different individual marine mammals that potentially could be exposed to ≥ 160 dB re 1 $\mu\text{Pa}_{\text{rms}}$ during the seismic survey as revised based on public comments, assuming that no animals move away from the approaching survey vessel before the received level reaches 160 dB. The ***Requested Take Authorization***, given in the far right column of Table 1, is based on the maximum estimates rather than the best estimates of the numbers exposed for large whales (sperm and baleen whales), because of uncertainties associated with the method of estimating their densities. The ***Requested Take Authorization*** for other species is based on the best estimates rather than the maximum estimates of the numbers exposed, as discussed in

TABLE 1. Revised estimates of the possible numbers of marine mammals exposed to different sound levels during L-DEO's proposed TAIGER seismic survey during March–July 2009, following changes made to the location and timing of survey lines. The proposed sound source is a 36-airgun array with a total discharge volume of ~6600 in³. Received levels of airgun sounds are expressed in dB re 1 μPa (rms, averaged over pulse duration), consistent with NMFS' practice. Not all marine mammals will change their behavior when exposed to these sound levels, but some may alter their behavior when levels are lower (see text). Species in italics are listed under the ESA as *endangered*.

Species	Number of Individuals Exposed to Sound Levels <160 dB (<170 dB, Delphinidae)										Requested Take Authorization							
	Best Estimate ¹					Maximum Estimate ¹												
	Leg 1	Leg 2	Leg 4	Total	% of pop'n ²	Leg 1	Leg 2	Leg 4	Total									
Balaenopteridae																		
<i>Western North Pacific gray whale</i>	0	0	0	0	0	0	0	0	0	0	0							
<i>North Pacific right whale</i>	0	0	0	0	0	0	0	0	0	0	0							
<i>Humpback whale</i> ³	1	5	0	6	0.60	1	8	0	9	9	9							
Minke whale	0	0	0	0	0.00	0	0	0	0	0	0							
Bryde's whale	13	15	16	43	0.17	19	22	23	65	65	65							
Omura's whale	1	1	1	4	NA	2	2	2	6	6	6							
<i>Sei whale</i>	1	1	2	4	0.04	2	2	2	6	6	6							
<i>Fin whale</i>	1	1	2	4	0.03	2	2	2	6	6	6							
<i>Blue whale</i>	1	1	2	4	NA	2	2	2	6	6	6							
Physeteridae																		
<i>Sperm whale</i>	1	1	2	4	0.01	2	2	2	6	6	6							
Dwarf sperm whale	208	240	254	703	6.28	333	384	407	1124	1124	703							
Kogia sp.	11	13	14	38	NA	17	20	21	58	58	38							
Ziphiidae																		
Cuvier's beaked whale	17	20	21	58	0.29	39	45	47	131	131	58							
Blainville's beaked whale	45	52	55	153	0.61	82	94	100	276	276	153							
<i>Mesoplodon</i> sp. (unidentified)	79	92	97	268	1.06	82	94	100	276	276	268							
Unidentified beaked whale	35	40	43	118	NA	46	53	56	155	155	118							
Delphinidae																		
Rough-toothed dolphin	63	(35)	72	(42)	77	(39)	212	(116)	0.14	256	(143)	295	(172)	313	(158)	865	(473)	212
Indopacific hump-backed dolphin	0	(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottlenose dolphin	1192	(666)	1374	(802)	1456	(734)	4021	(2201)	1.65	1745	(975)	2011	(1173)	2130	(1074)	5886	(3222)	4021
Indo-Pacific bottlenose dolphin	0	0	0	0	0	0	0	0	NA	0	0	0	0	0	0	0	0	0
Pacific white-sided dolphin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pantropical spotted dolphin	5979	(3340)	6890	(4020)	7300	(3680)	20169	(11040)	2.52	7010	(3916)	8077	(4714)	8558	(4314)	23646	(12944)	20169
Spinner dolphin	2812	(1571)	3240	(1891)	3433	(1730)	9485	(5192)	1.19	4558	(2546)	5251	(3064)	5564	(2805)	15373	(8415)	9485
Striped dolphin	14	(7)	12	(6)	12	(8)	38	(21)	0.01	22	(12)	19	(10)	19	(12)	60	(34)	38
Fraser's dolphin	4965	(2774)	5721	(3339)	6062	(3056)	16749	(9168)	5.80	6365	(3556)	7334	(4280)	7771	(3917)	21470	(11752)	16749
Short-beaked common dolphin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-beaked common dolphin	4	(2)	3	(2)	3	(2)	10	(6)	0.01	9	(5)	7	(4)	7	(5)	23	(13)	10
Risso's dolphin	2137	(1194)	2463	(1437)	2609	(1315)	7209	(3946)	4.12	3403	(1901)	3921	(2288)	4154	(2094)	11478	(6283)	7209
Melon-headed whale	644	(360)	742	(433)	787	(396)	2173	(1190)	4.83	1015	(567)	1170	(682)	1239	(625)	3424	(1874)	2173
Pygmy killer whale	97	(54)	112	(65)	118	(60)	327	(179)	0.84	154	(86)	178	(104)	188	(95)	520	(285)	327
False killer whale	234	(131)	270	(157)	286	(144)	789	(432)	1.97	245	(137)	282	(165)	299	(151)	825	(452)	789
Killer whale	51	(28)	58	(34)	62	(31)	171	(94)	2.01	88	(49)	102	(59)	108	(54)	297	(163)	171
Short-finned pilot whale	187	(104)	215	(126)	228	(115)	630	(345)	0.13	317	(177)	365	(213)	387	(195)	1069	(585)	630
Phocoeniidae																		
Finless porpoise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

¹ Best and maximum estimates of density are calculated as described in the original EA (see text).

