STATE OF CALIFORNIA – THE RESOURCES AGENCY PETE WILSON, *Governor*

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STAFF RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-153-97**
Staff:	MPD-SF
File Date:	10/30/97
45th Day:	12/14/97
60th Day:	12/29/97
Commission Meeting:	12/12/97

FEDERAL AGENCY: **U.S. Navy**

DEVELOPMENT LOCATION: West of Point Buchon, San Luis Obispo Co. (Exhibits 1 & 2)

DEVELOPMENT DESCRIPTION: Phase II of a 3-Phase Scientific Research Program studying effects on marine resources of low frequency sound and the Navy's Low-Frequency Active (LFA) Sonar Program (Exhibits 3 & 7)

SUBSTANTIVE FILE DOCUMENTS: See page 14.

EXECUTIVE SUMMARY

The Navy has submitted a consistency determination for Phase II of a three-phase scientific research program investigating the potential marine resources effects of high-intensity, low-frequency sound, using the Navy's Surveillance Towed Array Sensor System Low Frequency Active ("SURTASS LFA") system. More commonly known as "LFA," this system is a sophisticated military sonar technology designed to actively detect and track submarines at longer ranges than conventional (higher frequency) active sonar systems. While LFA has been operating for a number of years, its activities were previously "classified," and only relatively recently has the public been aware of the program or its potential adverse effects on the marine environment. Because LFA has the

potential to emit sounds well in excess of those generally considered able to cause significant adverse physiological effects on marine mammals and other species, the Navy recently agreed to prepare an EIS for the LFA program. To assist this effort, and to increase scientific knowledge of the effects of human-made, low-frequency sound on marine mammals, the Navy has designed a three-phased program to study a variety of marine mammal behaviors, including: (1) feeding blue and fin whales off San Nicolas Island; (2) migrating gray whales off Big Sur; and (3) humpback breeding offshore of Hawaii.

In August 1997 the Commission concurred with the Navy's consistency determination for Phase I, the San Nicolas Island phase studying blue and fin whales. This consistency determination is for Phase II, which will study the behavior of migrating gray whales off the coast of San Luis Obispo County, during January 1998. January is the peak time of southward migration for gray whales, and the research will seek to detect any deflections from gray whale migration paths when the LFA source is turned on. Past research has established that gray whales will deviate from their migration paths at continuous noises in excess of 120 decibels (dB). The Navy hopes to build on this information and to identify effects from higher intensity levels, but still below levels that could be expected to cause physiological damage. The Navy will monitor whale reactions using a wide spectrum of methods, and if the whales show any acute reactions the research will be stopped. Mitigation measures and peer review by an independent Scientific Advisory Group have been incorporated to assure protection of marine mammals and other marine species.

While the Commission has serious concerns over the effects of sound in the marine environment, including from the LFA submarine detection and tracking system itself, this research will lead to an improved understanding of the effects of LFA and other underwater sound on marine resources. To optimize this understanding, the Commission urges the Navy to complete its research using both its "whale-type" and "random noise-type" signals, (both of which represent sounds the LFA system is capable of transmitting), as gray whale reactions may vary considerably between the two types. Because gray whale patterns are more predictable and the Navy can locate the sound source closer to the whales than it did in Phase I, the risks to marine resources from Phase II should be even lower than they were in Phase I. With the maximum limits and other mitigation measures incorporated into the research, and given its short term duration (27 days with active transmissions), the research will avoid significant adverse effects. Therefore, the project is consistent with the marine resources, environmentally sensitive habitat, and commercial/recreational fishing/diving policies (Sections 30230, 30240, 30234, 30234.5, 30213 and 30220) of the Coastal Act.

STAFF SUMMARY AND RECOMMENDATION

I. Project Description

a. Background. The Navy proposes to conduct Phase II of a three-phase scientific research program to investigate the potential effects of low-frequency sound produced by the Navy's Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) system. LFA is a military system designed for active detection and tracking of submarines at longer ranges than conventional (higher frequency) active sonar systems. The LFA system uses a vertical line array of sound projectors to broadcast specially designed low-frequency (100-500 Hertz (Hz)) sonar pulses at high power levels, and a towed horizontal line array of hydrophones to receive echoes of the pulses from distant targets.

Due to concerns over the potential adverse effects from this system, the Navy recently agreed to prepare an EIS for the overall LFA program. To assist this effort, as well as to increase scientific knowledge of the effects of human-made, low-frequency sound on marine mammals in general, the Navy has designed a three-phased program to study a variety of marine mammal behaviors, including: (1) feeding blue and fin whales off San Nicolas Island; (2) migrating gray whales off Big Sur; and (3) humpback breeding offshore of Hawaii.

b. Phase II. This second phase involves studying the behavior of migrating gray whales off the coast of San Luis Obispo County during January 1998, the peak of the southward migration period for gray whales. This research will complement past research (Malme et al., 1983, 1984 [see Substantive File Documents]), which has established that gray whales will deviate from their migration paths at continuous noises in excess of 120 decibels (dB). The Navy hopes to build on this information and to determine effects from higher levels. The Navy will project underwater sounds at low frequencies (100-500 Hertz (Hz)). The Navy expects to expose whales to a range of about 150-160 dB "if they show... no deflection." To accomplish this, the sound intensity at the source will begin at 170 dB, and will be increased to 185 dB. If whale reactions are nonexistent or only minor, the sound will be increased to 200 dB.

The primary objectives of the Phase II effort are to:

1. Quantify avoidance responses of migrating gray whales to the SURTASS LFA source moored near the gray whale migration corridor.

2. Model and measure acoustic propagation in the study area in order to compare whale responses to received levels of sound.

3. Quantify whale responses to operational LFA sonar signals.

4. Compare responses to the same stimulus played back at several different source levels in order to determine whether gray whales respond more strongly to the received level, sound gradient or distance to the source of low frequency sounds.

5. Compare avoidance responses of migrating gray whales to stimuli of different duration, duty cycle, and bandwidth in order to develop a more general model to predict gray whale responses to low frequency sound.

Phase II will consist of three transmission periods, each approximately one week in duration, between January 4-30, 1998. Each period will consist of two-day blocks with each day being split into a morning and an afternoon session. These two sessions will be alternately playback and control, randomly selected. The Navy summarizes the approach during the three periods as follows (Scientific Research Permit (SRP), p. 25-27):

The first period will use a source moored in the migration corridor.... The goal of this first period is to compare responses of migrating gray whales to playbacks of the same stimulus at different source levels. ... We propose to start the playback series with a two-day block of playback of the LFA stimulus at the lowest proposed source level, 170 dB. The second two-day block will involve playback of the LFA stimulus at 185 dB. We will analyze whale tracks for each of these two blocks. If, at the end of the four-day playback period, whales exposed to the 185 dB source do not show the strong avoidance predicted by the model that they avoid exposure to received levels > 120 dB, then it would be useful to increase the source level to test responses of whales at a higher received level.

The second playback period will use the SURTASS LFA vessel moored offshore of the migration corridor.... [T]he goal of the first offshore source playbacks will be to expose whales moving past this same area where the moored source had been to received levels of sound in the 120-130 dB range. Fig. 3 [Exhibit 3] shows the acoustic field generated by the source ship operating at a source level of 195 dB approximately 2.5 nmi away from the primary observation point. The overall shape of the acoustic field differs from the moored source at 185 dB shown in Fig. 2[Exhibit 3], but whales migrating south would encounter received levels of 120-130 dB at approximately the same area in both conditions.

The third playback period will test responses of whales to sounds of different duration and duty cycles. These playbacks will use the same source moored in the migration corridor as will be used in Period 1. We propose to compare responses of gray whales to a 1/3 octave band of random noise centered at 250 Hz,

presented either 1 sec every 10 sec or as a continuous signal. Each of these stimuli will be presented for one two-day block of playbacks. The source level for these playbacks will be either 170 or 185 dB, depending upon which yields the most statistical power for detecting deflection and avoidance responses. These will be compared to the LFA stimulus which lasts 42 sec every 420 sec. After these two stimuli have been played back, if there are two days remaining, we propose to use a 1/3 octave band of random noise centered at 250 Hz, played at the same 42 sec every 400 sec as the LFA stimulus #1. This will allow us to test whether the differences between the LFA stimulus and the third octave stimuli result solely from differences in pulse duration and duty cycle or whether whales respond differently to the LFA stimulus compared to band-limited noise.

