Attention: San Luis Obispo County Board of Supervisors

Documentation for Review concerning High Energy Seismic Survey on the California Central Coast

This documentation is provided by the C.O.A.S.T. Alliance in order that the San Luis Obispo County Board of Supervisors may see that it is necessary to Call for a halt to any High Energy Seismic Surveys.

Item # 22 Meeting Date: 10/30/2012
Presented by: C.O.A.S.T. Alliance
Received prior to meeting and posted to web on: October 25, 2012

Citizens Opposing Acoustic Seismic Testing

Document for Review concerning High Energy Seismic Survey on the California Central Coast

Attention: San Luis Obispo County
Board of Supervisors

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Brian Stacy on PG&E 's Treatment of Fishermen and Lack of Adherence to Permits

Brian is currently the Vice President of Port San Luis Commercial Fishermens Association (PSLCFA). At the time it began in 2011 he was the Morro Bay Nearshore Rockcod Fishermen's Representative in High Energy Survey negotiations.

Dec. 4, 2011: Fishermen wake up to the M/V Bluefin conducting low energy seismic surveys in Port San Luis. My phone starts ringing as the impact was directly on the Nearshore Fishermen preventing them from fishing their spots: noise related and displacement.

Brian, describes what occurred: M/V Bluefin a 300' survey ship was off of Shell Beach on the fishing grounds. Fishermen are aware that they are required to avoid at-sea operations by this type of vessel.

PG&E had previously told the reps:

1. We are going to impact you
2. We want your cooperation
3. We want you to stay clear of our boats when they are working
4. We are going to compensate you for doing so

Discoveries: Fugro West is PG&E's contractor. They had been issued a lease based on a 1984 MND (Mitigated Negative Declaration). State Lands, Richard Greenwood was unable to produce a copy of the MND but he had issued Geophysical Survey Permits based on it. (MND 358). The MND was not on the CSLC website as it should be, but Jennifer Deleon produced it once I made her aware that I knew of its existence.

Mitigation measures were included in the 1984 MND, and the Geophysical Survey Permit Program (GSPP), and the Guidelines Intended to Reduce Conflicts Between Geophysical Surveys and Fishing Operations; but Fugro was not complying.

How did FUGRO not comply?

Complete and utter disregard for the "Guidelines Intended to Reduce Conflicts Between Geophysical Surveys and Fishing Operations". (See document in the notebook.), MND 358 and GSPP.

Based on the documents used to get the permit there should have been a Liason Officer hired by the permit holder:Fugro:

1. to develop a record system
2. provide a list of the names of fishermen who may be affected
3. maintain a map with dates and area extents of plan surveys

Among the mitigations outlined in the GSPP, MND 358 and the Joint Committee Guidelines which were not adhered to, were the following:

1. Fugro did not hire a Liason Officer
2. 15 day notices not adhered to
3. No attempts were made to reach agreements with fishermen for displacement or gear issues
4. No compensation was made for displacement of permitted fishing opportunities
5. Addresses Fugro was using were from the 1984 MND and the GSPP for associations, fishermen, fuel docks, and gear stores. Most were outdated.

In addition: Our fisheries that take place in the current survey area were not even in existence when the 1984 MND 358 and GSPP were produced. I was in shock that the state would allow them to use a 27 year old Southern California MND.

I began a quest to:

1. Update the old noticing addresses, which I did. CSLC Richard Greenwood took all the new addresses but failed to update them in the Geophysical Survey Permit Program. This has still not been done, to my knowledge. No one that I placed on the list, including MBCFO or PSLCFA has ever received 15 day notices prior to operations or been noticed that operations have ceased prior to the date on permit.
2. Find out how they were being allowed to use that old MND. SLC responded after I rattled their cage that they would be producing a current one (do not believe this occurred), and they indicated I should weigh in on it for types and locations of fisheries, etc. (this never occurred).

3. Get my fishermen compensated, as PGE had placed me in the middle by giving me claim forms and telling me to hand them out to affected fishermen; which I did. The forms were the same you get if there is a power outage and your refrigerator goes out and ruins your food. Just like the current obstacles for claims with the high energy survey. We adapted an old claim form from the fiber optic cable installation to add to the Refrigerator Form and these were distributed to all the Nearshore Fishermen.

All of us filed claims. We continued to "stay out of the way" figuring we would be compensated as we had been told. We were strung along for months with excuses that they were "dealing with" our claims.

All of us received REJECTION LETTERS from the law claims department. One fisherman did not cooperate; he tried to fish around the boat, tangled his gear and he was compensated.

(Read my posts of the past few days or more for more information.)

Brian Stacy V.P. PSLCFA Morro Bay

DRAFT

October 12, 2012

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

Re: Comment Letter on Proposed IHA for Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey off the Central Coast of California, November to December, 2012

Dear Mr. Payne:

The C.O.A.S.T.[1] Alliance, a diverse coalition of individuals and organizations from the Central Coast of California and beyond, is writing to express numerous serious concerns about NMFS proposed IHA for the acoustic seismic testing project due to the project's potential impacts on marine life in the project area. Based on review of the project description and relevant scientific literature, it is clear that the project is not eligible for an Incidental Harassment Authorization permit pursuant to the Marine Mammal Protection Act (MMPA), because impacts will not be limited to Level B harassment of 25 species of marine mammals, but will in fact result in significant *Level A* take of marine mammals. In addition, the project poses risk of Level A take of great white sharks.

The C.O.A.S.T. Alliance has the following serious concerns about the proposed IHA:

1. PG&E's Final Environmental Impact Report (EIR) for the proposed Central Coast seismic imaging project was certified by the California State Lands Commission (SLC) on August 20, 2012, with the finding in their Notice of Determination that *the project will have a significant impact on the environment*. (The EIR and related documents are available on the SLC website at: http://www.slc.ca.gov/division_pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/CCCSIP.html). In regard to impacts on marine mammals in particular, the EIR's Cumulative Impact Analysis states, "Assuming implementation of the APMs and MMs described in more detail in Section 4.4.5 and listed under Impact MARINEBIO-12, the Project would result in significant impacts to fin, humpback, and blue whales; the harbor porpoise; and the Southern sea otter. However, the severity is greatest for the harbor porpoise, even considering the implementation of the APMs and MMs." (p. 4.4-103) (note: APM = Applicant Proposed Measure , and MM = mitigation measure)

   Questions:

   - Under NEPA, is an Environmental Assessment the appropriate environmental review document for a project which will have significant environmental impacts to multiple federally listed marine mammals?
   - Has your office reviewed the comment letter dated August 10, 2012, sent from the Southwest Regional NMFS office to the National Science Foundation (NSF), in which NMFS (page 2/7) states that the project needs a more thorough NEPA analysis?

[1] C.O.A.S.T. = Citizens Opposing Acoustic Seismic Testing – please see attachment for additional information.

(letter attached) In addition, on page 4/7, this letter calls NSF's attention to the fact that there are inconsistencies between the state and federal analyses regarding impacts to marine mammals. The letter provides further illustrations of multiple apparent shortcomings in the draft EA, inconsistencies with the EIR, or additional analysis that is required. How does your office plan to address these concerns raised by the August 10, 2012 letter sent by the SW Regional NOAA/NMFS office?

2. The EIR predicts Level A take – injury or mortality - to twelve or more marine mammal species. The proposed project will result in Level A take - injury or mortality - to at least 12 species of marine mammals, according to PG&E's EIR, as described in both Chapters 4 (Table 4-14) and in Appendix H, the "Marine Mammal Technical Report (Table 4.1). Below is a table of the marine mammals which will be subject to injury or mortality (Level A Take) as described in PG&E's EIR:

Marine mammal species to be impacted by PG&E hi-intensity seismic imaging project per EIR	**Minimum Population Estimate**	**Level A Take estimates (see below for EIR's definition) per Table 4.4-14 in EIR**	
		Minimum	**Maximum**
Fin whale	2,624	2.5	8.9
Humpback whale	1,878	1.2	11.3
Blue whale	2,046	0.9	3.8
Minke whale	202	0.1	0.3
Short-beaked common dolphin	343,990	14.8	28.3
Long-beaked common dolphin	17,127	0.5	1.7
Small-beaked whale species	2,498	<0.1	<0.1
Harbor porpoise	1,478	22.8	51.6
Dall's porpoise	32,106	0.9	1.9
Pacific white-sided dolphin	21,406	1.6	3.0
Risso's dolphin	4,913	0.7	1.7
Northern right whale dolphin	6,019	0.6	1.0
Bottlenose dolphin – CA coastal	290	<0.1	<0.1
Sperm whale	751	<0.1	<0.1
Harbor seal	26,667	7.8	15.1
California sea lion	153,337	501.0	782.7

* **Level A Take per PG&E EIR**: Note that the EIR's criteria for Level A harassment was "both sound exposure over the duration of the survey, or cumulative sound exposure levels (SEL), and marine mammal hearing sensitivities. The cumulative SEL is described in this EIR as the *Injury SEL* when it is used to estimate Level A harassment, which addresses physical injury." (EIR p. 4.4-52)

Question: Since the Marine Mammal Protection Act (MMPA) authorizes issuance of an IHA only for incidental Level B harassment, and PG&E's EIR "Marine Mammal Technical Report" in Table 4.1 predicts Level A harassment (injury or mortality) of a minimum of 501 up to 782 marine

mammals of at least a dozen different species, wouldn't the project impacts predicted by PG&E's own EIR make the project ineligible for an IHA?

3. Western gray whales – risk of impacts incorrectly assessed by the EA. Both western and eastern gray whales have been identified as migrating south along the coast of California in the fall, heading toward breeding lagoons in Baja California ("Photographic Comparison of the Western and Mexican Gray Whale Catalogues: 2012", Urban R., et. al. *LSIESP* June 2012) The proposed project will result in potential take of western gray whales, as well as eastern gray whales, in the migration from northern waters to Baja. November and December are regular migration months through the Central California coastal waters for gray whales (citation). This potential impact to western gray whales was not addressed in the EA.

   Question: Was the potential for Level B or Level A take of eastern and western gray whales correctly assessed by EA in their assumption that there would be no migrating whales present during seismic testing?

4. Planned mitigation measures are inadequate to protect marine mammals from Level A take. The mitigation measures planned by PG&E, including aerial surveys, marine mammal observers, scout boats, "ramp-ups" of sound, etc., will still fail to avoid Level A take. The EIR admits this in Table 4.4-18 (p. 4.4-106), where it lists all of the planned mitigation measures and still concludes that "SU" or *Significant and Unavoidable"* to marine mammals and sea otters as follows:

   a. "Impact MARINEBIO-12: Injury or mortality to marine mammals would occur due to noise during seismic survey acquisition."

   b. "Impact MARINEBIO-13: Injury or mortality to Southern Sea Otters would occur due to noise during seismic survey acquisition"

   Question: What information was presented by the draft EA that adequately addressed, resolved and contradicted the above conclusions of the EIR of *Significant and Unavoidable* Level A impacts to marine mammals, including to Southern Sea Otters?

5. Potential impacts to great white sharks, being considered by NMFS for federal "endangered" status, were not evaluated by the EA. The EA did not address potential impacts to great white sharks, which are being considered for federal "endangered" status. Fewer than 400 great white sharks are estimated to remain in the northeast Pacific. The proposed project area on the central coast of California hosts prime marine mammal prey species of the great white shark, elephant seal, California sea lions, and harbor seals, among others; in addition, the northern extent of the project area lies within a few miles of the major elephant seal rookery in San Simeon.

   Question: Before an IHA can be issued, isn't it essential that the proposed acoustic seismic testing project be evaluated for its potential to impact the great white shark directly through physical trauma, as well as for its potential to impact the great white shark indirectly through its Level A and Level B impacts (as described in the EIR) to the shark's prey base of marine mammals?

....

Because the proposed PG&E Central Coast Acoustic Seismic Imaging Project will without question result in injury or mortality of hundreds of marine mammals, in violation of the Marine Mammal Protection Act,

the members of the C.O.A.S.T. Alliance believe that NMFS cannot and should not issue an IHA permit for this project.

Sincerely,

Julie Thomas

On behalf of the C.O.A.S.T. Alliance

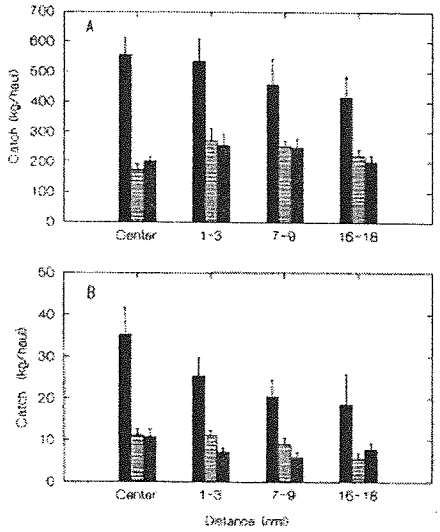
Attachments to email:

- Mission Statement
- List of Member Organizations
- 10 Aug 2012 Ltr from SW Regional NMFS to NSF re proposed IHA
- Excerpts from EIR: Chapter 4.4, Appendix H: Marine Mammal Technical Report

NRDC
THE EARTH'S BEST DEFENSE

SEISMIC AIRGUNS AND FISHERIES

While most of the attention has centered on marine mammals, seismic surveys also have serious consequences for the health of fisheries. Commercial fishermen in various parts of the world have complained about declining catch rates during seismic survey operations (McCauley et al. 2000), spurring a number of controlled experiments that compare fishing success at various distances from the source.

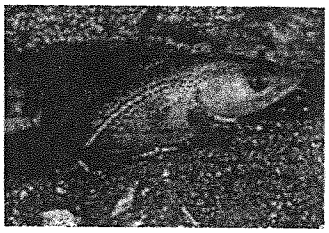


Average trawl catch rates of cod and haddock before (solid), during (striped), and after (gray) seismic shooting, by distance in nautical miles from the shooting area. (Engas et al. 1996)

Airguns have been demonstrated in Norwegian studies to dramatically depress catch rates of cod and haddock by as much as 40 to 80 percent (depending on catch method) over thousands of square kilometers around a single array (Engas et al. 1996; Løkkeborg 1991); and to displace two other commercial species, blue whiting and herring, on a similar spatial scale (Slotte et al. 2004), an area roughly the size of Rhode Island. These impacts were found to last for some time beyond the survey period—catch rates had not fully recovered during the five post-survey days monitored by researchers (Engas et al. 1996)—and researchers have characterized the impacts as "long term" (Slotte et al. 2004). Airguns have also been shown to substantially reduce catch rates of rockfish (Skalski et al. 1992) and possibly pollock (Løkkeborg et al. 2010).

Other impacts on commercially harvested fish include reduced reproductive performance and hearing loss (McCauley et al. 2000, 2003); and recent data suggest that loud, low-frequency sound causes severe acoustic trauma in cephalopods and disrupts chorusing in black drum fish, a behavior essential to breeding in this commercial species (Andres et al., 2011; C. Clark, pers. comm.). Furthermore, emerging research has found that juvenile Chinook salmon exposed to high-intensity impulsive sound suffer from tissue injuries associated with barotrauma (Halvorsen et al. 2012). A recent review cited stress-response data primarily from other species as reason for concern about long-term consequences for fish (Slabbekoorn et al. 2010).

For more information, contact Karen Garrison, (415) 875-6100 or Michael Jasny, (310)-560-5536



Haddock and Atlantic cod

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California State Lands Commission, Attn: Jennifer DeLeon, Division of Environmental Planning and Management

Hello,

I am a specialist in the impacts of noise on marine mammals, having focused on this issue for the last 20 years. As a bioacoustician, studying whale sounds and communication for 30 years now, I am gravely concerned about seismic surveys and the dangers they pose for marine life.

I have put together a summary of impacts on marine life from seismic surveys, including the most recent literature. Please accept this e-mail and the below review as my comments on your Final EIR. I hope that the range of impacts, along with all the references, should give you pause and help you to understand the potential severity of environmental damage which is at stake.

Sincerely,

Lindy Weilgart, Ph.D.

A Review of the Impacts of Seismic Airgun Surveys on Marine Life

Lindy Weilgart, Ph.D.
Department of Biology
Dalhousie University
Halifax, Nova Scotia

and

Okeanos Foundation
Darmstadt, Germany

14 August 2012

Noise from a single seismic airgun survey, used to discover oil and gas deposits hundreds of kilometers under the sea floor, can blanket an area of over 300,000 km2, raising background noise levels 100-fold (20 dB), continuously for weeks or months (IWC 2005, IWC 2007). Since this exposes large portions of a cetacean population to chronic noise, the International Whaling Commission's Scientific Committee noted "...repeated and persistent acoustic insults [over] a large area...should be considered enough to cause population level impacts." (IWC 2005).

Nieukirk et al. (2012) analyzed 10 years of recordings from the Mid-Atlantic Ridge, finding that seismic airguns were heard at distances of 4,000 km from survey vessels and present 80-95% of the days/month for more than 12 consecutive months in some locations. When several surveys were recorded simultaneously, whale sounds were masked (drowned out), and the airgun noise became the dominant part of background noise levels.

To compare the total energy output per year (in joules) of the various human-made noise sources, the highest is 2.1 x 1015 J, representing the contribution from nuclear explosions and ship-shock trials (explosions used by the Navy to test the structural integrity of their ships). Immediately following in contribution are seismic airgun arrays at 3.9 x 1013 J. Next, are military sonars (2.6 x 1013 J) and supertankers, merchant vessels, and fishing vessels at 3.8 x 1012 J (Hildebrand 2005).

Marine mammals

Gordon et al. (2004) found that marine mammals can be impacted by the intense, broadband pulses produced by seismic airguns through hearing impairment (temporary or permanent threshold shift, TTS or PTS), physiological changes such as stress responses, indirectly by impacting their prey, behavioral alterations such as avoidance

responses, displacement, or a change in vocalizations, or through masking (obliterating sounds of interest). Humpback and fin whales appear to communicate over distances of at least tens of kilometers (e.g. Watkins and Schevill 1979), so reducing this distance would compromise their ability to communicate.

Around 250 male fin whales appeared to stop singing for several weeks to months during a seismic survey, resuming singing within hours or days after the survey ended (International Whaling Commission 2007). Assuming male fin whale songs have a reproductive function, such as attracting and finding mates (Croll et al. 2002), it would be difficult to believe that such an effect would not be biologically significant. McDonald et al. (1995) noted that a blue whale stopped calling in the presence of a seismic survey 10 km away.

A different blue whale population showed the opposite reaction. Even a seismic survey using a low-to-medium power sparker caused blue whales in the St. Lawrence Estuary to modify their vocalizations (Di Iorio and Clark 2010). Blue whales called consistently more on days when the seismic survey was operating than when not, and more during periods within those days in which the sparker was on vs. off. The number of blue whale calls increased within the 1-hr block after sparker onset. The authors postulated that the blue whales were attempting to compensate for the additional introduction of noise, and noted that whales probably received a fairly low level of noise (131 dB re 1 mPa (peak to peak) over 30–500 Hz, with a mean sound exposure level of 114 dB re 1 µPa2 s). Thus, they suggested that even low source level seismic survey noise could interfere with important signals used in social interactions and feeding (Di Iorio and Clark 2010).

Marine mammals also avoid seismic noise by vacating the area. Castellote et al. (2012) showed extended displacement of fin whales by a seismic survey which lasted well beyond the survey length. Weir (2008) found that Atlantic spotted dolphins showed stronger responses to seismic airgun exposure than humpback or sperm whales. These dolphins were found significantly farther away from the airguns when they were on vs. off and only approached the seismic vessel when the airguns were silent. An analysis of cetacean responses to 201 seismic surveys in UK waters exhibited evidence of disturbance (Stone and Tasker 2006). During active seismic surveying, all small odontocetes, killer whales, and all mysticetes were found at greater distances from the seismic vessel than when it was not shooting. Small odontocetes showed the greatest horizontal avoidance, which reached to the limit of visual observation. Sighting rates for mysticetes, sperm whales, pilot whales, and killer whales did not decrease when airguns were off vs. on, but mysticetes and killer whales showed localized avoidance. During seismic shooting, fewer animals appeared to be feeding, smaller odontocetes seemed to swim faster, and mysticetes appeared to remain longer at the surface where sound levels are lower. Reactions were stronger to larger volume seismic arrays. Stone and Tasker (2006) theorized that smaller odontocetes may vacate the area entirely during exposure to seismic, whereas slower-moving mysticetes may remain in the area, simply increase their distance from the noise.

Responses can differ according to context, sex, age class, or species. Bowhead whales avoided seismic air-gun noise at received levels of 120–130 dB (rms over pulse duration) during their fall migration, though they were much more tolerant of noise when feeding in the summer, staying away from levels of 158–170 dB, which are roughly 10 000 times more intense (Richardson et al. 1995, 1999). Humpback cows and calves in key habitat evaded seismic air guns at 140–143 dB re 1 µPa mean squared pressure, which was lower than the reaction of migrating humpbacks at 157–164 dB re 1 µPa mean squared pressure (McCauley et al. 2000). Species with similar hearing capabilities and audiograms showed markedly different responses to airgun noise off British Columbia, with harbor porpoises appearing to be the most sensitive, responding to seismic noise at distances of >70 km, at received levels of <145 dB re 1 µPa rms (Bain and Williams 2006; International Whaling Commission 2007).

Reactions to seismic airguns can also be quite subtle and hard to detect. Sperm whales in the Gulf of Mexico did not appear to avoid a seismic airgun survey, though they significantly reduced their swimming effort during noise exposure along with a tendency toward reduced foraging (Miller et al 2009). Miller et al. (2009) tagged 8 sperm whales with tags recording sounds and movement while exposing them to operating airgun arrays. The longest resting bout ever observed in any sperm whale (265 min.) happened to the whale most closely approached by the actively firing seismic survey vessel, with the whale finally diving 4 min. after the final airgun pulse. Whales significantly reduced their fluke stroke effort by 6% during exposure to seismic noise compared with after, and all seven sperm whales studied reduced their fluke strokes on foraging dives in the presence of seismic noise. Moreover, there were indications that prey capture attempts were 19% lower during airgun noise exposure

(Miller et al. 2009). The authors note that even small reductions in foraging rate could result in lower reproductive rates and have negative consequences for the population.

Though summering bowheads showed no detectable avoidance of seismic surveys, no change in general activities or call types, and no obvious alteration of calling rate, they dove for shorter periods and their respiration rate was lower than non-exposed bowheads (Richardson et al. 1986). Such changes were observed up to 54–73 km from seismic surveys at received levels that could be as low as <125 dB re 1 µPa (Richardson et al. 1995).

Seismic noise has been thought to at least contribute to some species' declines or lack of recovery (Weller et al. 2006a, 2006b; International Whaling Commission 2007). Critically endangered western gray whales off Sakhalin Island, Russia, were displaced by seismic surveys from their primary feeding area, returning only days after seismic activity stopped (International Whaling Commission 2005). This change in distribution closely followed the timing of the seismic surveys (International Whaling Commission 2005, 2007; Weller et al. 2006a). Whales exposed to seismic noise levels of about 153 dB re 1 µPa zero-to-peak and 159 dB peak-to-peak on their feeding grounds also swam faster and straighter over a larger area with faster respiration rates during seismic operations (Weller et al. 2006b; International Whaling Commission 2007).

Parente et al. (2007) discovered a reduction in cetacean species diversity with increasing numbers of seismic surveys during 2000 and 2001 off Brazil, despite no significant oceanographic changes in this period. Between 1999 and 2004, there was a negative relationship between cetacean diversity and the intensity of seismic surveys.

When exposed to a single airgun or small airgun array, gray seals showed avoidance and switched from foraging to transiting behavior. They also began hauling out, possibly to escape the noise. Harbor seals exhibited a slowing of their heart rate together with dramatic avoidance behavior and stopped feeding (Thompson et al. 1998).

Seismic air guns are a probable cause of whale strandings and deaths as well, especially in beaked whales (Hildebrand 2005). A stranding of two individuals was tied very closely in space and time to a seismic survey in the Gulf of California. Even if impacts are fatal, only 2% of all cetacean carcasses are detected, on average (Williams et al. 2011). The authors state that for cryptic mortality events such as acoustic trauma, analytical methods are necessary to take into consideration the small percentage of carcasses that will be recovered.

A pantropical spotted dolphin suffered rigidity and postural instability progressing to a catatonic-like state and probable drowning within 600 m of a 3D seismic survey firing at full power (Gray and Van Waerebeek 2011). The authors explained the initial aberrant behavior by a possible attempt by the dolphin to shield its sensitive rostrum and hearing structures from the intense acoustic energy of the airguns, by lifting its head above the water's surface. They believed the seismic survey could have caused this observed behavior, presumably resulting from severe acoustic distress and even injury.
Other explanations were examined and considered less likely (Gray and Van Waerebeek 2011).
Stress effects or physiological changes, if chronic, can inhibit the immune system or otherwise compromise the health of animals. These can be very difficult to detect in cetaceans. Indications of increased stress and a weakened immune system following seismic noise broadcasts were shown for a whale and dolphin (Romano et al. 2004). Loud, impulsive noise produced from a seismic water gun caused significantly increased mean norepinephrine, epinephrine, and dopamine levels immediately after a high, but not low-level exposure in a captive beluga whale (Romano et al. 2004). All three of these stress hormones increased significantly with increasing noise levels. These hormone levels remained high even 1 hour after noise exposure, which is surprising given their short half-life, according to the authors. In a captive bottlenose dolphin, the seismic water gun produced significant neuro-immune values, namely increases in aldosterone and a decrease in monocytes. Aldosterone is one of the principal stress hormones in cetaceans and may surpass cortisol as a more sensitive indicator of stress (Romano et al. 2004).

Mitigation measures to safeguard whales against high noise exposures are very inadequate. Generally, only the area within 500 m of the seismic vessel is observed, yet high noise levels can occur at much greater distances. Madsen et al. (2006) discovered that in the Gulf of Mexico received levels can be as high at a distance of 12 km from a seismic survey as they are at 2 km (in both cases >160 dB peak-to-peak). Received levels, as determined from acoustic tags on sperm whales, generally fell at distances of 1.4 to 6–8 km from the seismic survey, only to increase again at

greater distances (Madsen et al. 2006).

Moreover, determining an exposure level that is "safe" for marine mammals is fraught with difficulty. For instance, a harbor porpoise exposed to airgun pulses was found to have lower (more sensitive) masked TTS levels than any other cetacean that has been tested, namely 164.3 dB re 1 µPa2•s SEL or 199.7 dB pk-pk re 1 µPa (Lucke et al. 2009). The noise level required to cause hearing loss (temporary threshold shift or TTS) in whales is still very uncertain, especially for seismic airguns, as there are so few empirical measurements. Between-individual variability, the population's average sensitivity (how representative of the population was the tested animal), and the validity of extrapolating between species, particularly between captive small dolphins or porpoises (on which the few tests have been done) to free-ranging large baleen whales are all unknown. Gedamke et al. (2011) model how various factors and assumptions can change the percentage of whales exposed to damaging levels. When factoring in uncertainty and sources of variability, 29% (10-62%) of whales within 1-1.2 km of a seismic survey would experience levels sufficient to produce TTS onset. Without considering these factors, no whales beyond 0.6 km would be at risk for TTS, showing how even fairly small degrees of uncertainty can have a large effect on risk assessment (Gedamke et al. 2011). If management decisions are to be based on so little data, uncertainty must be taken into consideration. At close ranges, avoidance by whales of the seismic survey actually increased their exposure slightly as their speed was slower than the seismic vessel. Overall, Gedamke et al. (2011) concluded that TTS in baleen whales is plausible at ranges up to several kilometers.

Many (36-57%) of the stranded or entangled dolphins or toothed whales have been shown to have profound hearing loss, implying that impaired hearing could have led to their stranding/entanglement (Mann et al. 2010).

Marine Turtles

Marine turtles show a strong initial avoidance response to air-gun arrays at a strength of 175 dB re 1µPa rms or greater (O'Hara and Wilcox 1990; McCauley et al. 2000; Lenhardt 2002). Enclosed turtles also responded progressively less to successive airgun shots which may indicate reduced hearing sensitivity (TTS). One turtle experienced a TTS of 15dB, recovering two weeks later (Lenhardt 2002). McCauley et al. (2000) estimated that a typical airgun array operating in 100–120 m water depth could impact behavior at a distance of about 2 km and cause avoidance at around 1 km for marine turtles. DeRuiter and Doukara (2010) found that 51% of turtles dived at or before their closest point of approach to an airgun array.

Fish

A wide range of acoustic impacts on fish has been observed. Seismic air guns extensively damaged fish ears at distances of 500 m to several kilometres from seismic surveys. No recovery was apparent 58 days after exposure (McCauley et al. 2003). Behavioral reactions of fish to anthropogenic noise include dropping to deeper depths, milling in compact schools, "freezing", or becoming more active (Dalen and Knutsen 1987; Pearson et al. 1992; Skalski et al. 1992; Santulli et al. 1999; McCauley et al. 2000; Slotte et al. 2004). Reduced catch rates of 40%–80% and decreased abundance have been reported near seismic surveys in species such as Atlantic cod, haddock, rockfish, herring, sand eel, and blue whiting (Dalen and Knutsen 1987; Løkkeborg 1991; Skalski et al. 1992; Engås et al. 1996; Hassel et al. 2004; Slotte et al. 2004). These effects can last up to 5 days after exposure and at distances of more than 30 km from a seismic survey. The impacts of seismic airgun noise on eggs and larvae of marine fish included decreased egg viability, increased embryonic mortality, or decreased larval growth when exposed to sound levels of 120 dB re 1 µPa (Kostyuchenko 1973; Booman et al. 1996). Turbot larvae showed damage to brain cells and neuromasts (Booman et al. 1996). Neuromasts are thought to play an important role in escape reactions for many fish larvae, and thus their ability to avoid predators. Increases in stress hormones have been observed in fish due to noise (Santulli et al. 1999).