² Regional population size estimates are from Table 2 of the original EA; NA means not available.

the EA. Take estimates for Indo-Pacific humpback dolphins, Indo-Pacific bottlenose dolphins, and finless porpoises have been reduced to 0 because of the elimination of seismic tracklines in shallow water. Those of most of the other species are lower because of the reduction in the ensonified area, despite the slight increase in densities.

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APPENDIX 1

TABLE 1. Comments received by NMFS on the Environmental Assessment/Incidental Harassment Authorization Application concerning a seismic survey in southeast Asia in March-July 2009.

General Opposition	Barbara Sachau	Why are we doing this research in Southeast Asia? Why don't we restrain all Americans to do work in America? I see no reason for this at all. I think Southeast Asia should be doing work in Southeast Asia. This makes no sense.
General Comment	Dr. Lemnuel Aragones	Most of the information used are outdated and most of the literature are from ETP and not really relevant to SE Asia.
General Comment	Center for Regulatory Effectiveness	The CRE objects to the statement in the proposed IHA (73 FR 78305, December 22, 2008) on page 78305, column one, paragraph three, that states: "However, controlled exposure experiments in the Gulf of Mexico indicate that foraging behavior was altered upon exposure to airgun sound (Jochens et al., 2006)." CRE states that this statement is misleading, and does not accurately reflect the underlying data, and it is not based on the most recent assessment of those data. NMFS' statement cites a 2006 Sperm Whale Seismic Study (SWSS) in the Gulf of Mexico Report which discusses data on foraging behavior and avoidance movements of seven tagged sperm whales in the Gulf of Mexico during exposure to airguns. The CRE requests that NMFS cite the final 2008 Synthesis Report on SWSS which cautions that the "...sample size of 7 animals that conducted foraging 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 populations can be made from the data sets available."
General Opposition	Hong Kong Dolphin Conservation Society	The HKDCS is concerned about the acoustic disturbance that can seriously affect several coastal populations of Indo-Pacific humpback dolphins, 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, the finless porpoise populations inhabiting the coastal waters of the South China Sea. The proposed tracklines of these seismic surveys will traverse through areas that will overlap or oare in close proximity to these resident dolphin and porpoise populations, posing serious threats to the livelihood of their daily lives.
Effects Analysis	Hong Kong Dolphin Conservation Society	The HKDCS believes 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 HKDCS strongly oppose these seismic surveys to be conducted in SE Asia unless further studies are conducted to fully investigate the potential impacts, and a full set of mitigation measures are proposed to the satisfaction of local conservation authorities and NGOs.
General Opposition	Linking Individuals for Nature Conservation	LINC objects to the IHA application and states that other local NGOs have not had time to respond due to the lack of sufficient notice. LINC is concerned that NMFS is eager to approve the L-DEO application and authorize destructive activities in the SE Asia region without verifying that L-DEO has complied with relevant local conservation laws and regulations. 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 governments, scientists, researchers, and NGOs based in this region. LINC states that the 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.
Extension of Public Comment Period	Various	Numerous parties (WWF Philippines, FormasaCetus Research and Conservation Group, CSI, Dr. Linda Wilgart, Wild at Heart, Ocean Conservation Research, Humane Society International, APEX Environmental, Whale and Dolphin Conservation Society, NRDC, Animal Welfare Institute) expressed concern regarding L-DEO's IHA application under the MMPA to incidentally harass marine mammals during a marine geophysical survey in SE Asia from March-July, 2009, as published in the <u>Federal Register</u> (73 FR 78294, December 22, 2008). Many interested persons and organizations requested an extension of the 30-day public comment period to allow for the adequate review of lengthy documents associated with the proposed IHA and prepare responses.
Effects Analysis	Animals Asia Foundation	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).
General Opposition	Animals Asia Foundation	Given the large volume of evidence for the association between anthropogenic noise and disturbance in cetaceans and other marine mammal, a precautionary approach is surely required (as recommended by Gordon et al., 2004). AAF urges NMFS to consider the application from L-DEO with information provided, and the findings and recommendations of the independent reviews of the Eastern Taiwan Strait Sousa Technical Advisory Working Group (ETSSTAWG) and others, in mind.
NEPA	Wild At Heart	WaH states the EA contains several erroneous claims, omissions, and unacceptable proposals with regards to the critically endangered ETS population of Indo-Pacific humpback dolphins (<i>Sousa chinensis</i>). to have occurred due to ship strikes and entanglement in fishing gear.
Monitoring	Wild At Heart	WaH states 68.7% of the ETS humpback dolphin population which L-DEO 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.
Effects Analysis	Wild At Heart	WaH states that 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 ensounded at received levels of >160 dB re 1 microPa (rms), with some dolphins being exposed to received levels of >180dB (rms), with some dolphins being exposed to received levels of >180 dB (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 5 km from shore.

TABLE 1 (continued).