II. Status of Local Coastal Program. The standard of review for federal consistency determinations is the policies of Chapter 3 of the Coastal Act, and not the Local Coastal Program (LCP) of the affected area. If the LCP has been certified by the Commission and incorporated into the CCMP, it can provide guidance in applying Chapter 3 policies in light of local circumstances. If the LCP has not been incorporated into the CCMP, it cannot be used to guide the Commission's decision, but it can be used as background information. The San Luis Obispo County LCP has not been incorporated into the CCMP.

III. Federal Agency's Consistency Determination. The Navy has determined the project consistent to the maximum extent practicable with the California Coastal Management Program.

IV. Staff Recommendation:

The staff recommends that the Commission adopt the following motion:

MOTION. I move that the Commission concur with the Navy's consistency determination.

The staff recommends a **YES** vote on this motion. A majority vote in the affirmative will result in adoption of the following resolution:

Concurrence

The Commission hereby **concurs** with the consistency determination made by the Navy for the proposed project, finding that the project is consistent to the maximum extent practicable with the California Coastal Management Program.

V. Findings and Declarations:

The Commission finds and declares as follows:

A. Marine Resources/Environmentally Sensitive Habitat.

1. Coastal Act Policies. Section 30230 of the Coastal Act provides:

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 30240 provides:

(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.

(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas, and shall be compatible with the continuance of such habitat areas.

2. Marine Resources in Project Area. The National Marine Fisheries Service's Draft EA (Section 3.1, Biological Environment) contains a thorough description of the types and concentrations of marine resources in the project vicinity. Exhibit 4 of this staff report contains a list of species in the vicinity. The proposed research focuses on the gray whale, which this Draft EA describes as follows:

The gray whale is currently only found in the North Pacific (Rice at al., 1984). Gray whales spend the summer feeding in the northern Bering, Chukchi, and Beaufort Seas (Rice and Wolman, 1971). These whales migrate near shore along the coast of North America from Alaska to the central California coast (Rugh et al., *1993) starting in the fall. The southbound migration generally begins in October and continues through January/February (Rice, 1981). Due to this timing, it is expected that numerous gray whales will be observed in the research area. Fig. 3.1.1-1 [Exhibit 5] shows the expected average number of whales per hour during the migration corridor, specifically off Pt. Buchon. The majority of*

these animals (52%) pass about 1 nmi (1.6 km) offshore with the remainder closer offshore.

After passing Pt. Conception, CA, the majority of the animals reportedly take a more direct offshore route across the SCB to northern Baja California, where they winter mainly along the west coast and the lagoons of Baja California (Rice et al., *1984). Gray whale abundance is currently estimated at 22,263, based on a 1995/96 southern migration (Hobbs,* et al., *1996, in press). The gray whale was recently removed from the endangered category under the ESA.*

3. Current Knowledge/Assumptions About Underwater Noise Impacts. There is growing evidence that man-made sounds can disturb marine mammals (Richardson et al 1995). Observed responses include silencing, disruption of activity, and movement away from the source. Sound carries so well underwater that animals have been shown to be affected many tens of kilometers away from a loud acoustic source, and low-frequency sources are likely to have effects at even greater ranges. Marine mammals rely on sound for communication, orientation, and detection of predators and prey. Although existing studies are inconclusive, they have led to at least some general consensuses. According to the National Marine Fisheries (NMFS):

In past research activities focused directly on large whales, acoustic source levels have been limited to less than 172 dB re 1 µPa with the result that the sound as received at an animal has rarely been greater than 130 dB re 1 µPa (Frankel and Clark, submitted to CJZ). Statistically significant differences in behaviors have been observed for continuous sounds at levels as low as 115-125 dB, corresponding to ranges usually <100m, but none of the responses were evident in the field and none can be considered biologically significant. [NMFS Draft EA, p. 11]

Ambient ocean noise levels during moderate sea states is approximately 70 dB. In analyzing whether the proposed research would trigger "takes by harassment"[1] due to potential annoyance and/or temporary threshold shift (TTS), NMFS suggests a value of 80-100 dB above best hearing threshold as the "take" threshold, stating:

Given the similarities of whale and seal ears to land mammal ears, it is possible that a relatively intense sound source (immediately adjacent) could produce

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[1] For purposes of NMFS review under The Marine Mammal Protection Act of 1973 (MMPA) and, for endangered marine mammals, the Endangered Species Act (ESA) of 1973, and their respective amendments, which prohibit taking (including harm and mortality), unless under permit or authorization or exempted from the provisions of these Acts.

acoustic trauma in some--but not all--species in the sound field. Because the LFA signal has a narrow frequency band with slow onset, losses in any one animal are likely to be restricted to frequencies in or near the broadcast band. Assuming TTS and PTS in marine mammals occur at intensity-duration limits similar to those in land mammals (given the lack of measured TTS/PTS data for marine mammals, this assumption is the starting point generally agreed upon by the scientific community) and, therefore, that such noise trauma requires a signal >80-100 dB over threshold, this means only those species capable of detecting signals below 1000 Hz would have to have a hearing sensitivity below the range of 60-80 dB to be adversely affected by 160 dB signals, even with repeated exposures. ...

For most species, based on human tests, NMFS believes that a signal must have an intensity 80-100 dB over the hearing threshold of the animal, at that particular frequency, to produce annoyance or temporary threshold shift (TTS). NMFS believes that it is unlikely that any of the mysticetes would experience significant effects, based on the fact that their exposure to LFS at potentially harmful levels would be brief, and that focal animals are likely to be ensonified only once and for a brief period, since they are moving past the source in a migration stream at approximately 5 km/hr. [NMFS Draft EA, p. 33-34]

The Navy has previously stated that 130 dB over ambient conditions, or a maximum of 200 dB, could lead to severe, or acute, effects. However the Navy has also cited a recent scientific workshop (High Energy Seismic Survey (HESS), 12-13 June 1997), stating: "Discussions at the HESS workshop reached a general consensus that 180dB re 1μPa was a reasonable estimate for the level at which potential physiological injury could occur for marine animals."

4. <u>Research Program Effects/Mitigation Measures</u>. The Navy assumes that gray whales will be affected if they receive a decibel level greater than 120 dB and estimates gray whale "takes" as follows:

The average rate during the peak week was 4.6 whales per hour. During the 1994 migration the peak day of the southward migration had 7.5 whales per hour. In order to estimate the maximum number of whales that might pass the sound source off Pt. Buchon, we will estimate a rate of 10 whales/hour. This estimate is high, being rounded upward to include animals that might have passed >6000 ft offshore (not counted in these estimate) and to cover the possibility of a higher peak migration rate than the average from 1981-1994. ... Whales passed the central California study site of Malme et al. *(1984) at speeds of 3-6 nmi/hour. If the whales were swimming at 3 nmi/hr and 10 were sighted per hour, then this would*

> *suggest that about forty whales would be ensonified at the start of a playback (6 nmi north and 6 nmi south), and that an additional 10 whales would be ensonified per additional hour of playback.*
>
> *The precise number of hours of playback will depend upon factors such as weather. Most days would have at most 4.5 hours of playback. At the start of playback, 40 whales might be within the 120 dB isopleth, and an additional 45 might swim through during the 4.5 hours of playback, yielding a daily total of 85 whales, which we round up to 100. If we estimate 26 days with 4.5 hours of playback each, then this would suggest a maximum of 2600 whales might be taken by harassment.*