Invertebrates

Invertebrates also do not appear to be immune from the effects of anthropogenic noise. Nine giant squid mass stranded, some of them live, together with geophysical surveys using air guns in 2001 and 2003 in Spain (Guerra et al. 2004). The squid all had massive internal injuries, some severe, with internal organs and ears badly

damaged. Another species of squid exposed to airgun noise showed an alarm response at 156-161 dB rms and a strong startle response involving ink ejection and rapid swimming at 174 dB re 1µPa rms (McCauley et al. 2000). Caged squid also tried to avoid the noise by moving to the acoustic shadow of the cage. McCauley et al. (2000) suggest that the behavioral threshold for squid is 161-166 dB rms. A bivalve, Paphia aurea, showed acoustic stress as evidenced by hydrocortisone, glucose, and lactate levels when subjected to seismic noise (Moriyasu et al. 2004). Catch rates also declined with seismic noise exposure in Bolinus brandaris, a gastropod, the purple dye murex (Moriyasu et al. 2004). In snow crab, bruised ovaries and injuries to the equilibrium receptor system or statocysts were also observed (Department of Fisheries and Oceans 2004). Seismic noise-exposed crabs showed sediments in their gills and statocysts, and changes consistent with a stress response compared with control animals.

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Date: October 19, 2012

To: San Luis Obispo County Board of Supervisors;

From: Richard E.T. Sadowski
C.O.A.S.T. alliance, Morro Bay, Ca.
Citizens Opposing Acoustic Seismic Testing

As a former Lead Test Operations Engineer on R&D hypersonic fluid dynamics aerospace project, I collaborated with scientists and skilled technicians to safely test scramjet propulsion models. The emphasis on any scientific data collections test, like the proposed PG&E Seismic Survey for the Diablo Canyon Nuclear Power Plant (DCPP), must first and foremost be fundamentally based on common sense. The amount of potential destruction that the PG&E seismic test proposal would levy, in and of itself, is beyond any reasonable discussion, and would not ensure additional safety measures for DCPP.

Besides the obvious violations to the MLPA, Endangered Species Act, Magnuson-Stevens Sustainable Fisheries Act, NEPA, and California's Coastal Act just to name a few, several issues and concerns come to mind regarding the current status of this project. For example, the Bureau of Ocean Energy Management (BOEM) is currently looking into the Peruvian mass mortality of dolphins from seismic testing using air cannons that occurred earlier this year. Undeniably, it would make sense for the SLO County Board of Supervisors (SLO BOS) to wait and evaluate some of those findings prior to endorsing any project of this caliber.

The PG&E seismic test proposal also has far reaching international implications, given that National Marine Fisheries Service (NMFS) is responsible for management of California's Exclusive Economic Zone (EEZ) which inevitably will be compromised by this action and has yet to be thoroughly evaluated. Also, the interstate implications have yet to be vetted given the recent MOU on Ocean Health by the West Coast Governors Alliance (WCGA).

On a humanistic note, we as a generation do not have the right to mitigate away the enjoyment of a healthy ocean from our future generations. The National Environmental Policy Act, of 1969 (NEPA) expressed a goal of maintaining and creating "conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans." The PG&E seismic testing project counters these goals under the auspices of nuclear safety and the short sited economic benefits for the few at the cost of many.

I urge each one of you as individuals to seek an honest moral assessment of your very being and take action to stop this unwarranted assault on our local environment and the livelihood of our local fisherman, business and or coastal tourism industry.
Each SLO County Supervisor, as an individual, has a moral obligation to personally

investigate the implications of this action, and the effects on the local citizenry quality of life, and pursuit of happiness.

Thank you for taking the time and consideration regarding this critically important issue.

Respectfully,

Richard E.T. Sadowski
Mechanical Engineer
C.O.A.S.T. Alliance member
490 Java Street
Morro Bay, Ca. 93442

Memorandum

To: Cassidy Teufel and Mark Delaplaine

From: Karen Garrison, NRDC

Date: Sept. 17, 2012

RE: Diablo Canyon Seismic Survey: MPA Mitigation and Monitoring, and Public Trust Issues

This memo supplements our Sept 7 communication, with a focus on (1) public trust issues; (2) mitigation measures for significant impacts on marine protected areas; (3) monitoring measures (as part of mitigation) (4) budgets for sample mitigation measures; and (5) legal authority for mitigation measures.

In summary, we have concluded that the survey will provide only marginal additional information that will not affect the safety of the Diablo plant. We recommend that the Coastal Commission deny the permit. If the project goes forward, all possible steps should be taken to minimize harm to the marine environment, and to mitigate impacts that are unavoidable.

Public Trust

NRDC started with the view that the proposed survey would provide valuable information that could improve the earthquake safety of the reactor. However, after reading numerous relevant reports and consulting experts, we have become convinced that the survey would at best very marginally improve our understanding of the dip of the Hosgri fault. PG&E has already modeled earthquake risk using worst case assumptions about that fault angle and concluded that the Diablo plant is safe. The survey might further constrain the uncertainty and tell us it is safer than indicated by the worst case scenario, but no changes would be made at the reactor. In light of this fact, *we now conclude that the projected harm from this project far outweighs the public benefits, and that the seismic survey should not go forward.*

PG&E conducted a study of the relative importance of various sources of uncertainty related to earthquake risk at Diablo Canyon. (See the talk "GENERAL 0104 Wooddell - Sensitivity" at this website: http://www.pge.com/mybusiness/edusafety/systemworks/dcpp/SSHAC/workshops/index.shtml).

Pages 56-58 show the uncertainty in modeled ground shaking due to various sources of uncertainty of the fault system, ranked top to bottom from most to least important. (The horizontal spacing of the circles shows the different results using different assumptions within the current uncertainty--greater spread of circles means more uncertainty.) The slip rate of the Hosgri Fault is the most important, followed by the location and dip of the Hosgri.

Pages 90-92 show the uncertainty due to various assumptions in the way the ground shaking is computed. These uncertainties have more effect on the ground shaking than the uncertainties in the fault system.

So, from PG&E's own study, the most important sources of uncertainty are, in order of importance: (1) how the ground shaking is modeled, (2) the slip rate of the Hosgri, and (3) the location and dip of the Hosgri. The seismic studies address only point 3. And, for any reasonable dip of the Hosgri fault (see p. 7), the modeled shaking is within the design specifications of the plant (the black line labeled 1977 HE), so point 3 is not of great importance to the safety of the plant.

For these reasons, we conclude that the proposed project would cause significant harm to the marine environment with little or no benefit to the public trust.

Mitigation Measures

If the project goes forward, the Coastal Commission should require mitigation for significant impacts to marine protected areas (MPAs)—specifically, for takings of sea life and resulting ecosystem disruption within their boundaries—under its authority to protect marine resources and "healthy populations of all species of marine organisms" in state waters. As you know, MPAs safeguard sensitive habitats and create productivity hot spots by allowing fish and other creatures to grow large and prolific. They also provide a haven for a wide range of species, including depleted rockfish that have begun a still-fragile recovery. Potential mitigation measures are summarized below.

- Contribute funds for MPA enforcement, public engagement and compliance efforts. For instance:
  - Sponsor an MPA watch program at Buchon Marine Reserve. MPA watch protocols and programs already exist in other coastal areas and nonprofit organizations are interested in starting additional programs, but lack of funds currently limits their geographical reach. See Appendix B for description of program and budget.
  - Fund Lighthawk, a non-profit aviation organization that assists with conservation projects, to do monthly aerial surveys to help identify potential MPA violations, enhancing enforcement, for a period of five years (see attached budget).
  - Sponsor additional MPA signage and public education activities, such as production and distribution of materials for use by local schools (over, for example, a five-year time span).
  - Provide one-time payment into a state fund for boats, enforcement technology, and/or warden training to ensure adequate enforcement of regulations limiting take in the Buchon Marine Reserve.
- Contribute to activities that compensate for marine life injury and mortality from other sources.
  - Funds for marine mammal rescue and rehabilitation efforts in SLO County.
  - Funds for activities to control land-based impacts to the MPAs, e.g. point-source and non-point-source water pollution.
  - Funds for habitat restoration, including invasive species removal, in Morro Bay, or elsewhere in the vicinity of affected MPAs.
  - Fund enforcement of a vessel traffic agreement designed to minimize the threat of an oil spill in the Pt. Buchon area, where large vessels are currently cutting corners. To secure a monitoring station at Pt. Sur ((Pt. Sur defines the coast so if the regulations are enforced at Pt. Sur, protection becomes effective for the Central Coast) would cost approximately $10,000 in monitoring hardware and another $20,000 for labor. An additional monitoring station at Diablo would be helpful, adding another $10,000 in hardware and another $5k or so in time (assuming permissions at Diablo are easily granted by PGE).
- Sponsor other regional conservation activities, such as expansion of PG&E's land stewardship activities at Buchon to better inform the public about local MPAs (e.g. training of trail guides and other on-site personnel, production of educational materials about MPAs). As a steward of the adjacent land, PG&E is well suited to take charge of education and outreach for the Buchon Marine

Reserve, possibly in partnership with the Monterey Bay and Channel Islands Marine Sanctuary Foundation.

Monitoring of MPAs

For fish and other sea life in and around MPAs, we believe monitoring activities provide a mitigation function because the dearth of information on effects of seismic activities on species other than marine mammals allows similar projects to go forward without adequate mitigation or environmentally sensitive design standards. In the case of the Diablo project, monitoring data could inform the design of 3D studies for San Onofre, which are likely to follow the 2D studies proposed for December of 2012. Include in the monitoring plan scuba studies of shallow water sites inside and outside of the impact zone, including Point Buchon and at least one control site.

- Require PG&E to work with Ocean Science Trust (OST) and local scientists to incorporate monitoring undertaken in 2013 under "Phase two" of this project into the Central Coast MPA monitoring framework that will soon be under development.
- Fund the development of monitoring protocols – to be applied during any 2013 monitoring – that will contribute to knowledge about acoustic impacts to fish, benthic invertebrates, and/or plankton.
- Require experimental studies of the effects of acoustic testing on valuable and potentially sensitive species, such as squid and salmonids.
- Require scuba studies of shallow water sites inside and outside of the impact zone, including Point Buchon and at least one control site, in addition to the monitoring program already approved by State Lands Commission.

Budget for Mitigation Measures

See attached budget, Appendix A, for a summary of costs for a sampling of these mitigation measures. Appendix B, C and D contain detailed budget of specific mitigation measures. The total for the three projects we review is approximately $820,000 for a five-year period.

Legal Authority for Mitigation Requirements

Mitigation measures must be within the regulatory authority of a given agency. While, the Coastal Commission may not be able to request mitigation for impacts to MPAs *per se* because it lacks authority to regulate take in MPAs, *the Commission has authority to protect marine resources and "healthy populations of all species of marine organisms" in state waters*. It may also apply this authority to federally permitted activities that affect state waters and resources, even if those activities are outside of state boundaries. This authority provides a flexible means of protecting species within and close to the MPAs.

- Mitigation measures required by a regulatory agency must have a nexus—and must be roughly proportional—to a project's expected impacts.
    - Under CEQA, mitigation is required for significant unavoidable impacts, and the Diablo Canyon Seismic EIR finds impacts on MPAs to be significant and unavoidable.
    - The Coastal Commission may make additional findings under the Coastal Act if supported by substantial evidence.

- Based on scientific studies that find seismic activities have caused trauma in fish, kill larvae in the vicinity of the testing, and harm fish and squid in other ways, the nexus between the likely impacts of the proposed project and mitigation activities that compensate for those impacts by reducing additional take in marine protected areas is evident (see attached fact sheet).
- The Commission should view this project from a highly precautionary perspective because the biological impacts of high-energy acoustic surveys are poorly understood. Although such surveys are becoming more common, companies are not investing in biological monitoring to understand the impacts.

- The Coastal Commission often uses a mitigation ratio to calculate mitigation requirements for loss of wetlands and other habitats (e.g. a 3:1 "area restored: area impacted" ratio). Application of a mitigation ratio, in this case extending the mitigation activity (e.g. improved MPA compliance) over a 5-year period, makes sense because of the time lag between the project and the mitigation, because impacts are likely to extend beyond the period of the actual project, and because of the need for precaution given that proponents cannot accurately quantify the impacts on protected areas. More specifically, we recommend that the CCC:
- Describing and quantifying acoustic impacts to non-mammal marine species (adult, juvenile, and larval fish; benthic invertebrates; and plankton) is a challenge given limited available data.
  - At the very least, monitoring for this project should be designed to contribute to knowledge about acoustic impacts to marine species, particularly species with suspected (but not experimentally confirmed) sensitivities.
  - While it would not be feasible to incorporate new monitoring protocols in time for a 2012 survey, a delay in the project would allow time to conduct baseline monitoring and experimental research on seismic impacts. Even if the survey proceeds in 2012, with sufficient resources and clear indication that a monitoring plan would be implemented, experiments for 2013 testing may be possible.

Sections from the Coastal Act that I found that give us the power to stop the testing

Section 30006 Legislative findings and declarations; public participation

The Legislature further finds and declares that the public has a right to fully participate in decisions affecting coastal planning, conservation and development; that achievement of sound coastal conservation and development is dependent upon public understanding and support; and that the continuing planning and implementation of programs for coastal conservation and development should include the widest opportunity for public participation.

Section 30230 Marine resources; maintenance

Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

Section 30231 Biological productivity; water quality

The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

Section 30234.5 Economic, commercial, and recreational importance of fishing

The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.

(Added by Ch. 802, Stats. 1991.)

(And to verify that we have a guaranteed voice in this matter)

Section 30323 Interested persons

For purposes of this article, an "interested person" is any of the following:

(c) A representative acting on behalf of any civic, environmental, neighborhood, business, labor, trade, or similar organization who intends to influence the decision of a commission member on a matter before the commission.

(Added by Ch. 1114, Stats. 1992.)

SLOSEA

San Luis Obispo Science and Ecosystem Alliance

Center for Coastal Marine Sciences ~ Biological Sciences Department
California Polytechnic State University San Luis Obispo, CA 93407
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To: California State Land Commission (SLC)
Jennifer DeLeon, Project Manager
From: San Luis Obispo Science & Ecosystem Alliance (SLOSEA) at the Cal Poly Center for Coastal Marine Sciences (CCMS)
Re: Comments to the Central Coastal California Seismic Imaging Project Draft Environmental Impact Report (CCCSIP DEIR)

Introduction

SLOSEA at Cal Poly's Center for Coastal Marine Sciences would like to thank the SLC for the opportunity to comment on the Central California Imaging Project DIER, and its work in preparing the document. We would like to share our thoughts related to this project as we are particularly concerned with the adequacy of the impacts assessed in sections 4.4 Biological Resources – Marine, and 4.13 Commercial Fishing. Also, impacts to on-going research projects located in the project area should be included and mitigation measures should be established. Lastly, impacts and mitigation measures to the Commercial Passenger Fishing Vessel (CPFV) (Section 4.10 Land Use & Recreation) should be more thoroughly discussed and considered.

Comment 1 - Based on the currently best available science the conclusion that impacts to biological resources will culminate in less than significant long-term impacts to commercial fishing catch rates is not supported. As such, if the CCCSIP is approved, the final EIR and mitigation measures should include a thorough long-term impacts research study conducted by California Collaborative Fisheries Research Program (CCFRP) (a collaborative organization among Cal Poly CCMS, Moss Landing Marine Laboratories, central coast fishermen, and government agencies). The CCFRP will employ an approved and vetted research protocol, and an existing 5-year baseline dataset for comparing catch levels and fish populations before and after the proposed seismic study. This research project should be funded by PG&E as part of project mitigation to help inform the long-term impacts of the proposed and future seismic studies.

The below comments relate to following sections:

1) Section 4.4 Biological Resources – Marine: Impact MARINEBIO-8: Injury or mortality to adult fishes would occur due to noise from air guns during the seismic survey. (Less than Significant)
2) Section 4.4 Biological Resources – Marine: Impact MARINEBIO-9: Injury or mortality to juvenile fishes, larval organisms, and planktonic resources would occur due to noise from air guns during the seismic survey. (Less than Significant)
3) Section 4.13, Commercial Fishing (Impact FISH-4) - Offshore Project activities would have long-term adverse effects on commercial fishing through fish population impacts. (Less Than Significant)

The conclusion reached in the DEIR that there are "less than significant adverse effects" on the commercial fishing industry as a result of fish population impacts (whether through impacts to adults, juveniles or larvae) is not supported by currently available science. As stated in the DEIR (section 4.13) the "concern about long-term effects on commercial fish populations has been raised repeatedly," and the report concludes, that we *do not have meaningful data to support or refute this fundamental concern.* As the report highlights, it is known that adult fish exhibit short-term physiological and behavioral changes as a result of projects such as the one proposed here. A variety of marine species have been shown to respond to sound impulses from seismic sampling efforts utilizing airguns (NSF 2011). Studies have shown that fish are sensitive to the range of sound produced by these airguns (e.g. Popper and Hastings 2009 and Sirovic and Demer 2009), and some studies have demonstrated alarm or startle responses in fish (e.g. Pearson et al. 1992 and Wardle et al. 2001) or physical damage to auditory structures (e.g. McCauley et al. 2003). Moreover, fish may hear airgun-produced sounds several to tens of kilometers from the source (e.g. Pearson et al. 1992 and Engas et al. 1996). Although the DEIR discusses many of these findings, the data and studies to determine the long-term impact to fish populations does not exist, and it is therefore not possible to conclude that there are "less than significant" long-term impacts to commercial fishing.

Indeed, as the DEIR reports there have been only a few efforts to examine whether airgun releases significantly affect catch rates of different marine fishes (e.g. Skalski et al. 1992 and Engas et al. 1996). One study of rockfish catch rates (*Sebastes spp.*), conducted along the central coast of California, found that CPUE decreased > 50% during airgun releases (Skalski et al. 1992). Additionally, one study (Engas et al. 1996) found that catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*), fished using trawl and longline, decreased significantly during and up to five days after seismic sampling with airguns.

Moreover, to our knowledge, *there are no peer reviewed studies examining the effects of seismic sampling using airguns on the catch rate of marine fish on a temporal scale longer than five days and none have examined the impacts after a sustained period (several months) of testing, such as the proposed project.* In fact, the DEIR discussed the inability to understand the impacts on populations during the last seismic testing in state waters off the coast of Santa Barbara in 1995. That inability was due to the fact that there was no baseline data for comparison. This is not the case for the Central Coast. As a result of the efforts of the California Collaborative Fisheries Research Project (CCFRP) including stakeholders from fishing communities along the central coast, government agencies, and scientists at Cal Poly's Center for Coastal Marine Sciences and Moss Landing Marine Laboratory, a 5-year data set on catch rates exists for the project area. These data have been generated using a standardized and vetted protocol in waters throughout San Luis Obispo and Monterey counties. *Therefore, the DEIR mitigation measures (Sections 4.4 and 4.13) should include a focused monitoring program that builds on the existing 5-year data set. Doing so will quantify the long-term impacts to populations and catch rates (and thus fishermen) of high-energy seismic testing.*

Given the economic significance of the proposed study area to the fishing industry, a study of the long-term impacts to catch rates must be conducted. If the project is approved, the Commission should take this opportunity to understand the long-term impacts of seismic testing to help inform future studies both in California and throughout the world.

Comment 2 – The DEIR does not discuss impacts to on-going state, federal, and foundation-funded marine protected areas/ fishery studies in the project area. Therefore, the final EIR should include a discussion of these impacts, and include a requirement that PG&E fund additional monitoring and an analysis of catch data between the proposed project area and areas outside the project scope.

The State of California (Marine Life Protection Act Initiative/ Monitoring Enterprise, Ocean Protection Council, CA Sea Grant), the California State University, private foundations, and our local fishing communities, have collectively invested several million dollars to assemble the 5-year baseline data set and research program established in the project area. The proposed seismic study has the potential to compromise the validity and utility of ongoing funded projects and the current 5-year baseline data set as it relates to understanding 1) the impact of California's MPAs on fish populations and 2) the use of these data by California State and Federal governments for stock assessments and fisheries management. It is imperative that PG&E provide funding as part of the mitigation measures to understand how the seismic testing impacts fish populations and therefore the utility of the existing baseline data set. As stated in the previous section, financial support through mitigation to fund existing monitoring protocols both during and following the seismic testing is essential. A time frame of an additional 5-7 years for monitoring is needed to understand the CCCSIP's long-term impacts, because rockfish species exhibit slow growth and many years to reach reproductive maturity. Thus, impacts to the populations may not appear for many years following the seismic testing. Determining the duration and magnitude of impacts from seismic sampling to fish populations will be critical in order to validate the use of our data set in resource management and peer-reviewed publications.

Comment 3- Section 4.10, Land Use & Recreation, does not include an analysis of the economic impact that the project will have on the commercial fishing vessel industry (CPFV), nor does it suggest effective mitigation measures to off-set those impacts. As such, the SLC should revisit this section in order to conduct a thorough impacts analysis and include proper mitigation measures.

The DEIR should include a more detailed analysis of the economic impact to the CPFV industry; especially given that the proposed project timeline, and scope significantly overlap with the industry's peak operation time. Closure of the proposed seismic sampling blocks to commercial boat traffic could have damaging effects on the business of the three CPFV charter companies in Morro Bay and Port San Luis. These companies rely heavily on recreational angler business during the recreational rockfish season (May 1 to December 1). The proposed closure from September to December will significantly reduce the length of their fishing season to commonly fished areas in San Luis Obispo County. Mitigation measures, including compensating these companies, should be included in the final EIR.

Conclusion

In closing, there is obviously a very serious concern related to the seismic sampling required to better elucidate the geologic features around Diablo Canyon nuclear power plant. However, the purpose of these comments is to raise biological and social concerns regarding the project, and to suggest mitigation measures to help offset impacts to the marine environment as well as the local community and industry.

Yours sincerely,

SLOSEA, Cal Poly CCMS

Dean Wendt, PhD
SLOSEA, Executive Director
Cal Poly CCMS, Acting Director
Cal Poly College of Science & Mathematics, Associate Dean

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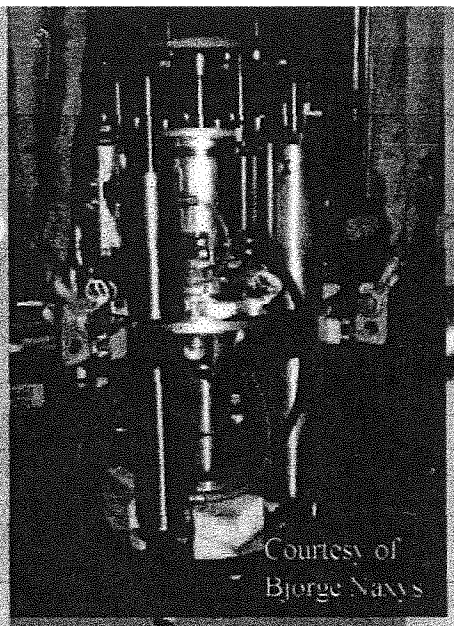

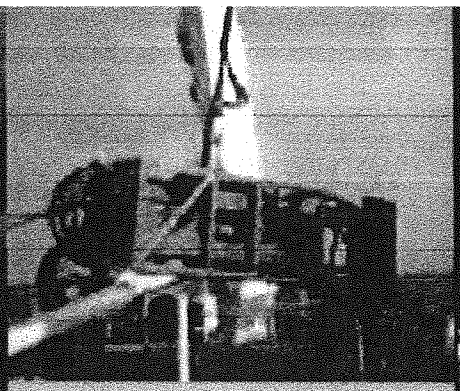

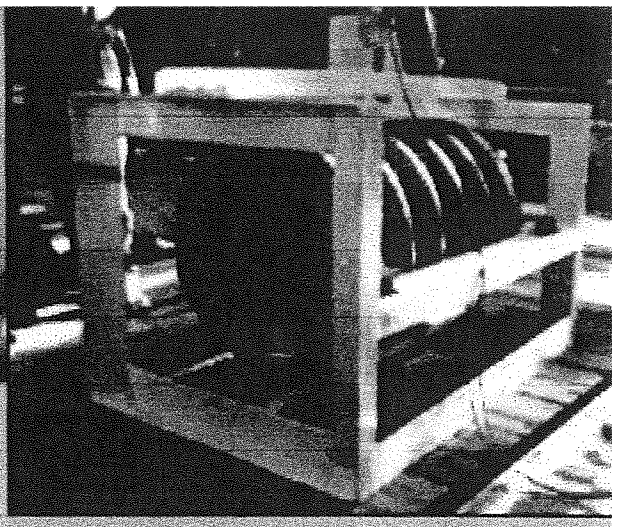

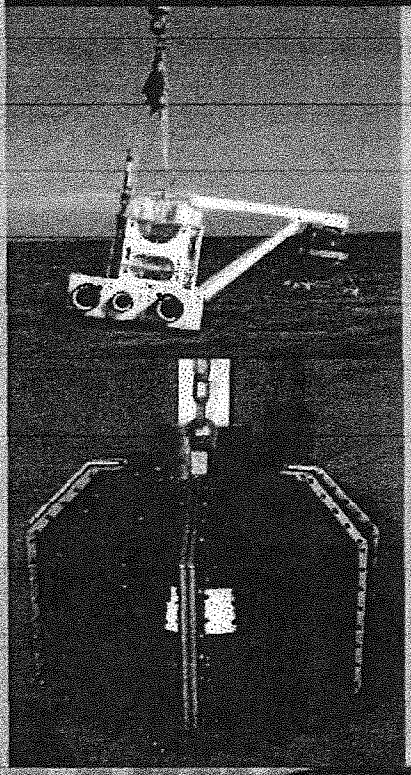

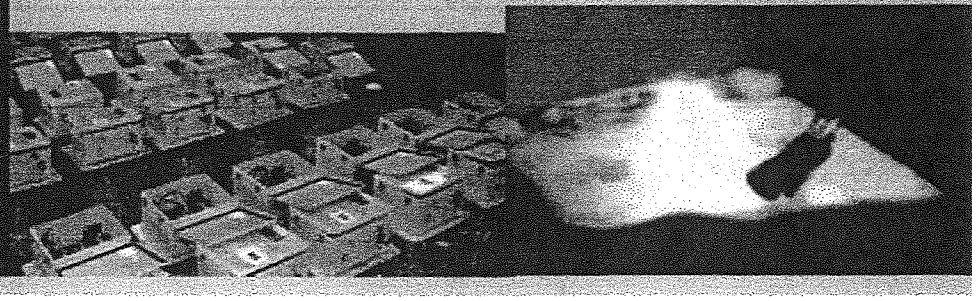

REPORT OF THE WORKSHOP ON

ALTERNATIVE TECHNOLOGIES TO SEISMIC AIRGUN SURVEYS FOR OIL AND GAS EXPLORATION AND THEIR POTENTIAL FOR REDUCING IMPACTS ON MARINE MAMMALS

Held by Okeanos - Foundation for the Sea
Monterey, California, USA
31st August – 1st September, 2009

Edited by

Lindy Weilgart, Ph.D.

March, 2010

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Prologue

By Dieter Paulmann

As part of our continuing efforts to preserve the oceans and their inhabitants, we, Okeanos – Stiftung für das Meer (Foundation for the Sea), have focused on the issue of anthropogenic (human-made) underwater noise and its impact on marine mammals. Okeanos has held a number of international, multi-disciplinary workshops on various novel aspects of this issue, ranging from noise-induced stress effects, and noise management through spatial planning, to ship-quieting technologies, and techniques for assessing the cumulative impacts of underwater noise together with other anthropogenic stressors facing marine mammals. Fruitful, productive discussions and collaborations, especially between experts from diverse fields that don't commonly interact, have resulted from these workshops. Scientists from a diversity of disciplines and specialties (ranging from biologists to engineers) and policy makers, working together, have managed to merge their expertise to develop new ideas, techniques, and mechanisms for making progress on the science and management of ocean noise.

One such management mechanism to reduce ocean noise is source-based mitigation, i.e. making sound sources more benign to marine mammals. Seismic airgun surveys, including those used in the exploration of oil and gas deposits underneath the ocean floor, produce loud, sharp impulses that can raise noise levels substantially over large areas. These surveys can last for months and the noise they produce is virtually ubiquitous in the world's oceans. Though noise impacts on marine life (fish and even invertebrates, along with marine mammals) from seismic surveys are well documented, the biological relevance of these impacts on wild populations remains controversial among the various stakeholders. Rather than address the controversy or evaluate the evidence for or against impact, our purpose in this workshop was to examine quieter, potentially less harmful technologies that might be able to, at least partially, replace airguns. While airguns are excellent tools to image formations, structures, and deposits deep in the ocean substrate, they also have drawbacks from an engineering/industry point of view. They produce more noise than is needed for hydrocarbon exploration, the signal is not very repeatable or controllable, and the frequencies produced are not as low as are sometimes necessary for good penetration of the substrate. In the same way that, historically, airguns replaced explosives for oil and gas exploration because airguns were safer for humans, it is perhaps now time for airguns themselves to evolve into technologies that are more environmentally sensitive and perhaps even more effective in finding oil and gas deposits.

To this end, and supported by the Okeanos Foundation, an international, multi-disciplinary group of geophysical scientists, seismologists, biologists, and regulators met in Monterey, California, 31 August-1 September, 2009, to seek alternatives and/or modifications to airguns and airgun array configurations in order to minimize their potential impacts. Participants were asked to evaluate the strengths and limitations of various alternative/supplementary technologies, consider the conditions under which each could be applied, and discuss aspects such as the timeframes over which they would be commercially available, if not in use presently. Only participants with expertise in a particular alternative technology or airgun array configuration were invited, along with marine mammal biologists. The goal was to preferentially eliminate the use of sound for hydrocarbon exploration, or to reduce the amount or type of potentially harmful acoustic energy introduced, or the total area ensonified.

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On the first day, each participant gave a presentation, generally about the technology in which they specialize. These technologies were then discussed on the second day, and a consensus summary statement was formulated by the group. This report consists of that summary statement, along with some supplementary notes by various participants, and three tables on seismic survey characteristics, applications for airgun alternatives, and characteristics of airgun alternatives, respectively.