General Opposition	Wild At Heart	WaH states the level of harassment for which L-DEO has applied for permission (Level B) is inappropriate for a survey which threatens to expose ETS humpback dolphins to received levels of 180 dB re 1microPa(rms), which can cause permanent physiological damage and would constitute at a minimum Level A harassment.
Effects Analysis	Wild At Heart	WaH states the claim in the EA that the impacts of the TAIGER survey will be minor and short-term "because 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.
Effects Analysis	Wild At Heart	WaH states, 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 >180 dB (rms) may cause serious injury or even death while noise levels >160 dB 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 significant threat to the future existence of the population.
General Comment	Wild At Heart	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.
Strandings / Beaked Whales	Wild At Heart	WaH states 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. 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, L-DEO has not attempted to adopt all available precautionary measures that may help to reduce impacts.
Mitigation	Wild At Heart	WaH states 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.
Mitigation	Wild At Heart	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.
Mitigation	Wild At Heart	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 >180 dB, again exceeding the type of take for which L-DEO has applied.
Effects Analysis	Wild at Heart	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 or not completely impossible to detect visually at distances at which they may still be exposed to noise levels >190 dB (rms), and do not vocalize at all times.
Mitigation	Wild At Heart	WaH states 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.
Mitigation	Wild At Heart	A lack of understanding of the distribution and status of the above mentioned 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: (1) the proposed number of MMOs is insufficient (a minimum of only one observer working during daytime operations, except for 30 minutes before and after ramp when this will be increased to two observers); (2) nighttime seismic survey could be (but are not) prohibited, meaning impaired effectiveness of MMOs and greater reliance on PAM, which provides no certainty of detection of animals that are not vocalizing.
Mitigation	Wild At Heart	WaH states an IHA should not be granted for the proposed survey because: (1) the number of ETS humpback dolphins that L-DEO proposes to harass and the likely level of harassment both exceed the levels for which an IHA should be granted; (2) 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; (3) 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; (4) 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); and (5) the EA reflects serious misunderstanding and error in the analysis of potential cumulative impacts where such impacts matter greatly.

TABLE 1 (continued).

Mitigation	Wild At Heart	WaH states that 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 "no 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.
Mitigation	Wild At Heart	In the event that no attempt was made by LGL to consult with the ETSSTAWG prior to completion of the EA, WaH would recommend that this is 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 through the region in question.
Mitigation	Wild At Heart	WaH is aware that this L-Deo survey proposal is one of a very small number of 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 L-DEO's, WaH recommends 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.
Mitigation	Dr. Robert Brownell and Dr. Lien-Siang Chou	Dr. Robert Brownell and Dr. Lien-Siang Chou from National Taiwan University's Institute of Ecology and Evolutionary Biology state that the permit application is only requesting permission for the incidental harassment of marine mammals (Level B) while conducting the proposed marine geophysical survey in SE Asia. 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 ginkgo-toothed beaked whales) have occurred during all months of the year except May, August, October, and December. Taiwan has the highest number 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 "NMFS 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 numbers 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 plans need to be developed in case any strandings or NMSEs occur. In
	Dr. Robert Brownell	Dr. Robert Brownell states that the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 dB, during the proposed L-DEO seismic survey in SE Asia, should be considered erroneous based on regional population estimates from two main sources. Of the 37 cetacean populations listed in Table 2 of the Federal Register notice (78 FR 78294, December 22, 2008), 22 are from the ETP and have no relationship at all to the region to be surveyed in the 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 cannot 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 about 100 from Taiwan. The IUCN has listed the subpopulation of these dolphins along the limited part of the western coast of Taiwan as "critically endangered" and the subpopulation is estimated at 100 individuals. Based on the problems of the population estimates noted above, the estimates of the possible number of cetaceans exposed in Table 3 of the Federal Register notice (78 FR 78294, December 22, 2008) are unrealistic either as the best estimate or maximum.
Mitigation-Stranding	Dr. Robert Brownell	The NMFS 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 advanced plan must be made to respond to any stranding of live animals during the proposed seismic surveys.
Effects Analysis	Dr. Linda Weilgart	Dr. Linda Weilgart urges NMFS to reject this application for an IHA and states that L-DEO's powerful array of airguns, and the permit application does not seriously consider the possibility of irreversible harm to marine mammals and the marine environment.
Mitigation	Dr. Linda Weilgart	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 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.
	Dr. Linda Weilgart	Unfortunately, cetaceans are difficult to observe, and many cetaceans in this area are poorly known and little studied.

TABLE 1 (continued).

		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.
Effects Analysis	Dr. Linda Weilgart	
Effects Analysis	Dr. Linda Weilgart	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.
Effects Analysis	Dr. Linda Weilgart	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.
General Opposition	Minor and Wilson	Minor and Wilson object to the proposed undertaking are numerous, and feels there is a lack of balance and objectivity in the submitted documentation.
Small Numbers	Minor and Wilson	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 L-DEO is for 71,669 cetaceans. Minor and Wilson propose that a reasonable upper bound for a small number is what can be counted on their fingers and toes. The Federal Register 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.
Effects Analysis	Minor and Wilson	Minor and Wilson have read the IHA request and are disappointed about the lack of balance in its presentation. The numerous graphs and tables that describe the activity and levels of take are not 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 15 x (which is a 1,500% modeling error).
Effects Analysis	Minor and Wilson	Statements such as "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" are stupid.
Effects Analysis	Minor and Wilson	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 170 dB pulses out for 7,808 m either side of a boat traveling for 1,113 km through the shallow water critical habitat of several endangered species is wrong.
Effects Analysis	Minor and Wilson	Minor and Wilson 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 (1,500%). 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).
Mitigation	Minor and Wilson	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, L-DEO). Minor and Wilson think that these strandings clearly constitute something greater than "Level B harassment."
Mitigation	Minor and Wilson	Minor and Wilson 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. Minor and Wilson do not feel that chasing these animals around with a boat that produces seismic "bangs" that are still 170 dB at a distance of 7,808 m from the boat will be anything other than harmful to these endangered animals.
Mitigation	General Opposition	Minor and Wilson, as scientists, are greatly saddened to see government funding being used to cause the "Level B harassment" of 71,669 cetaceans. We also doubt that the data that might be gained from the proposed "taking" is worth the harm that it will do. Minor and Wilson 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, and several more endangered species are 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. 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.
General Opposition	Humane Society International	While we appreciate L-DEO's efforts to comply with the MMPA and the NEPA, 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.