The research will be short term, will not include nighttime transmissions, and will be closely and continuously monitored. While designed to elicit some reaction, the Navy believes these conditions should ensure that any potential effect of the proposed action will be negligible. NMFS also believes, for all marine species potentially affected by the research, that effects would be minimal[2]. NMFS Draft EA (p. 45) states:

> *The potential effects of low frequency sound on the marine environment discussed in this section address both focal and non-focal species. With respect to focal groups or individuals, exposure will be at levels gradually increasing from barely detectable sound. Depending on the distance from the source, the animals may deviate (if they are observed to do so) from their course. Close monitoring of the focal group or individual will be in place to record potential reactions to the LFS signals. Procedures have been incorporated into the protocol to terminate transmissions in the event of adverse behavioral response. Furthermore, mitigation measures, particularly visual observations, reduction of source levels, ramping up, and SPL monitoring near the focal animal (s) should combine with the brief period of the research and limited geographic area to ensure that the potential effect of low frequency sound on such animal(s) will be less than significant.*
>
> *With respect to non-focal group animals, it is possible that incidental takes will occur to animals passing by or resident in the research area. ... The Proposed Action has the potential for incidental takes of very low numbers of animals. The short period of the research activity (about 3 weeks), the limited research area, the lack of night time transmissions, a limited duty cycle, plus close and continuous visual monitoring of the immediate research area, particularly that area within 0.5 nm (1 km) of the source vessel where the sound field, estimating very conservatively,*

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[2] See Exhibit 6 for NMFS estimates of "take" for both gray whales, as well as "non-focal" species

> *will reach 160 dB—these are conditions which should ensure that any potential effect of the proposed action is negligible.*

Whale reactions will be closely monitored, and if acute responses occur, the source will be turned off. The Navy believes it will be able to detect reactions and to quantify acoustic exposure conditions that elicit them, without exposing whales to any harm. The project site selected offers a particular advantages for visual surveys from land, which will complement other monitoring. The NMFS Draft EA (p. 47) states:

> *The objective of these observations is to maintain track of any animals within the close-in 160 dB sound field and to ensure that no animal approaches the source close enough to be subjected to potentially harmful sound levels. Under conditions of normal visibility, the field of visual observation is approximately 3 nm (5.6 km) from the source. Observations from a minimum of 2 observers will begin at least 1 hour prior to initial transmissions. To supplement this procedure, a separate, thorough 360° scan of the vicinity will be performed for at least 30 min prior to the initiation of transmissions. The visual observation and monitoring watch will be maintained throughout the period of transmission and for 30 minutes thereafter. Once transmissions have commenced, they will be suspended if animals are observed demonstrating significant behavioral modification. Examples of such behavioral modification would include significant slowing of the migration rate, course reversal, major deviations from the migrating direction, rate, or pattern. With respect to non-focal animals, particularly whales, transmissions would be suspended, if in the opinion of the principal investigator, such animals are demonstrating exaggerated behavior, rapid and erratic breaching, and extended surface periods, possibly contemporaneous with LFA transmissions.*

The Navy has also committed to cessation or suspension of transmission in the event of any acute reactions to the source. The definition of "acute" reactions include: "Reversal of swim direction, slowing, major deflection from migratory route" and/or "Repeated/prolonged, or excessive activity (severe breaching, prolonged time on surface, etc.)."

The Navy's proposal also includes provisions for peer review and independent observers. For Phase I, the Navy invited "independent observers, scientists or environmental group representatives to attend various portions of the research phases in order to observe experimental operation of the LFA system and the research procedures." The Navy states it "has made a commitment of making this research as open as possible in order to help guarantee its independence." The Navy has also established a Scientific Advisory Group, which includes experts in the field of marine mammal acoustics which will serve as independent peer review committee. This group will assist in key decisions, including

being consulted if any acute reactions are observed and, in any event, prior to using the maximum proposed source level. The Navy states (SRP, p. 10): "Every effort will be made to maintain rapid contact with the members of the Scientific Advisory Group during the actual field work."

5. Commission Conclusion. The proposed research has been designed to help determine the potential risk to marine animals imposed by low-frequency sound of the sort that is already being introduced into the marine environment by the LFA program and other human activities. The Commission agrees with the Navy's underlying assumption that more research is needed on the effects of underwater sounds in the marine environment. The Commission noted in reviewing Phase I that noise from large, fast vessels, in some cases with poorly-maintained marine engines: "... may range from 150-160 dB for outboards and other small vessels, to 185-200 dB for supertankers and large container ships (Richardson et. al., 1991) which can cause potentially disturbing noise for many kilometers (Tyack, 1989)." (Note: See Exhibits 8& 9 for a comparison of natural and human-induced underwater sounds.)

The proposed research is likely to be helpful in understanding human-induced noise impacts and developing future programs to regulate and/or reduce any such adverse effects of noise on marine mammals. Furthermore, given its short term nature (up to 27 days of transmissions), maximum sound levels that will not be exceeded, commitments to cease transmissions if acute responses are observed, and the other mitigation measures described above, the project will avoid significant adverse effects on marine resources. Hopefully, the Navy's proposed research will also assist in the understanding of the LFA program itself, over which the Commission remains greatly concerned, as stated in the Commission's Phase I findings and in the Commission staff's August 28, 1996, letter to the Navy commenting on the Navy's decision to prepare an EIS for the overall LFA program (see Exhibit 10 for excerpts).

Thus, while retaining strong concerns over normal LFA operations, the Commission believes that the proposed research will help evaluate these issues and will improve our understanding of, and hopefully our ability to protect, marine resources. The Commission notes that in its effort to fully understand the LFA system's potential impacts, the Navy has proposed both a "whale-type" signal and a "random noise-type" signal, both of which represent sounds the LFA system is capable of transmitting. The Commission urges the Navy to complete its research using both types of signals, as gray whale reactions may vary considerably between the two types of sounds. Finally, the Commission agrees with the Navy that because gray whale patterns are more predictable and the Navy can locate the sound source closer to the whales than it did in Phase I, the risks to marine resources from Phase II should be even lower than they were in Phase I. In conclusion, given the short term nature of the research, and with the commitments discussed above provided by the Navy as an integral part of this research effort to

monitor and protect marine resources, the Commission finds that the proposed research should improve our understanding of whale reactions to underwater sounds and, as proposed, will be carried out in a manner avoiding significant adverse effects on marine resources and environmentally sensitive habitat. The Commission therefore concludes that the project and will be consistent with Sections 30230 and 30240 of the Coastal Act.

B. Commercial and Recreational Fishing and Diving.

Section 30230 of the Coastal Act, quoted on page 6 above, provides for the protection of economically (as well as biologically) significant marine species. Section 30234 provides: "Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded." Section 30234.5 provides that: "The economic, commercial, and recreational importance of fishing activities shall be recognized and protected." Section 30213 provides that "Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided." Section 30220 of the Coastal Act provides that: "Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses."

1. **Fishing**. The Navy believes that impacts on commercial and recreational fishing will be minimal, citing NMFS draft EA, which states:

Fish

The central California area has a large and economically important commercial fishing industry. In 1987, a total of over 34 million pounds of fish with a value of almost $35 million was landed at Moss Landing, Monterey, Santa Cruz and Princeton, the major commercial fishing ports. The diversity of the commercial catch is shown by the number of different species or species groups landed. These statistics include salmon, albacore, flatfish, California halibut, rockfish, anchovy, herring, as well as dungeness and rock crab, shrimp, octopus, squid, eels, lobster, abalone, and sea urchins....

Hastings (1991) makes some general conclusions from evidence based on a thorough literature search that, in the 50-2000 Hz frequency band, received levels at or above 180 dB would be harmful to fish. Relatively small numbers of individual fish would be expected in the potential hazard zone (within a very few meters [<100 m] of the source @195 dB), certainly an insignificant proportion of any population of a species. Further, fish can swim out of the hazard zone during source ramp-up transmissions. Since the proposed action is not known to be a

significant area from the standpoint of any threatened or endangered fish species (including the endangered Northern California Coast Coho salmon), in light of the short test period, low duty cycle and intermittent nature of SURTASS LFA sound transmissions, given the fact that this area comprises only a small portion of the range of large pelagic fish species, and considering that any SURTASS LFA-induced threshold shifts would be temporary and not create a negative habitat effect for any fish species, the potential for effects to fish is insignificant. This judgment is further supported by the fact that no commercially or recreationally important species would be affected.