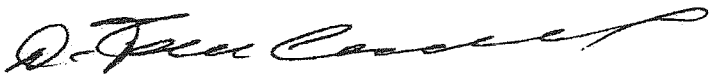
Discussions were extremely collegial, and there was little disagreement on the main points, namely that:

- airguns produce "waste sound" that is not used by the industry, yet has the potential to impact marine life;
- that this sound (mainly high frequencies and lateral propagation) could be eliminated without sacrificing any data quality for the hydrocarbon industry;
- that reducing peak sound levels is a worthwhile goal even at the expense of requiring a slightly longer signal;
- that technologies are available or emerging that do not introduce any anthropogenic sound, or introduce substantially less sound, into the environment;
- that less sound may be required to gather the same quality of data due to more sensitive receivers;
- and, finally, that regulatory pressure/incentives and more funding to develop these technologies will expedite their availability and broaden their applications.

As the ever-expanding search for petroleum deposits moves towards deeper water (possibly requiring a louder signal) and more sensitive habitats, such as the Arctic, the need for more benign alternatives to airguns will escalate. Nevertheless, in some particularly vulnerable, critical, and productive habitats, any addition of noise may be too much. Moreover, alternatives that are assumed to be more environmentally benign than airguns, may in fact not be. Quieter is almost always better, but all alternatives should be assessed for their environmental impact before being put to wide use. This report is not meant to advocate any alternatives without such essential prior testing.

Some of the information contained within this report is somewhat preliminary in nature. There is still much research and development that needs to be done on some alternatives to seismic airguns. However, this report should dispel any doubts that substantial improvements can be made, even in the near future. What is mainly lacking is regulatory pressure as well as funding. This report seeks to stimulate debate and interest from companies, which in some cases are already developing alternatives to airguns, and policymakers.

This report also includes lists of participants and their presentations, the latter with abstracts.



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Consensus Summary

of the
Workshop on Alternative Technologies to Seismic Airgun Surveys for Oil and Gas Exploration and their Potential for Reducing Impacts on Marine Mammals

Lindy Weilgart (ed. and co-organizer of the workshop), Andrew Wright (co-organizer of the workshop), Leila Hatch (chair)

Participants (alphabetically): Ron Brinkman, MMS; Chris Clark, Cornell University; John Diebold, LDEO; Peter Duncan, Microseismic Inc.; Rob Habiger, Spectraseis AG; Leila Hatch, NOAA; John Hildebrand, Scripps Institution of Oceanography; Phil Nash, Stingray Geophysical Ltd.; Jeremy Nedwell, Subacoustech; Dave Ridyard, EMGS; Rune Tenghamn, PGS; Peter van der Sman, Shell; Lindy Weilgart, Dalhousie University; Warren Wood, NRL; John Young, ExxonMobil

Abstract

Past experience shows us that a fraction of the airgun sound that has potential to impact marine mammals (either physically or behaviorally) comes from "waste sound" that is either too high frequency and filtered out before recording or propagates laterally away from receivers and is also never recorded. The Okeanos Seismic Airgun Alternatives workshop panelists identified several ways in which unwanted sound or noise from seismic airguns might be reduced with little or no effect on the quality of data acquired. In addition to eliminating this noise or unused signal, peak sound levels required for exploration might also be reduced by spreading the source energy out over time, and/or moving sources and receivers closer to the seafloor. Panelists also discussed promising new imaging technologies that are either completely silent (e.g. controlled source electromagnetics) or that can lessen the amount of seismic sound required to gather seismic data (e.g. increasing the density of more sensitive receivers, such as fiber optics or through the use of passive seismic technology) thereby still allowing for a reduction of the economic risk of hydrocarbon recovery. Workshop panelists acknowledged that these technologies are purpose driven and do not work in all circumstances. Many of these technologies may be either available now or in the next 1-5 years, depending on funding and technology advancements.

Introduction

Supported by Okeanos, a multi-disciplinary group of geophysical scientists, seismologists, biologists, and regulators met to seek ways to reduce noise from seismic airgun surveys, specifically the large airgun arrays used for oil and gas operations in the ocean. We, the participants of this unique gathering, agree that marine life would benefit from a quieter ocean. With the introduction of new technologies and techniques, turning the tide on rising levels of noise in the oceans now seems feasible. The following findings and recommendations represent the key results of our discussions at the workshop.

Findings and Recommendations

The most effective acoustic mitigation remains not exposing marine life (i.e., through avoidance) to additional anthropogenic noise.

- Government agencies responsible for regulating offshore seismic data acquisition activities (hereafter: 'Regulators') should collect or fund collection of baseline data on the distribution of marine mammals in space and time in areas where seismic data acquisition is being planned. These data should be collected as far in advance of the seismic data acquisition as is practicable (especially where species distribution is poorly understood or in areas where seismic data acquisition is new).
- In areas where seismic data acquisition will take place and is likely to expose marine animals to noise, efforts should be made by regulators in conjunction with the operator of the seismic data acquisition activity to reduce sound levels to the lowest practicable and/or integrate the use of alternative technologies into planned activities to reduce noise exposure.
- Impulsive sources like airguns have the potential to physically impact marine life because of the sharp rise times and high peak pressures of airguns. Behavioural effects are also possible due to exposure to sound at distances away from the airguns.
- A multi-dimensional metric or scoring system to quantify the impacts of airguns or alternatives on various marine animals would be very helpful, though difficult.

Airguns

- Airgun design can be optimized to reduce unwanted energy.
    - Imaging deep geological targets requires an acoustic source outputting relatively low frequency content (<200Hz). The lower frequencies provide the deep energy penetration into the earth. Currently seismic airguns produce broad-band acoustic energy (>200Hz) and in directions (both inline and horizontal to the plane of interest) that are not of use. During collection of seismic data for deep imaging purposes one should strive to reduce unnecessary acoustic energy (noise) through array, source, and receiver design optimization. A more general statement can be made that regardless of the imaging target, anyone collecting seismic data should strive to reduce unwanted energy or noise. It should be noted that even if unwanted frequencies (> 200 Hz) are removed, there will still be frequency overlap with several marine animals (including most baleen whales) that can and should be minimized.
- Lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). For example, new receiver technologies, such as fibre optic receivers, may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise floor.
- Some evidence exists which indicates that re-engineered air guns with "mufflers" can be used to attenuate unwanted high frequency energy without affecting frequencies of interest.
- Bubble curtains may be used to optimize the directivity of the source, but they can be difficult to use, produce some noise themselves, and cannot fully eliminate horizontal propagation.

Use of alternative technologies with airguns and/or instead of airguns

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Controlled sources generally put the same level of geophysically useable energy into the water as impulsive sources like airguns, but over a longer period of time, and a resulting lower peak sound level, i.e. they are quieter. For example, for a rough calculation in the near-field, a one-second oscillatory/vibrator/projector pulse puts the same level of geophysically useful energy into the water as an airgun's ten millisecond pulse, but is one-hundred times quieter, resulting in a ten-thousand fold reduction in the area of ensonification. These sources include technologies such as the electro-mechanical modern marine vibrator, low frequency acoustic projector (driving cylinder, e.g. LISA, a low frequency electromagnetic transducer system), the solid state piezo-ceramic Helmholz resonator (e.g. The Naval Research Laboratory's DTAGS), and other non-impulsive, oscillating sound sources. Furthermore, controlled sources can produce sound over the frequency range desired, generating signals that can be specifically designed to minimize the impact on marine mammals and maximize geological interpretability (e.g. pseudo-random sequences).

It has been suggested that masking, or the obscuring of signals important to marine life, may worsen over this smaller ensonified area, because of the more continuous nature of the vibratory source. However, airguns at distance, especially in a reverberant environment, permanently raise the noise floor, as the previous pulse does not decay fully to background noise levels before the next shot is fired. Thus, airgun shots do not represent truly intermittent signals, with gaps of silence between shots. To better understand the environmental advantages or disadvantages of the use of controlled acoustic sources will require further research.

Controlled sources, such as marine vibrators (e.g., hydraulic, electric, etc.), offer the opportunity to reduce the peak amplitudes introduced into the water column and to tune the frequencies transmitted to exactly the band-width required for operations. By using a sweep instead of an impulse source, one can reduce the amplitude (peak levels) by 30 dB. This is done by spreading out the energy over time. A sweep that is 10 s has the same amplitude after correlation that a short 40 ms pulse generated by the airgun has. The use of pseudo noise (PN) sequences could reduce the acoustic footprint further (perhaps by an additional 20 dB/Hz by spreading out frequencies over time), but more research is needed to fully understand how to implement these sequences in an effective and optimized way.

- There is some evidence that a swept signal with lower peak amplitude would have less impact on marine animals than a higher peak impulsive signal. It is possible that pseudonoise sequences would reduce impacts further than normal up or down sweeps as they would sound broadly similar to natural background noise--noise to which such animals would presumably be adapted. More research is needed to assess this.
- In certain situations and with certain non-airgun source types, placing the sources and/or receivers near or on to the sea floor can reduce the required source level, as well as the amount of sound that needs to travel through the water column. For example, marine vibrators can operate close to the sea-bed and accomplish increased penetration relative to shallow towing.
- A controlled source offers improved receiver optimization possibilities compared to airguns. For instance, a combination of fiber optic sensors with a reduced bandwidth seismic source, such as a marine vibrator, may make the most optimal use of these technologies.
- Marine vibrators also have the advantage of being more vertically directional in deeper water.
- Front-loading the exploration workflow with the use of silent technologies (e.g., CSEM / 3D EM, gravity, gravity gradiometry, etc.) has potential to optimize the exploration process and require

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less sound to be injected into the environment. For instance, if 2D airgun surveys followed by quieter technologies (e.g. 3D CSEM) do not show promising targets, proceeding with 3D seismic surveys may not be worthwhile. Conversely, one may optimize 3D seismic activities based on the results from 2D seismic and 3D CSEM.

- Technologies such as marine vibrators, microseismic monitoring (passive seismic), and fiber optics have potential to reduce the need for 4D airgun surveys, used to monitor the movement of oil or gas in an exploited reservoir over time.
- Regulators and/or the geological and geophysical industry (including oil and gas exploration and production companies) should fund or undertake research into impacts on marine animals of alternative technologies such as marine vibrators and CSEM / 3D EM surveys. Companies developing these technologies need to work together with marine biologists to better understand, design, and carry out research needs in this area.
- While some airgun alternative technologies are available now or in the next 1-5 years (see Table 1), an increase in R&D funding for alternative exploration technologies (e.g., CSEM / 3D EM, marine vibrators, passive seismic, fibre optics receivers, etc.) will accelerate development and expand the application window. Governments should encourage the development and use of alternative technologies in an environmentally sensitive manner through both regulatory changes as well as additional funding to regulatory bodies, scientists, and engineers.

Coordination / Incentives

- Regulators should fund or undertake efforts to produce higher quality, accessible, and well-managed databases for marine animal distribution in space and time, which are needed to inform environmental impact assessments. Note: The Minerals Management Service (MMS) is data basing all current marine mammal observer sighting records and, although presently not a requirement, is encouraging the use of Passive Acoustic Monitoring (PAM) for future surveys.
- Efforts should be made to characterize the current (snap-shot in time) spatial distribution and other characteristics of noise exposure from airgun use in worldwide waters (centralize data on incidence of different uses and locations/regional use). Good measurements of the frequency content of seismic airgun pulses at various depths and ranges should be made.
- Holders of geological and geophysical data should mine their data to more fully characterize what is known about where airguns were used, what their output characteristics were, and any related propagation information that is available. Additionally, marine mammal observer databases, along with passive acoustic monitoring data, should be maintained for information on the distribution and behavior of marine mammals. Radiated acoustic energy from airguns should be related to marine mammal observer reports and other marine mammal data.
- Oil and gas industry associations could play a role in facilitating the collaboration between oil and gas operators, contractors, regulators, and scientists so that all parties can jointly exploit currently missed opportunities to share and/or obtain useful, multi-disciplinary information about the potential impacts of the various exploration methods and make the results available.
- Some countries have inherent incentives for airgun surveys within their work programs and in doing so, have implied disincentives for alternative technologies. Governments should discontinue programs that discourage the utilization of non-airgun technologies. Governments should develop incentives for any alternative technologies that are found to have clear environmental benefits over current airgun technology.

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- The academic geophysical community should also be encouraged to research quieter alternatives to airguns, with the aid of government and/or industry funding.
- Regulators should encourage and help fund research and development of quieter, alternative sources and their impact assessments.
- Governments and regulators should produce, domestically and internationally, clear, consistent environmental compliance laws, regulations, and standards, as well as apply them in a similarly consistent manner across different geographical areas. This would facilitate the development of more environmentally benign technologies.

Additional Notes/Information

While proponents of LACS and gravity gradiometry, two technologies we mention in our tables, were unable to attend our workshop, we nevertheless supply information about these technologies in the interest of being more complete.

From:

http://www.bjorge.no/modules/module_123/proxy.asp?D=2&C=233&I=1691&mid=-1&sid=-1&pid=766

LACS (patented) Low-frequency Acoustic Source

LACS can be used for seismic acquisition. It is a digital source, is small in size, and does not need high pressure air to operate. It can control the spectral contents of single pulses, is repeatable with precise timing, and has a high pulse rate yet no interaction between pulses. In contrast, the interaction between airgun pulses which are close together in time (gas bubbles) is less predictable and weakens the pulses. Several LACS units may operate together to provide an increased pulse pressure. The system also allows accurate simulation of shipping noise, since it is similar both in the time and frequency domain, without a sweeping fingerprint.

Bjørn Askeland, a developer of LACS, adds: "... The important issue now is to get an overview of the potential of time-coded sequences for marine seismics. LACS is a digital high fire rate marine source. In telecommunications signals used to be analog, but now most of them are digital."

"... new sources [could] replace airguns for borehole seismic applications within 5 years if research money is made available and access to offshore wells is regulated. Taxation of borehole airgun surveys may be a way of speeding up the technological development and also for providing the necessary research money...".

Gravity Gradiometry

The following is supplied by Duncan Bate, ARKeX Inc.:

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Unlike air guns, both gravity and gradiometry are passive; no energy is put into the earth or water. Variations in the naturally occurring gravity field are measured. Both technologies are fairly well developed and have been used by both mining and oil and gas industries for decades.
The major difference between gravity and gravity gradiometry is the way the field is measured. To measure the gradient of the field, a much more complex piece of equipment is needed, which is newer and more expensive than traditional gravity meters. The benefit of gravity gradiometry is the increase in resolution. The resolution is now more on the same scale as seismic data. Also, there has been a big step forward in the processing and interpretation of gravity gradient data. Gravity and gravity gradiometry are not applicable in all geological settings, and seismic data will always be preferred. However, in the correct setting, working with an integrated data set of seismic and gravity gradiometry, a better picture of the subsurface can be delivered which may also reduce the amount of seismic needed.

Additional Notes/Information from Participants:

Christopher Clark:

Past research has shown that bowhead and gray whales respond to seismic airgun arrays by moving away from and avoiding the area of the seismic survey (*Malme, C.I., Miles, P.R., Clark, C.W., Tyack, P., and Bird, J.E. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Report of Bolt Beranek & Newman, Inc., Cambridge, MA, to U.S. Minerals Management Service, Anchorage, AK. NTIS PB86-218377.; Richardson, W.J., Greene, C.R., Jr., Malme, C.I., and Thomson, D.H. 1995. Marine mammals and noise. Academic Press, New York, 576 pp.*). There is also evidence that baleen whales change their vocal behavior in response to seismic exploration sounds. For example, blue whales summering in the Gulf of St. Lawrence increased the rates at which they produced mid-frequency (30-90Hz), social calls when a seismic sparker was operating (*Di Iorio, L., and Clark, C.W. 2009.* doi: *Exposure to seismic survey alters blue whale acoustic communication. Biol. Lett., doi: 10.1098/rsbl.2009.0651, 4 pp.*), while fin whales wintering in the area to the west of the British Isles stop singing in the presence of seismic airgun surveys *(Gagnon and Clark, unpublished data)*. Di Iorio and Clark (2009) suggested that the blue whales increased their call rates as a way of compensating for the increased amount of background noise from the sparker. The fin whale response of song cessation is similar to that of humpback whale singers when disturbed by loud sounds or noises. In sum, none of the observed responses by large whales to geophysical exploration sounds is surprising, and we should expect continuing evidence to accumulate demonstrating that these low-frequency specialists respond to seismic impulses and seismic surveys in ways that are biologically sensible.

John Diebold:

A larger number of smaller airguns can be more effective when it comes to focusing the energy downwards, especially at higher frequencies. In theory, increasing receiver density can have a similar effect, and the proprietary "Q" streamers do this in the along-track direction. But with the current approach of individual streamers, it's dangerous to increase the across-track density very much.

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With Wide Azimuth acquisition, there are more sources (typically 3 or 4) but the total number of shots is about the same, although they are more greatly distributed in space. If the number of receivers was doubled, the same result could (in principle) be achieved with half the shots. This certainly is what happens with multi-streamer vs. single-streamer 3D acquisition.

There are a couple of things going on simultaneously with tow depth of the array. Deeper towing enhances low frequencies in all directions, but it also limits the useful upper frequency boundary, and thus the resolution in travel time. A secondary effect is that shallow towing decreases the horizontal sound propagation, due to the Lloyd's mirror cancellation effects.

John Young:

Typical offshore 2D seismic surveys can cost in the millions to tens of millions of dollars, 3D seismic can cost in the tens to hundreds of millions, and deep water wells would also be in the tens to hundreds of millions. Field production facilities can be in the hundreds of millions to billions of dollars.

To image the geological target requires a certain degree of signal to noise ratio. This can be obtained by either reducing the noise or increasing the signal or a bit of both. For example, additional receivers can provide both additional signal and/or reduced noise through beam steering. Futhermore, finer receiver spatial sampling allows one to sample the noise better which, in turn, allows it to be removed more easily and optimally when the data are processed.

As an example (not an endorsement), WesternGeco's Q streamer acquisition technology has three distinct components. 1) It has finer receiver sampling in the inline direction or along a given seismic cable; 2) It has the ability to measure each source signature and then extrapolate to a far-field signature; 3) It has both lateral and vertical cable position control. Improvements to the data come from additional inline receiver sampling which allows one to sample the noise for better noise removal and/or sum adjacent receiver channels for increased signal. By measuring each source for each shot of the airgun, one can use individual signatures to deconvolve the data (in other words, remove the source signature on a shot-by-shot basis leaving only a spike for each acoustical interface). This in effect improves the signal-to-noise ratio (S/N). By controlling the positions of receivers more precisely one can minimize smear (most data processing algorithms like straight cables) which again is a form of increased S/N.

Another example (again, not an endorsement) so called across-track or cross-line density has increased to the point that the PGS Ramform Sovereign (2008) provides 22 streamer capability. PGS has since gone a step further with the development of "GeoStreamer" technology which allows streamers to be equipped with both a pressure and velocity phone. The dual sensor capability allows suppression of the surface ghost. Suppression of the surface ghost provides improved data quality via broad bandwidth/higher resolution and lower noise from being able to tow the streamers deeper. The deeper tow also allows one to work in higher sea states which provides greater operating efficiencies i.e., less time footprint in a given geographic area. On the other hand, operating in higher sea states means mitigation through visual detections of marine mammals in the safety zone is less effective.

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Peter van der Sman:

Improvements in reducing high frequency noise could be made in airguns by altering the port/throat design. Some work has been done in the past to illustrate this. While the ideas are published, the results are not available in the open literature. However, a patent has been filed on this concept in 2005 proposing such changes and suggesting an attendant reduction in high frequency noise.

Noise can be added in or convoluted with the actual data at all stages of the exploration process, and the actual design and implementation of this whole chain of events (design, acquisition, processing, interpretation, etc.) will decide if the final objective can be met. For instance, self-noise from the streamer can be an important consideration. Increasing the output power at the source may not help, and indeed even hinder, the signal to noise ratio, if the source power is not the weakest link. "Shot-generated noise," for instance, is source energy that cannot be interpreted. If the sound decay of the previous shot has not yet reached ambient levels, increasing the source power may in fact raise the noise level for the subsequent shot. Though difficult, ideally, all components in the exploration process must be matched and designed to work optimally together. The source level should be lowered to the point just before it becomes the weakest link.

Warren Wood:

Deep Towed Acoustic Geophysical Systems (DTAGS) can detect areas missed by surface-towed airguns, but there is less penetration than from surface-towed airguns. This is mostly due to frequency content. DTAGS operates at higher frequencies (220-850 Hz) thus providing greater resolution at a cost of reduced penetration (100-200m in sand, 1000 m in soft mud). The vertical resolution is better because of the higher frequency content, and the horizontal resolution is better because of the proximity to the target (i.e. deep).

Any deep-towed instrument, of which DTAGS is one, limits the speed of the towing vessel. DTAGS is towed at 2.0 to 2.5 knots, whereas a surface towed seismic system may be towed up to 3 times faster, thus covering a greater number of kilometers per day of ship time. For surface or deep-tow, traversing from site to site requires pulling in all the gear and traveling at full speed (15-20 knots) to the next site and re-deploying the source and receivers. Deployment and recovery of DTAGS requires 2-3 hours. This is perhaps slightly more than required for a small surface seismic system, but much less than for a large 3-D system.

With the DTAGS system in its present form, there is also an issue of navigating the source and receivers. Right now, the system is simply towed, with knowledge of its location but without having complete control over where it goes (on the sub-wavelength scale). However, technology exists to solve this problem, so this could be accomplished with adequate funding.

Dave Ridyard:

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The EM source is towed deep, 10-50 m above the seabed. As the depth of investigation of the EM method increases in the future, the power of the technology to de-risk further exploration efforts will increase accordingly.

Rune Tenghamn:

The latest version of PGS's Electrical Marine Vibrator will probably have an efficiency which is 4-6 times higher than for an airgun, though this needs to be tested before it can be confirmed. The Marine Vibrator is as reliable as an airgun.

Vibrators could have multi-azimuth applications. With coded output, several vibrators can be used at the same time with a different azimuth.

Vibrators have been used at a water depth of 100 m, but from an operational perspective, it is difficult to operate them at great depth (>1,000 m). They are pressure compensated and can therefore be used at different depths. The limitation is the length of the umbilical (electrical losses) and the change of air density. At some depth, the air will become a liquid or have such a high density that the performance will be affected.

To have mainly vertical propagation, the vibrator has to be at the right depth. For 20 Hz, the source would have to be at 18.75 m (a quarter of a wavelength). This is not possible if one is operating in shallower water. Seafloor reflections will spread the energy more in shallow water.

In shallow water operations with 6-10 sources, one has the option to not only send out a signal once at each location, but to "stack" several signal sweeps or sequences, i.e. repeat the signal generation at the same source location until an adequate signal to noise ratio is achieved. By doing this, one can improve the signal to noise ratio even if the source itself is rather weak. The reason one can "stack" the signal with a marine vibrator (a controlled source) is that the signature of the signal can be made identical each time. For an airgun, the signature will change from shot to shot, which will make this process less effective.

Even if many vibrator sources are needed for deep-water operations, the peak signals will be much quieter than for an airgun array. This is due to three factors: 1) the energy is more spread out in time; 2) the frequency is more spread out in time; 3) only the energy in the seismic band of interest is sent out.

Rob Habiger:

Low Frequency (~1-10 Hz) measurements of the earth's passive seismic wave field are being studied by multiple academic and industry groups as a new technology for identifying and delineating hydrocarbon reservoirs. This technology has been predominately applied on land where acquisition instrumentation, survey design, and processing workflows/software are evolving fairly rapidly among a limited technical community. The technology is much less mature for marine applications, with

only one offshore survey acquired to date. Additional experiments are required to fully test it offshore and advance its application to oil and gas exploration.

Peter Duncan:

Passive seismic (using earthquakes or interferometry) for structural imaging is a lot less costly than the acquisition of conventional seismic on land. However, it may not be in the marine environment (compared to streamer acquisition) as it requires the deployment of ocean bottom receivers, either cables or autonomous nodes.

Passive imaging techniques today offer a lower resolution imaging suitable for frontier exploration and to rank order a list of exploration opportunities to determine which are the most likely to be successful, and therefore pursued, but they are not sufficient for field development.

The frequency limit of 20 Hz achievable with interferometry means that the resolution is low. Conventional streamer data has signal content up to 60 Hz and sometimes higher, thus achieving higher resolution. Over the next years (perhaps 5), passive techniques might be able to achieve higher frequencies, hence higher resolution.

****

Note: The following tables contain values that are highly variable, e.g. from survey to survey, etc. We have attempted to give our best guess in the interest of giving the reader "ballpark" values only. Many thanks to Ron Brinkman, John Diebold, John Hildebrand, and Warren Wood, for filling in values for airguns and other acoustic sources used in seismic surveys.

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Table 1. Characteristics of various technologies used to image the ocean substrate for petroleum deposits.

	Pings /Survey	J /Ping	Duty Cycle	Peak Frq	Frq Range	Watts	Peak Pres re 1 µPa	Pulse Duration	Directionality sr/4pi	Source Depth	Tow Rate
Added noise:											
Airgun Array &	100,000	2.5 x 10^5	20 s	50 Hz	5-200 Hz@	8.3 x 10^6	256 dB	.03 s	0.25	3-12 m	4 kts
Silenced Airguns										3-12 m	4 kts
Marine Vibrators	Similar to airguns			10 Hz	6-100 Hz#	?	20-50 dB below airguns	6-10 s	omni	0-1000 m	0-4 kts
DTAGS	c20k		30s	650 Hz	220-850Hz			250ms	omni	0-6 km	2kts
Para-metrics	?	?	?	?	?	?	?	?	10 deg.	0-6 km	?
LISA			100%	10	5-500	20-200K	210@1m	continuous	variable	0-100m	0-4kts
Sparkers +	c20k	300	1 s	500 Hz	480-520 Hz	1.5 x 10^5	233 dB	2 ms	omni	0-6 m	
Boomers	c20k	280		600Hz	0.1-15 kHz			2-3 ms	omni	0-6 m	4 kts
LACS**				50 Hz	10-150 Hz		212 dB	8-100 ms			
No added noise:											
Gravity*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gravity Gradiometry*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Passive Seismics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Near seabed	1.5 kts
Micro-seismics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Receivers:											
Fibre Optics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Added by Duncan Bate, ARKeX Inc., a supplier of gravity gradiometry

**Added by Bjørn Askeland, a developer of LACS

***LACS increases its signal energy by transmitting many pulses at a rapid rate.

Any harmonic attenuated, practically no energy above 100Hz

@ - Frequencies extend to at least 10,000 Hz, but typically, the industry will record at 2 ms intervals, which means that no frequencies > 250 Hz are recorded, regardless of what

& - Turner et al. 2006. Preliminary acoustic level measurements of airgun sources from ConocoPhillips' 2006 seismic survey in Alaskan Chukchi Sea. JASCO Research Ltd. Report, July 27, 2006.

+ - Cannelli, G.B. and D'Ottavi, E. 1994. Optimization of marine sparker source efficiency by electroacoustic method. IEEE I-750-755.

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Table 1 (cont'd.).

	Days /Survey Area	Water Depth	Burial Depth	Vert. Resol.	Horiz. Res.	Deployment	Receiver Density	Signal Process. Maturity	Est. Time to Commer. Avail.	EIA Maturity	Max. fire rate
Added noise:											
Airgun Array &	30	all		30 m	20-200	surface tow	variable	mature	available	medium	10 s
Silenced Airguns		all		30 m	20-200	surface tow	variable	mature	1 yr	medium	10 s
Marine Vibrators		all		3 m	20-200	8 - 15m	variable	medium	3-5 yrs	young	continuous
DTAGS		all	1km	1.5	20m	Deep tow (full ocean)	variable	medium	1 yr	young	30 s
Para-metrics	?	all	?	?	?		variable	young	5-10 yrs	infant	10 pings/s
LISA		all		30 m	30m	surface tow	variable	young	5-10 yrs	young	
Sparkers +		<1000		1 m	20-200	surface tow	variable	mature	available	young	5 s?
Boomers	1-14 days	<1000		1.5 m	20-200	surface tow	variable	mature	available	young	5 s?
LACS**								medium	2 yrs.	available	15 shots/s***
No added noise:											
Gravity*	~200 sq mi/mo.	all	all	depth dep.	2000m	boat/air/water bottom	N/A	mature	available		
Gravity Gradiometry*	~200 sq mi/mo.	all	all	depth dep.	200m	boat/air	N/A	medium	available		
Passive Seismics	365	all	water bottom	300m	150m	water bottom	4/sq mi	mature	5 yrs	young	N/A
EM	5-100	>20 m	<6 km	1-200 m	1-200 m	seabed	500-5,000m	medium	available	emerging	
Micro-seismics	life of field	all	water bottom	100m	50m	water bottom	4/sq mi	medium	2 yrs	young	
Receivers:											
Fibre Optics	life of field	all	water bottom	100 m	50 m	seabed	150/sq m	mature	available	emerging	

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Any harmonic attenuated, practically no energy above 100Hz

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Table 2. Applications of various technologies used to image the ocean substrate for petroleum deposits.

	Applications									
									Penetration	
Added noise:	**Site Survey**	**2D**	**3D**	**4D**	**Refraction**	**High Res**	**WAZ**	**Other**	**Shallow**	**Deep**
Airguns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Silenced Airguns	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marine Vibrators	P	P	P	P	P	Y	P	P	Y	Y
DTAGS	Y	P	P	P	P	Y	P	P	Y	N
Para-metrics	N	N	N	N	N	P	N	N	P	N
LISA	P	P	P	P	P	Y	P	P	Y	Y
Sparkers	Y	N	N	N	N	Y	N	N	Y	N
Boomers	Y	N	N	N	N	Y	N	N	Y	N
LACS	P	P	P	P	P	P	P	P	P	P
LACS**	Y	Y	Y	Y	P	P	P	P	Y	P
No added noise:										
Gravity	-	+	+	+	+	-	+		-	+
Gravity*	-	++	++	-	N/A	-	N/A		+	++
Gravity Gradiometry*	+	++	++	+	N/A	+	N/A		++	++
LF Passive Seismics	-	+	+	+	+	-	+		+	+
CSEM / 3D EM	+	++	++	++	+	+	+		++	+
Magneto	-	+	+	+	+	-	+		-	+
Heatflow	-	+	+	+	+	?	-		-	+
Micro-seismics	-	+	+	++	-	-	+		-	+
PSTT	-	+	+	+	+	-	+		-	+
Daylight Seismic	-	+	+	+	-	-	+		-	+
Receivers:										
Fibre Optics	+	+	+	++	+	+	+		+	+

"P" = possibly

*Added by Duncan Bate, ARKeX Inc., a supplier of gravity gradiometry

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Table 3. Characteristics of various types of seismic surveys and imaging technologies.