TABLE 1 (continued).

Effects Analysis	Humane Society International	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.
Precautionary Approach	Humane Society International	The agency and the applicant 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. [Abridged Comment]
Threshold	Humane Society International	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.
Threshold	Humane Society International	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 ensouffied by airguns because it is important habitat.
Threshold	Humane Society International	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). The failure to consider the possibility of an animal not reacting because leaving a prime feeding spot is more costly than moving laterally along a migration pathway 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. [Combined and Abridged Comment]
Threshold	Humane Society International	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.
Effects Analysis	Humane Society International	The applicant and the Federal Register notice never indicate that the Eastern Taiwan Strait (ETS) population of the Indo-Pacific humpback dolphin, <i>Sousa chinensis</i> , 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 <i>Sousa</i> populations together. While the IUCN did list the larger regional <i>Sousa</i> 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.
Effects Analysis	Humane Society International	The discussion of the critically endangered western gray whale (<i>Eschrichtius robustus</i>) 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.
Effects Analysis	Humane Society International	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.

TABLE 1 (continued).

Mitigation	Humane Society International	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.
Effects Analysis	Humane Society International	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.
Mitigation	Humane Society International	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.
NEPA	Humane Society International	L-DEO has ignored the mitigation measure to avoid species temporally 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.
Threshold	Humane Society International	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	Humane Society International	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.
Threshold	Humane Society International	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.
Threshold	Humane Society International	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.
Mitigation	Humane Society International	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.

TABLE 1 (continued).

Effects Analysis	Humane Society International	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.
General Opposition	Humane Society International	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.
International Legal Compliance	Humane Society International	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.
International Legal Compliance	Humane Society International	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.
Effects Analysis	Humane Society International	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.
International Legal Compliance	Humane Society International	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.
Threshold	Humane Society International	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
General Opposition	E. Taiwan Strait Technical Advisory Working Group (ETSSTAWG)	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.
Effects Analysis	ETSSTAWG	The project description does not adequately consider the relevant scientific literature on risks of seismic activities to cetaceans.
Precaution-ary approach	ETSSTAWG	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').
Mitigation	ETSSTAWG	Proposed mitigation practices are inadequate to prevent injury to cetaceans.
Beaked Whales	ETSSTAWG	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.
Mitigation	ETSSTAWG	The Eastern Taiwan Strait Technical Advisory Working Group (ETSSTAWG) recommends that 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. [Separated Comment]
Mitigation	ETSSTAWG	ETSSTAWG recommends that the survey effort should be suspended at night as night-time observations are of insufficient acuity to detect cetaceans and that the survey effort should be suspended when adverse weather conditions prevail that would preclude effective spotting (e.g. in fog, rain, heavy seas > Beaufort 3). [Abridged Comment]
Mitigation	ETSSTAWG	ETSSTAWG recommends that two cetacean observers, not just one, should be on watch at the same time. The duration of watch times should be reduced from 4 to 2 hours to prevent compromised efficiency as a result of fatigue. Also, 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. [Abridged Comment]

TABLE 1 (continued).

Mitigation	ETSSTAWG	ETSSTAWG recommends that L-DEO must better incorporate changes in bottom topography during the survey into the designation of 'safety zones', and adapt the cruise accordingly.
Enforcement	ETSSTAWG	It should be noted that many seismic surveys are conducted in the Taiwan region every year without requesting IHAs. The actions of private oil and gas companies within the EEZ's of other countries is beyond the jurisdiction of the MMPA, thus they need no such U.S. authorizations. 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.
Effects Analysis	ETSSTAWG	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 (EA2). Do the effective source levels offered in the EA (259 dB re 1 μ Pa – m, with dominant frequencies at 2–188 Hz) pertain to the longer or shorter streamers? There are likely to be differences.
Monitoring	ETSSTAWG	What is the frequency range of the PAM system? Is it suitable for detecting signals produce by all the marine mammals within the area?
International Legal Compliance	ETSSTAWG	Has LDEO applied for the relevant permits and authorisations under the laws of the various countries where they will be conducting the survey?
Mitigation	ETSSTAWG	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).
Effects Analysis	ETSSTAWG	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.
Mitigation	ETSSTAWG	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 L-DEO's surveys in the Taiwan Strait (and throughout the operation) shut down at night.
Monitoring	ETSSTAWG	A minimum of two MMOs should be used at all times, with one of those having considerable prior experience as a MMO (preferably within the area of Taiwan).
Monitoring	ETSSTAWG	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.
Mitigation	ETSSTAWG	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.
Threshold	ETSSTAWG	L-DEO should use 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 μ Pa, 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 μ Pa rms.") Thus 180 dB rms SPL would be reached with a SEL of 165 dB.
Precautionary Approach	ETSSTAWG	Since empirical data is not available for L-DEO 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 L-DEO should use a mean between the shallow and deep water ranges, rather than one adjusted by the apparently arbitrary correction factor. See Table 1.
Mitigation	ETSSTAWG	The EA states that "the current 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.
NEPA	ETSSTAWG	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."
Effects Analysis	ETSSTAWG	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.

TABLE 1 (continued).