The Commission concludes that given the short term nature of the research (27 days), combined with the maximum sound levels committed to described in the marine resources section above, the project will avoid adverse effects on commercial and recreational fishing in the area. The Commission therefore concludes that the project is consistent with Sections 30230, 30234, and 30234.5 of the Coastal Act.

2. Diving. The Navy also believes that impacts on commercial and recreational diving will be minimal, citing NMFS draft EA, which states:

3.3.1 HUMAN DIVING ACTIVITIES

Human recreational and commercial diving activities occur in the vicinity of the planned research area. More than 70 percent of the nearly 65,000 divers found between Pt. Conception and Oregon congregate in the area from Cannery Row on the Monterey Peninsula to Pt. Lobos State Underwater Reserve (U. S. Department of the Interior, 1987). Further down the Big Sur coast, recreational diving sites are sparse and difficult to access along the affected coast. The area is characterized by unexpected high surf, rogue waves and strong, unpredictable currents. Extreme caution is recommended, particularly in winter months when surf and sea conditions are most confused. Shore access in most cases is non-existent, requiring access from charter boats. The few sites in the area are strongly recommended for use by only the hardiest and most experienced divers. South of Pt. Sur, recreational diving is extremely rare, as it involves difficult overland access, cliff descents, no accessible beaches and extended boat voyages. Access to the coast along the research site at Pt. Buchon is restricted and any divers would have to utilize boats. Winter storms in January tend to restrict diving even more. Dive boat proprietors, harbor patrol, Coast Guard officials and dive shop owners report that recreational diving from Pt. Buchon to Pt. San Luis is virtually non-existent in the month of January. Accordingly, the number of divers at this time of year is expected to be minimal to none.

Attempting to determine thresholds for divers, the Navy has relied on its Bureau of Medicine and Surgery, which has issued interim guidance for operation of low frequency sound sources. To protect divers, the Navy has committed to the following mitigation:

> *Visual observation techniques will be in force where there might be a possibility of human diver activity in the vicinity. Whenever diver underwater activity is known to be occurring within the predicted 130 dB sound field of the vessel, transmissions will be suspended until such time as divers are known to be out of the water. Diver activity is normally marked by flagged surface buoys, and in the case of offshore diving, by the presence of a support vessel which will be visible from the LFA source vessel. (NMFS Draft EA, p. 44)*

As if found in reviewing LFA Phase I (CD-95-97), the Commission concludes that given the short term nature of the research (27 days), combined with the maximum sound levels committed to described in the marine resources section above, and the Navy's commitment to avoid exposing any diver to sound intensities greater than 130 dB, the project will avoid adverse effects on commercial and recreational diving in the area. The Commission therefore concludes that the project is consistent with Sections 30213 and 30220 of the Coastal Act.

VI. SUBSTANTIVE FILE DOCUMENTS:

1. Application for Permit for Scientific Research under the Marine Mammal Protection Act, and Scientific Purposes under the Endangered Species Act, U.S. Navy, June 26, 1997.

2. Draft Environmental Assessment for Low-Frequency Sound Scientific Research Program in the Southern California Bight, September/October 1997, National Marine Fisheries Service, June 1997.

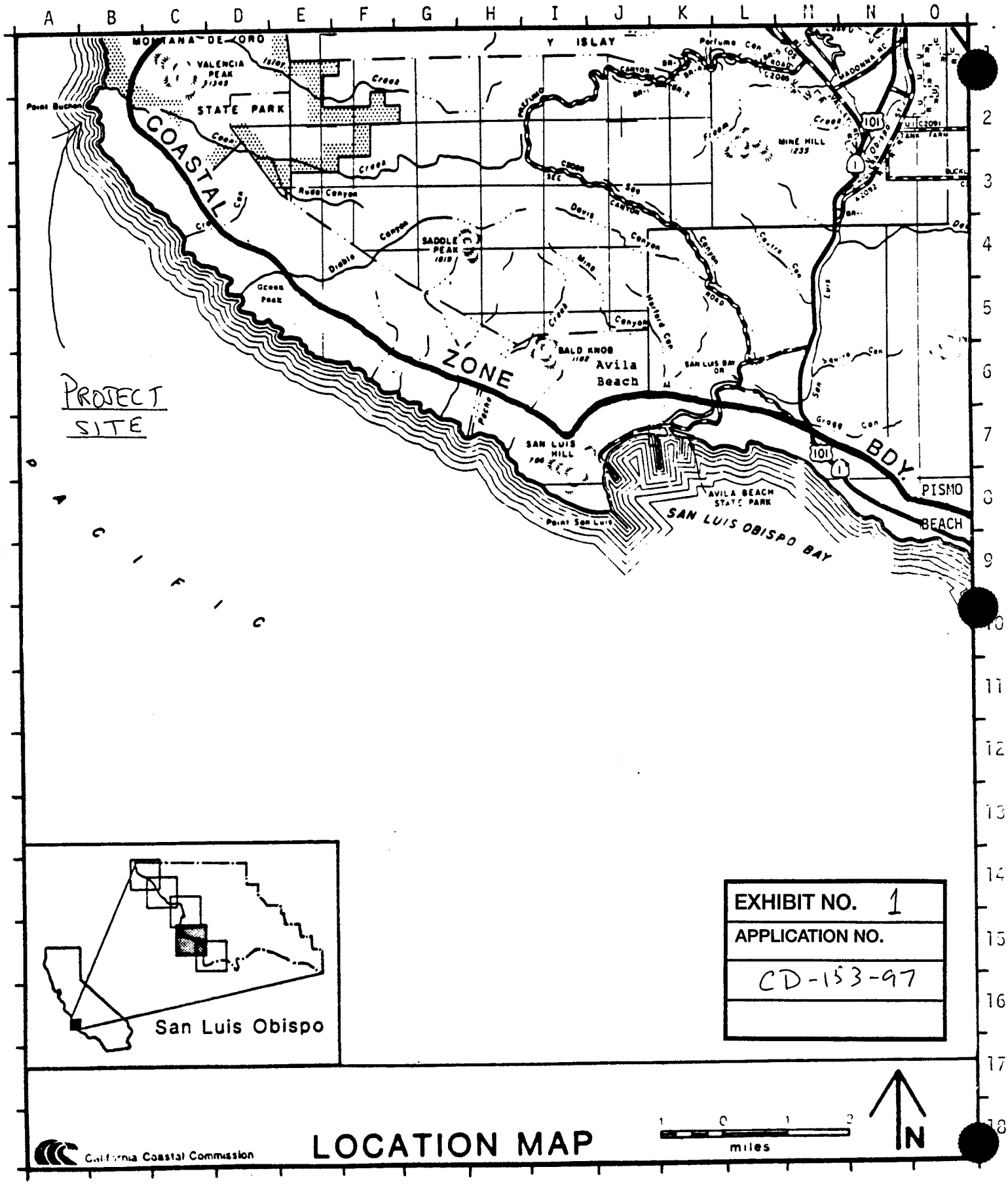
3. Consistency Certification CC-110-94/Coastal Development Permit Application 3-95-40 Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP).

4. Low-frequency Sound and Marine Mammals: Current Knowledge and Research Needs, Committee on Low-frequency Sound and Marine Mammals, Ocean Studies Board, Commission on Geosciences, Environment, and Resources, National Research Council, March 21, 1994.

5. Consistency Determination No. CD-95-97 (Navy, LFA, Phase I, 10-25 miles off San Nicolas Island).

6. Malme CI, PR Miles, CW Clark, P Tyack and JE Bird (1984) Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Bolt Beranek and Newman Report No. 5586 submitted to Minerals Management Service, U. S. Dept. of the Interior.