Uses	Area Covered (typically)	Survey Time	Sound Intensity (dB re 1μpa)**	Power (Watts)*	Incidence (Shots / Day)	Peak Pressure (PSI)	Frequencies (Hz)
Shallow							
2D	100-5,000 miles	28 days-6 mos.	215-230 dB	150 - 270 KW	4,320 - 8,640	2,000	10-10,000 #
3D	9-1,000 sq. miles	2 mos.-1 year	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
4D	9 sq. miles	2 weeks-1 mo.	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
Deep							
Site Spec. Survey	60-600 miles	5 days-2 mos.	200-230 dB	1,500	17,280	2,000	10-10,000 #
2D	100-10,000 miles	28 days-1 year	215-230 dB	150-270 KW	4,320 - 8,640	2,000	10-10,000 #
3D (including WAZ)	9-25,000 sq. miles	2 mos.-3 years	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
4D	9-27 sq. miles	2 weeks-1 mo.	240-255 dB	150 KW	4,320 - 8,640	2,000	10-10,000 #
Shallow and Deep							
Refraction	Linear	1 day		270 KW	1,440	2,000	6 - 60
Bathymetry (@)	60-120 miles	varies	210 dB	100 - 2,000 KW	8,640 - 86,400	N/A	3,500 - 12,000
High Res		varies		500 KW	17,280	2,000	30 - 300
Sidescan Sonar	9-90 sq. miles	5 days- 2 weeks			1,440 - 7,200	N/A	50-600 kHz
Site Spec.Survey	60-120 miles	5 days- 2 weeks	200-230 dB	1,500 KW	17,280	2,000	10-10,000 #
Sub-Bottom Profile	60-120 miles	5 days- 2 weeks	200-230 dB		1,440 - 7,200	N/A	10-10,000 #
VSP	near well	1-2 days	200-230 dB		4,320 - 8,640	2,000	10-10,000 #

Note: several instruments are often used concurrently, such as bathymetry and high res for site surveys

* - note: actual units are total energy, Joule/square meter-Hz; one Joule = one Watt-second

** - note: an airgun signal is an energy signal (not power), therefore intensity @ 1 μPa makes more sense

- typically, the industry will record at 2 ms intervals, which means that no frequencies > 250 Hz are recorded, regardless of what is generated.

@ - time, area, and power values vary a lot for swath bathymetry surveys.

In deep water, power is high, pings are further spaced apart, swaths are wide, so more area is covered in a given time.

In shallow water, power is low, pings are frequent, swaths are narrow.

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Presentation Abstracts

An Overview of the Uses of Sound by Marine Mammals and the Impacts from Anthropogenic Underwater Noise Sources

Lindy Weilgart, Dalhousie University

Marine mammals, particularly cetaceans (dolphins, porpoises, and whales), use sound for all aspects of their life, including reproduction, feeding, communication, navigation, hazard avoidance, and otherwise sensing their environment. Hearing is their primary sense, as sound travels very efficiently underwater (hundreds of kilometers), whereas vision is limited to only tens of meters. Some cetacean species are primarily solitary and widely scattered, so that sound could be particularly important in uniting them. In blue and fin whales, for instance, females probably must rely on finding mates by the loud, low frequency sounds males make. Such calls can theoretically travel almost across ocean basins, at least in the absence of appreciable human-made noise. Cetacean vocalizations are thought to be used for purposes such as to coordinate movements and maintain contact between group members, to repel mating competitors and attract mates, to identify group membership, etc. Mating songs probably also allow females to assess the quality of potential mates. Echoes from the ice may help whales found in polar waters navigate through open leads safely (Ellison et al. 1987). Similarly, whales likely use acoustic cues, such as echoes from ocean bottom features or surf noise, to find their way during long migrations.

Some of the observed effects of anthropogenic underwater noise on marine mammals include: changes in vocalizations (increases in call duration, falling silent, etc.), displacement or avoidance, changes in diving or feeding behavior, changes in swim speed or breathing rate, shifts in migration path, stress, hearing damage (from captive animal studies), and strandings and deaths at sea. Specifically, some of the more concerning impacts from noise are: noise causing hemorrhaging and death in beaked whales (Jepson et al. 2003, Fernández et al. 2005), the displacement of gray whales from their breeding lagoons for about 10 yrs. (Bryant et al. 1984), the avoidance of noise by killer whales for 6 yrs. (Morton and Symonds 2002), belugas fleeing from noise at distances of 35-50 km and staying away for 1-2 days (Finley et al. 1990, Cosens and Dueck 1993), increased stress hormones in a captive beluga whale with exposure to noise (Romano et al. 2004), indications of a reduction in feeding in sperm whales (Miller et al. 2009), and a greater fatal entanglement rate in fishing gear by humpbacks exposed to noise (Todd et al. 1996). Given that we know cetaceans use sound for so many life functions, the consequences of noise might be to decrease their feeding efficiency, place higher energetic demands on them, interfere with their group cohesion and social behavior, cause mother-calf separations, increase predation pressure, produce more navigational errors (e.g. strandings, entanglements in fishing gear, etc.), and lower calving rates. Thus, the welfare of cetacean populations could be impacted. Indeed, noise is thought to contribute to some species' population declines or their lack of recovery (e.g. killer whales, western gray whales; NMFS 2002, IWC 2007).

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Biological Implications of Chronic Exposure from over Large Spatial Scales: Seismic Surveys

Christopher W. Clark, Cornell University

There is little to no precedent as to the scientific processes for quantifying and evaluating the potential impacts of chronic exposure from anthropogenic sources of sound on marine animals. This statement certainly applies to the situation when a seismic airgun array is the sound source, and to a lesser extent when another mechanism is the source of the intense, impulsive survey signal (e.g., sparkers). Although shipping noise is undoubtedly the largest contributor to chronic ocean noise on an ocean basin scale, noise from a seismic airgun array survey can change the acoustic environment on a seasonal timescale and for a region much larger than the region within which the survey is conducted. It is noteworthy that a seismic survey generates sound intentionally, while a ship produces noise as a bi-product of its propulsion system. Thus, although one could say that the seismic sound is a signal and the ship sound is noise, from the perspective of a marine mammal both activities introduce sounds that have the potential to interfere with and mask bioacoustically important activities (e.g., communication, finding food, navigating, detecting predators). Under sound propagation conditions which promote frequency and time dispersion, a seismic signal can be transformed from an impulsive, reasonably broadband sound into a much longer sound with biologically salient features. Under such circumstances the original, *ca.* 100ms seismic signal can last for many seconds and/or have distinctive frequency-modulation characteristics such that the original seismic sound is no longer impulsive and simply noise, but acquires structure and becomes bioacoustical clutter. Present regulations do not yet

recognize this acoustic phenomenon as representing a shift from the impulsive into the non-impulsive behavioural response regulatory paradigm. Overall, these seismic survey situations can result in complex acoustic scenes that infuse large ocean areas with varied mixtures of impulsive noise and frequency-modulated sounds, often convolved with high levels of reverberation. As a result, for situations in which multiple seismic sources are operating concurrently in the same region, the active bioacoustic space for a given species can be dominated by seismic sounds for periods of many months.

Impacts of Airguns on Marine Animals: Thresholds for Injury and Behavioral Alterations

John Hildebrand, Scripps Institution of Oceanography

The sound pressure fields created by airguns have been shown to create both injuries and behavioral disturbances to marine animals such as cetaceans and fish. This presentation provides background information on relevant acoustic metrics, and examples of injuries and behavioral disturbances following exposure to operating airguns.

Decibel sound pressure level (dB re: μPa RMS) is the standard metric for describing an acoustic field, but may not be the best criterion for judging the impact of sound exposure. Acoustic peak pressure (dB re: μPa peak) and sound exposure level (dB re: μPa – s) are alternate metrics with appeal for impulsive sources such as airguns. Using acoustic peak pressure accounts for the potential for sound impact, independent of duration. Alternately, sound exposure level is a metric that takes into account the signal duration by integration of the sound pressure level over the duration of the signal, a proxy for acoustic energy. A dual exposure criteria for tissue injury and behavioral disturbance from noise exposure has been proposed, based on these two metrics.

Studies with captive beluga whales and bottlenose dolphins have demonstrated that following exposure to sounds of sufficient intensity, these animals exhibit an increased hearing threshold, described as a temporary threshold shift (TTS). The trade-off between sound intensity and duration that produces TTS, follows roughly an equal-energy curve; long duration signals produced TTS at lower signal intensities than short duration signals.

Field studies have demonstrated behavioral disturbance of cetaceans following exposure to airguns. Migrating gray whales deviate from their swim tracks to reduce received sound pressure levels from exposure to airguns. Likewise, observations during seismic surveys demonstrate that small odontocetes show large lateral spatial avoidance, while mysticetes and killer whales show localized spatial avoidance.

Studies with caged fish suggest that the ears of fish exposed to airguns sustain severe damage to their sensory cells, with no evidence of repair or replacement of damaged cells after exposure. Likewise, acoustic mapping and fishing trawls before, during, and after airgun usage suggest severely affected fish distribution, local abundance, and catch rates.

Marine seismic surveys for science: Purpose, operation and product

John Diebold, Lamont-Doherty Earth Observatory

Marine seismology using controlled sources began in the 1930's, producing fundamental new understanding of the extension of continental structures along continental shelves, and also that the deep ocean is floored by an entirely different kind of crust. By necessity, the sources used were explosives, sometimes in great quantity (many hundreds of pounds.)

The introduction of the airgun as a marine seismic source during the early 1960's represented a great increase in safety and resolution, though it took several decades of additional development to achieve the kinds of airgun arrays that are in use today. These arrays typically use a dozen or more small airguns, firing simultaneously, but spread out in space so as to deliver a short and repeatable pulse of acoustic energy in a generally downward direction.

Current developments in active-source marine seismology are increasing the resolution with which acoustic images can be made, and increasing the depths that can be imaged. Typically the latter effort requires longer arrays of passive receivers, though signal strength is a concern as well. Increased resolution typically requires smaller, specially designed sources and increased number and wider aerial disposition of receivers.

The resulting images and structural details are a critical data type, providing fundamental improvements in humankind's understanding of earth processes. This understanding in turn allows important progress to be made in a wide range of topics from the locations and mechanics of earthquakes to the history of climate change.

Airguns, explosives, and a number of other marine seismic sources depend upon the same basic principle – a bubble of gas, which, due to its internal pressure, expands. In the case of airguns, the pressure within the initial bubble is well constrained, and is far less than that produced by the rapid combustion of explosive solids. As a result the expansion of the air bubble is much slower, and comparatively few high frequencies are produced.

On board US academic research vessels environmental impact is reduced in a number of ways. Minimum source level is used in the first place, and timing of each survey is planned to avoid times of known seasonal breeding, feeding and migration for key marine mammal species. Track lines are often adjusted for local areas of sensitivity and principal investigators are encouraged to favor deeper water options whenever possible. A comprehensive program of visual observation is always carried out, most often supplemented with passive acoustic monitoring. Typically five experts, independent of other operations, are devoted to these tasks. A complete report of sighting and behavioral descriptions is filed with NMFS for every survey and these data are available for inclusion in larger database efforts.

How Seismic Data Is Used By the Petroleum Industry

John Young, ExxonMobil

By 2030, it is widely estimated that global energy demand will increase approximately 30% from today's level. In order to address this need for energy, the petroleum industry explores for

hydrocarbon deposits beneath the earth's surface including under oceans. Seismic surveys are the most accurate and efficient method currently available for hydrocarbon exploration.

Today, the most common marine seismic operations include acoustic sources and receiver streamers, towed behind a vessel. The sources are activated, releasing sound energy directed downward through the water column and into the earth. As a result of differences in acoustic impedance between geologic strata, seismic energy is reflected back to the streamers. The reflected energy is digitally recorded and processed to obtain a detailed image of the subsurface.

Sophisticated subsurface imaging, facilitated by increased computing power, allows for the identification of previously unknown hydrocarbon deposits and reduces the risks associated with drilling in water depths of up to two miles. Increased drilling success rates equate to increased hydrocarbon reserves for the world's energy needs.

The potential for reducing unnecessary horizontal and high frequency components of sound produced by airguns

Peter van der Sman, Shell

Since the early sixties, the seismic industry started to move away from using dynamite as seismic energy source. The main reason for this move was safety, yet in the years to follow also the environmental impact started being used as a motivation. Being used to deal with impulsive sources, the first alternative the industry came up with was impulsive in nature; the airgun. Yet, it was soon follow with marine vibroseis in the mid sixties. Since then, a host of different sources have been proposed and used. Currently though, over 95 percent of the seismic operations is conducted using airguns. So what are the underlying reasons for the airgun to 'survive' in a Darwinian like sense?

As with any new technology, it takes time to develop it in all relevant aspects needed to realize the desired objectives. A typical timeframe in this sense is often in the range of 10 to 25 years. On the other side, one needs to realize that development is costly and that over the duration of such a development the industry tends to alternate several times through periods of prosperity where new technologies are nurtured and others where technologies are shelved or worse.

In the case of the airgun for instance, it took about 10 years before arrays of airguns emerged, tuning a range of volumes to collectively emit a signal suitable for seismic prospecting. Yet it took another 10 to 15 years or so to develop them into the high-fidelity source systems the industry needs. Marine vibroseis though did not do as well. In contrast to their onshore cousins, the marine version never really got of the ground. The fundamental reason for this may be the geophysical requirement to generate sufficient low-frequent energy (say 5 to 10 Hz) at typical surveying speeds. To do so, units become large and heavy which also prevents the use of fair sized arrays to circumvent this. Then again, the vibroseis technology offers a huge potential in that it can shape both the emitted signal and its frequency spectrum and this is exactly where the technology is believed to have merits in an environmental sense. So is marine vibroseis the way to go or can we still work the airgun system to accommodate both geophysical and environmental constraints.

In my presentation I will present a few concepts and ideas on airguns, aiming to complement the contributions by the other speakers such that we collectively present the whole spectrum and merits of all the technologies at our disposal in the context of the workshop.

A Deep Water Resonator Seismic Source

Warren T. Wood, U.S. Naval Research Laboratory

The Naval Research Laboratory's deep-towed acoustics/geophysics system (DTAGS), originally designed to characterize abyssal plain sediments, is an example of a seismic source technology capable of generating 220 Hz – 1 kHz swept frequency sound waves at levels up to 200 dB (re 1 μPa @ 1 m), and at full ocean depths. The source is composed of a series of five concentric rings each composed of pie-shaped piezo-ceramic material. The natural resonance of the ceramic transducers provides the high frequencies and the size and shape of the barrel-shaped resonator cavity boosts the low frequencies. This combination yields a broadband (over two octaves) signal with a relatively flat spectrum. The solid-state nature of the construction ensures not only that the source is extremely repeatable, but also that it is insensitive to changes in depth; yielding nearly identical signals from the sea surface to full ocean depth (6000 m). The source can be energized with almost any kind of waveform, and at almost any sound level below 200 dB, allowing significant flexibility to tune the source amplitude, frequency, and waveform for specific needs.

Although the resonator source operates in all water depths, it is most useful where other sources fail. As hydrocarbon exploration moves into deeper waters, the signal loss from surface towed sources becomes excessive. In 2000 m (6562 ft) of water signal loss from spherical spreading results in sound levels at the seafloor only 0.05 percent as strong as at the sea surface, (a 66 dB loss in amplitude). For example: a 180 dB source at the surface fades to 114 dB at the seafloor.

DTAGS is currently configured as a towed multi-channel system, capable of recording 48 hydrophones (3 m spacing) for trace lengths of two seconds, at a two kHz sample rate, on a duty cycle of 30 seconds. The system is typically towed at 2 knots at an altitude of 100m above the seafloor. After some conventional, and some unique processing steps, the resulting seismic sections allow detection of both vertical and lateral changes in the sediment as small as 1-2 meters, and can fully resolve features at a scale of 5-10 meters.

To augment its use as a deep-towed multi-channel seismic system, efforts are currently underway to design and build a coupling system to enable the resonator source to be set directly on the seafloor. In this mode we anticipate not only increased excitation of P and S waves, but also increased signal to noise by repeated firings at the same location (similar to techniques used on land with swept frequency systems).

Deep water sources in general, and the DTAGS Helmholz resonator specifically represent an attractive option for achieving commercially useful sound pressure equivalent levels in the earth, while minimizing the instantaneous sound levels in the ocean, particularly the shallow ocean where sound sensitive marine life is concentrated. These advantages are achieved mainly through proximity of the source to the target of interest, and time integration over a highly controlled and repeatable source waveform.

Potential application of 3D EM methods to reduce effects of seismic exploration on marine life

Dave Ridyard, EMGS Americas

Introduction

This paper addresses the question "Can 3D EM methods reduce the amount of seismic activity ?". It does not address the broader question "Is there any need to reduce the amount of seismic activity ?".

3D EM method summary

It has been known for over 80 years that hydrocarbon saturated rocks exhibit higher electrical resistance than brine saturated rocks. In recent years the 3D EM method (Controlled source electromagnetics) has emerged as a powerful exploration tool. A dipole electric source towed close to the seabed generates electric and magnetic fields which are perturbed by any subsurface resistive structures. These fields can be measured by sensors deployed on the seabed. The measurements can be processed to create a 3D image of the subsurface resistive structures. Where a resistor is observed co-located with a prospective hydrocarbon bearing structure, the risk of drilling a dry hole is significantly reduced.

It should be noted that a 3D EM image shows resistors … not hydrocarbon reservoirs. There are many other resistors buried in the subsurface – salt, volcanic rocks, carbonates and methane hydrates all exhibit resistive properties. The deep penetration and high resolution of seismic data is invaluable in creating meaningful, detailed regional geologic models and identifying potential hydrocarbon traps. However, seismic data is clearly more reliable if it is used in conjunction with EM.

Environmental impact of EM

Receivers deployed on the seabed use biodegradable anchors and have negligible environmental impact. The source uses extremely low spatial and temporal frequencies – typically wavelengths of many kilometers and frequencies of 0.1 to 1 Hz. When these low frequencies are considered in combination with the exponential decay of energy caused by highly conductive seawater, the region of potential influence on marine life resulting from EM transmissions is tiny. Furthermore, since EM methods reduce the number of dry wells drilled, the method can be considered environmentally positive.

Potential reduction in seismic activity

In theory, broader application of EM methods could reduce "dry 3D seismic surveys" in the same way it currently reduce dry wells. However, the current impact of EM methods on seismic activity is negligible. There are 2 reasons for this.

1) Current EM methods have neither the resolution nor the penetration to replace seismic in a significant range of exploration and production applications.

2) Even where EM technology is effective, it is underutilized by many oil companies due to the wide spread lack of understanding and adoption of the technology.

Summary and Recommendations

EM offers some, limited potential to reduce the growth in seismic activity, but action is needed in 2 areas to enable this.

1) Further R&D investment is required to grow the application window for EM methods by increasing depth of penetration and resolution of the method.

2) Regulatory changes in leasing practices, taxation, accounting (reserves estimation etc.) can accelerate the adoption of EM methods.

Vibroseis Technology

Rune Tenghamn, PGS Data Processing and Technology

For several decades, airgun sources have dominated the marine seismic acquisition market. Surprisingly, few new source concepts have been presented to the industry during this period. During the eighties, however, developments related to marine vibrator sources took place. These sources were tested mainly for deep target marine seismic applications. These applications have since been limited, due to factors such as high cost, handling and operational difficulties, etc.

During the late nineties, PGS started the development of a completely new electro-mechanical marine vibroseis concept. The objective of the project was to develop a 100% repeatable low-cost vibrator source with an energy output in the frequency band of 6-100 Hz and with a size and weight easy to operate in the field. Target applications of the source are shallow water acquisition, seismic monitoring and environmentally sensitive areas.

A marine vibrator will provide several environmental advantages. Vibrator technology spreads the net source energy over a long period, reducing the acoustic power in comparison to impulsive sources. The peak power of a Marine Vibrator is about 30 dB lower in sweep mode than the corresponding peak power of an impulsive source. This is attractive for applications where high peak power may be problematic. There is no need for heavy equipment and hydraulic systems that can cause hydraulic oil spills. As the electrical vibrator requires only an electrical power supply it can be easily transported to different vessels and locations without any costly installations and potential environmental hazards.

Electrical marine vibrators also have several operational advantages. Due to the high efficiency of the sources, controllable and arbitrary signals can be generated in the frequency band of interest. This fact has been used to develop a control system that makes the acoustic sources repeatable over time. Having a feedback loop for control of the output means that not only can high repeatability be achieved, but the harmonics can also be attenuated. Any mechanical system will generate harmonics. Tests have shown some dramatic change in harmonics generated by a sweep. Some of the harmonics are attenuated by more than 30 dB.

The controllability of the source makes it possible to introduce Pseudo Noise sequences (PN). With the use of PN signals it will be possible to reduce the peak power even more. The PN sequences will not only spread the source energy over time, but will also spread the frequencies over time. This technology will further reduce the peak power for any frequency at any particular time by another 20 dB compared to a sweep.

In a future scenario, we could have an array of controllable marine vibrators with the energy concentrated in the vertical plane through beam steering of the acoustic output. The PN signals would "mimic" natural background noise. By having a continuous "noise" signal the active array would be difficult to distinguish from the natural background noise.

Low frequency passive seismic for oil and gas exploration and development: a new technology utilizing ambient seismic energy sources

Robert M. Habiger, Spectraseis

Introduction

A growing number of low frequency surveys at different oil and gas field locations throughout the world have indicated the possible relationship between certain microtremors and the presence of hydrocarbons. These narrow-band, low frequency (from ~1Hz to ~10Hz) micro-tremor signals offer new types of seismic attributes for the optimization of decisions for exploration and development phases of hydrocarbon exploitation.

Although the primary application of this technology to date has been on land, the potential exists for applying in a marine environment and a proof of concept survey was conducted in April, 2007 in the North Sea.

Data Acquisition

The low frequency data were acquired by using broadband seismometers located on the ocean bottom. The ocean bottom sensors (OBS) can be deployed in deep water and left to record data for days, weeks, or even months. No active sources, such as air guns, are needed in these measurements since only modifications to the earth's natural background energy are monitored. The OBS units can be easily deployed and recovered using well known operating procedures.

Data Processing

The main challenges of moving this technology from land to marine applications are adequate coupling of the sensors to the ocean floor for short data acquisition durations and the large amounts of extraneous ambient noise in the oceans. The nature of the ocean noises and how it can interfere with the quality of measurements and analysis will be discussed along with suggestions for mitigation.

The workflow consists of removing unwanted noise, characterizing the measured signal according to time stability and frequency characteristics, and then calculating low frequency attributes related to hydrocarbon micro tremors.

Conclusions

Low Frequency passive seismic is a new technology that has been applied mostly in land surveys but warrants further investigation and development for application to a marine environment. An initial test has been completed in the North Sea for oil and gas applications and the information gained can be used for planning follow-on surveys to further advance this technology.

Passive Seismic Tomography: structural imaging using natural sources

Peter M. Duncan, MicroSeismic

Reflection seismology is a mainstay of the exploration for hydrocarbons, whether onshore or offshore. While the use of controlled sources (dynamite, airguns or vibrators) for such imaging is certainly the standard, it has been appreciated for many decades that one can also use the earth's natural seismic sources to illuminate the earth's structure. Much of our knowledge of the interior structure of the earth on a global scale has been derived from imaging involving the transmission and reflection of seismic waves whose source was an earthquake on the other side of the earth. Recent work using surface waves excited by the pounding of waves on the beach has begun to unravel the crustal structure of continents. In the last decade there has been work directed at using these same energy sources to create images useful for hydrocarbon exploration and production. These efforts are driven by both environmental concerns and by the expense of conventional seismic imaging. Collectively we refer to these imaging techniques using naturally occurring or ambient noise sources as passive seismic tomography.

The most straightforward application of this passive technology is commonly referred to as passive seismic transmission tomography (PSTT). PSTT creates 3-D images using the observed travel time of seismic signals originating from micro-earthquakes occurring below the target. A sparse array of independent seismometers is established above the target. The array usually consists of 20 to 100 stations each recording the output of a 3-component geophone. With the array in place, the survey proceeds by simply listening. Assuming an initial velocity model, the observed micro-earthquakes are located in time and space using long-standing location algorithms based upon picks of the p and s phase arrival times at each observation station. Once a number of events has been located one flips the process, assumes the origin time and hypocenters of the events are known, and uses some form of travel time inversion to estimate a new velocity model. As more events are added to the dataset, finer estimates of the velocity structure can be achieved. The process proceeds in this boot-strapping fashion until the desired resolution is reached.

If one cross correlates the time signal recorded by the stations of the array established for PSTT, it is often possible to identify 2 other types of seismic signal that are useful for imaging. The first is the surface waves that course back and forth along the earth's surface. The speed of travel of these waves is controlled by the velocity of the material that the wave "sees". Longer wavelengths penetrate more deeply into the earth and therefore sample the earth to a greater depth. This allows one to create a structural image from the rate that these surface waves traverse the array.

The second signal that may be extracted by the cross correlation process contains the multiple reflections of the ambient noise that have been bounced downward from the free surface of the earth and then reflected off velocity contrasts in the subsurface. This technique of recovering 3-D reflection image data from ambient noise signals was first postulated 40 years ago as "daylight seismic". Recent experimental work has shown promise that such a technique may be able to deliver seismic images with a resolution sufficient to be useful in hydrocarbon exploration.

The dBht Method for Evaluating Impact, Airgun Silencers and LF Projector Arrays

J Nedwell, Subacoustech

Introduction

High levels of man-made noise may be created by oil and gas exploration, construction, blasting, and many other offshore activities. Death and injury are extreme effects of underwater sound, occurring mainly where explosives are used. These are relatively well understood and unlikely in a well-managed programme.

However, the more subtle behavioural effects of sound have been an increasing focus of concern internationally. It has been alleged that seismic exploration may have undesirable side-effects upon aquatic animals over ranges of kilometres, or even tens of kilometres.

This paper reports on tests of two possible methods of attenuating the effects of seismic surveying, such that its likely impact on marine mammals will be reduced but its effectiveness as a sound source for seismic surveys would be adequate.

Estimating effects

The ability to estimate effect is critical in rating or comparing technologies intended to reduce the effects of seismic surveying. A simple measurement of sound, such as its peak pressure, is inadequate to judge the likelihood of, for instance, a behavioural avoidance response. Marine species have a wide range of hearing ability, and the same underwater sound will affect each species in a different manner depending upon the its hearing sensitivity and frequency range. Consequently, many researchers are now advocating the use of audiogram-based weighting scales to determine the level of the sound in comparison with the auditory response of the aquatic or marine animal. Madsen *et al.* (2006), for example, recommend that "*as the impact of sounds impinging on the auditory system is frequency-dependent, noise levels should (as for humans) ideally be weighted with the frequency response of the auditory system of the animal in question*".

The dB_{ht} metric developed by the author incorporates the concept of "loudness" for a species. It incorporates hearing ability by referencing the sound to the species' hearing threshold, and hence evaluates the level of sound a species can perceive, rather than its absolute level. It is critically important to judge the effects of noise reduction of seismic sources in this way, because a modification that reduces the level of high-frequency noise, for instance, may well reduce its "loudness" for a high-frequency hearer such as many marine mammals. The peak level may, however, be unaffected, or even, as in the experiments reported here, increased.

Measurements were made at Vobster Inland Diving Quay, a water-filled former quarry near Mells in Somerset, of the pressure time history generated by an airgun with and without a compliant silencer. The silencer was intended to reduce the high-frequency components that marine mammals can hear, while leaving the low frequency components used for seismic exploration unchanged. It was found that the broadband (chiefly low frequency) output of the airgun was actually consistently higher, by about 3 dB on average, for the results with the silencer. However, there was an associated reduction in level of the airgun at low operating pressures in terms of its dB_{ht}(*phoca vitulina*) value, and hence in its effects on a seal, of about 6 dB. At the higher discharge pressures the silencer material was thought to be collapsed by the airgun discharge, causing it to become relatively rigid, hence having less effect on the acoustics of the airgun. The silencer was thus beneficial for both seismic surveying and for the environment.

While the reduction achieved by the airgun silencer was modest, and, it is thought, well below that potentially achievable, a 6 dB reduction in dB_{ht} level represents a 4-fold reduction in the area of sea in which a seismic survey might have a given effect on a marine mammal, or 12-fold for an airgun array of constant Source Level if the increase in Source Level, and consequent reduction in the number or power of airguns required, is taken into account.

The concept of the low impact seismic array (LISA) was based on the use of inexpensive but powerful and rugged electromagnetic projectors to replace airgun arrays. The prospective benefit was that since the signal could be well controlled, both in frequency content and in the direction in which the sound propagated, the possibility existed of undertaking seismic surveys in environmentally sensitive areas with little or no collateral environmental impact.

The LISA project embodied the idea of using a large array of small but powerful electromagnetic projectors to replace airgun arrays. Initial measurements were made on a small (n=4) array of existing electromagnetic transducers designed by Subacoustech. It was found that a Source Level of about 142 dB re 1 µPa per volt @ 1 metre was achieved, at a peak frequency of 25 Hz. The operating frequency could be reduced to under 10 Hz with reasonable modifications, allowing use of an array for seismic exploration. The results indicate that it would be possible to achieve an array Source Level of about 223 dB re 1 µPa @ 1 metre, which is adequate for seismic surveying.

In summary, both of these technologies have significant prospective benefits in respect of reducing environmental effects during seismic surveying. In the case of the airgun silencer, the technology has additional benefits for seismic surveying, as it increases the level of the airgun while simultaneously reducing its environmental effect on marine mammals.

Fibre optic receivers and their effect on source requirements

P. Nash, A.V. Strudley, Stingray Geophysical

There is growing interest in the use of Seismic Permanent Reservoir Monitoring to maximise recovery and optimise production by time-lapse reservoir monitoring. In comparison to repeat towed streamer surveys, such systems offer greatly improved repeatability, better seismic signal/noise, and provide additional value from the direct recording of the full 4C vector wave-field. Seabed arrays based on

fully fibre optic sensing and telemetry are particularly attractive for this application because of their increased reliability and relative ease of deployment and operation compared to electrical systems.