		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).
Threshold	ETSSTAWG	
		Southall et al. (2007) also add the following caveat with regards to their report: <i>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.</i> 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
Threshold	ETSSTAWG	
		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).
Threshold	ETSSTAWG	
		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 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).
Threshold	ETSSTAWG	
		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 begins.
Threshold	ETSSTAWG	
		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.
Effects Analysis	ETSSTAWG	
		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. I can only assume this is also not good for marine mammals who have a limited range, such as Sousa. The paper can be found in Norwegian at http://www.fiskeribladetfiskaren.no/filarkiv/vedlegg/96.pdf .
NEPA	ETSSTAWG	
		After detailing all the threats and outlining the uncertainties, the EA concludes that: <i>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.</i>
NEPA - Cumulative Impacts	ETSSTAWG	
		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 fetuses 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.
Effects Analysis	ETSSTAWG	
		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.

TABLE 1 (continued).

Effects Analysis	ETSSTAWG	According to the EA, the Multibeam Echosounder & Sub-bottom Profiler have outputs up to 204 dB re 1 μ Pa – 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.
Effects Analysis	NRDC	NRDC is concerned that 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; a migratory pathway for the critically endangered western Pacific gray whale; and beaked and sperm whale habitat in southeastern and southwestern Taiwan.
Effects Analysis	NRDC	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).
Effects Analysis	NRDC	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.
Effects Analysis	NRDC	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 acknowledge this shortcoming, they nonetheless proceed without sufficient precautions.
International Legal Compliance	NRDC	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.
Mitigation	NRDC	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.
Mitigation	NRDC	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.
Mitigation	NRDC	NRDC urges NMFS to restrict L-DEO's access to all South China Sea from December through May (due to gray whale migration).
Mitigation	NRDC	NRDC urges NMFS to restrict L-DEO's access to the 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).
Mitigation	NRDC	Mitigation measures should restrict L-DEO's access to submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat).
Mitigation	NRDC	NRDC urges NMFS to restrict L-DEO's access to the 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).
Mitigation	NRDC	Mitigation measures should restrict access to the 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)
Mitigation	NRDC	Mitigation measures should include a year-round coastal exclusion in the waters surrounding Taiwan to 20 km (because of Indo-Pacific humpback dolphin and finless porpoise habitat).
Mitigation	NRDC	Mitigation measures should restrict access to the 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).
Mitigation	NRDC	NRDC urges NMFS to restrict L-DEO's access to submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat); and marine protected areas.
NEPA	NRDC	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.
Effects Analysis	NRDC	NRDC recommends further consultation regarding the impacts of seismic sounds on marine mammals.

TABLE 1 (continued).

MMPA	NRDC	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). [Abridged Comment].
NEPA	NRDC	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.
Effects Analysis	NRDC	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.
Mitigation	NRDC	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 <i>NRDC v. Gutierrez</i> , 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.
Mitigation	NRDC	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).
Monitoring	NRDC	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.
NEPA	NRDC	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.
NEPA	NRDC	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).
Effects Analysis	NRDC	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.
Effects Analysis	NRDC	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).
Effects Analysis	NRDC	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.

TABLE 1 (continued).

NEPA	NRDC	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." <i>TOMAC v. Norton</i> , 433 F.3d 852, 863 (D.C. Cir. 2006) (quoting <i>Grand Canyon Trust v. FAA</i> , 290 F.3d 339, 345 (D.C. Cir. 2002).
NEPA	NRDC	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.
NEPA	NRDC	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.
NEPA	NRDC	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.
NEPA	NRDC	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.
General Opposition	Dr. John Wang	At best, this proposal appears to have been prepared without adequate information from local publications or sufficient consultation of experts in marine mammals of the region; contained faulty reasoning, did not provide scientific data to support several claims, and failed to provide confidence that the mitigation measures proposed would have even minimal effectiveness.
General Opposition	Dr. John Wang	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. The request for an IHA should be rejected until L-DEO can demonstrate 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. [Combined comments]
Effects Analysis	Dr. John Wang	NMFS has determined that the proposed activity "may result, at worst, in a temporary modification in behavior (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.
Effects Analysis	Dr. John Wang	There is little knowledge available for most of the marine mammal species that inhabit the waters of SE Asia. What little information that exists is only for a small proportion (mostly coastal waters) of the expansive region. Few estimates of abundance or distribution exist. 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. [Abridged Comment]
Effects Analysis	Dr. John Wang	L-DEO has declared that the impacts of its proposed seismic surveys on local marine mammals will be minimal. However, L-DEO is conducting the survey when many local marine mammal populations are most vulnerable. The tracks pass through almost the entire distribution of the critically endangered population of humpback dolphins. The vessel follows closely the edge of the continental shelf where marine mammals concentrate and passes through waters during humpback whale migration or when humpback whales are in wintering/calving grounds. [Abridged Comment]
Precautionary Approach	Dr. John Wang	The applicant has not attempted to minimize the impacts of its survey; has not taken a precautionary approach in addressing potential impacts; nor has it 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, but they are scientifically incorrect. Absence of evidence is not evidence of absence. [Abridged Comment]
Effects Analysis	Dr. John Wang	I disagree that the proposed survey will have a negligible impact on local species of 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".
Threshold	Dr. John Wang	There is 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.

TABLE 1 (continued).