7. Malme CI, PR Miles, CW Clark, P Tyack and JE Bird (1983) Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Bolt Beranek and Newman Report No. 5366 submitted to Minerals Management Service, U. S. Dept. of the Interior.



County of San Luis Obispo

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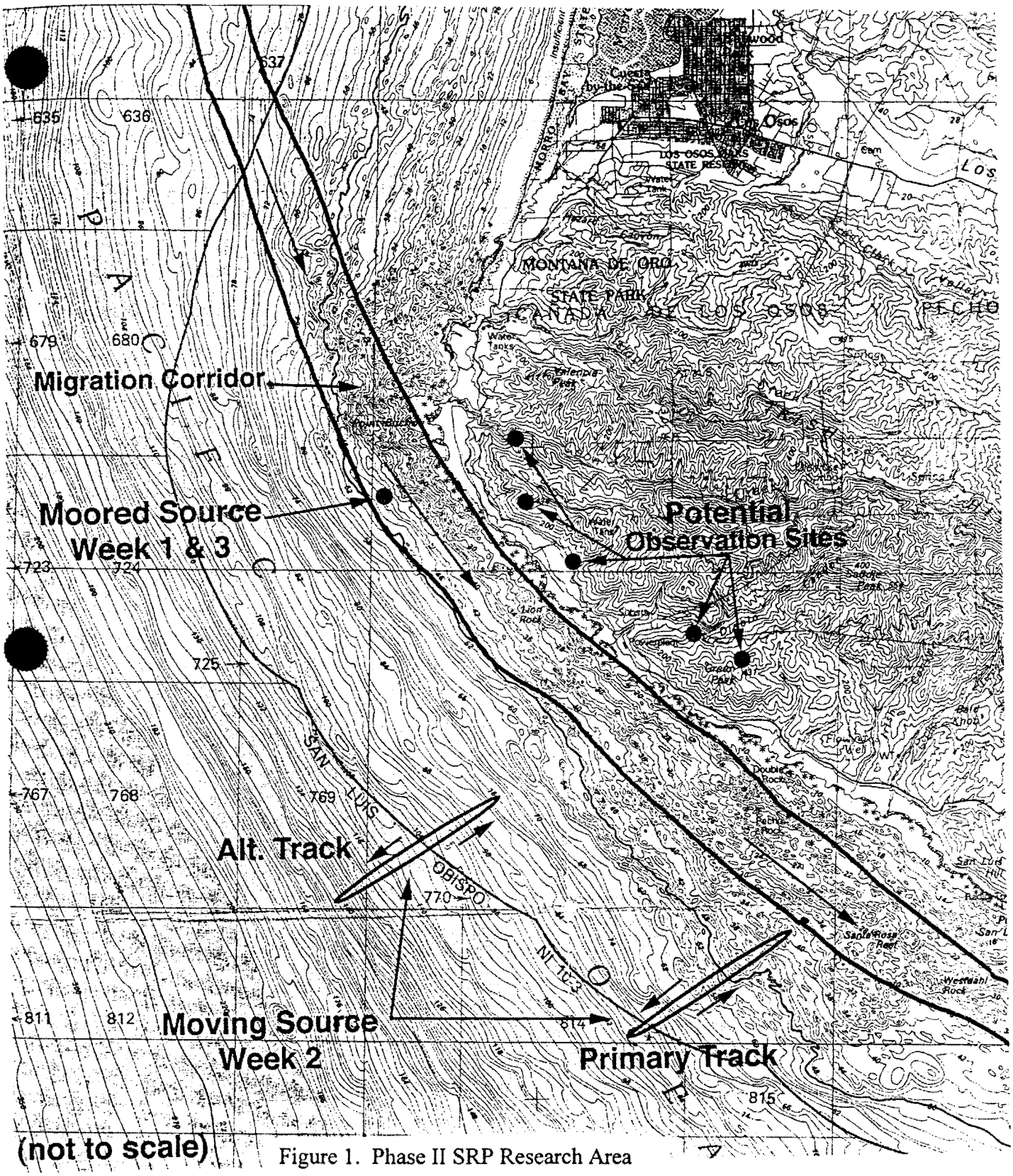

Figure 1. Phase II SRP Research Area

EXHIBIT NO. 2
APPLICATION NO.
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whales avoided in the Malme et al. (1984) study, would be 50 dB. This would occur clearly at a range within 500 m from the source, less than 1/4 way between the source ship and the shore. If whales respond to this louder, more distant source as they did in the Malme et al. (1984) study, they would be expected to deflect around this zone, which they could achieve by passing several hundred meters inshore or offshore of the source. However, this 120 dB zone would not extend north of Pt Buchon.

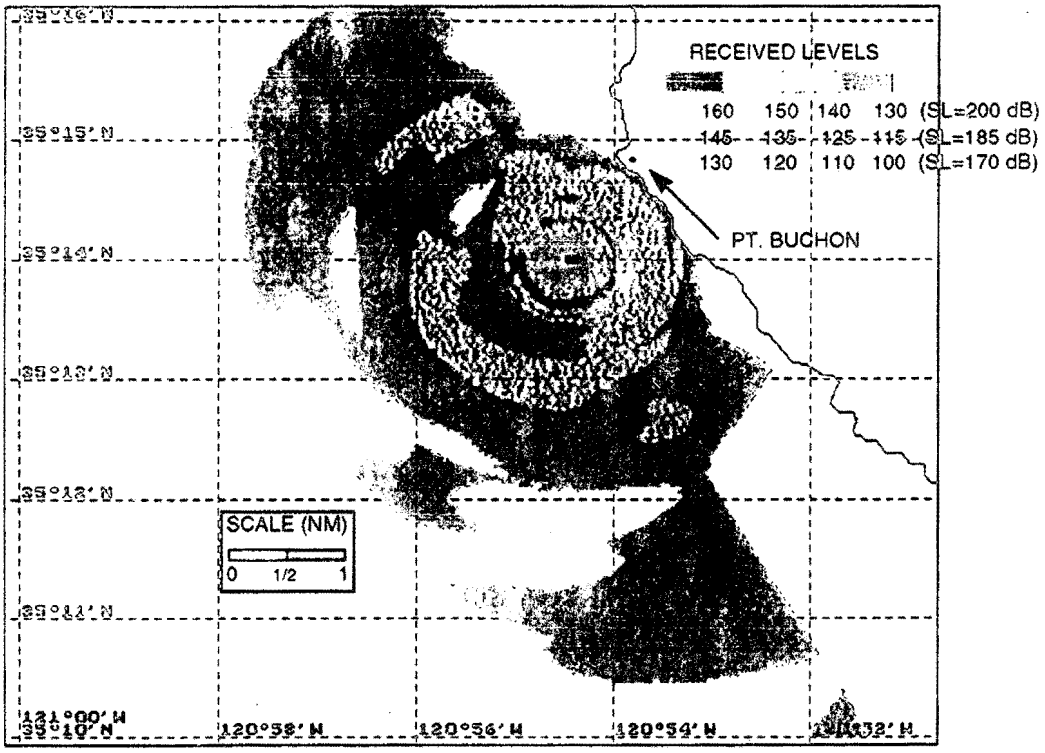

Figure 2. Predicted Received Levels at Moored Site off Pt. Buchon

From Fig 2, it can be seen that the 120 dB isopleth would extend well beyond several nm north of the source in the upper 10-15 m of water, and whales moving inshore of the source would not be able to find an area of exposure < 120 dB. If whales avoid exposure to 120 dB during playback at this source level, they would be expected to start deflecting many nm north of the source and/or to move several nm offshore of the source. On the other hand, if the whales are not avoiding exposure to 120 dB at greater ranges from this louder source, then this will be extremely obvious on plots of whale tracks. We propose to plot whale tracks each evening after playbacks, and to monitor changes in track deflection for the source as it is operated at higher source levels. Sommerville (1994) reports that the majority of migrating whales passed within 5000-6000 feet of shore. This means that if the source is placed in the center of this corridor, that most whales under control conditions will pass within 500 feet or approx. 150 m. This

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whales pass the observation sites. This will be accomplished by moving the source track closer to the observation sites and/or increasing the source level of the moving source.