The characteristics of fibre-optic seismic PRM systems result in different seismic source requirements compared to conventional systems as described below:

Reduced amplitude: Permanent seabed systems typically achieve better signal to noise ratio than towed streamer systems because the receivers are directly coupled into the seabed and hence are not subjected to towing or weather induced noise. Also, the signal is only subject to one-way transmission loss in the water column. Further fibre-optic sensors have high sensitivity which, together with the lower noise floor results in reduced requirements for high amplitude sources. For these reasons, seismic Permanent Reservoir Monitoring (Seismic PRM) has so far been conducted with relatively small seismic airgun sources –typically, a towed airgun array with around 70 bar-m p-p output (0-128Hz).

Reduced airgun volume: Typically, large volume airguns are used in the array for improved low frequency content. With fibre-optic seismic PRM the availability of pressure and acceleration measurements allows improvement in the low frequency performance by combination of the two wave-fields up to the limit imposed by the low frequency noise floor. The use of accelerometers rather than velocity sensors avoids a low frequency limitation in sensor bandwidth associated with sensor resonance (typically 10 -15Hz for a velocity sensor). Hence the requirement for large airgun volumes may be reduced, with beneficial effects across the whole source bandwidth.

Reduction in total survey duration: Because the receiver array is permanently deployed total survey time is reduced compared to towed streamer surveys because no infill is needed and weather downtime is minimised. In areas where Ocean Bottom Seismic is required (e.g. for 4C data), there is no requirement for repeated shots at the edges of the receiver spread unlike the case for retrievable systems. Hence, for the same shot coverage, the total number of shots is likely to be reduced.

Reduced high frequency bandwidth: Fibre-optic hydrophones and accelerometers are very broadband sensors with responses into the 10s of kHz range. Typical airgun sources have appreciable energy output at these frequencies and hence the receivers require a large top end system dynamic range (typically ~ 180dB) to avoid sensor saturation. Significant efficiencies in fibre-optic architectures, which would result in reduced receiver array cost, could be gained if this dynamic range requirement were reduced. Hence a seismic source array with reduced high frequency output is desirable.

In summary, Seismic PRM based on fibre-optic technology is likely to be of increasing importance in the near future for improved reserves recovery. Such systems offer a number of potential opportunities for optimisation of seismic survey source requirements and in particular would benefit from reduced high frequency airgun source output, such as a marine vibrator or other non-impulsive, oscillating sources.

Alternatives to Acoustic (Seismic) Geophysical Data Collection

Ron Brinkman, Minerals Management Service

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Minerals Management Service (MMS) is a bureau of the Department of the Interior. Its mission is to manage the mineral resources of the Outer Continental Shelf in an environmentally sound and safe manner.

The collection of geophysical and geological data is critical for the MMS to fulfill its mission in helping meet our Nation's energy needs. However, the approval of seismic data collection activities must be considered in conjunction with concerns over the impact of these activities on the environment. These concerns are largely focused on sound introduced into the environment from seismic surveys and related activities (i.e., icebreaking, support vessel traffic, and aircraft over flights) and the effects of this sound on marine life and resources.

The issue of effects is further heightened by the lack of scientific certainty on the true impacts, the level of significance of these effects, and the ever increasing public scrutiny over these concerns. Despite these challenges, MMS is still charged with making decisions using the best available information. This leads to more conservative protective measures, additional mitigation and monitoring requirements, public criticism of environmental analyses and decision making, increased litigation, greater uncertainty on costs and risks for companies wanting to conduct seismic activities, impacts to access, and additional costs and delays in agency programs.

Ultimately, MMS must ensure that all seismic survey activities it regulates are in full compliance with all relevant environmental statutes and requirements. It is, therefore, imperative that MMS re-examine its processes for addressing seismic survey activities, both regionally and nationally, to identify where full environmental compliance is not yet reached and develop a plan forward to more effectively integrate seismic surveying and environmental compliance needs in light of these many challenges.

MMS is currently undertaking NEPA mandated geological and geophysical (G&G) Environmental Impact Studies (EIS) in all Regional Offices to determine compliance with call existing Laws. MMS is concurrently studying potential methods of noise reduction to existing seismic surveys. Samples of these studies include the following alternatives:

- ◊ Attenuate lateral noise with air bubble curtains, like has been shown in the literature, or with some special bubble curtain material, acting as a more solid (like a curtain) barrier;
- ◊ Make arrays more vertically directional, and thus narrow the cone of sound;
- ◊ Change the structure of the airguns to reduce high frequency sound (noise) while maintaining the strong source signal and low frequency source needed for exploration.

For more technical assessment and research studies see: http://www.mms.gov/tarprojectcategories/

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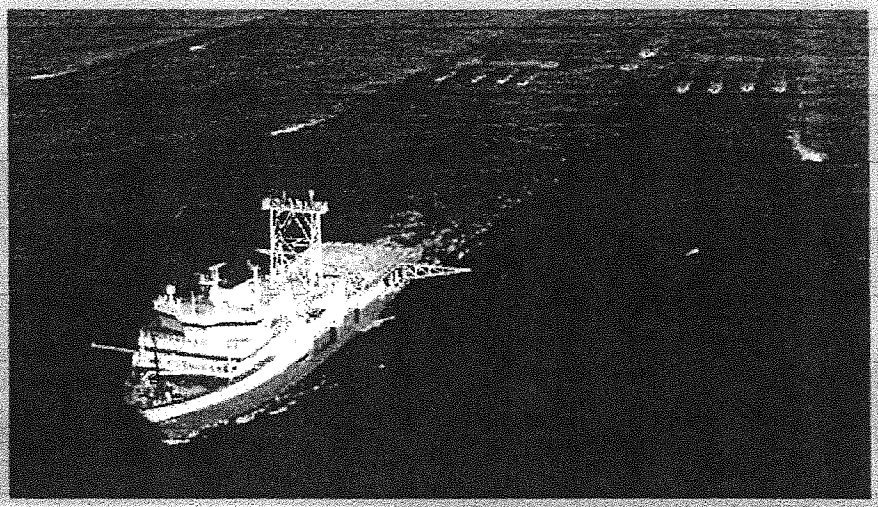

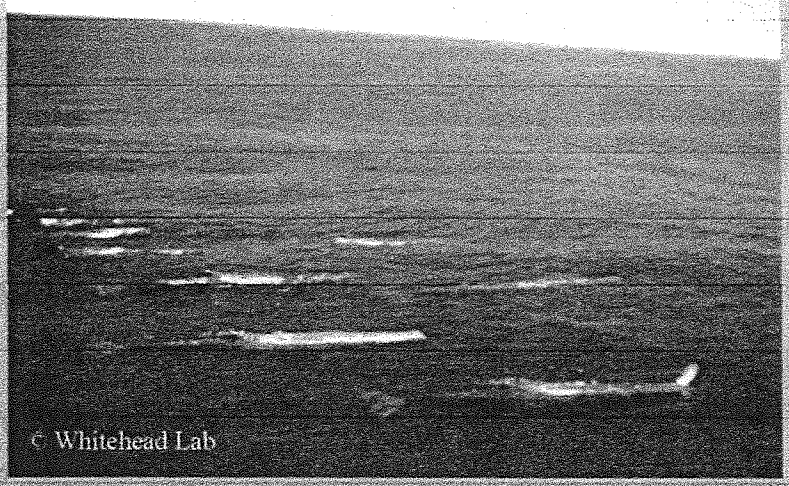

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MONTEREY COUNTY

BOARD OF SUPERVISORS

October 12, 2012

Mary Shallenberger
Chair, California Coastal Commission
North Central Coast District Office
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

SUBJECT: PG&E Offshore High-Energy Seismic Study
(November 2012 - Coastal Committee Meeting Agenda Item)

Dear Chair Shallenberger:

On behalf of the Monterey County Board of Supervisors, I am writing to express our concerns regarding the Pacific Gas & Electric (PG&E) proposal for offshore high-energy seismic study near the Diablo Canyon Power Plant.

While we are concerned with the seismic safety of the region surrounding PG&E's Diablo Canyon Nuclear facility, those concerns must be balanced with the disturbance of marine mammals and fish in the environmentally sensitive survey areas.

PG&E plans to use the research vessel *Langseth* to tow an array of air guns through the waters that include two state marine protected areas which is adjacent to the Monterey Bay National Marine Sanctuary, the largest national marine sanctuary and one of the largest marine protected areas in the United States. The air guns emit loud sounds into the ocean that penetrate Earth's crust resulting in three-dimensional images of the earthquake faults near Diablo Canyon which are intended to give seismologists a better picture of the seismic danger facing the nuclear power plant. However, dozens of endangered species use these waters and the loud sounds emitted by the air guns could injure marine wildlife or drive it away from the area (McCauley, R.D. et al 2000).

One of the main concerns is that the high-energy sound blasts could disturb and/or damage animal life, particularly cetaceans such as whales, porpoises and dolphins, all of which use the area off of the Central Coast as a migratory route to and from their annual feeding and birthing areas. Marine mammals such as whales, porpoises and dolphins use sonar and hearing to navigate and communicate, such seismic testing could damage their sensitive systems leading them off-route and possibly missing critical milestones along their routes putting them at risk to be in the wrong areas at the wrong time of the year.

We request that PG&E seek alternatives to the manner in which it researches potential seismic safety concerns so that to the maximum degree practical these efforts protect and respect the marine protected areas and Monterey Bay National Marine Sanctuary, thereby preserving the environment and economic viability of our pristine coastal areas while simultaneously safeguarding the public.

Sincerely,

Dave Potter

Dave Potter, Chair
Monterey County Board of Supervisors

cc: Congressman Sam Farr
Senator Dianne Feinstein
Senator Barbara Boxer
Governor Gerald Brown
Assembly Member Luis Alejo
Assembly Member Bill Monning
Senator Anthony Cannella
Senator Sam Blakeslee
John Laird – Secretary, California Resources Agency
Monterey County Board of Supervisors
Lew C. Bauman – CAO, Monterey County
Charles J. McKee – County Counsel, Monterey County
Benny Young – Director, Resources Management Agency, Monterey County
Nicholas E. Chiulos – Director, Intergovernmental & Legislative Affairs, Monterey County
Clerk of the Board, Monterey County
John E. Arriaga – JEA & Associates
Brent R. Heberlee – Nossaman LLP

October 17, 2012

In recognition of the significant biological impacts and the resulting negative impacts to our coastal economy, The Polynesian Kingdom of Atooi unites with C.O.A.S.T. Alliance in seeking a cessation to all offshore acoustic testing, planned or in progress and an end to all high intensity acoustic testing as means for seismic mapping.

We, The Polynesian Kingdom of Atooi, are rightfully concerned with the uncertain long term effects and potentially devastating impacts on; marine life throughout Oceania, fishing economy, Chumash Sacred sites and culture, public safety, and the potentially enormous expense to rate payers.

Marine Life

Numerous studies correlate devastating marine animal deaths in regions where seismic testing has occurred. In addition, no long-term study(s) has been conducted to ensure long-term implications do not exist.

From noyonews.net:

"Each of these underwater blasts will be at the volume level of a shock wave, that will instantly deafen, maim and possibly kill everything unfortunate enough to be in its path. A 240 dB blast is reportedly like being one foot away from the mouth of a large cannon. For a human, your ears, or what's left of your ears, would probably never stop ringing. The consequences of experiencing this level of sound can only be presumed to be immediate and permanent deafness – if not worse. For sea life, beyond just broken eardrums, the transfer of low-frequency shock waves from water-air-water causes hemorrhaging of lungs and air-sacks, and will result in the death of marine mammals – whales, dolphins, seals, sea lions and otters – and fish."

The Natural Resources Defense Council has put out a warning stating that the loud blasts could deafen porpoises and other marine animals, which rely heavily upon their sense of hearing for survival.

Fishing Economy

Local and potentially distant fishermen will be impacted both through closure of the designated fishing area as well as the decline of marine resources during/after the seismic testing.

Financial impact on Ratepayers:

On Sept 13, 2012, the California Public Utilities Commission approved a PG&E request to pass along the $64 million dollar price tag for the seismic studies to its California customers through rate increases

Perpetuation of Tribal Genocide

The possible destruction, to submerged Chumash Sacred Sites, and Chumash Cultural Resources with the anchoring of a very large vessel along the coastline.
The Chumash warn that these 260db sonic blasts, which will travel through the water and 10 miles into the earth's crust, will devastate the local marine ecosystem and possibly destroy fragile and sensitive Sacred Chumash Cultural Sites.

The same whales that travel the California coastline travel and nurse their young along our Hawaiian Island waters and are subject to further trauma and disorientation from naval seismic and sonic testing.

See: http://climate-connections.org/2012/09/26/chumash-nation-speaks-out-against-seismic-testing-off-california-coast/

Public Safety Concerns

"If you are in the water too near the airguns while they are being deployed for the surveys, your hearing could be severely damaged, or worse." excerpts from PG&E's EIR (Chapter 4.10 – Land Use and Recreation) about the following impacts to recreational activities on the Central Coast during testing:

The PG&E high-intensity seismic imaging project violates at least 15 laws, regulations and plans including: the Marine Mammal Protection Act, National Marine Sanctuary Act, and the Coastal Zone Management Act

Putting Polynesia At Risk

As Polynesians we have great reverence for the sea for we know it is all life creating. The vitality of the world's oceans is essential for the health of the Earth and all peoples. In the Kumulipo chant - the Hawaiian chant of creation - the Second Era speaks of the birth of the whale: "Hanau ka palaoa noho I kai" - born is the whale living in the ocean. The whale is our knowledge keeper and greatly revered. Putting the whale at risk throughout the range of their great journey, with seismic and sonic testing, puts our people at risk.

As with many Original peoples, our culture is our 'aina (land) and our moana (ocean). Our 'aumakua (ancestral guardians) are the animals. "Ho 'ihi ka 'aina a malama ka moana." (Respect the land and take care of the ocean)

We kindly request a cessation to all off shore acoustic testing.
E malama pono 'oukou.

Sincerely,

Ali'i Nui Aleka Aipoalani
Polynesian Kingdom of Atooi
Hawaiian Kingdom

Fw: Seismic Testing item Oct. 30

Dan Buckshi to: cr_board_clerk Clerk Recorder 10/24/2012 07:27 AM
Cc: Kristi Gutierrez

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/24/2012 07:26 AM -----

From: Julie Tacker <julietacker@charter.net>
To: dbuckshi@co.slo.ca.us
Date: 10/23/2012 07:33 PM
Subject: Seismic Testing item Oct. 30

Mr. Buckshi,
Please see that the Board receives these comments from Steve Shimek, Otter Project and Coast Keeper from Monterey County.
Thanks,
Julie

Coastal Commission.pdf

Item # 22 Meeting Date: 10/30/2012
Presented by: Julie Tacker
Received prior to meeting and posted to web on: October 25 , 2012

The Otter Project
www.otterproject.org

475 Washington St. Suite A
Monterey, CA 93940
831/646-8837

October 23, 2012

Cassidy Teufel
Coastal Analyst, California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105

Re: Central Coast Seismic Imaging Project—Request for permit denial

Dear Mr. Teufel:

Thank you for the opportunity to comment on the Central coast Seismic Imaging Project. With over 3000 contributing members, 400 active advocates and over 100 volunteers, The Otter Project is the largest sea otter organization in the United States. Our members come from all 50 states plus Australia, Great Britain, and France.

We are very concerned by the rushed process to approve this permit. We believe the expedited process has led to a series of potentially harmful miscalculations. Specifically, we believe the impacts to sea otters – in terms of both degree and extent of harm – have been underestimated. In addition, we see a serious disconnect between what is needed to monitor sea otter impacts in real time and the monitoring and mitigation program being proposed – and implemented – by the US Fish and Wildlife Service and Department of Fish and Game.

We ask that the permit be denied. In addition, we ask the Coastal Commission to urge project proponents to take the proper time to review what will be learned from the project and to balance that with a proper evaluation of the risks.

Attached is our comment letter to the US Fish and Wildlife Service Draft Incidental Harassment Authorization (IHA) for sea otters. We conclude that the IHA is seriously flawed and the critical points are as follows:

- From Draft to Final EIR, the number of otters impacted by Level A harassment (potential to injure a marine mammal or marine mammal stock in the wild) changes from 74 to 0 with no explanation, new literature cited, or mitigation measures proposed.

- The Final EIR and the IHA conclude a sea otter will not be exposed to the airgun blasts because otters rest with their heads out of water. We conclude, while an otter's head is submerged, over 50-percent of some animal's daily activity, the otter will be exposed to the air gun blasts.

- A subset of 62 otters would be impacted by Level A noise (potential injury or permanent physiological damage) in Box 4.

- The IHA fails to consider the cumulative impacts of repeated and persistent ensonification of overlapping boxes, particularly Box 4.

- Sea otters will be displaced from their Box 4 home ranges and will cause additional unavoidable negative impacts to otters in nearby ranges. This impact will ripple out from Box 4.

- Due to the incorrect use of sea otter foraging habitat, Level A and B impacts to sea otters are underestimated.

- Together, the failure to consider Level A noise disturbance, lack of consideration of cumulative noise and disturbance impacts in Box 4, potential to displace otters from their home ranges and into adjacent ranges, and the incorrect assumption that otters are somehow restricted to the area within the 40m isobath leads to both an incorrect assessment of impact and an underestimation of the numbers impacted. Otters will be ensonified above 180 dB and be subjected to Level A harassment; otters will be ensonified much longer than anticipated – intermittently over a period of years in Box 4; more otters will be ensonified because otters rest in areas beyond the 40 m isobath; and otters in adjacent ranges, beyond the project area, will be impacted when otters are displaced from their home ranges and into adjacent ranges.

- The aerial survey protocol in the Final EIR flies at an altitude too high to see sea otters. The pre, during, and post project surveys (APM-6 and MM MarineBio 12b) will be meaningless for otters. In addition, the IHA monitoring relies on these ineffective surveys.

- As a result of the unreliability of detecting otters within the exclusion zone, both due to the issues of seeing an otter 1 km distant from a rolling boat in open water and due to the fact that no effort will be made to see otters offshore at night, otters will be ensonified at levels of 180 dB and possibly far greater. Level A harassment will inevitably occur.

- We find particularly disturbing that the US Fish and Wildlife Service appears to be mitigating what they consider a Level B take with a much more intrusive and high risk Level A take – trapping and repeated surgery on a large number of sea otters.

- The IHA is clearly deficient. No triggers have apparently been established to prompt a stoppage or pause in the project if unanticipated impacts occur. This is a fatal flaw. The proposed monitoring and mitigation plan does little to inform THIS project.

- We believe, by the US Fish and Wildlife Service's own measure, there will be Level A disturbance and these "takes" will be entirely undetected by the monitoring plan. All the while, the most significant measure of impact – dead animals on the beaches – will go un-monitored.

Further explanation of the above points can be found in the attached comment letter to the US Fish and Wildlife Service.

Sincerely,

Steve Shimek
Chief Executive / Founder

Attachment

The Otter Project
www.otterproject.org

475 Washington St. Suite A
Monterey, CA 93940
831/646-8837

October 23, 2012

Diane Noda, Field Supervisor
Ventura Field Office
US Fish and Wildlife Service
2493 Portola Road, Suite B
Ventura, CA 93003

Via email: R8_SSO-IHA_Comment@FWS.gov

Re: Proposed Incidental Harassment Authorization – Sea otters near Diablo Canyon
FWS-R8-FHC-2012-N194
FRES48010810420-L5-FY12

Dear Ms. Noda and Ms. Carswell,

Thank you for the opportunity to comment on the sea otter Incidental Harassment Authorization (IHA). With over 3000 contributing members, 400 active advocates and over 100 volunteers, The Otter Project is the largest sea otter organization in the United States. Our members come from all 50 states plus Australia, Great Britain, and France.

We are very concerned by the process leading to this point and with the IHA. We believe, the Service has dramatically underestimated the risk to sea otters. Further, we believe the proposed monitoring program serves the Pacific Nearshore Project but is a poor fit for monitoring sea otters disturbed by the Seismic Imaging Project (SIP). We ask that the Service re-evaluate the IHA in light of our comments and new information.

We further urge the Service to stop and take a breath to fully evaluate the potential impacts to sea otters and the proposed monitoring and mitigation plan in this draft IHA. There seems a total disconnect between the impacts outlined in the Draft and Final EIRs and the IHA. And there seems another disconnect between monitoring the project risks and impacts in real time and the proposed monitoring program.

We will organize our comments as follows:

1. General comments and comments to the IHA
2. Proposed monitoring requirements and mitigation measures – Marine Mammal Monitoring

1. General comments and comments to the IHA

a. Level of disturbance and take is underestimated. There is an extreme amount of "drift" in the level of impact to sea otters from the Draft Environmental Impact Report (DEIR), to the Final Environmental Impact Report (FEIR), and finally to the IHA. The DEIR states that a total of 74 southern sea otters will be taken by the project:

> "Assessment of NMFS Level A: *Minimum* take and boat disturbance to sea otters resulted in values of 62 and 12 individuals, respectively, for the Project. The boat disturbance estimates are for one vessel only. If more vessels would be used for mitigation, then the numbers for boat disturbance should be increased proportionate to the number of vessels present and their proximity to sea otter habitat." (Emphasis in original) DEIR 4.4-97.

With no additional evidence, literature cited, or mitigation measures the Project Proponents seem to walk back their estimates of take in their response to US FWS comments on the draft EIR stating:

> The 180 decibel (dB) re: 1 micropascal (μPa) root mean square (rms) isopleth is typically used by the National Marine Fisheries Service (NMFS) as the threshold for Level A harassment (injury) of cetaceans. Sea otters have the ability to avoid immersion of their heads and ears, and have a limited range of acoustic responses (e.g., Malme et al. 1984). Although no Level A take is anticipated based on the above behavioral characteristics, because sea otters have special status (protected under the Endangered Species Act [ESA], the Marine Mammal Protection Act [MMPA], and the Fish and Game Code), the Level A threshold was used to assess the extent of disturbance (Level B harassment) to Southern sea otters due to noise. Malme et al. (1984) reported no foraging or behavioral change in Southern sea otters exposed to playbacks of seismic survey noise as close as 0.6 mile (900 meters [m]). Level B takes (takes caused by disturbance) were calculated for three stressors: noise from the air guns; the presence of the survey vessel; and the presence of vessels during the laying and recovery of the geophone lines. Therefore, the 180 dB re: 1 μPa rms isopleth radius was used for production lines (0.5 mile [856 m] inshore of site location 1) and mitigation single air-gun turns (150 feet [46 m]) to delineate a buffer around the survey tracks. In turn, this buffer area was overlain with sea otter density estimates for the Project area to determine Level B take estimates as summarized in Table 1 (from Appendix H Table 4.9; note that Alternatives IIIb and IIIc are identified as Alternatives 1 and 2 in that Appendix).

The Final EIR then seems to use the new commentary in their Final EIR stating:

"Sea otters appear insensitive to seismic noise (Malme et al. 1984) at ranges greater than 0.6 miles (900 m), but can be disturbed by close approaches from boats. There are limited available data on responses of sea otters to seismic air guns, as well as their hearing abilities, but the ability to raft without immersing their heads and ears would be considered enough to preclude injury from noise.

For this analysis the NMFS Level A threshold for cetaceans (180 dB) was used as the Level B threshold for sea otters. Because sea otters have the ability to avoid immersion of their heads and ears, this Level A noise level was considered to be appropriate for assessing the extent of disturbance (Level B harassment) to Southern sea otters due to noise. nNoise modeling results were used to determine the area corresponding to the 180 dB isopleth radius. This area was compared this with the expected sea otter density within this area. The 180 dB radius overlaps with sea otter habitat (including in the vicinity of Point Buchon); however, much of the overlap is in waters deeper than 98 feet (30 m) (i.e., out of the female and pup core areas). Overall, the overlap area was estimated to contain 62 animals (2.2 percent of population).

Assessment of Level B take regarding boat disturbance to sea otters resulted in values of 12 and 8 individuals, respectively, for the survey vessel and geophone line deployments. The boat disturbance estimates during the survey are for one vessel only. If more vessels would be used for mitigation, then the numbers for boat disturbance should be increased proportionate to the number of vessels present and their proximity to sea otter habitat."

From Draft to Final the number of otters impacted by Level A harassment (potential to injure a marine mammal or marine mammal stock in the wild) changes from 74 to 0 with no explanation, new literature cited, or mitigation measures proposed.

The USFWS IHA appears to accept the argument advanced by the Project Proponent in the Final EIR that states:

"There are limited available data on responses of sea otters to seismic air guns, as well as their hearing abilities, but the ability to raft without immersing their heads and ears would be considered enough to preclude injury from noise."

The IHA states:

"Because underwater behaviors constitute less than half of the total activity budget of southern sea otters along the central California coast, their exposure to underwater sounds is limited."

This argument is both nonsensical and inaccurate: As noted in the IHA, sea otters have a high metabolic rate and must maintain a food intake of approximately 25-35 percent of body weight. While foraging, they are underwater (36.3 percent of their activity budget), swimming (8.5 percent), and grooming (9.1 percent). The activity budget percentages cited in the IHA are for a small and skewed sample of all male otters. Other studies have shown that reproductive aged female otters – the critical demographic segment -- can spend nearly 50-percent of their time foraging (Ralls and Siniff, 1990).

While an otter's head is submerged, over 50-percent of some animal's daily activity, the otter will be exposed to the air gun blasts.

The USFWS IHA accepts the NMFS Level B and Level A disturbance levels of 160 and 180 dB stating:

> "Currently, NMFS uses 160 dB re 1 µPa at received level for impulse noises (such as air gun pulses) as the onset of behavioral harassment (Level B harassment) for all marine mammals that are under its jurisdiction, and 180 dB re 1 µPa at received level as the threshold for potential injury or permanent physiological damage (Level A harassment) for cetaceans (70 FR 1871, January 11, 2005). *In the absence of data on which to base thresholds specific to sea otters, we utilize the 160 dB re 1 µPa and 180 dB re 1 µPa thresholds for Level B and Level A harassment of sea otters.*" (Emphasis added)

The USFWS IHA is inconsistent in its evaluation of level of take. The IHA review and discussion of "Hearing Impairment and other physical effects" (pgs. 15-17) dismisses without any evidence whatsoever any physical impacts of the survey. Then, the Service accepts the 180 dB threshold for Level A disturbance (potential injury or permanent physiological damage).

Inexplicably, the IHA does not then acknowledge the 62 otters exposed to 180 dB noise in the Draft and Final EIRs. Note: The 62 impacted otters are for all four survey boxes while the IHA only considers boxes 2 and 4. The Final EIR further states this exposure is:

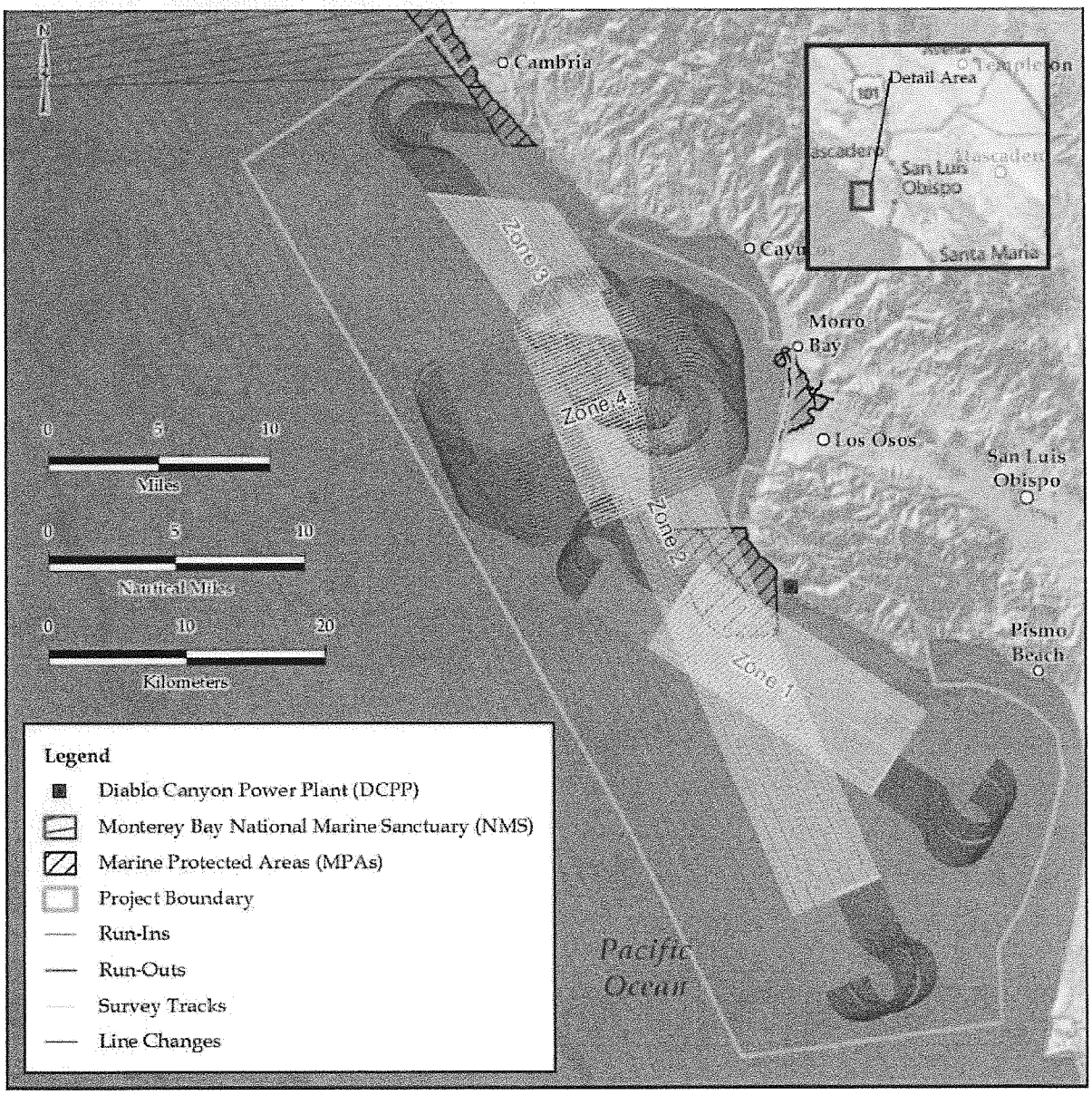
> "Therefore, the impact is considered to be *Significant and Unavoidable* because of the proximity of the survey to sea otter habitat." Emphasis in original.