Effects Analysis	Dr. John Wang	There are several cetaceans in this region that are particularly sensitive or are highly vulnerable given their low remaining numbers. These include the 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. Also, at least four species of (and three genera) of beaked whales, known to be highly sensitive to intense noise, occur in these waters. Minimal impacts can cause irreversible damage to the population. [Abridged Comment]
Mitigation	Dr. John Wang	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.
Mitigation	Dr. John Wang	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.
Mitigation	Dr. John Wang	The effectiveness of the mitigation measures proposed by L-DEO for reducing threats range between having questionable effectiveness and being entirely inadequate.
Effects Analysis	Dr. John Wang	There is strong evidence that finless porpoises comprise two species. L-DEO should consider each species separately.
Monitoring	Dr. John Wang	Finless porpoises are 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 1 km, yet the predicted distance for received levels > 190 dB is more than 2 km from the source).
Mitigation	Dr. John Wang	The distinct population of the Indo-Pacific Humpback dolphin is very small at <100 individuals. The dolphin is a year-round resident of a very restricted (approximately 200 km) stretch of shallow coastal waters along western Taiwan (i.e., the eastern Taiwan Strait). Any single threat (e.g., loss of habitat, pollution, bycatch, and noise) has the potential to be the final cause of extinction. Unless effective mitigation measures are taken to reduce these threats, it is unlikely that the population will continue to exist. Mortality (by human causes) of even a single individual per year from this population is not sustainable. [Abridged Comment]
Exclusion Zone for ETS	Dr. John Wang	The survey will bring the Langseth to waters within 1 km from the shores of Taiwan and right through the middle of almost the entire linear coastal distribution of the eastern Taiwan Strait population. At this distance from shore, the Langseth will inevitably subject the entire population to noise levels > 180 dB. Even staying at least 2 km from the coastline does absolutely nothing to reduce the noise exposure for these critically endangered (IUCN Red List) dolphins. And based on the values in Table 1 of the FR, even at 8-10 km from shore, all dolphins will still be exposed to at least 160 dB with an unknown number that may be exposed to > 180 dB. [Abridged Comment]
Shallow Water Concerns	Dr. John Wang	The predicted rms distances for different levels of exposure (Table 1 of the FR), 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.
Shallow Water Concerns	Dr. John Wang	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.
Sound Propagation	Dr. John Wang	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.
NEPA Cumulative Impacts	Dr. John Wang	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. 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.
Exclusion Zone for ETS	Dr. John Wang	Given the threat of noise on the health of the ETS dolphins, the ETS TAG 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). 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).

TABLE 1 (continued).

		L-DEO's estimation of the number of critically endangered ETS humpback dolphins that might be exposed to greater than or equal to 160dB 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.
Small Numbers	Dr. John Wang	
Exclusion Zone for ETS	Dr. John Wang	<i>Sousa chinensis</i> is also a slow swimming species with average speeds between 3.6 and 7.2 km/hr (Saayman and Tayler, 1979; 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.
JRE Population	Dr. John Wang	The Jiulong River Estuary (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. 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.
Effects Analysis	Dr. John Wang	The other of two proposed approaches to the mainland Chinese coast by the Langseth will be in the waters near Pingtan (where records of <i>Sousa chinensis</i> also exist - see Wang, 1999; Zhou, 2004). However, almost nothing is known about <i>Sousa chinensis</i> in these waters so the impact of the seismic survey cannot be estimated. <i>Sousa chinensis</i> is listed as 'near threatened' under the IUCN Red List and is afforded the highest level of protection in China and Hong Kong.
Masking	Dr. John Wang	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.
Threshold	Dr. John Wang	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.
Impacts to Prey	Dr. John Wang	A large proportion of the prey of <i>Sousa chinensis</i> 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.
Monitoring	Dr. John Wang	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.
Spatial Temporal Restrictions	Dr. John Wang	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.
Exclusion Zones	Dr. John Wang	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.
Masking	Dr. John Wang	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.

TABLE 1 (continued).

Effects Analysis	Dr. John Wang	The blue whale 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.
Tracklines	Dr. John Wang	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.
Systematic Surveys	Dr. John Wang	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. 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 Porpoise	Dr. John Wang	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. [Abridged Comment]
Sightability	Dr. John Wang	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) 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. Sighting effectiveness will drop dramatically even for highly experienced observers in slight seas. 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.
Masking	Dr. John Wang	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).
Negligible Impact	Dr. John Wang	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.
Effects Analysis	Dr. John Wang	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.
Effects Analysis	Dr. John Wang	Loud intense noises have also been suspected to disturb or harm other odontocete species that are found in the waters of Taiwan. 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.
Stranding Events	Dr. John Wang	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 Madagascar waters) so there is growing concerns about the potential impact of such activities on this species. Seismic surveys along the shelf edge of eastern Taiwan during the daytime will likely have an impact.
Tracklines	Dr. John Wang	Several tracklines of the proposed seismic survey immediately stand out as being very likely to cause great risk to marine mammals in the region. Some of the problematic tracklines include: (1) Coastal waters of western Taiwan; (2) approaches to the mainland of China; (3) the shelf edge along eastern Taiwan and oceanic islands off eastern and northern Taiwan, northern Philippines and the Ryuku archipelago; (4) the shelf edge along the eastern side of the Penghu Channel; (5) all waters of the Taiwan Strait.
Temporal Restrictions	Dr. John Wang	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).

TABLE 1 (continued).

Calving / Wintering Grounds	Dr. John Wang	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).
Calving / Wintering Grounds	Dr. John Wang	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.
Shallow Water Concerns	Dr. John Wang	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 <i>Sousa chinensis</i>), 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.
Monitoring	Dr. John Wang	L-DEO should address the ineffectiveness of MMVOs at detecting cetaceans, especially small cetaceans, under non-ideal sighting conditions (low light, rough seas, rain) and the 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).
Monitoring	Dr. John Wang	L-DEO should address the ineffectiveness of MMVOs 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).
Monitoring	Dr. John Wang	L-DEO should address the 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).
Monitoring	Dr. John Wang	L-DEO should address the inadequacy of 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)
Monitoring	Dr. John Wang	L-DEO should address 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).
Monitoring	Dr. John Wang	L-DEO should address the 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).
Monitoring	Dr. John Wang	L-DEO should address the ineffectiveness of MMVOs at detecting beaked whales (detection is known to be very low even for experienced observers in good conditions).
Monitoring	Dr. John Wang	L-DEO should address the 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)
Monitoring	Dr. John Wang	L-DEO should address the 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).
Monitoring	Dr. John Wang	L-DEO should address the ineffectiveness at detecting beaked whales when they are very quiet near the surface and the ineffectiveness of PAM at determining the location and direction of travel of cetaceans.
Mitigation	Dr. John Wang	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.
Mitigation	Dr. John Wang	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.
Monitoring	Dr. John Wang	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.
Mitigation	Dr. John Wang	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.

