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

CALIFORNIA COASTAL COMMISSION

45 FREMONT STREET, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200

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STAFF RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-109-98**
Staff:	MPD-SF
File Date:	8/27/1998
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Extended to:	12/11/1998
Commission Meeting:	12/8/1998

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

PROJECT LOCATION: West of I-5, Camp Pendleton Marine Corps Base, San Diego Co., and offshore waters in the Southern California Bight (Exhibits 1-3) (Note: the specific locations of the offshore transmissions and areas of operations are classified)

PROJECT DESCRIPTION: Advanced Deployable System (ADS) acoustic undersea surveillance system tests (Exhibits 2-5)

SUBSTANTIVE FILE DOCUMENTS: See page 20.

EXECUTIVE SUMMARY

The Navy has submitted a consistency determination for its Advanced Deployable System (ADS) Ocean Tests. The ADS is a primarily a passive acoustic monitoring system designed to detect, locate, and report surface vessel and submarine activities in littoral (nearshore) marine environments. The Navy proposes to install several hundred miles of underwater cables and listening devices, connect the cables to a shoreside facility on Camp Pendleton, and, to test the system, perform various active acoustic tests from ships in various locations in the Southern California Bight. Active acoustic tests would include 1,344 hours of active tests (104 hours of pulsed sounds and 1,240 hours of continuous sounds) for up to 56 days of active (and a total of 265 days of active and passive) testing over the 3-year test period. The cables and other equipment would be removed at the conclusion of the tests. The sound levels would range from 130-170 dB (decibels, (re 1 μPa[1])) for the continuous sounds and 120-175 dB for the pulsed sounds. The tests would also include light bulb implosions, and noise would also occur from vessel positioning systems. The location and frequency of the sounds are considered "classified" by the Navy, although general frequency ranges have been provided (see page 11, Table 4-4).

Determining the appropriate noise impact thresholds for marine mammals is an evolving science. For the ADS program, the Navy is relying on a noise level of 120 dB as the impact threshold for impacts from continuous noise on marine mammals, based on several studies (including 1983-84 studies by Malme et al.), which have shown that "Gray whales involved in these playbacks tended to avoid exposure to playback of continuous noises at levels of around 120 dB" (Tyack and Clark, LFA Phase II Quick Look report, 1998). The Navy has committed to avoiding exposure of marine mammals to sounds exceeding this threshold. The Navy will visually inspect the area during active transmissions, which will be halted if any mysticete (baleen whale) approaches within 320 meters (i.e., the >120 dB area; see Table 4 (page 13) and Exhibit 16) during maximum continuous sound transmissions (170 dB). For other marine mammals (e.g., odontocetes (toothed whales) and pinnipeds), the Navy states they are less sensitive to noise in this frequency range,[2] and therefore that this area need only be cleared if a mammal is within in the >120 dB area for over ½ hour. For pulsed noises, the Navy considers a greater threshold applicable, and the Navy commits to ceasing pulsed transmissions when an animal is within 10 meters of the source. The Navy has also committed to: (1) no nighttime transmissions >140 dB; (2) special restrictions for reduced-visibility weather conditions (e.g., fog); (3) avoiding transmissions within the Channel Islands National Marine Sanctuary (including waters 1 mi. beyond the Sanctuary boundary) and within 3 miles of all other islands; (4) avoiding all areas shallower than 200 ft. (60 meters) (again, including around islands); (5) avoiding transmissions within 0.5 miles of diving activities; and (6) monitoring and reporting to the Commission the mammal sightings and avoidance measures taken. The Navy also points out that the noise levels are comparable to common noises emitted regularly in the marine environment (e.g., typical shipping noises - see Exhibit 12).

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[1] All decibel levels shown in this report are based on the water reference standard (i.e., dB re 1 μPa (reference 1 micro Pascal at 1meter)). See Exhibits 18 & 19 for discussions of the difference between the air and water reference standards.

[2] See Exhibit 15 for underwater audiograms of odontocetes, showing hearing sensitivity frequency ranges.

Due to operational needs the Navy states it cannot commit to avoiding either the gray whale migration period or the migration path itself. Nevertheless, with the avoidance and mitigation measures incorporated into the project, the noises will avoid significant adverse reactions or physiological effects on marine resources. Nearshore marine resources will be protected because the cable laying through nearshore waters will avoid kelp beds and other sensitive habitat (Exhibit 9). Onshore, the cable trenching through the surf zone and beach will avoid the snowy plover nesting period. Finally, ideally the project may lead to implementation of passive acoustic monitoring systems, which could possibly benefit marine resources, in the event they were to replace or reduce military reliance on active, high-intensity, acoustic monitoring systems. The project is consistent with the marine resource, environmentally sensitive habitat, commercial and recreational fishing and diving policies (Sections 30230, 30240, 30234, 30234.5, 30213 and 30220) of the Coastal Act.