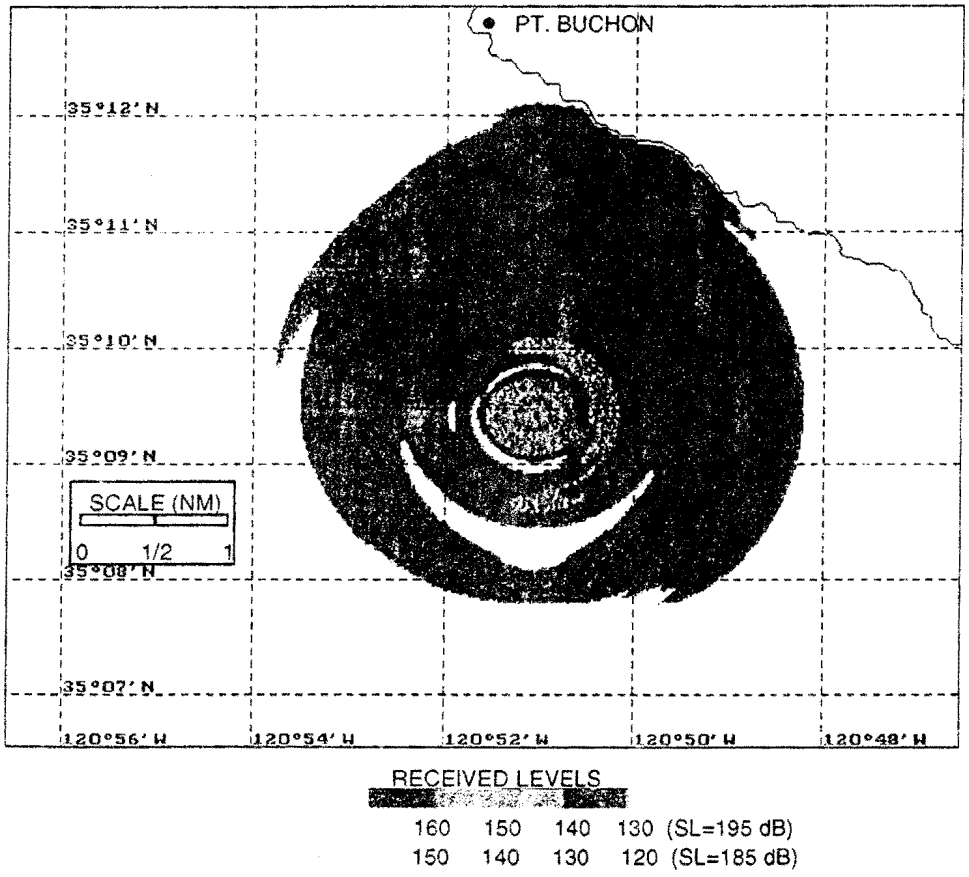

Figure 3. Predicted Received Levels from Moving Source (Innermost Point)

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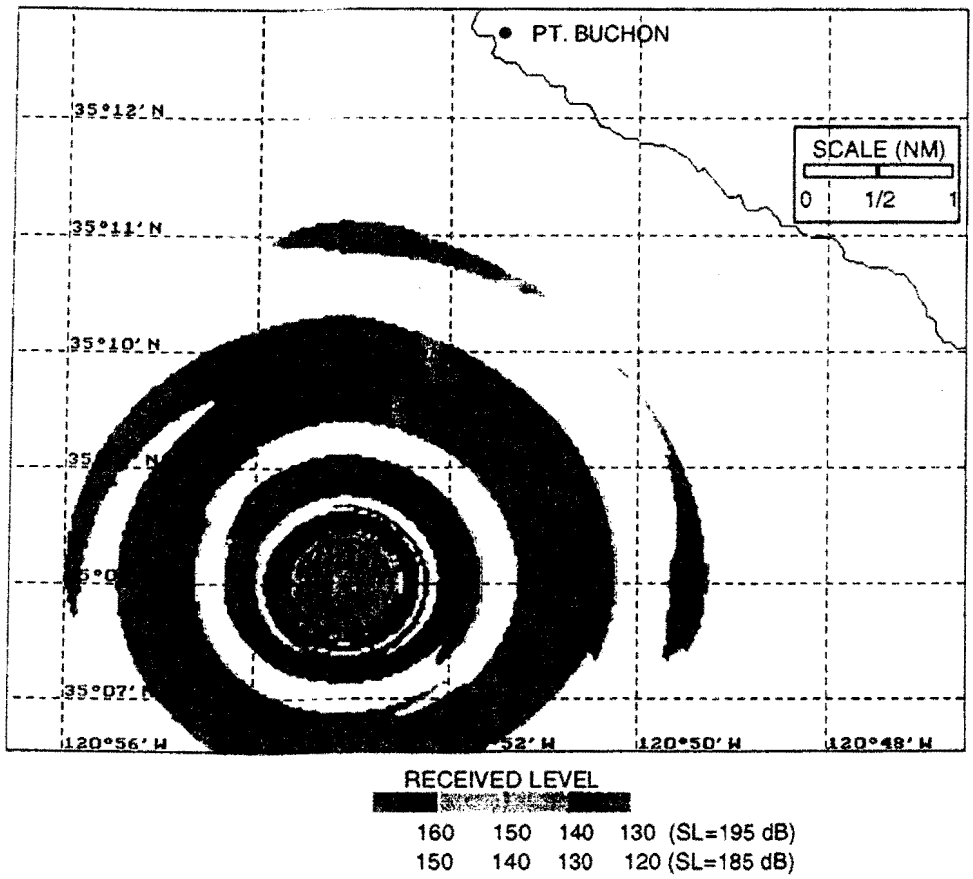

Figure 4. Predicted Received Levels from Moving Source (Outermost Point)

6.3.3.3 Acoustic Monitoring

The Malme et al (1983, 1984) studies used simple transmission loss equations to estimate the received level at each whale. We propose to use sound propagation models in order to improve our estimate of received level at the whale. Sound velocity profiles will be collected on a regular basis by the playback vessel for modeling sound exposure. These models will be tested by deploying a small vessel in order to measure sound levels as a function of range and location from the source. The vessel will deploy a calibrated hydrophone to calibrate sensitivity of a vertical array (VLA) of hydrophones, and this VLA will be used to monitor received level at several depths as the recording vessel drifts quietly. Measurements will be taken throughout the area in which we are following whales, and these measurements will be used to fine tune the acoustic propagation models that are used to predict sound exposure at whale sightings.

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EXHIBIT 4

List of significant marine resources in the greater project area according to the NMFS Draft EA (p. 13 et seq.):

Baleen whales, or mysticetes:

blue whales (*Balaenoptera musculus*)
fin whales (*B. physalus*)
humpback whales (*Megaptera novaeangliae*)
gray whales (*Eschrichtius robustus*)
minke whales (*B. acutorostrata*)
sei (*B. borealis*)
Bryde's whale (*B. edeni*)
and northern right whales (*Eubalaena glacialis*).

Toothed whales and other odontocetes:

sperm whale (*Physeter macrocephalus*)
pygmy sperm whale (*Kogia breviceps*)
dwarf sperm whale (*Kogia simus*)
beaked whales (*Ziphius cavirostris, Berardius bairdi,* and *Mesoplodon spp.*)
striped dolphin (*Stenella coeruleoalba*)
Risso's dolphin (*Grampus griseus*)
Pacific white-sided dolphin (*Lagenorhyncus obliquidens*)
bottlenose dolphin (*Tursiops truncatus*)
killer whale (*Orcinus orca*)
Dall's porpoise (*Phocoenoides dalli*)
northern right whale dolphin (*Lissodelphis borealis*)
and common dolphins (*Delphinus delphis, D. capensis*).