A subset of 62 otters would be impacted by Level A noise (potential injury or permanent physiological damage) in Box 4.

b. <u>Cumulative impacts of surveys conducted in Boxes 1 thru 4 are not considered.</u> The IHA fails to discuss or even acknowledge the potential of additive impacts from surveys being conducted over two years in the overlapping Boxes 1 thru 4. The most

recent project description proposes that Box 4 will be surveyed in late 2012. The project description in the Final EIR specifically states that at least one air gun will continue to fire thru turns, run-ins, and run-outs. Final EIR 2-37. According to the IHA, table 2, 263 sea otters inhabit Box 4. These otters will be ensonified not only during the survey of Box 4 but repeatedly during surveys of Boxes 1 thru 3 as shown in Final EIR figure 2.5-7. Boxes 2 and 3 will be blasting the full airgun array as they survey through the already surveyed box 4. Additive impacts will be significant and will persist literally ove the course of two years.

Figure 2.5-7 Proposed Offshore Survey Track Map



The IHA fails to consider the cumulative impacts of repeated and persistent ensonification of overlapping boxes, particularly Box 4.

One study near Monterey found that sea otters have average size home ranges of 56 hectares (.56 sq. kilometer) with a range in size of 18.3 to 198.2 hectares (.183 – 1.982 sq. kilometers). The IHA contains no discussion of home range, nor any discussion of displacing otters entirely out of their home ranges.

Displacing otters from their home range (whether by Level A or Level B harassment) will cause a ripple impact to otters in adjacent ranges. This impact is essentially similar to impacts already considered in the Revised Draft Supplemental Environmental Impact Statement [for] Translocation of Sea Otters, August 2011. While the stress and risk of trapping and transport do not apply to this situation, the disruption to the otter social structure is "unavoidable." The impact to sea otters in adjacent ranges from otters displaced from their Box 4 home range has not been considered. That document (DSEIS) states:

> "Relocating sea otters from the management zone to the northern or central portion of the existing range would increase competition among sea otters, especially in areas of the central coast now thought to be food limited (see Tinker *et al.* 2008b), disrupt natural behaviors, and likely result in the deaths of otherwise healthy animals. The incidental injury or death of sea otters removed from the management zone would likely be unavoidable. The relocation of sea otters may result in increased risk of mortality due in part to the stress associated with capture, handling, and time out of water, and in part to the general lack of familiarity of the animals with their new environments (Estes *et al.*, n.d.). For males, there may be an added risk of death or injury from encountering territorial males in foreign habitats (Estes *et al.*, n.d.)."

Sea otters will be displaced from their Box 4 home ranges and will cause additional unavoidable negative impacts to otters in nearby ranges. This impact will ripple out from Box 4.

c. Discussion of sea otter habitat is incomplete. The IHA states:

> "Sea otters occasionally make dives of up to 328 ft (100 m), but the vast majority of feeding dives (more than 95 percent) occur in waters less than 131 ft (40 m) in depth (Tinker et al. 2006a). Therefore, sea otter habitat is typically defined by the 40-m (131-ft) isobath (Laidre et al. 2001)."

In rocky bottomed areas, sea otters often wrap themselves in kelp to keep from drifting while resting. However, in soft bottomed areas otters will often swim offshore to rest, this is especially true in embayments (even relatively open bays such as Monterey and Estero Bays). This behavior requires that offshore areas be

aerially surveyed during the annual sea otter census. The metadata for the aerial census states:

> "1. Census Methods
> During each census, the entire mainland range of the sea otter in coastal California is counted by one of two methods: aerial surveys or shore-based counts. The latter method is used in all areas that are accessible by ground-based observers, except in a few regions *where otters often move far off shore* (such as shallow, sandy embayments) and are therefore difficult to count reliably from the shore." Emphasis added. (found online at http://www.werc.usgs.gov/fileHandler.ashx?File=/project_91/shared%20documents/census_sum_2010_metadata.htm .

Estero Bay (the entirety of Box 4) is an area where there are numerous anecdotal reports of sea otters far from shore and outside 40m isobath. The IHA incorrectly uses the project overlap with the region inside the 40m isobath to calculate many types of disturbance including boat strike and noise impacts.

It could be incorrectly assumed that these otters are resting with their heads out of water and will not experience the noise. This is an incorrect assumption because as noted earlier, otters groom, swim, and interact intermittently with their heads underwater.

Due to the incorrect use of sea otter foraging habitat, Level A and B impacts to sea otters are underestimated.

Together, the failure to consider Level A noise disturbance, lack of consideration of cumulative noise and disturbance impacts in Box 4, potential to displace otters from their home ranges and into adjacent ranges, and the incorrect assumption that otters are somehow restricted to the area within the 40m isobath leads to both an incorrect assessment of impact and an underestimation of the numbers impacted. Otters will be ensonified above 180 dB and be subjected to Level A harassment; otters will be ensonified much longer than anticipated – intermittently over a period of years in Box 4; more otters will be ensonified because otters rest in areas beyond the 40 m isobath; and otters in adjacent ranges, beyond the project area, will be impacted when otters are displaced from their home ranges and into adjacent ranges.

d. The marine mammal aerial surveys and Protected Species Observers (PSOs) will be ineffective at locating sea otters and avoiding disturbance. The Final EIR states that:

> "Fixed wing aircraft (such as a Piper Seneca Twin or Cessna 172) would be used to monitor sea life activities within the proposed survey area prior to the survey, throughout the survey, and up to 1 week after the offshore survey is completed.

These flights would be conducted from approximately 850 feet (240 meters), following an established grid."

The Otter Project (together with our project partner LightHawk) regularly uses aircraft to monitor fishing activity in marine protected areas. Our survey altitude is 1000 feet. In addition, this writer (Steve Shimek) is a private pilot – in short, we have a great deal of experience flying and working from small planes and we are very familiar with what can be seen from 1000 feet altitude in a small plane. Sea otters are extremely difficult to spot from 850 feet; a sea otter survey from 850 is perhaps meaningless or is unreliable at best. This is exactly why the aerial survey protocol for the annual sea otter survey calls for use of a high visibility bubble-window plane and a survey altitude of 200 feet:

"For those portions of the range where ground counting is impossible or impractical, aerial surveys are conducted using a Partenavia PN68 "Observer" fixed-wing plane. The plane carries three observers and a pilot, and flies at an air speed of approximately 167 kilometers per hour (90 knots) at an altitude of approximately 60 meters (200 feet). Pilot and data recorder/observer occupy front seats; principal observers occupy middle seats viewing out through bubble-type viewing windows."
http://www.werc.usgs.gov/fileHandler.ashx?File=/project_91/shared%20documents/census_sum_2010_metadata.htm

The IHA relies on these same PGE marine mammal surveys to inform boat operations so as to avoid high concentrations of otters. The IHA states:

"PG&E would conduct an aerial survey approximately 1 week prior to the start of the seismic survey to obtain pre-survey information on the numbers and distribution of southern sea otters in the seismic survey area. Weekly aerial surveys would also be conducted throughout the survey program. Survey routes would be adjusted as feasible to avoid concentrations of sea otters"

The aerial survey protocol in the Final EIR flies at an altitude too high to see sea otters. The pre, during, and post project surveys (APM-6 and MM MarineBio 12b) will be meaningless for otters. In addition, the IHA monitoring relies on these ineffective surveys.

The IHA heavily relies on boat based Protected Species Observers (PSOs) to keep watch for otters and to power down the air gun array when otters appear to be nearing or are seen within the 1 km radius, 180 dB Exclusion Zone. The IHA states:

"Level A harassment (harassment that has the potential to injure southern sea otters) is not authorized. PSOs would ensure that sea otters are not exposed to sounds or activities that may result in Level A harassment. PSOs would be

present during all daylight survey activities and would have the authority to order a power-down or shut-down of the seismic air guns, and/or redirect survey activities to avoid observed sea otters if sea otters appeared to enter or approach the 180 dB re 1 µPa exclusion zone. If a sea otter were observed within or approaching the 180 dB re 1 µPa exposure area of 1,010 m (0.63 mi), avoidance measures would be taken, such as decreasing the speed of the vessel and/or implementing a power-down or shut-down of the air guns. Nighttime monitoring would be conducted with the aid of night-vision binoculars and a FLIR system when the R/V *Marcus G. Langseth* was inshore of the 40-m (131-ft) depth contour."

We believe the PSOs will be ineffective at seeing otters at a distance of 1 km and forewarning the primary survey vessel. Boats roll and seas are choppy: Seeing an otter from an elevated coastal bluff at a distance of 1 km is difficult enough, seeing an otter from a rolling boat – even from an elevated observer platform will be ineffective or – at best – unreliable.

As a result of the unreliability of detecting otters within the exclusion zone, otters will be ensonified at levels of 180 dB and possibly far greater. Level A harassment will inevitably occur.

The difficulties of observing sea otters within the exclusion zone will be compounded at night when – within the 40 m isobath – observers will use night-vision equipment. Night vision equipment will be totally ineffective at observing a submerged or mostly submerged (swimming) otters. Nearshore areas with kelp canopy are also problematic as otters are often covered in kelp.

Outside the 40m isobath PSOs will not be watching for otters at all. The Final EIR and IHA state:

"During nighttime operations, whenever the vessel survey tracks were located inshore of the 40-meter depth contour (where physical encounters with sea otters are more likely), PSOs would visually monitor the area forward of the survey vessel with the aid of infra-red (night vision) goggles/binoculars and the forward-looking infra-red (FLIR) system available onboard the R/V *Marcus G. Langseth*. Mitigation measures, such as avoidance or power-downs/shut-downs, would be implemented if a sea otter were detected in the path of the survey vessel."

As noted earlier, in embayments – especially those with soft bottoms – sea otters often move offshore to rest. It is a certainty that sea otters will be encountered in the offshore waters of Estero Bay.

Again, as a result of the unreliability of detecting otters within the exclusion zone, both due to the issues of seeing an otter 1 km distant from a rolling boat in open water and due to the fact that no effort will be made to see otters offshore at night, otters will be ensonified at levels of 180 dB and possibly far greater. Level A harassment will inevitably occur.

e. "Small numbers" determination is not protective of the sea otter population. While we recognize the US FWS can use its discretion to interpret the phrase "small numbers" we can see no rationale in this case. Using the Service's estimate, 9.4 percent of the entire southern sea otter population will be disturbed by the survey of Box 4 alone – and we believe this is an underestimate both in terms of number and level of take. We cannot understand how this qualifies as a small number.

2. Proposed monitoring requirements and mitigation measures – Marine Mammal Monitoring

The Otter Project has always been generally supportive of recovery focused sea otter research. In fact, no other NGO, other than Monterey Bay Aquarium, has invested so heavily in research; The Otter Project has invested nearly $750,000 of either its own funds or mitigation funds under its control in sea otter recovery focused research. In addition, The Otter Project is generally supportive of basic ecological research in order to better understand the dynamics of our Nearshore ocean ecosystems.

It is abundantly clear to any person familiar with current sea otter research that the Marine Mammal Monitoring program proposed in the IHA – and being prematurely implemented before the public comment period is closed – is simply backfill funding for the Pacific Nearshore Project (www.werc.usgs.gov/nearshoreproject).

In our opinion the Pacific Nearshore Project could certainly be considered as a possible mitigation, but cannot realistically be considered as monitoring for the Seismic Imaging Project. In our opinion, the merits – and impacts to sea otters -- of the Pacific Nearshore Project must stand on their own and should not be disguised as monitoring of the Seismic Imaging Project.

What we find disturbing is that the US Fish and Wildlife Service appears to be mitigating what they consider a Level B take with a much more intrusive and high risk Level A take – trapping and repeated surgery on a large number of sea otters.

We see nothing in the IHA that requires real-time feedback to the public and project proponents on the impacts of the seismic testing. Many many thousands of rate payer dollars are being spent to have high-tech rebreather equipped divers scoop dozens of sleeping otters up with Wilson traps, transported to a surgery suite to be anesthetized and surgically implanted with transmitter and data recorder, poked prodded and tissue samples taken, and then released dazed, confused, and undoubtedly stressed. Months later the

otter will be tracked, trapped, anesthetized, and cut open again. Prior to the Seismic Imaging Project start and for the many weeks of the project the otter will be tracked and its location and behavior monitored.

For all these rate payer dollars and effort, what will we gain? A paper. The paper possibly published in an obscure scientific journal, many months, maybe years, after the conclusion of the project. According to the IHA:

> "Due to the lack of data on the effects of air guns on sea otters, in addition to project related mitigation monitoring, the Service has recommended that PG&E and LDEO use the survey as an opportunity to investigate the potential effects of air guns on sea otters."

The monitoring plan is being conducted as a scientific study: Pre, during, and post position and activity will be statistically compared to see if and how much the project impacted sea otters. Instead, the monitoring should be a real time assessment of impact.

With all this effort and technology – perhaps misplaced – it seems there should be a set of defined triggers that could lead to a stop or pause in the seismic testing due to unanticipated project impacts if they occur.

According to a recent article in the San Luis Obispo Tribune, the US Fish and Wildlife Service could stop the project if:

> "• An inordinate number of sick or dead otters wash up on local beaches.
> • A dead otter is found with damage to its brain or eardrums as a result of the sonic blasts.
> • A significant number of female otters are displaced from the survey area"

We see nothing in the IHA referring to these potential triggers and we see nothing in the proposed monitoring and mitigation plan that would feed real-time information into these triggers. Inexplicably, points one and two above would be the simplest, least expensive, and most on-point monitoring exercise, yet it is not being implemented or even suggested. This is in spite of the fact that the sea otter stranding network has been recovering carcasses from Estero Bay beaches for over a decade and comparative data exists.

The IHA is clearly deficient. No triggers have apparently been established to prompt a stoppage or pause in the project if unanticipated impacts occur. This is a fatal flaw. The proposed monitoring and mitigation plan does little to inform THIS project.

We believe, by the Services own measure, there will be Level A disturbance and these "takes" will be entirely undetected by the monitoring plan. All the while, the most significant measure of impact – dead animals on the beaches – will go un-monitored.

We are very concerned by the process leading to this point and with the IHA. We believe, the Service has dramatically underestimated the risk to sea otters. Further, we believe the proposed monitoring program serves the Pacific Nearshore Project but is a poor fit for monitoring sea otters disturbed by the Seismic Imaging Project (SIP). We ask that the Service re-evaluate the IHA in light of our comments and new information.

We further urge the Service to stop and take a breath to fully evaluate the potential impacts to sea otters and the proposed monitoring and mitigation plan in this draft IHA. There seems a total disconnect between the impacts outlined in the Draft and Final EIRs and the IHA. And there seems another disconnect between monitoring the project risks and impacts in real time and the proposed monitoring program.

Sincerely,

Steve Shimek
Chief Executive / Founder

Cc: California Coastal Commission

References

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Laidre, K.L., R.J. Jameson, and D.P. DeMaster. 2001. An estimation of carrying capacity for sea otters along the California coast. Marine Mammal Science 17(2):294-309.

Loughlin, T. 1980. Home range an territoriality of sea otters near Monterey, California. J. Wildl. Manage. 44(3): 576-582.

Ralls, K. and D.B. Siniff. 1990. Time budgets and activity patterns in California sea otters. J. Wildl. Manage. 54(2):257-259.

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Fw: New Project Specific Plan Negotiation Instead of mediation

Bruce Gibson to: Bruce Gibson, Paul Teixeira, James Patterson, Frank Mecham, Adam Hill, Amy Gilman, Hannah Miller, Vicki Shelby, Debbie Geaslen — 10/24/2012 11:17 AM

Sent by: Cherie Aispuro

Cc: cr_board_clerk Clerk Recorder

I have been asked by Brian Stacy to forward several emails for Oct 30, 2012 discussion item.

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:11 AM -----

From: brian stacy <bstacy166@yahoo.com>
To: JohnShoals <JTSU@pge.com>
Cc: ahill@co.slo.ca.us, bgibson@co.slo.ca.us, cteufel@coastal.ca.gov, greg.haus@mail.house.gov, salmonkirk@gmail.com, fvdbear@charter.net, fvzfrog@charter.net, bcartercasa@aol.com
Date: 10/08/2012 12:40 PM
Subject: New Project Specific Plan Negotiation Instead of mediation

Dear John;
We at PSLCFA are disappointed that you took the liberty to lump us into the "group" After I explained to you in writing how we were only a "group" that one day after your team failed to negotiate AGAIN as promised if we joined with MBCFO. Opting instead to not negotiate or even produce a counter offer of any reasonable kind just the refrigerator form that you had me hand out last year for low energy displacement and then denied all the claims. That equates to no counter as far as we are concerned. And to proclaim we have to go to mediation without ever having made a counter offer seems kind of like a bully tactic. Also the call to mediation for Monday you made Friday night when we do not have a

Item # 22 Meeting Date: 10/30/2012
Presented by: Brian Stacy
Received prior to meeting and posted to web on: October 25, 2012

project specific plan on the table seems a bit hurried.
After initially refusing you indicated we would be allowed to go forward as a individual association as we had been operating throughout the non negotiations, Further you indicated to me last Thursday we would "be allowed our own mediation process" based on the plan we submitted in writing in June that we never even received a written response to just you saying they were looking at it.
We would prefer your team make a good faith effort to produce a agreement and except a plan versus mediation that your team obviously has the advantage in as we are fishermen and are paying out of our pocket for any consultant or legal services we may use if we can afford them.
I am surprised that your team is trying to force mediation based on a plan that was proposed to you based on the old project? Also We are a little unhappy that you failed to back off the forced mediation and instead request a new proposal based on the new shorter project And review and hopefully except or at least make an effort for once in this process.
Thus far your team has not made one attempt to negotiate not one John. When you call a meeting, show up with new paperwork that you paid your consultant to produce, that we should have had and reviewed prior to the meeting so we could be prepared, versus trying to digest on the spot and comment on it pretty much ruined every chance for us to negotiate at that meeting

that happened at every meeting it seems even after it was mentioned. For the record when you guys come to a meeting in regards to this you are getting paid. When we come to a nonproductive meeting do to your tactics, to try and lookout for our fellow fishermen and ourselves that is right out of our pocket. Gas, lost work, preparation time all that is paid for by us because you proposed this project so we have to eat a year+ of expensive over your proposed project along with our professional services that your company has refused to pay for and is sticking us with among others and the stress you have created in our lives as well.

This has been a less than fair process to put it mildly and we hope in the final stretch here you can come to the table and except a reasonable plan based on fishing potential which we will not be able to access if your project is approved, Passed mitigation for the same area with a way less intrusive and destructive project, with a qualifying criteria that will keep it confined to local fishermen that are going to be impacted (not 2010 or 2011 landings).

Last I would point out we are in discussions with MBCFO to produce such a plan revolving around the new shorter survey the plan I would have thought your team would have realized was needed to even think about mediation. But hopefully we can avoid mediation and your team will really show up this time with the intent of reaching an agreement and not bring the refrigerator form

again.
Please let me know if you are willing to make an effort to come to a agreement finally?
Sincerely,
Brian Stacy V.P. PSLCFA

Fw: Fridays Meeting/Reaquest to have it placed on the agenda

Bruce Gibson, Paul Teixeira, James Patterson,
Bruce Gibson to: Frank Mecham, Adam Hill, Amy Gilman, 10/24/2012 11:17 AM
Hannah Miller, Vicki Shelby, Debbie Geaslen
Sent by: Cherie Aispuro
Cc: cr_board_clerk Clerk Recorder

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:17 AM -----

From: brian stacy <bstacy166@yahoo.com>
To: Adam Hill <ahill@co.slo.ca.us>, bgibson@co.slo.ca.us
Date: 10/09/2012 08:23 AM
Subject: Fridays Meeting/Reaquest to have it placed on the agenda

Dear Supervisors Hill and Gibson;

First I would like to extend our thanks from both PSLCFA and MBCFO for taking time on short notice to meet with us on Friday, and for your willingness to examine our situation with regard to PG&E's unwillingness to negotiate in good faith. PG&E's failure to mitigate impacts of low energy seismic surveys that have already occurred and unwillingness to address our concerns for the last year have placed the one hundred small businesses we represent and other stakeholders in our ports in jeopardy.

As we expressed in our meeting after over a year of attempting to negotiate with PG&E we have little faith in a acceptable agreement being reached prior to issuance of their Coastal Commission permit to do the high energy survey. We at PSLCFA are having discussions with our fellow organization MBCFO to craft a mitigation package based on the new survey, and based on past mitigation plans negotiated with the fiber optic cable companies with regard to displaced fishermen. We're taking the initiative and on our own have begun working on a new package we feel both sides should consider. The invasive nature of the proposed tests, and the potential loss of income that comes with these tests are much more devastating than the fiber optic cable installation in 2000.
PG&E has tried to force us into mediation based on the plan that was developed for the longer survey. We have brought it to their attention that we would prefer to make a proposal based on the new survey parameters and have PG&E give it serious

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consideration and hopefully accept it.

As we indicated to you in our discussions on Friday both PSLCFA and MBCFO feel we will need a permit condition from the Coastal Commission requiring a Memoranda of Understanding (MOU) signed by both parties, PG&E and San Luis Obispo County commercial fishermen that outlines the proper procedures for mitigation. Without intervention we feel that PG&E will continue to ignore the impacts as they have for the past year. We would like for you to place this on your agenda and support our new plan which we will supply to you soon to allow time for your review prior to your next meeting. We hope you will be ready to support the fishermen of San Luis Obispo County in our attempt to acquire fair compensation with regard to the high energy surveys planned for next month.
Thank you for your consideration of this matter;

David Kirk President,
Brian Stacy Vice President,
Barbara Carter Secretary
Directors; Bill Barrow, Bill Ward, Jerry Sato, Tom Capen
Port San Luis Fishermen's Association
Dere; Terra President
Directors Tom Hafer, Bill Blue

To:	Bruce Gibson/BOS/COSLO@Wings, Paul Teixeira/BOS/COSLO@Wings, James Patterson/BOS/COSLO@Wings, Frank Mecham/BOS/COSLO@Wings, Adam Hill/BOS/COSLO@Wings, Amy Gilman/BOS/COSLO@Wings, Hannah
Cc:	cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Bcc:	
Subject:	Fw: Our CCC Permitt Condition agenda Item, Fishermens mitigation plan Update
From:	Bruce Gibson/BOS/COSLO - Wednesday 10/24/2012 11:18 AM
Sent by:	Cherie Aispuro/BOS/COSLO

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:18 AM -----

From:	brian stacy <bstacy166@yahoo.com>
To:	Adam Hill <ahill@co.slo.ca.us>, bgibson@co.slo.ca.us
Date:	10/17/2012 03:43 PM
Subject:	Our CCC Permitt Condition agenda Item, Fishermens mitigation plan Update

Dear Supervisors Hill And Gibson, I wanted to update you on the status of the Fishermens Mitigation Plan. The one we reffrenced in our request to have the Board of supervisors place our CCC permitt condition adopting our mitigation Plan on your agenda. To hopefully get the Board of Supervisors support in regard to our request to have it adopted and inserted as a condition of approval Should these destructive and intrusive High enaergy seismic surveys be Permitted.

As you can imagine it has not been easy task for me to mediate the issues that arise in bringing the two ports together in one plan as one entity I am within one issue and working on that now. We are going to ask for your help if it is adopted to iron out some issues and oversee the Bond that is smaller than before but still adequate I beleive. And all of the counties addministrative fees will be covered out of it.

We in the fishing community both PSLCFA and MBCFO are in the process of finishing it now, the mitigation plan that we indicated to you in our request for this to be on the agenda would be delivered ASAP. We have worked hard the past 15 days since we met with you, to as mentioned in our request, put a fair plan together based on past Mitigation for displacement of fishermen in the same area, negotiated in "good faith" for the 2000 cable installation off of shell Beach. We did not add anything to what most fishermen recieved 12 years ago.

We feel this is more than fair conscidering the nature and magnitude of the impending displacement by HESS, and the after effects of stunned uncooperative fish. And we have tried to address all of the issues we face. But keep the cost down as much as possible to keep it acceptable to your body and the CCC.

We sincerily Hope this project will not be permitted but if it is we know our only hope for fair compensation is a CCC permitt condition and hope we will recieve your support in haveing one attached adopting our plan, as a "condition of approval". We hope to have it to you by monday at the latest I will let you know if it is delayed.

Thank you very much for your time and conscideration of our Item. I hope the board supports us. Last should I copy our request letter and this along with the plan to the rest of the board?

Kind Regaurds, Brian Stacy V.P. PSLCFA 805-225-1316 feel free to call with any questions

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Presented by: Brian Stacy

Received prior to meeting and posted to web on: October 25 , 2012

To: Bruce Gibson/BOS/COSLO@Wings, Paul Teixeira/BOS/COSLO@Wings, James Patterson/BOS/COSLO@Wings, Frank Mecham/BOS/COSLO@Wings, Adam Hill/BOS/COSLO@Wings, Amy Gilman/BOS/COSLO@Wings, Hannah
Cc: cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Bcc:
Subject: Fw: PSLCFA And SLO County Fishermens Mitigation Plan
From: Bruce Gibson/BOS/COSLO - Wednesday 10/24/2012 11:19 AM
Sent by: Cherie Aispuro/BOS/COSLO

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:18 AM -----

From: brian stacy <bstacy166@yahoo.com>
To: Adam Hill <ahill@co.slo.ca.us>
Cc: bgibson@co.slo.ca.us, caispuro@co.slo.ca.us, abwilson@co.slo.ca.us
Date: 10/22/2012 02:23 PM
Subject: PSLCFA And SLO County Fishermens Mitigation Plan

Dear Supervisors Hill and Gibson, I am forwarding our Mitigation Plan for All San Luis Obispo County Commercial Fishermen to use if they choose, in the event this project is approved and goes forward. I am sad to have to inform you that the MBCFO "directors" are not on board With our plan for the majority of San Luis Obispo County Fishermen.

This plan is based on Negotiated past mitigation for displacement by a much less invasive cable installation project twelve years ago in the same area. We have not added for inflation ect. I have taken steps to identify and sign up the majority of potentially impacted Morro Bay Fishermen to support a "one size fits all" mitigation plan like this one. I will forward those "Personel information" sign up sheets which show their fishing licsense information, contact information and are signed by the fishermen to support the PSLCFA "one size fits all" plan. I have had no fisherman request their Information back, or indicate they did not support the concept.

I do know the group I originally was elected to represent "Morro Bay Nearshore Fishermen" are solidly behind my efforts to see to it that they are properly compensated should HESS be permitted and done, and that that fishery will be the most impacted by the "High Energy Seismic Surveys" (HESS) accourding to PG&E in Our discussions early on.

I would also point out that all studies indicate "after effects" from airgun surveys these range from 5 to 14 days or more, and those impacts have not been studied in the shallow water like these surveys will be conducted, And were the Nearshore Fishery takes place. We are not requesting compensation for these Impacts at this time. This Plan will be available for all San Luis Obispo county fishermen to use. We have taken steps to protect the project applicant from a large volume of claims by provideing quallifying criteria that confines it to local fishermen that will be impacted by thes surveys.

I thank you for your conscideration of supporting our plan and hopefully recomending to the California Coastal Commission that they adopt it as a "condition of approval" should they permit and allow these harmfull tests to take place in our local waters. Last I would like to point out again that PSLCFA and the Morro Bay fishermen we represent and all fishermen I believe, Oppose the HESS in our local waters. You are welcome to call me with any questions you may have. 805-225-1316 or 805-440-8032

Brian Stacy, Vice President Port San Luis Commercial Fishermens Association
Morro Bay Nearshore Rockcod Fishermens Representitive

PG&E draft mitigation plan[1][2].doc

Item # 22 Meeting Date: 10/30/2012
Presented by: Brian Stacy
Received prior to meeting and posted to web on: October 25, 2012

PG&E High Energy Seismic Survey Mitigation plan

for displacement impacts to Commercial Fishermen

1. Each fisherman able to prove eligibility will receive $1,000.00 per day for the length of the survey. PG&E has indicated high energy blasting will occur 9 to 12 days to complete the 2012 survey.

2. To qualify each fisherman shall be required to provide CDF&G landing receipts (delivered in Morro Bay or Port San Luis) in the amount of $5,000.00 for 2011 or 2012, the vessels commercial registration and captains personnel commercial fishing license and permits for the fisheries affected.

3. Claims are based on historical catch in and around the "racetrack" in at least a 30 mile perimeter. (Studies show behavioral changes 30 miles away from the airguns).

4. PG&E shall be required to pay the nine days identified as the shortest duration of the survey within twenty days of the permit approval.

To use this portion of the mitigation plan a fisherman will need to have their claim to PG&E within seven days after the permit is approved.

PG&E will pay claims that qualify under this mitigation plan provided they are filed within 6 months of the project completion date.

The compensation days will be calculated from the first day that the airguns are fired, from ramp up to the conclusion of airgun use.

5. Should PG&E dispute any fisherman's claim to be eligible for this mitigation plan, the claim shall be resolved through an independent third party mediator to be identified and approved by PG&E and PSLCFA prior to commencement of the survey. The mediator will determine if a fisherman qualifies under the terms outlined in this document.

6. PG&E will place a bond in the sum of 8 million dollars in an account for potential long term damage that may result from the High Energy Seismic Survey. These funds if needed will be replenished as used until the scientific data indicates the resource has recovered to the pre survey condition with regard to the Catch Per Unit of Effort [CPUE] as monitored by SLOSEA (San Luis Obispo Science and Ecosystem Alliance).

The remainder of these funds will be released to PG&E when the data indicates the resource has recovered to pre survey conditions.

This bond account would be administered by the County of San Luis Obispo and the County will be reimbursed for any administrative costs the County incurs.