Concerning other issues raised, access and recreation impacts would be minimal, and the onshore support facilities will be located in a developed portion of Camp Pendleton and will avoid adverse visual effects. The project is therefore consistent with the public access and view protection policies (Sections 30210-30212 and 30251) of the Coastal Act.

STAFF SUMMARY AND RECOMMENDATION

I. Project Description. The Navy proposes to test an acoustic monitoring system called the Advanced Deployable System (ADS) in the marine environment of southern California, between Point Conception and the U.S.-Mexican border (Exhibit 1). The system includes the following activities: establishment of a shore station, deployment of the system, inspection and operation of the system, and retrieval of the system. The location of the onshore and nearshore portions of the system are as shown in Exhibits 1-3; however the Navy has "classified" both the location and frequency of the offshore system and ship-based active acoustic transmissions. The Navy states the classified status is needed "... to ensure the safety, security, and integrity of the ADS program and equipment" (Exhibit 11, page 3). The Navy describes the need for the system as follows:

> ***Purpose and Need***
>
> *ADS was created in response to the Navy's* Mission Needs Statement for Undersea Surveillance in Littoral Waters. *The Mission Statement identifies the need to provide undersea surveillance capability, cites shortfalls of current systems to furnish this capability, and identifies additional capabilities being explored by the ADS Program Office. Surveillance requirements include the ability to:*

- *detect, locate, and report submarines and surface shipping;*
- *provide a worldwide, flexible, and tailored response;*
- *bring tactical forces into contact with threat submarines; and*
- *gather operational and technical intelligence.*

Unlike the Navy's "LFA" system (Low Frequency Active Sonar, an *active* acoustic surveillance system), the proposed ADS is designed to function as a passive acoustic undersea surveillance system to detect, locate, and report surface vessel and submarine activities in the littoral, or nearshore marine environment. The general components of the system are depicted in Exhibits 4 & 5 (these figures are for illustration purposes only; configurations can vary). Once the system is deployed, underwater sounds are received by listening devices (hydrophones), which convert the sound signals to electronic signals (and ultimately optical signals). These are then amplified in a pressure vessel and transmitted via internode cable to the next series of hydrophones, and, ultimately, connected through a shore cable to a shore station on Camp Pendleton (Exhibits 2-3) for recordation, processing, and analysis.

To test and evaluate the capabilities of the system, the Navy needs to use both active and passive acoustic transmissions, which the Navy describes as follows:

> *ADS ocean test activities would require a maximum of 24 shipboard personnel (16 scientists and 8 crew) and 30 shore station personnel for installation, operation, and retrieval of the system. The proposed tests would occur over a 3-year period. Once the system has been deployed, the maximum number of days of operation for all four tests would be approximately 265 days; however, tests would not occur continually. ADS ocean test activities would incorporate both active and passive acoustic testing. Although ADS is an inherently passive system, artificial low frequency active acoustics must be introduced into the ocean environment to enable testing the system over its full range. A maximum of 1,344 hours (56 days) of active acoustic testing is proposed over the 3-year period. The capability of the system and the hydrophone sensors would also be tested by listening passively to shipping traffic in the area. During active acoustic testing of the system, a sound projector would be deployed from a test vessel. Data processing would take place at the shore station. Table 1 provides a summary of each of the four proposed ADS ocean tests.*

Table 1. Summary of ADS Ocean Tests

Key Test Parameters	Test 1 Multinode Test (MNT)	Test 2 Development Test-ID	Test 3 Integrated Deployment Test (IDT)	Test 4 All Optical Deployable System (AODS)
TEST CHARACTERISTICS				
Maximum Test Period	70 days	150 days	15 days	30 days
Number of Test Vessels	2	2	2	2
Nodes/Fingers	4/1	20/5	1/1	3/1
Total Length of Cable	130 km	550 km	50 km	150 km
Remotely Operated Vehicle	Yes	Yes	Yes	Yes
Battery Type	Lithium	Lithium	Alkaline	Alkaline
Maximum Number of Batteries	4	20	1	3
Shore Station	Yes	Yes	Yes	Yes
Wet-end Inspection and Repair[1]	Yes	Yes	Yes	Yes
Component Retrieval[2]	Yes	Yes	Yes	Yes
ACOUSTIC PARAMETERS				
Maximum Active Acoustic Testing	480 hours	720 hours	48 hours	96 hours
Pulsed Sound Source				
Total Number of Hours of Operation	32 hours	48 hours	8 hours	16 hours
Source Level	120-175 dB	120-175 dB	120-175 dB	120-175 dB
Frequency Range	20-1,000 Hz	20-1,000 Hz	20-1,000 Hz	20-1,000 Hz
Signal Duration	0.25 to 10 seconds	0.25 to 10 seconds	0.25 to 10 seconds	0.25 to 10 seconds
Range of Time between Pulses	1.75 seconds to days	1.75 seconds to days	1.75 seconds to days	1.75 seconds to days
Continuous Sound Source				
Total Number of Hours of Operation[3]	448 hours	672 hours	40 hours	80 hours
Continuous Source Level Range	130-170 dB	130-170 dB	130-170 dB	130-170 dB
No. of hours less than 140 dB	335 hours	426 hours	17 hours	50 hours
No. of hours between 140 and 170 dB	113 hours	246 hours	23 hours	30 hours
Frequency Range	20-1,000 Hz	20-1,000 Hz	20-1,000 Hz	20-1,000 Hz
Light Bulb Acoustic Tests				
Number of Lightbulb Tests	32	96	16	48
Duration of Pulse for Lightbulb Tests	1.8 ms	1.8 ms	1.8 ms	1.8 ms
Time between Implosions	20-30 minutes	20-30 minutes	20-30 minutes	20-30 minutes