Pinnipeds:

California sea lions (*Zalophus californianus*)
Steller sea lions (*Eumetopias jubatus*)
northern elephant seals (*Mirounga angustirostris*)
northern fur seals (*Callorhinus ursinus*)
and harbor seals (*Phoca vitulina*).

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Other marine species discussed in the Draft EA include the southern sea otter (*Enhydra lutris*), as well as various species of sea turtles, fish, seabirds, invertebrates and plankton.

generally begins in October and continues through January/February (Rice, 1981). Due to this timing, it is expected that numerous gray whales will be observed in the research area. Fig. 3.1.1-1 shows the expected average number of whales per hour during the migration corridor, specifically off Pt. Buchon. The majority of these animals (52%) pass about 1 mile (1.6 km) offshore with the remainder closer offshore.

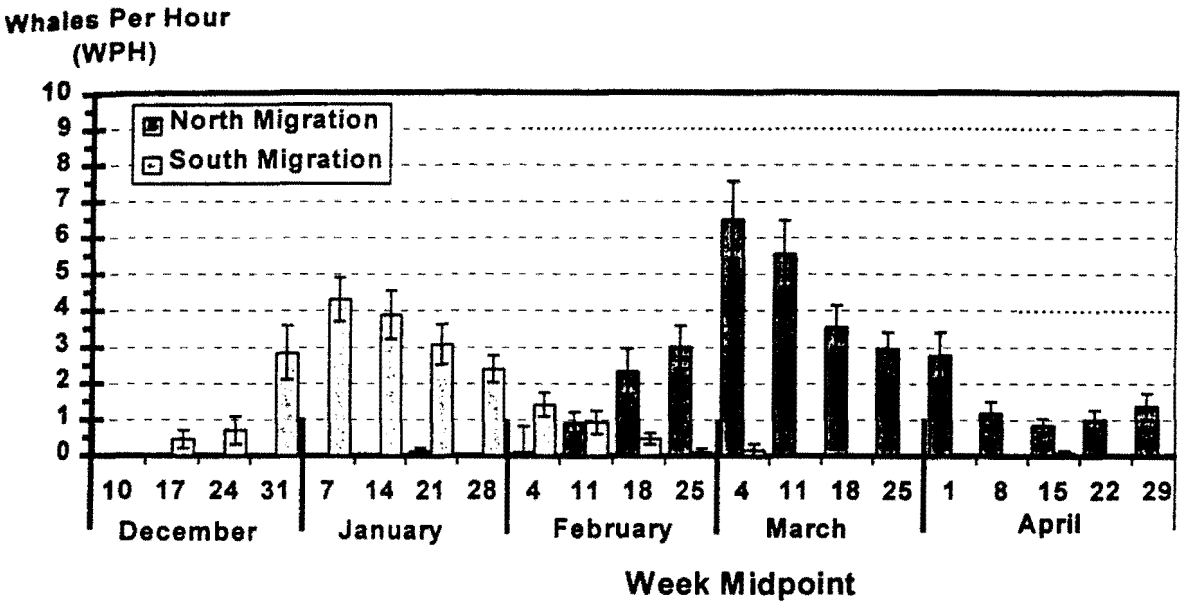

Figure 3.1.1-1. Weekly average of whales per hour (WPH) from 1981 through 1994 between months of December and April
(Sommerville, 1994)

After passing Pt. Conception, CA, the majority of the animals reportedly take a more direct offshore route across the SCB to northern Baja California, where they winter mainly along the west coast and the lagoons of Baja California (Rice *et al.*, 1984). Gray whale abundance is currently estimated at 22,263, based on a 1995/96 southern migration (Hobbs, *et al.*, 1996, in press). The gray whale was recently removed from the endangered category under the ESA.

Blue whales winter from central California to about 20° N latitude, and summer from central California to the Gulf of Alaska. They are seen relatively often off California from June to December, with sightings most frequent from July to October (Calambokidis *et al.*, 1993; Leatherwood *et al.*, 1987). Blue whale abundance estimated from a 1991 spring/summer ship survey was between 2,134 and 2,250 (Barlow, 1995). Forney and Barlow (1993) estimated 28 animals off California during winter /spring 1991-92 aerial surveys; however, this estimate was based on only a single whale sighting offshore of the SCB. The population of blue whales appears to be increasing, with incidental mortality from ship strikes less than PBR. They are however listed as endangered under ESA, and thus as depleted under MMPA. They are considered a strategic stock under the MMPA.

mainly young gray whales (Rice and Wolman, 1971). Oil or other contaminants in sediments may kill or displace prey, foul baleen, or result in hydrocarbon accumulation through sediment ingestion. The frequency of ship strikes is not known, but available data suggest they are less common than for certain other mysticetes (e.g., right whales; Kraus 1990).

Central California Coast (January) **Species**	Density n/km^2	Est. Correction Factor	Total Est. Taken by Harassment
Blue whale (*Balaenoptera musculus*)	--	--	125
Fin whale (*B. physalus*)	--		477
Sei whale (*B. borealis*)	--		5
Minke whale (*B. acutorostrata*)	--	n/a	263
Humpback whale (*M. novaeangliae*)	--	n/a	382
Bryde's whale (*B. edeni*)	--		5
Right whale (*E. glacialis*)	--		5
Striped dolphin (*S. coeruleoalba*)	0.023	2	8
Bottlenose dolphin (*T. truncatus*)	0.002	2	5*
Killer whale (*Orsinus orca*)	0.0004	2	5*
Sperm whale (*P. macrocephalus*)	0.0009	10	5*
Beaked whale (*B. bairdii, Mesoplodon spp., Z. cavirostris*)	0.0039	10	6
Pygmy sperm whale (*K. breviceps*)	0.0011	5	5*
Risso's dolphin (*G. griseus*)	0.0011	2	5*
Pac. wh.-sided dolphin (*L. obliq.*)	0.012	2	5*
Harbor porpoise (*P. phocoena*)	0.069	2	22
Dall's porpoise (*P. dalli*)	0.096	2	31
Common dolphin (*D. delphis, D. capensis*)	0.301	2	130
N. right whale dolphin (*L. borealis*)	0.012	2	5*
Pilot whale (*G. macrorhynchus, 1993 est.*)	0.0012	5	5*
N. elephant seal (*M. angustirostris*)	0.0625	4	363
N. fur seal (*C. ursinus*)	0.0049	2	5*
California sea lion (*Z. californianus*)	0.0535	2	17
Harbor seal (*P. vitulina*)	--	n/a	845
Steller sea lion (*Eumetopias jubatus*)	--	n/a	585
Southern sea otter (*Enhydra lutris*)	--	--	0
Leatherback sea turtle (*D. coriacea*)	--	--	0

* where estimated take computation yields <5, the total expected "takes" is given as 5.

Table 1. Estimated incidental takes by harassment of non-focal mysticetes, odontocetes, pinnipeds, fissipeds, and sea turtles during LFA playback experiments in the Central California Coast study area.

(There will be a maximum of 20 days with LFA playback on focal animals. For non-focal mysticetes, no significant numbers of blue, fin, humpback, right, Bryde's and sei whales are expected in the period of the experiment. Density values were compiled from existing NMFS reports, and a pen from Gerald D'Spain. See text for further explanation of how estimates were

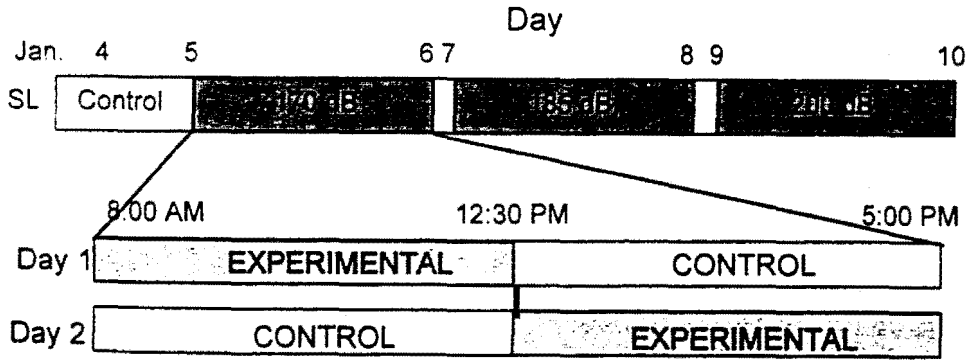

Figure 1.2.4-1. Typical research pattern of experimental and control sequences Periods 1 & 3

Table 2. Overall playback schedule

Playback period	Dates	Playback blocks
Pre-playback control	4 Jan	
1. Moored source, LFA stimulus	5-10 Jan	6 days, 2@SL=170, 2@SL=85, 2@SL=200
2. Moving source, LFA stimulus	11-22 Jan	8 days, 4@RL=120-130, 4@RL=130-140
3. Moored source, 1/3 octave	23-30 Jan	6 days, 2@1/10, 2@ continuous, 2@40/400

Table 1. Playback stimuli for source moored in the corridor of migrating gray whales.