Reimbursements for long term lost fishing income will be determined by a process to be determined by PSLCFA, and County Board of Supervisors for the effected ports.

The California Coastal Commission will monitor this process for compliance and proper data collection and processing. They will be compensated out of the fund for any costs they incur in doing so.

7. PG&E shall be required to pay all professional fees incurred by the Fishermen's Association with regard to the review of this project.

8. PG&E shall produce a fishing industry specific claim form. The fishermen's association agrees to advise and help produce this claim form in concert with the County Board of Supervisors from both port supervisors districts.

9. This Mitigation Plan is available to all San Luis Obispo County Commercial Fishermen that qualify.

To:	Bruce Gibson/BOS/COSLO@Wings, Paul Teixeira/BOS/COSLO@Wings, James Patterson/BOS/COSLO@Wings, Frank Mecham/BOS/COSLO@Wings, Adam Hill/BOS/COSLO@Wings, Amy Gilman/BOS/COSLO@Wings, Hannah
Cc:	cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Bcc:	
Subject:	Fw: Scan Attached
From:	Bruce Gibson/BOS/COSLO - Wednesday 10/24/2012 11:45 AM
Sent by:	Cherie Aispuro/BOS/COSLO

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:45 AM -----

From:	brian stacy <bstacy166@yahoo.com>
To:	Adam Hill <ahill@co.slo.ca.us>
Cc:	bgibson@co.slo.ca.us, caispuro@co.slo.ca.us, abwilson@co.slo.ca.us
Date:	10/22/2012 04:04 PM
Subject:	Fw: Scan Attached

Dear sipervisors Hill And Gibson, here are the reffrenced "sign up sheets" I gave them out with the understanding that by filling them out it indicated you supported the "one size fits all" Mitigation Plan being proposed by myself as "MB Nearshore Rep." and PSLCFA at the time. MBCFO was represented by council and myself as Nearshore Representative was not a member at that time. I was later "adopted" by MBCFO but never gave them dues or indicated I wanted to be a member it was because of the "personnel information" sheets.
Thank You for conscidering Looking out for the fishermen of SLO County.
Brian Stacy PSLCFA

--- On **Thu, 3/1/12, Jeff <*Jeff@asapreprographics.com*>** wrote:

From: Jeff <Jeff@asapreprographics.com>
Subject: Scan Attached
To: bstacy166@yahoo.com
Date: Thursday, March 1, 2012, 11:01 AM

Thank you,

Jeff Beasley
Manager

ASAP Reprographics

Printing for Professionals, by Professionals

Item # 22 Meeting Date: 10/30/2012
Presented by: Brian Stacy
Received prior to meeting and posted to web on: October 25, 2012

495 Morro Bay Blvd

Morro Bay, Ca 93442

Phone: 805.772.3540

jeff@asapreprographics.com
www.asapreprographics.com

Documents scan 3-1-12.pdf

PERSONEL INFORMATION SHEET

LEGAL NAME: Joseph S. Abiera

ADDRESS:

PHONE/CELL

FISHING LICENSE #: L053220

BOAT LICENSE #:

BOAT NAME: Surf fisherman

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Joseph S. Abiera DATE: 12-20-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Fredrick Rene Italo Arnoldi

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L34590

BOAT LICENSE #: 34388

BOAT NAME: Rosalena Mia

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Fred Arnoldi DATE: 12, 9, 11

PERSONEL INFORMATION SHEET

LEGAL NAME: Travis Baker

ADDRESS:

PHONE/CELL

FISHING LICENSE #: L 53933

BOAT LICENSE #: F6 2014 1

BOAT NAME: Thunder Chicken

HOME PORT: Morro Bay CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/15/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Daniel E. Barker

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: 51405

BOAT LICENSE #: 286579

BOAT NAME: North Star.

HOME PORT: Morro Bay.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/15/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Henry Bernard

ADDRESS: ———

PHONE/CELL:

FISHING LICENSE #: L16246

BOAT LICENSE #: SurS

BOAT NAME: ———

HOME PORT: Avila Beach

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Henry Bernard DATE: 1-9-12

PERSONEL INFORMATION SHEET

LEGAL NAME: William Edward Cereghino

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L 77123

BOAT LICENSE #: FG04949 , CF3804SJ

BOAT NAME: Susie P

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 1/6/12

PERSONEL INFORMATION SHEET

LEGAL NAME: William Edward Cereghino

ADDRESS: [redacted]

PHONE/CELL: (

FISHING LICENSE #: L77123

BOAT LICENSE #: FG40887 CF4874KC

BOAT NAME: Lost Wages

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 1/6/12

PERSONEL INFORMATION SHEET

LEGAL NAME: CINDY KAY CULLEN

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L 75430 LIC # D0000 83708-3
NEARSHORE + TRAP ENDORSED

BOAT LICENSE #: F6 43734 LIC # D000 8370727

BOAT NAME: DORADO II

HOME PORT: MORRO BAY SLIP # 19

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1/6/12

PERSONEL INFORMATION SHEET

LEGAL NAME:	ROGER P. CULLEN
ADDRESS:	
PHONE/CELL:	
FISHING LICENSE #: NEARSHORE TRAP ENDORSMENT	L 75431 LIC # D0008-37073-8
BOAT LICENSE #:	FG 07328 LIC # D0000 837 080-6
BOAT NAME:	DORADO FG 07328
HOME PORT:	MORRO BAY SLIP # 17

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Roger Cullen DATE: 11/4/12

PERSONEL INFORMATION SHEET

LEGAL NAME: James Dunn

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L49460

BOAT LICENSE #: 05394

BOAT NAME: Foa Dog

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-14-11

PERSONEL INFORMATION SHEET

LEGAL NAME: RANDALL EATON

ADDRESS:

PHONE/CELL:

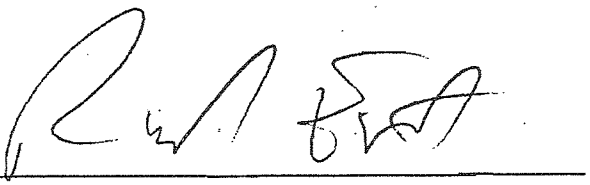
FISHING LICENSE #: L 23020

BOAT LICENSE #: 46428

BOAT NAME: CURLY

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: 

DATE: 2-19-12

PERSONEL INFORMATION SHEET

LEGAL NAME: LEONARD EWING

ADDRESS:

PHONE/CELL

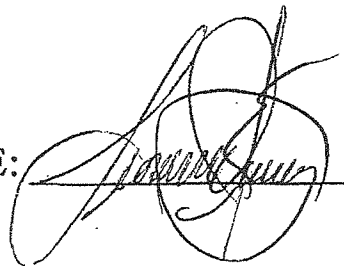
FISHING LICENSE #: 12252

BOAT LICENSE #: 0471 SR

BOAT NAME: EMERALEE

HOME PORT: MORRO BAY CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: 

DATE: 1-14-12

PERSONEL INFORMATION SHEET

LEGAL NAME: JACK HANSEN

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L07210

BOAT LICENSE #: 12451

BOAT NAME: DARLENE

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Jack Hansen DATE: 12-15-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Fred E Harpster Jr

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L92002

BOAT LICENSE #: F/G 39545 CF 1038 HY

BOAT NAME: Fortuna

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Fred Harpster Jr DATE: 12-30-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Timothy F. Horwer

ADDRESS: [redacted]

PHONE/CELL: [redacted]

FISHING LICENSE #: L 71826

BOAT LICENSE #: 03776

BOAT NAME: High Expectations

HOME PORT: Morro Bay / Avila

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 1-1-2012

PERSONEL INFORMATION SHEET

LEGAL NAME: MANUEL JAVIER

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L31469

BOAT LICENSE #: SURFPERCH

BOAT NAME: SURFPERCH

HOME PORT: AVILA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 1-10-12

PERSONEL INFORMATION SHEET

LEGAL NAME:	RANDY KANN
ADDRESS:	
PHONE/CELL	
FISHING LICENSE #:	L18906
BOAT LICENSE #:	4416S
BOAT NAME:	PENNY CHASER
HOME PORT:	M 13

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/11/11

PERSONEL INFORMATION SHEET

LEGAL NAME: LEAGE BRADLEY W.

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L 006921

BOAT LICENSE #: 22804

BOAT NAME: PRINCESS

HOME PORT: MORRO BAY Ca

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Brad League DATE: 1-13-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Steven Loiseau

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: SL 71032

BOAT LICENSE #: 07376

BOAT NAME: Fast Eddie

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Steven Loiseau DATE: 12/7/2011

OPEN ACCESS

PERSONEL INFORMATION SHEET

LEGAL NAME:	Steve McGill
ADDRESS:	
PHONE/CELL:	
FISHING LICENSE #:	L 54278
BOAT LICENSE #:	FG 20129
BOAT NAME:	4 BAJA
HOME PORT:	Morro Bay, CA 93442

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1-11-12

PERSONEL INFORMATION SHEET

LEGAL NAME: EDWIN J. MILLIGAN

ADDRESS: [redacted]

PHONE/CELL:

FISHING LICENSE #: 48373

BOAT LICENSE #: 40358

BOAT NAME: HOT TRIVALLY

HOME PORT: MORRO BAY CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Ed J Alff DATE: 12-09-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Harold Morris

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L 47037

BOAT LICENSE #: F6 07066

BOAT NAME: Plan B

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: _____

PERSONEL INFORMATION SHEET

LEGAL NAME: Kenneth Nakazawa

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: 53060

BOAT LICENSE #: 07367

BOAT NAME: Arima

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/22/11

PERSONEL INFORMATION SHEET

LEGAL NAME: CRAIG R. NELSON

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L60895

BOAT LICENSE #: FG 70428

BOAT NAME: TRAPPER

HOME PORT: MORRO BAY, CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Craig R Nelson DATE: 12/29/11

PERSONEL INFORMATION SHEET

LEGAL NAME:	JOSEPH NUNGARAY
ADDRESS:	
PHONE/CELI	
FISHING LICENSE #:	L 15033
BOAT LICENSE #:	03394
BOAT NAME:	MICHAEL TOO
HOME PORT:	MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Joseph Nungaray DATE: 12-10-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Jerald M Patchen

ADDRESS:

PHONE/CE

FISHING LICENSE #: L77180

BOAT LICENSE #: 54915

BOAT NAME: KAPS

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Jm Patchen DATE: 12/19/11

PERSONEL INFORMATION SHEET

LEGAL NAME: STEVE PSCHAIDA

ADDRESS:

PHONE/CEI

FISHING LICENSE #: (L16798) D00007862104

BOAT LICENSE #: (14384) D0000 801520-6

BOAT NAME: IRENE M

HOME PORT: SAN DIEGO

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Steve Pschaida DATE: 12-9-11

OPEN

PERSONEL INFORMATION SHEET

LEGAL NAME: GEORGE REES

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L27656

BOAT LICENSE #: FG70371 / CF 8859 TA

BOAT NAME: OVERTIME

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1/5/12

PERSONEL INFORMATION SHEET

LEGAL NAME: Raymond P. Richardson

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: 21558

BOAT LICENSE #: 37371

BOAT NAME: Raggamaffin

HOME PORT: ~~[redacted]~~ Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 2/2/12

PERSONEL INFORMATION SHEET

LEGAL NAME: ADAM RILEY

ADDRESS:

PHONE/CEl

FISHING LICENSE #: L10982

BOAT LICENSE #: 25629

BOAT NAME: LADY MAXINE

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Adam Riley DATE: 1-5-12

PERSONEL INFORMATION SHEET

LEGAL NAME: EDWARD E. RIVERS

ADDRESS:

PHONE/CEL

FISHING LICENSE #: 206759 - 30019

BOAT LICENSE #: SURF Fisherman

BOAT NAME: PERCH RAIDER (Perch Fisherman)

HOME PORT: AVILA (602)

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Ed Rivers DATE: 12/20/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Garrett Rose

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: 53864

BOAT LICENSE #: [redacted] 39579

BOAT NAME: Taurus

HOME PORT: Morro Bay, Ca.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 1/12/12

PERSONEL INFORMATION SHEET

LEGAL NAME: PAUL E. SCHUYLER

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L 44737

BOAT LICENSE #: FG 43841

BOAT NAME: FLYER

HOME PORT: MORRO BAY, CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-9-11

HAG FISH
OPEN ACCESS

PERSONEL INFORMATION SHEET

LEGAL NAME:	Jonathan A. Smith
ADDRESS:	
PHONE/CELI	
FISHING LICENSE #:	L 30949
BOAT LICENSE #:	20207
BOAT NAME:	Pt. Estero
HOME PORT:	M B

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1·12·17

PERSONEL INFORMATION SHEET

LEGAL NAME: Edward J Sylvester

ADDRESS:

PHONE/

FISHING LICENSE #: L 19031

BOAT LICENSE #: 5581

BOAT NAME: Little Joe

HOME PORT: Avila CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Edward J Sylvester DATE: 12-9-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Richard J. Sylvester

ADDRESS:

PHONE/CE

FISHING LICENSE #: L-22933

BOAT LICENSE #: 8793

BOAT NAME: Trudy "5"

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Richard Sylvester DATE: 12-9-11

PERSONEL INFORMATION SHEET

LEGAL NAME: NEAL E. TOBIN

ADDRESS:

PHONE/CELI

FISHING LICENSE #: L 25852

BOAT LICENSE #: 03758

BOAT NAME: PLEASURE

HOME PORT: MORRO BAY, CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Neal Tobin DATE: 12-20-12

PERSONEL INFORMATION SHEET

LEGAL NAME: Kirk E. waddell

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L 75491

BOAT LICENSE #: 70320

BOAT NAME: Nora Rose

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Kirk E Waddell DATE: 12/15/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Forest Whiteside

ADDRESS:

PHONE/CE

FISHING LICENSE #: L06790

BOAT LICENSE #:

BOAT NAME: Surf fisherman

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Forest Whiteside DATE: 12/20/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Ryan Tony Wells

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L92276

BOAT LICENSE #: FG20888

BOAT NAME: Estelle Marie

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Ryan Wells DATE: 12/14/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Brian F Williamson

ADDRESS:

PHONE/CEI

FISHING LICENSE #: 36722

BOAT LICENSE #: (39066 Sandy B)
(36761) R.T. Marie

BOAT NAME: Sandy B - R.T. Marie

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Brian Williamson DATE: 12-17-11

To: Bruce Gibson/BOS/COSLO@Wings, Paul Teixeira/BOS/COSLO@Wings, James Patterson/BOS/COSLO@Wings, Frank Mecham/BOS/COSLO@Wings, Adam Hill/BOS/COSLO@Wings, Amy Gilman/BOS/COSLO@Wings, Hannah

Cc: cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,

Bcc:

Subject: Fw: Not all sign ups were in that scan

From: Bruce Gibson/BOS/COSLO - Wednesday 10/24/2012 11:46 AM

Sent by: Cherie Aispuro/BOS/COSLO

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:45 AM -----

From: brian stacy <bstacy166@yahoo.com>
To: Adam Hill <ahill@co.slo.ca.us>
Cc: bgibson@co.slo.ca.us, abwilson@co.slo.ca.us, caispuro@co.slo.ca.us
Date: 10/22/2012 04:14 PM
Subject: Not all sign ups were in that scan

I also have other sign up sheets from MB fishermen that were turned in since I had ASAP do that pdf file. I do not have a pdf convertor, let me know if you need them or a exact count? Not all fishermen in there will quallify. I provided them to John Shoals in March at his request. PSL has a folder as well let me know if you want it I assume you know we have full support of our members they voted 99% in favor of one size fits all with 1 no vote by a high production fisherman.

Item # 22 Meeting Date: 10/30/2012

Presented by: Brian Stacy

Received prior to meeting and posted to web on: October 25 , 2012

To: Bruce Gibson/BOS/COSLO@Wings, Paul Teixeira/BOS/COSLO@Wings, James Patterson/BOS/COSLO@Wings, Frank Mecham/BOS/COSLO@Wings, Adam Hill/BOS/COSLO@Wings, Amy Gilman/BOS/COSLO@Wings, Hannah cr_board_clerk Clerk Recorder/ClerkRec/COSLO@Wings,
Cc:
Bcc:
Subject: Fw: commercial fishers info
From: Bruce Gibson/BOS/COSLO - Wednesday 10/24/2012 11:46 AM
Sent by: Cherie Aispuro/BOS/COSLO

----- Forwarded by Cherie Aispuro/BOS/COSLO on 10/24/2012 11:46 AM -----

From: brian stacy <bstacy166@yahoo.com>
To: Adam Hill <ahill@co.slo.ca.us>
Cc: bgibson@co.slo.ca.us, caispuro@co.slo.ca.us, abwilson@co.slo.ca.us
Date: 10/22/2012 07:34 PM
Subject: Fwd: commercial fishers info

Dear Bruce and Adam, Here are the Sign up sheets from PSLCFA,There are several Morro Bay Fishermen In with Our personnel info sheets at PSLCFA several Joined down there following my lead, and after I explained the difference between "voteing members" like PSLCFA and "non-voteing members" Like MBCFO and "director based" decision makeing vs "member based" decision makeing like PSLCFA as far as 501C3s go.

So those are intermingled with ours and some members Of Pslcfa and some are not. If they are from north of SLO they are definately fishing out of Morro Bay along with a few from SLO. Probably not as important as the overall number that signed up from both ports to support the call for Level mitigation for the truely impacted Fishermen.

I have some other paper copies I would need to pull them out of the folder that created the PDF. If you need a accurate count let me know I believe It was around 110 but many will not quallify due to criteria outlined in the plan we felt there would be between 80 and 100 overall for the county. Those that do not quallify will ve givin the oppertunity under our plan to have their case reviewed by a mediator. I hope this is helpfull. Brian

Fisherman_Info_02-29-2012-1.pdf

Item # 22 Meeting Date: 10/30/2012
Presented by: Brian Stacy
Received prior to meeting and posted to web on: October 25 , 2012

PERSONEL INFORMATION SHEET

LEGAL NAME: Joseph S. Abiera

ADDRESS

PHONE/CI

FISHING LICENSE #: L53220

BOAT LICENSE #: Surf

BOAT NAME:

HOME PORT: Avila - Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Joseph S. Abiera DATE: 12-27-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Aaron Appel

ADDRESS

PHONE/CI

FISHING LICENSE #: L12648

BOAT LICENSE #: 46917

BOAT NAME: Klamath

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Aaron Appel DATE: 12-4-11

PERSONEL INFORMATION SHEET

LEGAL NAME: William R Barrow

ADDRESS:

PHONE/CEL

FISHING LICENSE #: 33734

BOAT LICENSE #: 30284 26970

BOAT NAME: 2- Foxy Patience II

HOME PORT: Port Sulphur Port Sulphur

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1-11-12

PERSONEL INFORMATION SHEET

LEGAL NAME: JOHN BECKHAM

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L 10650

BOAT LICENSE #: FG 539 29

BOAT NAME: NO NAME

HOME PORT: PORT SANDS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: John Beckham DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: HENRY BERNARD

ADDRESS:

PHONE/CE

FISHING LICENSE #: L16246

BOAT LICENSE #: —

BOAT NAME: SURF

HOME PORT: AVILA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Henry Bernard DATE: 12-15-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Christopher L. Buccat

ADDRESS:

PHONE/CE

FISHING LICENSE #: L47256

BOAT LICENSE #: FG7053

BOAT NAME: Hook up

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: EUGENE / GENE BLANCHARD

ADDRESS:

PHONE/CE

FISHING LICENSE #: L18082

BOAT LICENSE #: 06680

BOAT NAME: DREAM CATCHER

HOME PORT: PORT SAN LUIS / AVILA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Eugene Blanchard DATE: 12-08-2011

PERSONEL INFORMATION SHEET

LEGAL NAME: DREW LINDSEY BRANDY

ADDRESS:

PHONE/CE

FISHING LICENSE #: L078873

BOAT LICENSE #: FG 06190

BOAT NAME: ANSWERED PRAYER

HOME PORT: PORT SAN LUIS.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Drew L Brandy DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Joseph Campopiano

ADDRESS:

PHONE/CE

FISHING LICENSE #: L 58309

BOAT LICENSE #: 49197

BOAT NAME: Island Hopper

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-5-2011

PERSONEL INFORMATION SHEET

LEGAL NAME:	THOMAS CAPEN
ADDRESS:	
PHONE/CEI	
FISHING LICENSE #:	L 16718
BOAT LICENSE #:	33180
BOAT NAME:	ELEANOR MARIE
HOME PORT:	PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: THOMAS CAPEN

ADDRESS:

PHONE/CELI

FISHING LICENSE #: L 16718

BOAT LICENSE #: 39922

BOAT NAME: "SKY"

HOME PORT: PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Barbara Jane Carter

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L028198

BOAT LICENSE #: Happy Hoochie # 02156
Double-Up # 70326

BOAT NAME: same as above

HOME PORT: Port San Luis, Avila, CA 93424

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Barbara Jane Carter DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Antony Louis Clarke

ADDRESS

PHONE/C

FISHING LICENSE #: 02733

BOAT LICENSE #: 60705

BOAT NAME: None

HOME PORT: Morro Bay CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Antony Louis Clarke DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: CARL M. CODORNIZ (MARTY)

ADDRESS:

PHONE/CE

FISHING LICENSE #: L 92877

BOAT LICENSE #: FG 70532

BOAT NAME: REEL JOB

HOME PORT: PORT SAN LUIS / AVILA BEACH

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: CARLOS CODORNIZ

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L15470

BOAT LICENSE #: 07472

BOAT NAME: F/V DORIS

HOME PORT: PORT SAN LUIS, PIER #3, AVILA BEACH, CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Carlos Codorniz DATE: 12-01-2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Michael Cohen

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L34186

BOAT LICENSE #: G05132

BOAT NAME: Linda Jean

HOME PORT: Avila Beach

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: John David Costello

ADDRESS

PHONE/CELL:

FISHING LICENSE #: L39663

BOAT LICENSE #:

BOAT NAME:

HOME PORT:

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 11/30/11

PERSONEL INFORMATION SHEET

LEGAL NAME: John M Costello

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L078876

BOAT LICENSE #: FG 46530 Salmon Permit Shallow Nearshore Deeper Nearshore Slope / Shelf / Blackcod

BOAT NAME: TAurus

HOME PORT: Avila

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: _____

PERSONEL INFORMATION SHEET

LEGAL NAME:	Robert M. Cruce
ADDRESS:	
PHONE/CE	
FISHING LICENSE #:	L49779
BOAT LICENSE #:	48787
BOAT NAME:	"Criva"
HOME PORT:	Morro Bay, Ca

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Robert M Cruce DATE: 12-5-19

PERSONEL INFORMATION SHEET

LEGAL NAME: PETER ALAN GRIFFIN

ADDRESS

PHONE/CE

FISHING LICENSE #: 10350

BOAT LICENSE #: 41340 F/V ELLIE'S WAY
52722 F/V NYLISA

BOAT NAME: (S) ELLIE'S WAY - NEARSHORE, LOBSTER, GEN. TRAP.
NYLISA - SALMON, CRAB, TUNA, ECT.

HOME PORT: MORRO BAY, CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Pete Griffin DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME:	James Gritzfeld
ADDRESS:	
PHONE/CE	
FISHING LICENSE #:	L02673
BOAT LICENSE #:	23389
BOAT NAME:	Rose Lynn
HOME PORT:	Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Guy Grondmeier

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L65507

BOAT LICENSE #: FG 20223

BOAT NAME: JC's Sea

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Guy Grondmeier DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Terry Len Gunnerman.

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L337194

BOAT LICENSE #: 06660

BOAT NAME: No Name

HOME PORT: Ajijic

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Terry Gunnerman DATE: 12-4-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Terry Wayne Gummerman

ADDRESS

PHONE/C

FISHING LICENSE #: L33715

BOAT LICENSE #: 42692

BOAT NAME: No Name

HOME PORT: Avila

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Terry Gummerman DATE: 12-4-11

PERSONEL INFORMATION SHEET

LEGAL NAME: William G. James.

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L 21116

BOAT LICENSE #:

BOAT NAME:

HOME PORT: Utica .

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: William G James DATE: JAN 19, 2011

PERSONEL INFORMATION SHEET

LEGAL NAME: MANUEL JAVIER JR

FISHING LICENSE #: L31469

BOAT LICENSE #: SDRF

BOAT NAME: SDRF

HOME PORT: BUIG

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 12-23-11

PERSONEL INFORMATION SHEET

LEGAL NAME: JERRY JAMES

ADDRESS:

PHONE/CE

FISHING LICENSE #: 074355

BOAT LICENSE #: 53936

BOAT NAME: MOLLY-O

HOME PORT: PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-6-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Charles E. Kennedy

ADDRESS:

PHONE/CE

FISHING LICENSE #: FG-37558

BOAT LICENSE #: F.H. 947981

BOAT NAME: Twilight Lady

HOME PORT: Los Osos (Morro Bay)

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Charles E Kennedy DATE: 12-5-2011

PERSONEL INFORMATION SHEET

LEGAL NAME: DAVID KIRK

ADDRESS:

PHONE/CE

FISHING LICENSE #: L31072

BOAT LICENSE #: 27749

BOAT NAME: SUNSHINE LADY

HOME PORT: PSL

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-4-11

PERSONEL INFORMATION SHEET

LEGAL NAME: HENRY LARA

ADDRESS:

PHONE/CE

FISHING LICENSE #: 074626

BOAT LICENSE #: 06207

BOAT NAME: C-BASS II

HOME PORT: Port SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Michele Leary

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L78104

BOAT LICENSE #: 07022

BOAT NAME: Rita G

HOME PORT: Marco Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: _____

PERSONEL INFORMATION SHEET

LEGAL NAME: Michael Limon

ADDRESS

PHONE/CE

FISHING LICENSE #: L45940

BOAT LICENSE #: Docd # 551478 Ice 22728

BOAT NAME: XIPHIAS

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/4/1

PERSONEL INFORMATION SHEET

LEGAL NAME: Robert Linder

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L13406

BOAT LICENSE #: FG70398

BOAT NAME: Loco

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Robert Li DATE: 12/5/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: MICHAEL LEE LOGAN

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L017086

BOAT LICENSE #: N/A

BOAT NAME: N/A

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-05-16

PERSONEL INFORMATION SHEET

LEGAL NAME: MONTY LEE LOGAN

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L017052

BOAT LICENSE #: ~~FL [illegible]~~ FG 46529

BOAT NAME: LOGO

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature]

DATE: 9/12-06-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Joseph Walter Loiseau

ADDRESS:

PHONE/CE

FISHING LICENSE #: L 23146

BOAT LICENSE #: 07376

BOAT NAME: Fast Eddie

HOME PORT: Morro Bay C.A.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Joseph W. Loiseau DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Hugh James McCaffrey

ADDRESS:

PHONE/CE

FISHING LICENSE #: L93022

BOAT LICENSE #: FG 7054O

BOAT NAME: Reel a Lure

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: H McCaff DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: RICHARD BURT MCNUTT

ADDRESS

PHONE/CELL

FISHING LICENSE #: 419164

BOAT LICENSE #: 20223 - 18825 —
~~20~~ 0492

BOAT NAME:

HOME PORT: AVILA BEACH

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: [illegible]

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L 73899

BOAT LICENSE #: F6 38690

BOAT NAME: Dads Fincutter

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: MOCKLER WOLFGANG JUERGEN

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L 68689

BOAT LICENSE #: 40017

BOAT NAME: SEA WOLF

HOME PORT: PORT SAN LUIS OBISPO, CA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: W Mockler DATE: 12/3/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: THOMAS L. MOORE

ADDRESS:

PHONE/CE

FISHING LICENSE #: # 12871 SURF PERCH FISHMAN

BOAT LICENSE #:

BOAT NAME:

HOME PORT:

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Thomas L Moore DATE: 12-23-11

PERSONEL INFORMATION SHEET

LEGAL NAME: ANTHONY MAY

ADDRES

PHONE/C

FISHING LICENSE #: L53732

BOAT LICENSE #: FG 70492

BOAT NAME: BAY Runner

HOME PORT: AVILA Beach, PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Tony May DATE: 12/3/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Peter Stephen Nelson

ADDRESS:

PHONE/CE

FISHING LICENSE #: L 07251

BOAT LICENSE #: FF 07386

BOAT NAME: JUK FUD

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Pete Nelson DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: PAUL PETERSEN

ADDRESS:

PHONE/CE

FISHING LICENSE #: 12943

BOAT LICENSE #: 52731

BOAT NAME: LITTLE DEBBE

HOME PORT: SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Paul Petersen DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: Archie Ponds

ADDRESS:

PHONE/CE

FISHING LICENSE #: L00 5749

BOAT LICENSE #: F+G 06905

BOAT NAME: Big Easy

HOME PORT: PSL

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1-15-12

PERSONEL INFORMATION SHEET

LEGAL NAME: FORREST ARCHIE PONDS

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L029941

BOAT LICENSE #: F&G 18825

BOAT NAME: EASY LIMIT

HOME PORT: PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Forrest A Ponds DATE: 1-15-12

PERSONEL INFORMATION SHEET

LEGAL NAME:	Edward Powers
ADDRESS:	
PHONE/CE	
FISHING LICENSE #:	LO 6760
BOAT LICENSE #:	FL0576 3
BOAT NAME:	K B
HOME PORT:	PSL

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: RICK REHFER

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L-11173

BOAT LICENSE #: 46422

BOAT NAME: WHITEWATER

HOME PORT: PORT SAN LUIS - AVILA

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 1/5/12

PERSONEL INFORMATION SHEET

LEGAL NAME: EDWARD E. RIVERS (ED RIVERS)

ADDRESS

PHONE/CELL:

FISHING LICENSE #: L06759-30019

BOAT LICENSE #: SURF

BOAT NAME: PERCH RAIDER

HOME PORT: AVILA BEACH (#602)

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Ed Rivers DATE: 12/15/11

PERSONEL INFORMATION SHEET

LEGAL NAME:	GERALD J. SATO
ADDRESS:	
PHONE/CELL	
FISHING LICENSE #:	OC 5787
BOAT LICENSE #:	41604
BOAT NAME:	SUPER SKIFF
HOME PORT:	PSL

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Gerald J. Sato DATE: 12.5.11

PERSONEL INFORMATION SHEET

LEGAL NAME: Richard Scavgarello

ADDRESS:

PHONE/CELL:

FISHING LICENSE #: L92802

BOAT LICENSE #: 922

BOAT NAME: AQUILA

HOME PORT: Port San Luis, CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 12/4/2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Tyler Schroeder

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L 54813

BOAT LICENSE #: 416530

BOAT NAME: Taurus CDHO

HOME PORT: Avila

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/2/2011

PERSONEL INFORMATION SHEET

LEGAL NAME:	JOHN ALLEN SCHUMANN JR
ADDRESS:	
PHONE/CE	
FISHING LICENSE #:	L91958
BOAT LICENSE #:	70223 - 18825 - GO5132
BOAT NAME:	
HOME PORT:	PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: ALAN SERIO

ADDRESS:

PHONE/CEI

FISHING LICENSE #: #21035

BOAT LICENSE #: #35970

BOAT NAME: SEA RAVEN

HOME PORT: PORT SAN LOUIS -

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 2/14/12

PERSONEL INFORMATION SHEET

LEGAL NAME: Steve Snyder

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L03230

BOAT LICENSE #: 01784

BOAT NAME: SATURNIA

HOME PORT: 805-489-6664

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Steve Snyder DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Brian Stacy

ADDRESS:

PHONE/CEI

FISHING LICENSE #: L24114

BOAT LICENSE #: 18407

BOAT NAME: Marsa

HOME PORT: Morro Bay

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Brian Stacy DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Edward L. Tamsi

ADDRES

PHONE/C

FISHING LICENSE #: L 54328

BOAT LICENSE #: PENDING!!