TABLE 1 (continued).

Effects Analysis	Dr. John Wang	L-DEO completely overlooked physiological impacts on cetaceans (see Wright et al. 2007a,b). This must be addressed.
Mitigation	Dr. John Wang	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.
Recommendations	Dr. John Wang	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.
Sightability	Dr. John Wang	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.
Mitigation	Dr. John Wang	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.
Monitoring	Dr. John Wang	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.
Temporal Restrictions	Dr. John Wang	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.
Monitoring	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS 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.
Monitoring	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS clarify the qualifiers "when practical" and "when feasible" with respect to (1) using two MMOs to monitor the exclusion zone for marine mammals during daytime operations and nighttime start-ups of the airguns, and (2) using MMOs during daytime periods to compare sighting rates and animal behavior when the seismic airguns are operating and when they are not.
Monitoring	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS 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.
Monitoring	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS 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.
Mitigation	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS 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.
Mitigation	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS 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).
Mitigation	Marine Mammal Commission	The Commission recommends that, before issuing the requested authorization, the NMFS describe the reasons why and the conditions under which the application 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 1microPa(rms). The Commission also note that it makes more sense to use a single distance, rather than a range, to prevent the survey from approaching the Taiwan coast too closely.
General Comment	Marine Mammal Commission	The Commission is concerned that most of the issues raised in its letter have been raised before and, to their knowledge, little is being done to resolve them. The Commission believes that the action agency and contractor should bear primary responsibility for carrying out the studies needed to reduce the existing uncertainty and that the authorizing and oversight agencies have a degree of responsibility as well.

TABLE 1 (continued).

General Comment	Marine Mammal Commission	The Commission is concerned that the opportunity for scientists, conservationists, and other interested parties from other countries to comment on research activities to be conducted by U.S. organizations in foreign waters. Scientists, conservationists, and others are generally unfamiliar with the procedures for permit review and authorization in the U.S. 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. The Commission believes 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.
General Comment	Dr. McIntosh and Dr. Wu	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.
General Comment	Dr. McIntosh and Dr. Wu	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.
Mitigation	Dr. McIntosh and Dr. Wu	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.
General Comment	Dr. McIntosh and Dr. Wu	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.
Mitigation	Dr. McIntosh and Dr. Wu	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.
Mitigation	Dr. McIntosh and Dr. Wu	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.
Recommendations	Dr. McIntosh and Dr. Wu	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.
Mitigation	Dr. McIntosh and ZDr. Wu	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.
Mitigation	Dr. McIntosh and Dr. Wu	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.
Effects Analysis	Dr. McIntosh and Dr. Wu	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.

TABLE 1 (continued).

General Opposition	CSI	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.
General Comment	CSI	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 their 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 MMPA.
General Comment	CSI	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 experts 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).
General Comment	CSI	CSI states 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.
Mitigation	CSI	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?
Effects Analysis	CSI	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 (2007), NMFS must require an adequate review of the recent references given in the attached documents.
NEPA	CSI	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.
NEPA	CSI	The EA violates the 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.
General Comment	CSI	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.
General Comment	CSI	CSI is well aware that the L-DEO, NSF, 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?
General Comment	CSI	In lieu of such loft 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?
Mitigation	CSI	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.
General Comment	CSI	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 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.

TABLE 1 (continued).

General Comment	CSI	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).
General Comment	CSI	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.
General Comment	CSI	Only a small proportion of the large expanse of sea in the region (and mostly coastal waters) has been surveyed systematically for marine mammals.
General Comment	CSI	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.
General Comment	CSI	What little is known clearly shows the region to be an area with a high diversity of marine mammal (and other marine) species.
General Comment	CSI	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).
General Comment	CSI	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.
General Comment	CSI	Some marine mammals have been reduced to numbers so low that even minimal 'takes' will have a large impact on the remaining population.
General Comment	CSI	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 details below.
Threshold	CSI	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 the entire distribution of the ETS population. At this distance from shore, the Langseth will subject the entire population to noise levels much greater than 180 dB.
General Comment	CSI	No escape from noise. <i>Sousa chinensis</i> 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 exist.
Effects Analysis	CSI	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.
Small Numbers	CSI	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.
Mitigation, Threshold	CSI	Proposed impact mitigation measures and predicted RMS distances. Even staying greater than or equal to 2 km 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 8-10 km from shore will still expose all animals to greater than 160 dB and an unknown number would still be exposed to greater than 180 dB. The above statements are conservative because they are based on the predicted RMS distances for different levels of exposure (Table 1 in the 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 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 5-6 m 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 less than 100 m) 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 the any given distance from source than the predicted values in the tables. The distance to reduce exposure to noise levels of 160 dB or greater is unknown for dolphins in water depths less than 25 m and could be much greater.
Recommendations	CSI	In December 2008, for the 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 be out to at least 5 km 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).
Threshold	CSI	Calculations of how far the Langseth should be to prevent the ETS population from being exposed to levels greater than 160 dB should be based on at least on the recommended 5 km buffer boundary (i.e., the waters from shore to 5 km offshore should not be exposed to levels greater than 160 dB). However, given the populations 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.