Stimulus	Frequency	Timing
1	LFA 300/200 Hz	40 sec every 400 sec
2	1/3 octave bandlimited random noise centered at 250 Hz	1 sec every 10 sec
3	1/3 octave bandlimited random noise centered at 250 Hz	Continuous
4	1/3 octave bandlimited random noise centered at 250 Hz (223-281)	40 sec every 400 sec

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Range from ATOC Source	dB (water standard)	dB (air standard)	Comparable Sounds
1 m (approximately 3 ft)	195	133.5	Container ship at comparable distance. Very high powered loudspeaker system at comparable distance. Ambulance siren at comparable distance.
30 m (approximately 100 ft)	165	103.5	Large ship at comparable distance. Rock concert (comparable to sounds 200-400 ft from ATOC source). Jet airliner (10 m) Ambulance siren (somewhat closer than 34 m). "Very loud"
1000 m (sea surface above ATOC source)	135	73.5	Small power boat. Freeway 34 m away. Beluga whale threshold (1000 Hz). "Moderately loud"
12-18 km (7-10 nm)	120	58.5	Sea sounds (wind and wave action) during storm. Normal speech (1 m)
50-60 km (27-32 nm)	110	48.5	Symphony orchestra at 6 m (20 ft) Heavy surf on beach at 1 m (3 ft) Heavy truck (64 km/hr) at 15 m (50 ft)

Table ES-1. Relationship of sound level of common sounds in air and water (20-1000 Hz)

Source: ATOC EIS

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NOISE SOURCE	MAXIMUM SOURCE LEVEL	REMARKS	REFERENCE
UNDERSEA EARTHQUAKE	272 dB	Magnitude 4.0 on Richter scale (energy integrated over 50 Hz bandwidth)	Wenz, 1962.
SEAFLOOR VOLCANO ERUPTION	255+ dB	Massive steam explosions	Dietz and Sheehy, 1954; Kibblewhite, 1965; Northrop, 1974; Shepard and Robson, 1967; Nishimura, NRL-DC, pers. comm., 1995.
AIRGUN ARRAY (SEISMIC)	255 dB	Compressed air discharged into piston assembly	Johnston and Cain, 1981; Barger and Hamblen, 1980; Kramer et al., 1968.
LIGHTNING STRIKE ON WATER SURFACE	250 dB	Random events during storms at sea	Hill, 1985; Nishimura, NRL-DC, pers. com., 1995.
SEISMIC EXPLORATION DEVICES	212-230 dB	Includes vibroseis, sparker, gas sleeve, exploder, water gun and boomer seismic profiling methods.	Johnston and Cain, 1981; Holiday et al., 1984.
FIN WHALE	200 dB (avg. 155-186)	Vocalizations: Pulses, Moans	Watkins, 1981b; Cummings et al., 1986; Edds, 1988.
CONTAINER SHIP	198 dB	Length 274 meters; Speed 23 knots	Buck and Chalfant, 1972; Ross, 1976; Brown, 1982b; Thiele and Ødegaard, 1983.
ATOC SOURCE	**195 dB**	**Depth 980 m; Average duty cycle 2-8%**	**DEIS/EIR for the California ATOC Project and MMRP, 1994.**
HUMPBACK WHALE	192 dB (avg. 175-190)	Fluke and flipper slaps	Thompson et al., 1986.
SUPERTANKER	190 dB	Length 340 meters; Speed 20 knots	Buck and Chalfant, 1972; Ross, 1976; Brown, 1982b; Thiele and Ødegaard, 1983.
BOWHEAD WHALE	189 dB (avg. 152-185)	Vocalizations: Songs	Cummings and Holiday, 1987.
BLUE WHALE	188 dB (avg. 145-172)	Vocalizations: Low frequency moans	Cummings and Thompson, 1971a; Edds, 1982.
RIGHT WHALE	187 dB (avg. 172-185)	Vocalizations: Pulsive signal	Cummings et al., 1972; Clark 1983.
GRAY WHALE	185 dB (avg. 185)	Vocalizations: Moans	Cummings et al., 1968; Fish et al., 1974; Swartz and Cummings, 1978.
OFFSHORE DRILL RIG	185 dB	Motor Vessel KULLUK; oil/gas exploration	Greene, 1987b.
OFFSHORE DREDGE	185 dB	Motor Vessel AQUARIUS	Greene, 1987b.
OPEN OCEAN AMBIENT NOISE	74-100 dB (71-97dB in deep sound channel)	Estimate for offshore central Calif. sea state 3-5; expected to be higher (≥ 120 dB) when vessels present.	Urick, 1983, 1986.

Note: Except where noted, all the above are nominal total broadband power levels in 20-1000 Hz band. These are the levels that would be measured by a single hydrophone (reference 1 µPa @ 1 m) in the water.

Table 1.1.3-1 Natural and human-made source noise comparisons.

SOURCE: ATOC EIS

1-12

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EXHIBIT 10

Excerpts from Commission staff's August 28, 1996, letter to the Navy commenting on the Navy's decision to prepare an EIS for the overall LFA program:

We applaud the Navy for agreeing to examine the environmental effects of its program involving the development and deployment of a low-frequency, high-power density sonar system, which is designed to detect submarines throughout the world. At the same time, we wish to express grave concerns over the effects this program may have on marine resources and hope the Navy will undertake serious efforts to fully disclose the activity's effects. ...

Unlike the 195 dB (decibel) maximum ATOC[3] sound sources, where there was some uncertainty as to its effects, it appears that the LFA program poses a substantial risk of significant harm to the marine environment. The Navy's LFA sources are expected to be louder and of much greater duration than ATOC. Based on contractor reports (see "Low-Frequency, High-Power-Density, Active Sonars," Sea Technology, May 1995), past Navy LFA testing has been in the range of 235 dB, which is 40 dB louder than the ATOC source. This intensity is over ten thousand times louder than ATOC. This level is also louder than any natural sound emitted by any marine mammals, and it may well be loud enough to cause actual physiological damage to marine organisms. Moreover, we have reviewed reports that indicate, based on the Navy's own research, that such sounds can cause serious adverse effects on human divers (see "Exposure Guidelines for Navy Divers Exposed to Low-Frequency Active Sonar," Pestorius and Curley, May 14, 1996). ...

We are also, as we were with the ATOC program, greatly concerned over potential cumulative effects, including the combined effects from: (1) oil drilling and exploration, construction, and production activities, including well drilling, platform installation, platform removal, pipeline construction and repairs, and seismic surveys; (2) ongoing shipping activities; (3) other military activities (e.g., Navy "Ship Shock" detonations); and (4) scientific research. One of the few consensuses reached by all parties involved in the ATOC program was that the extent of human-introduced noises into the marine environment, worldwide, has increased exponentially in recent decades, with virtually no information available or ongoing monitoring to determine the ability of the marine environment to accommodate such noises. Given the worldwide scope of the LFA program, it is incumbent on the Navy to understand the effects of this program to the degree possible prior to implementing it on a regular basis.

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[3] Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP).

EXHIBIT NO. 10
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