BOAT NAME: PENDING

HOME PORT: PORT SAN Luis - Avila Beach, CA.

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: Dec. 5, 2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Benjamin Terra

ADDRES:

PHONE/C

FISHING LICENSE #: L58348

BOAT LICENSE #: 05407

BOAT NAME: EL ZAPO

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Ben Terra DATE: 12/5/11

PERSONEL INFORMATION SHEET

LEGAL NAME: HUGH L. THOMAS

ADDRESS:

PHONE/CEL

FISHING LICENSE #: L 29755

BOAT LICENSE #: BEING REPLACED AT THIS TIME

BOAT NAME: NO NAME

HOME PORT: PT. SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Hugh L Thomas DATE: Dec 1, 2011

PERSONEL INFORMATION SHEET

LEGAL NAME: Dorothy Torres

ADDRESS

PHONE/CI

FISHING LICENSE #: L53001

BOAT LICENSE #: 42692

BOAT NAME: No Name

HOME PORT: Avila

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: Dorothy Torres DATE: 12-5-11

PERSONEL INFORMATION SHEET

LEGAL NAME: Jerald Todd Vido

ADDRES

PHONE/(

FISHING LICENSE #: L92610

BOAT LICENSE #: F6 70490

BOAT NAME: Little Thunder

HOME PORT: Avila / Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-1-11

PERSONEL INFORMATION SHEET

LEGAL NAME: WILLIAM THOMAS WARD

ADDRESS:

~~PHONE~~/CEL

FISHING LICENSE #: L 18171

BOAT LICENSE #: 19692

BOAT NAME: DANCIN BEAR

HOME PORT: PORT SAN LUIS

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: W. T. Ward DATE: 2-22-12

PERSONEL INFORMATION SHEET

LEGAL NAME: DONALD HELBORG

ADDRESS

PHONE/C

FISHING LICENSE #: 10951

BOAT LICENSE #: 08482

BOAT NAME: LINDA J

HOME PORT: MORRO BAY

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: [signature] DATE: 12/5/11

PERSONAL INFORMATION SHEET

LEGAL NAME: Jerry Willett

ADDRES

PHONE/C

FISHING LICENSE #: L 20651

BOAT LICENSE #: 04569

BOAT NAME: Emmy Loo

HOME PORT: Port San Luis

BY SIGNING BELOW, I AM VERIFING THAT THE ABOVE INFORMATION IS TRUE AND CORRECT

SIGNATURE: _____ DATE: 12-1-11

Fw: Testing in he Ocean

Board of Supervisors to: BOS_Legislative Assistants 10/24/2012 02:08 PM
Sent by: Amber Wilson
Cc: cr_board_clerk Clerk Recorder

----- Forwarded by Amber Wilson/BOS/COSLO on 10/24/2012 02:08 PM -----

From: Ybi Van Ekeren <ybiart@att.net>
To: Board of Supervisors <boardofsups@co.slo.ca.us>
Date: 10/24/2012 01:45 PM
Subject: Testing in he Ocean

To the Board of Supervisors

I wrote something for you to consider at the next meeting
Last Sunday Oct. 21 at about 12 P.M. I felt the ground move. The next day I heard about the 5.3 earthquake north of Paso Robles near King city. The same earthquake was also felt in the Diablo Power plant. We all know that we are sitting on a fault that is moving and nobody can predict when and how big the next quake will be. We do not need any study for that.

We already know the outcome of the study because the shareholders of P.G.& E want to continue to keep that plant open. We have seen what happened in Japan and what could happen here it there is an earthquake big enough to damage the power plant. Why not use all that money to put windmills near the Ocean instead of storing radioactive material there. Since the customers have to pay for it, they should be the ones that decide if they want to pay for this test.

It there is an earthquake, the shareholders only loose their money, but we will loose our land, our homes and our livelihood and maybe our lives as well.

If something goes wrong and thousands of fish and sea creatures die, the damage can not be undone and all the fish will come ashore and smell up our beaches, making the coastline a mess and killing not only the fishing industry but also tourism along the coastline.

Please speak up for the people that elected you and trusted you to represent them. We do not want this testing and would rather spend our money for green energy and keep our fishing industry alive.

Ybi Van Ekeren
731 B Santa Ysabel
Los isos Ca. 93402

Item # 22 Meeting Date: 10/30/2012
Presented by: Ybi Van Ekeren
Received prior to meeting and posted to web on: October 25 , 2012

Fw: Surfrider Foundation's letter to CCC re: PG&E Seismic Study

Dan Buckshi to: cr_board_clerk Clerk Recorder 10/25/2012 06:55 AM
Cc: Kristi Gutierrez

----- Forwarded by Dan Buckshi/Admin/COSLO on 10/25/2012 06:54 AM -----

From:	Brad Snook <snookbw@yahoo.com>
To:	dbuckshi@co.slo.ca.us, jpatterson@co.slo.ca.us, fmecham@co.slo.ca.us, Bruce Gibson <bgibson@co.slo.ca.us>, Supervisor Teixeira <pteixeira@co.slo.ca.us>, jwhite@co.slo.ca.us
Cc:	Stefanie Sekich <ssekich@surfrider.org>, SLO Surfrider Chair <chair@slo.surfrider.org>
Date:	10/24/2012 08:27 PM
Subject:	Surfrider Foundation's letter to CCC re: PG&E Seismic Study

Dear Chairman Patterson, Honorable Supervisors, and Chairman Guerena,

Please consider Surfrider Foundation's *Opposition to Pacific Gas and Electic Seismic Study* (attached) for your meeting on October 30th. This document was recently submitted to the California Coastal Commission in preparation for their November meeting and it more fully descibes Surfrider's concerns -- beyond recreational impacts, which were submitted to Mr. Buckshi last week.

Kind regards,
Brad Snook
Chair, Surfrider SLO
(805) 440-9489

CCC seismic ltrFINAL .pdf

Item # 22 Meeting Date: 10/30/2012
Presented by: Brad Snook
Received prior to meeting and posted to web on: October 25, 2012

SURFRIDER
FOUNDATION

October 24, 2012

Mary Shallenberger, Chair
California Coastal Commission
45 Fremont Street Suite 2000
San Francisco, CA 94105

RE: Opposition to Pacific Gas & Electric Seismic Survey: Consistency Certification and Coastal Development Permit (E-12-005 and CC-027-12).

Dear Chair Shallenberger and Honorable Commissioners,

On behalf of the Surfrider Foundation and the San Luis Obispo Chapter of the Surfrider Foundation (Surfrider), thank you for the opportunity to submit comments regarding Pacific Gas and Electric's (PG&E) proposal ("Project") to conduct seismic testing near the Diablo Canyon Power Plant (DCPP). Surfrider has identified significant impacts within PG&E's Final Environmental Impact Report (FEIR) and we have acquired outside information that leads us to highly question the value of the Project. While PG&E recently modified implementation of the Project (segmenting testing over the course of a few years) we are still bothered by the enormous impacts testing will have on marine life and ocean users. We urge you to carefully consider the below concerns and ***deny both the Consistency Certification and the Coastal Development Permit.***

Recreational Impacts:

Surfrider's concerns about impacts to ocean users began when we first read the Draft Environmental Impact Report (DEIR). In May 2012, we submitted comments to California State Lands Commission (CSLC) and PG&E highlighting our concerns about recreational impacts. We pointed out measures were only being taken to protect divers in the area, but the DEIR did not consider potential impacts to surfers, swimmers and other ocean users. In Volume I of the FEIR, PG&E responded *directly to Surfrider's* concerns, with the below statement:

> "In response to this and other related comments...MM LU-1 has been revised to include noticing beaches and local dive shops ***regarding offshore areas closed to diving, surfing, and swimming.***"[1]

Based on this statement, it seems clear that diving, surfing, and swimming will not be allowed within Project zone. However, in the FEIR, PG&E only addresses the prohibition of diving and is *clearly disregarding the safety of other ocean users* and is *obviously presenting contradictory information.*

[1]http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/FEIR_Comments/FEIR_RTCs_NGOs_(13of14)_Surfrider.pdf

Surfrider would like to highlight statements from PG&E's FEIR that clearly **acknowledge impacts to ocean users:**

> "The proposed offshore activities *would* expose persons present in the water to harmful noise levels..."
>
> "Studies have shown that high levels of underwater noise can cause dizziness, hearing damage, or other sensitive organ damage to divers and swimmers, as well as indirect injury due to startle responses"
>
> "Noise levels in excess of 154 dB re 1 µPa could be considered potentially harmful to recreational divers *and swimmers* in the Project area".
>
> "The potential exists that noise levels in water due to Project activities could be harmful to humans who ignore the notices and enter water in close proximity to the air guns while being *deployed within the an active survey area" (emphasis added).* [2]

Yet within the same section of the FEIR, PG&E makes this contradictory declaration:

> "Therefore, potentially harmful noise levels from the air guns would not be expected to affect swimmers and surfers because there would be a substantial distance between them and the noise source. In addition, they would not be fully submerged. Based on the above, the potential impacts to swimmers and surfers from seismic survey noise are Less than Significant". [3]

Despite the contradictory statements, it's clear the Project will expose ocean users to harmful seismic testing impacts.

Determining Impacts to Ocean Users

From the beginning of Surfrider's investigation into the impacts of seismic testing on recreationalists, we have struggled to find detailed information contained within PG&E's FEIR. For example, Surfrider kept asking the following questions:

> 1.) How close will the vessel/air guns be to shore?
> 2.) What would be the instantaneous decibel (dB) exposure levels be to nearshore environments?

The below charts and maps (which *finally* answer the above questions) were <u>not</u> originally contained in the FEIR. Surfrider contacted Coastal Commission Staff asking for clarification; and in order to answer our questions, Coastal Commission Staff had to request additional information from PG&E.

It's important to reiterate the PG&E affirms 154 dB "could be harmful to swimmers and divers" [4].

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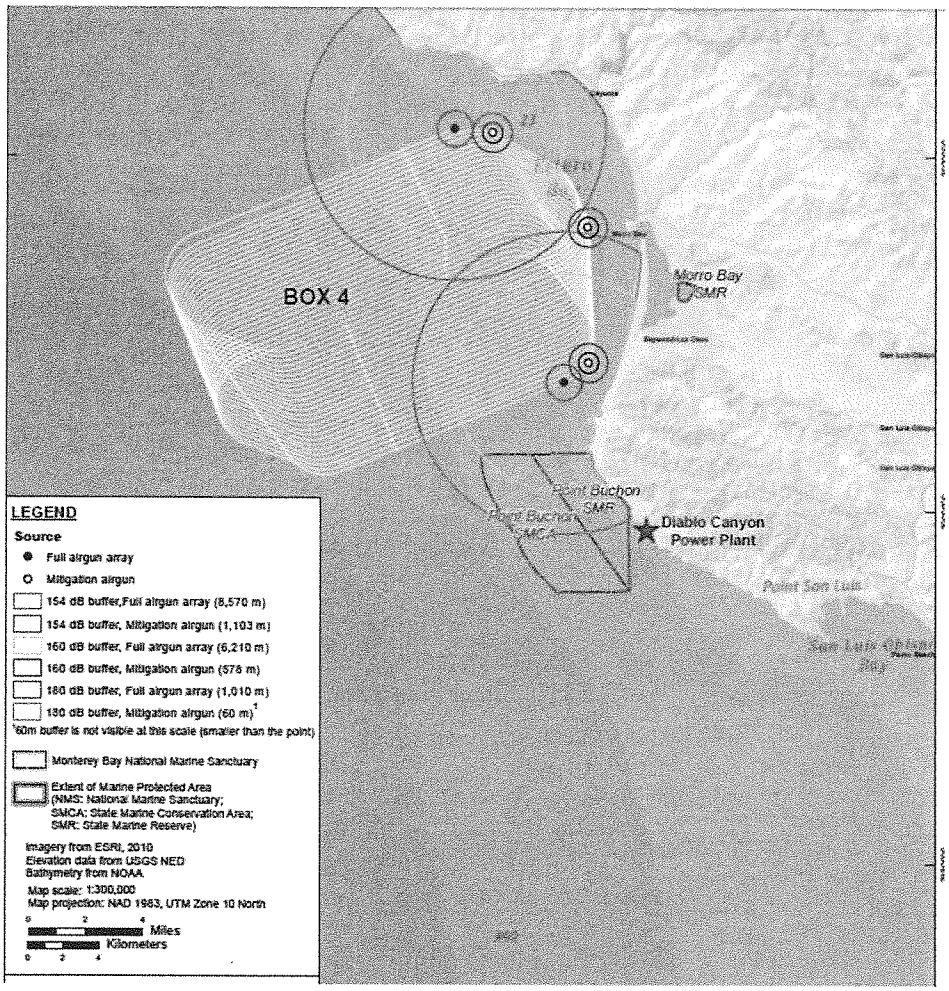
[2] PG&E FEIR: http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.11_NOISE.pdf
[3] PG&E FEIR: http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.11_NOISE.pdf
[4] PG&E FEIR: http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.11_NOISE.pdf

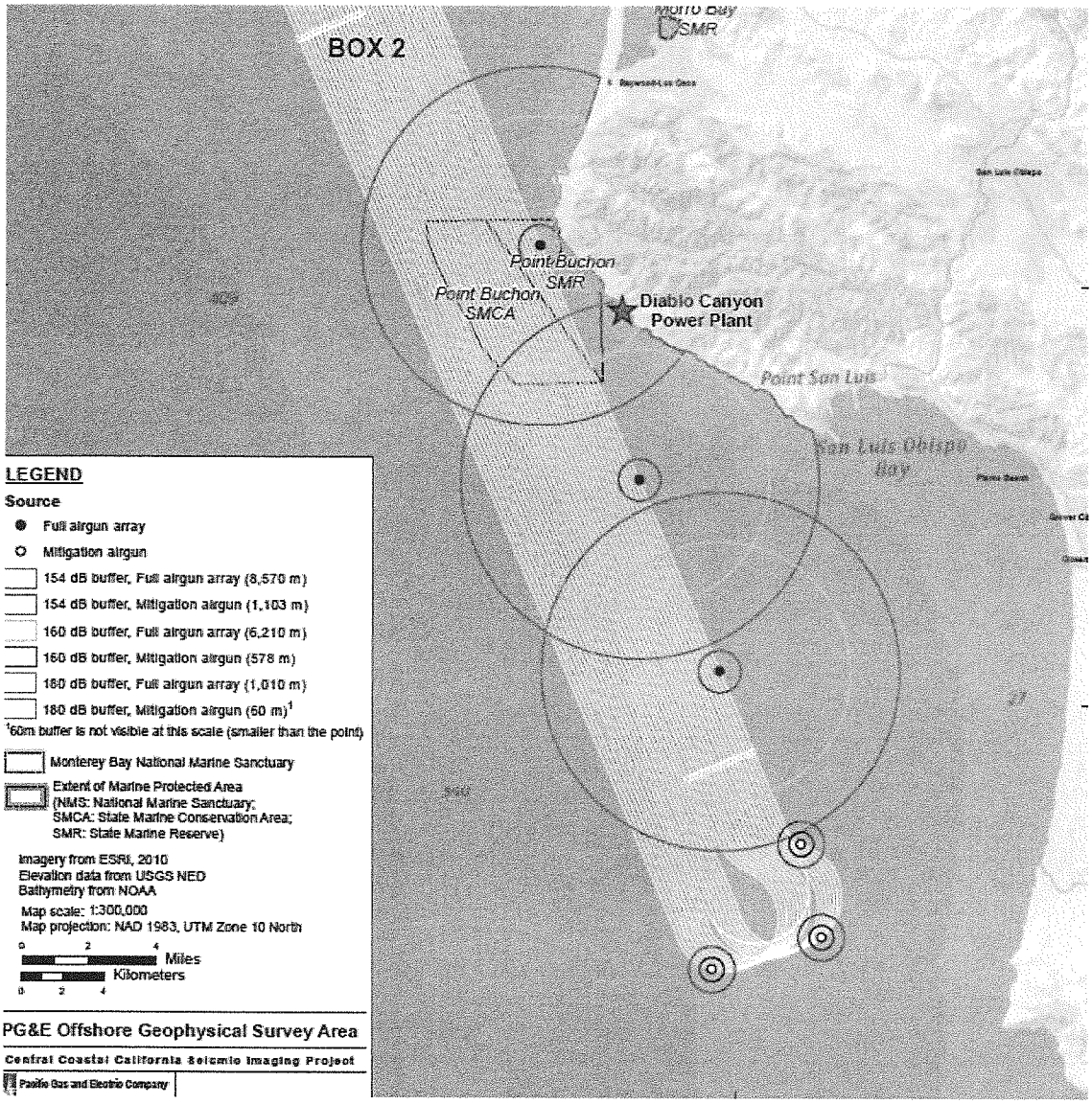
More importantly, the U.S. Navy conducted a study on divers and concluded that **145 dB is a safe level for humans**, stating:

> "In June 1999 NSMRL set interim guidance for the operation of low frequency underwater sound sources in the presence of recreational divers at 145 dB... Based on this guidance, the operation of the SURTASS LFA sonar will be restricted in the vicinity of known recreational and commercial diving so that sound levels will not exceed 145 dB".[5]

The below Project maps illustrate some beaches will receive 160 dB (yellow circles). Since dB ratios are logarithmic, 160 dB is **30 times above the safety threshold** the Navy identified at 145 dB.



[5] U.S. Navy Diver Study establishing safety threshold: http://www.surtass-lfa-eis.com/DiverStudies/index.htm



The below upslope sound propagation chart illustrates that dB levels could reach 190 at 0.13 nautical miles (which is approximately 789 feet <u>from</u> shore). That means that anyone who is recreating in the nearshore environment **would be exposed to decibel levels that are 1,000 times greater than the established safety threshold.**

Sound Pressure Level (SPL) (dB re 1 uPa)	Upslope Distance (In Shore)			Downslope Distance (Offshore)			Alongshore Distance		
	M[1]	SM[2]	NM[3]	M[1]	SM[2]	NM[3]	M[1]	SM[2]	NM[3]
190	250	0.16	0.13	280	0.17	0.15	320	0.20	0.17
187	390	0.24	0.21	370	0.23	0.20	410	0.25	0.22
180	1,010	0.63	0.55	700	0.43	0.38	750	0.47	0.40
170	2,990	1.86	1.61	1,760	1.09	0.95	1,760	1.09	0.95
160	6,210	3.86	335	4,450	2.77	2.40	4,100	2.55	2.21
154	8,570	5.33	4.63	7,820	4.86	4.22	6,780	4.21	3.66
120	24,650	15.32	13.31	251,320	156.16	135.70	94,870	58.95	51.23

M[1] = Meters; SM[2] = Statute miles; NM[3] = Nautical Miles

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[6] Central Coastal California Seismic Imaging Project 1.0 Expanded Project Description. Originally obtained from CCC Staff.

Clearly, this Project will have significant impacts to ocean users. Surfrider is very troubled that PG&E is not applying the precautionary principle when analyzing seismic testing impacts to humans.

Documented Impacts to Ocean Users:

Dr. Marsha Green has been studying and documenting underwater acoustic impacts on humans and marine mammals for several decades. In 2004, she was appointed to the Federal Advisory Committee to make recommendations to the U.S. Congress regarding acoustic impacts on marine mammals. During the course of her research she has compiled the following impacts to humans from underwater acoustic noise.

- "On August 25, 1994 a scuba diver was accidentally exposed to testing of the US Navy's LFA sonar system. (Comments submitted at Public Hearing of California Coastal Commission, 12/12/97). The ship transmitting the sonar was over 100 miles northwest of the diver who reported distinct and disorienting lung vibration as a result.

- Pestorius and Curley (1996) exposed Navy divers to low frequency active sonar and reported that one of the divers had to be hospitalized and was later under treatment for seizures.

- A Hawaiian resident who was in the water when the Navy was conducting their low frequency active sonar test in Hawaii in March, 1998 was disoriented and nauseous afterward and had to see a physician who diagnosed her with symptoms comparable to acute trauma. (Declaration filed in court, March 25, 1998.) The Navy admitted that this swimmer was exposed to the sonar at 120 dB while she was in the water, far below the operational sonar at 240 dB. In her court declaration this woman also detailed the behavior of nearby dolphins while the broadcast was taking place. The dolphins' behavior, in her view as a naturalist and long term observer of dolphins, was abnormal, including staying close to shore, staying near the surface and vocalizing excessively."[7]

Ecological Impacts:

Impacts to ocean ecosystems due to seismic testing can be potentially significant; including harm to sensitive habitats and marine mammals (i.e. fish, sea birds, invertebrates, turtles, porpoise, sea otters, etc); and four endangered species. PG&E's FEIR openly admits there will be "significant and unavoidable" impacts to marine life, and their "takings analysis" shows thousands of marine mammals will be harassed and/or possibly killed. [8] As mentioned above, Dr. Green has logged reports of impacts to marine mammals from underwater noise. She explains the following account of harm to marine mammals in her research compilation:

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[7] Compilation of Dr. Green's research regarding noise impacts to marine mammals and humans. http://www.oceanmammalinst.com/mgpaper.html#document

[8] PG&E's FEIR Marine Resources: http://www.slc.ca.gov/Division_Pages/DEPM/DEPM_Programs_and_Reports/CCCSIP/PDF/FEIR_4.04_BIOLOGICAL_RESOURCES-MARINE.pdf

> "In a more recent statement in Nature (March 5, 1998), Alexandros Frantzis linked a stranding of Cuvier's beaked whales in the Mediterranean to military low frequency active (LFA) sonar trials the day before. Cuvier's beaked whales rarely strand. A Bioacoustics Panel investigated this stranding and it is clear that the NATO vessel transmitting the LFA sonar came within 10 km of the beach where the whales stranded. The panel concluded these whales were exposed to LFA sonar at 150-160 dB". [9]

Another well-cited article from *Canadian Journal of Fisheries and Aquatic Sciences* documents that fish catches, after air gun use, decreased 40%-80% (depending catch method). [10] Finally a statement made the Marine Mammal Commission from former California Coastal Commissioner Sara Wan shows evidence of marine mammals stranding following anthropogenic noise activities saying:

> "However, while the connection is more obvious in the case of beaked whales, other cetaceans have also been involved in strandings associated with anthropogenic noise. Minke whales, (Bahamas 2000), pygmy sperm whales (Canary Islands 1988), and bottlenose whales (Canary Islands 1988) have stranded concurrent with beaked whales. In other instances, melon-headed whales (Hawaii 2004), harbor porpoises (Haro Strait 200317), and humpback whales (Brazil 2002) have stranded in events that did not involve beaked whales. In addition to these, NMFS is still investigating whether the pilot whales, minke whales, and dwarf sperm whales that stranded in North Carolina (January 2005) had traumas consistent with acoustic impacts." [11]

In addition to these discrete ecological impacts, Surfrider is also concerned about broader impacts to the newly developed network of Marine Protected Areas (MPA). *The State spent the better half of a decade working on establishing MPA and this project would clearly interfere with MPA productivity.*

It's equally concerning that this project would completely halt biological monitoring of MPAs and impair effective management of the network. The MLPA requires scientific monitoring of protected areas in order to evaluate MPAs as a tool for conservation and fisheries management. The EIR openly admits significant impacts to biological monitoring of MPAs. This Project would therefore have statewide implications since the monitoring of MPAs at Morro Bay is tied to larger statewide efforts to collect data (currently conducted by Monitoring Enterprise).

Finally, we are concerned that the FEIR does a poor job of considering the project's cumulative impacts on marine resources when combined with the impacts from the operation of the DCPP, which include impacts from its seawater intake. We mentioned this in our DEIR comment letter in May and we believe both CSLC and PG&E are dismissing the cumulative impacts from once-through cooling of the DCNPP. As such we believe this dismissal is inconsistent with CEQA guidelines § 15130(a) and 14 CCR § 15130(b)(5).

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[9] Compilation of Dr. Green's research regarding noise impacts to marine mammals and humans. http://www.oceanmammalinst.com/mgpaper.html#document

[10] Engås, A., Løkkeborg, S., Ona, E., and Soldal, A.V. (1996). Effects of seismic shooting on local abundance and catch rates of cod (Gadus morhua) and haddock (Melanogrammus aeglefinus). *Canadian Journal of Fisheries and Aquatic Sciences 53(10), p.* 2238-2249.

[11] Commission Wan Statement: http://awionline.org/sites/default/files/uploads/legacy-uploads/documents/CCC_Comments_12-05-1238105852-10137.pdf

Project Not Required by State Legislation

There have been incorrect statements made in the media that seismic testing at DCPP is required by state legislation (AB 1632). AB 1632 merely requires the California Energy Commission (CEC) to compile and evaluate existing scientific studies in order to determine the potential vulnerability of the State's nuclear power plants due to aging or from a major seismic event—but it does not mandate seismic testing. [12] There has also been some confusion regarding recommendations/directives from the California Energy Commission (CEC) and California Public Utilities Commission (CPUC) to conduct testing at DCPP.

Cited case law states both the PUC and the CEC must collaborate with other state agencies in fulfilling agency roles; and neither the PUC nor the CEC can overstep the jurisdiction of any other state agency that originally comes from a federally approved program, such as the California Coastal Commission (CCC)[13]. Therefore in order for CPUC to direct PG&E to conduct testing, the CCC *must* also approve. Most notably, the Nuclear Regulatory Commission (NRC) has exclusive jurisdiction over nuclear safety and operations and the NRC has not mandated the use of this seismic testing.

Flawed Scope of Work:

After careful review of the existing documentation, analysis of expert testimony and discussions with expert geophysical researchers, Surfrider questions the overall value of the PG&E's Project and believes testing is unnecessary. Simply put, the Project is unlikely to provide the information necessary to improve seismic safety estimates for DCPP and will not advance worst-case scenario modeling or address the most serious risks.

Upon speaking with an expert research geophysicist at the USGS, Surfrider learned that PG&E's seismic surveying **would not answer the two most critical questions required to understand seismic risk.** The first parameters are the geometry of the faults (which may be addressed by seismic surveys) and the relationship of adjacent faults to each other (do they intersect), which is partly based on geometry and partly on other factors such as how a particular earthquake behaves (not addressed by seismic surveys). The second parameters are how the faults behave (slip rate, frequency, return interval). The proposed study will not address both set of parameters and will only potentially and marginally reduce uncertainties related to the first parameter - fault geometry. [14]

Our concerns about Project necessity were compounded when we learned the Project would duplicate pervious studies, and that existing data was not being synthesized to paint a full picture of fault lines near DCPP. A former PG&E geologist testified the following:

> "A good deal of their planned work includes offshore and onshore geophysical programs that duplicate existing investigations and analyses completed by the USGS and others.... Nothing in the planned

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[12] Legislation text: http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=ab_1632&sess=0506&house=B&author=blakeslee

[13] See case law: *Orange County Air Pollution Control Dist. v. Pub. Util. Com.*, 484 P.2d 1361, 1367 (Cal. 1971) and *Voices of the Wetlands v. SWRCB, 69 Cal Rptr 3d 487(2007)*

[14] Derived from personal communication with Dr. Jeanne Hardebeck Sept and Oct 2012;

additional surveys, both onshore and offshore, offers any prospect for any result beyond marginal improvement to what is already known...."[15]

Conclusion:

Surfrider questions the overall value of this Project because it will have devastating effects on ocean ecosystems and impact coastal and ocean recreation, tourism and the local economy. This Project jeopardizes marine life and ocean users while hoping to create a seismic profile that will not conclusively reduce uncertainties regarding earthquake hazards at DCPP. PG&E has not conducted due diligence to justify the need for this project. Instead, PG&E should synthesize existing data (collected over the decades by several entities), utilize recent data (collected by PG&E both terrestrially and through offshore low energy testing) to better understand seismic risks, seek further independent review of the need for additional study, and only then propose a project using state of the art techniques that minimize environmental harm to estimate earthquake hazards.

The proposed project violates several sections of the Coastal Act that address marine life protection and recreational resources (specifically Sections: 30220, 30224, 30234.5, 30223, 30230,30260, and 30210). The onus of stopping these precedent setting and harmful project resides squarely on the Coastal Commission and we respectfully urge you to deny this Project.

Thank you in advance for considering these comments.

Sincerely,

Stefanie Sekich-Quinn
Stefanie Sekich-Quinn

Surfrider Foundation, HQ
California Policy Manager

Brad Snook
Brad Snook

Surfrider Foundation, San Luis Obispo Chapter
Chair

[15] Dr Hamilton testimony at CPUC Feb 2012. http://a4nr.org/wp-content/uploads/2012/02/021012-Hamilton-testimony-014-Full.pdf