TABLE 1 (continued).

Effects Analysis	CSI	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.
Mitigation	CSI	If the Langseth approaches to within 10 km from shore, dolphins using waters east of the Chinmen islands may be exposed to levels greater than 160 dB and some may 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 25-30 m isobath.
General Comment	CSI	Although the JRE dolphin's 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. Far less is known about <i>Sousa chinensis</i> 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 <i>Sousa chinensis</i> also exist - see Wang 1999, Zhou 2004), dolphins of these coastal waters would be expected to be impacted.
General Comment	CSI	Even lower thresholds of exposure than those discussed above may increase the risks to these dolphins by altering dolphin behavior. 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).
Recommendations	CSI	It is recommended that activities that would increase the risk of extinction of these populations, including physiological and behavioral impacts, not be permitted.
General Comment	CSI	Potential threat of L-DEO 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.
General Comment	CSI	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 Ginkgo-toothed beaked whales 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).
Recommendations	CSI	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 20 km from shore where almost no cetacean survey effort exists) to determine if and what concentrations of beaked whales exist.
General Comment	CSI	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.
Monitoring	CSI	Finless porpoises are 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 behavior of the animals, it can be near impossible to detect. Jefferson et al. (2002) reported that during calm sighting conditions, finless porpoises were observed primarily within 300 m from the trackline (perpendicular distance) and none were observed beyond about 700 m. 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 190 dB.
Monitoring	CSI	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.
General Comment	CSI	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.
Stranding	CSI	Other Odontocetes. Recent mass strandings of melon-headed whales may have been related to the use of naval sonar and seismic surveys 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).
General Comment	CSI	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).

TABLE 1 (continued).

Recommendations	CSI	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.
General Comment	CSI	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).
Mitigation	CSI	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 and neonatal and other young calves from the calving/nursing grounds of the Babuyan waters.
Recommendations	CSI	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.
Mitigation	CSI	CSI is concerned with the timing of the proposed seismic surveys, especially regarding dates, locations, and species.
Mitigation	CSI	The routes and months when western gray whales may undertake their migration from a suspected wintering grounds 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.
Mitigation	CSI	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).
Mitigation	CSI	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. 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.
Mitigation	CSI	The ETS population of humpback dolphins is found in the coastal waters of 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.
Mitigation	CSI	Concerns regarding particular mitigation measures. The mitigation measures proposed by L-DEO would be ineffective or have limited effectiveness at best. 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. Given the entire period of the proposed survey overlaps with humpback whale concentrations in the Babuyan island 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.
Mitigation	CSI	Distance offshore (ETS) Dolphins). The critically endangered ETS population of humpback dolphins will be subjected to greater than 180 dB received levels even if mitigation measures are taken (i.e., to remain offshore of 2 km from shore). Even 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 tabulated predicted RMS distances for different received levels and accepting the recommendations of the ETSSTAWG for this population that for noise issues an additional (i.e., additional to the 3 km 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 >160 dB levels. However, the model underestimates the actual levels at different distances. Further compounding the underestimation of levels is the fact that shallow water category is less than 100 m but the ETS population lives in waters less than 25 m. Much better predicted RMS distances for different received levels are needed for very shallow waters. Being 2 km 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 8-10 km 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, 8-10 km from shore still may not be sufficient to reduce exposure of animals to greater than 160 dB 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 greater than 180 dB. The proposed seismic surveys will expose almost the entire ETS population of humpback dolphins to levels greater than 180 dB. As such, all or almost all ETS dolphins will be exposed to greater than 160 dB levels even if the Langseth remains 8-10 km from shore.

TABLE 1 (continued).

		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 190 dB received level (1600 to 2182 m); for 180 dB, the distances can be 2761 to 3694 m from source and for 160 dB, the distances are 6227 to 8000 m. Again, these distances must be considered underestimates because the coastal waters of western Taiwan in which some cetaceans inhabit are much shallower than 100 m (e.g., the critically endangered ETS humpback dolphin are in waters from 1.5 to 15 m deep; finless porpoises and Indo-Pacific bottlenose dolphins are often commonly observed in waters shallower than about 50 m). Finless porpoises are difficult to detect even if they are within several hundred meters 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 <i>Kogia</i> 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 as 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.
Monitoring	CSI	
Monitoring	CSI	L-DEO claims that "marine mammal detection by MMVOs is high at short distances from the source." With the possible exception of 180 dB at 950 m 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 1 km 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 3694 m, 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 no low and (as discussed above) cannot be avoided by implementing the inadequate mitigation measures proposed.
Monitoring	CSI	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. 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).
Mitigation	CSI	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.
Mitigation	CSI	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.
Effects Analysis	CSI	Additional concerns: masking, displacement, impact on 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.
Effects Analysis	CSI	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.
Effects Analysis	CSI	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.
Small Numbers	CSI	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 statement from the Federal Register notice is incorrect. L-DEO estimated that 68.7% of the critically endangered ETS population of humpback dolphins will be impacted. 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.
Data from ETP	CSI	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 cetaceans scientists. This should be re-examined carefully.

TABLE 1 (concluded).

Effects Analysis	CSI	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 portion of the diet of these species consists of scianids (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 (Wang, unpublished data).
Effects Analysis	CSI	The assumption that animals will move away from noise source 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 greater than 180 dB 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 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.
Threshold	CSI	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 porpoise, etc.) have not been examined and there appears to be great variability amongst individual cetaceans tested so interspecific extrapolations need to be considered cautiously (for a review, see Weilgart, 2007).
Recommendations	CSI	General recommendations 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.