[1] Wet-end inspection and repair would occur only as required.
[2] Plastic clips used to hold shells together in canister would not be retrieved (5 for Test 1, 30 for Test 2). No clips are used for Tests 3 and 4.
[3] The total hours for continuous sound source do not represent constant transmission since some time would elapse between sound source operations.

As stated above, active acoustics would be used during the system's proposed testing, using the following four principal sound sources: test vessels; an acoustic positioning system; imploding lightbulbs; and a towed sound source projector. The Navy describes these as follows:

> ***Test Vessels.*** *Two test vessels would be used as part of the proposed activities; however, only one vessel would be deployed at any given time. The test vessels would have deck lights which would provide visibility from between 150-300 ft (46-91 m) at night.*
>
> ***Acoustic Positioning System.*** *The acoustic positioning system is a commercially available projector/hydrophone and would be used to "interrogate" acoustic beacons. The positioning system would produce brief, high-frequency repetitive pulsed chirp sounds with a sound source*

level of 196 dB reference 1 micro Pascal meter (re 1 μPa-m) at a repetition rate up to once per second. The frequency would be 15-18 kHz [kilohertz], *and the pulse duration would be about 80 ms* [milliseconds]. *The 80 ms "pulse" actually consists of eight 1.2 ms chirps separated by 10 ms gaps, so the actual transmission time is 9.6 ms per "pulse." The acoustic positioning system on the ROV and TDV would reply to each interrogation signal with a sound source level of 183-186 dB re 1 μPa-m in the same frequency band as the interrogator signal. The positioning system would only be used for approximately 30 days during deployment and repair of the system.*

Lightbulbs. *A simple system consisting of imploding lightbulbs to generate acoustic signals would be used during the acoustic testing portion of all ADS ocean tests. The operation would consist of lowering standard, off-the-shelf lightbulbs (for example, a 2.5-inch diameter General Electric 40625/W 40-watt globe) to a specified depth and breaking the lightbulbs, thus creating a short duration impulse on the order of 2 ms. For the ADS ocean tests, a mousetrap would be used to implode the lightbulb. ... Each lightbulb would be encased in nylon to facilitate retrieval and to ensure that no glass chards are released into the water. This system is often used as a cost-efficient means to provide a sound source.*

Towed Sound Source. *A U.S. Navy Underwater Sound Reference Detachment sound projector (model J15-1) is proposed for use during the proposed ADS ocean tests. According to its specifications, this projector is capable of transmitting tonals at sound source levels shown in Table 2.*

Table 2. Underwater Sound Source Levels for Sound Projector

	J15-1 Sound Source Levels at 3 amps			
Frequency	**100 Hz**	**400 Hz**	**700 Hz**	**1,000 Hz**
dB re 1 μPa at 1 meter from sound source	175	171	169	163

The Navy states:

The towed source would have two *modes of operation: a pulsed mode and a continuous mode. The maximum amount of time proposed for all four tests for pulsed sound source (maximum of 175 dB) testing is 104 hours (refer to Table 1* [see page 5]). *Maximum proposed continuous sound source testing in 1,240 hours (828 hours at less than 140 dB and 412 hours at no greater than 170 dB). A support vessel would be used to tow a sound source at various depths and distances from the hydrophone array to test its listening capabilities. The sound source would be towed at*

> *speeds of 2-6 knots. The maximum sound source level would be 175 dB in waters deeper than 200 ft (60 m). The towed sound source projector would not be used in waters 200 ft. (61 m) or less in depth. In addition, all active acoustic transmission would cease if divers or dive flags are observed within 0.5 mile (1 km) of the test vessel.*

Onshore on Camp Pendleton the Navy proposes a temporary shore station for receiving, processing, displaying, and storing the data received. The station would be located within a previously disturbed area adjacent to the Marine Corps Tactical Systems Support Activity (MCTSSA) facility (Exhibits 2-3). The site already has adequate road access and parking; however the Navy will need to grade the approximately ½ acre area. Other improvements at the site include: (1) upgrading the existing access road; (2) installing security fencing around the proposed site; and (3) constructing a concrete slab to accommodate the support vans.

In addition to the shore station, a cable is needed to connect an offshore junction box to the shore station site (see schematic, Exhibit 4). Cable installation would require trenching across the beach and into the surf zone to bury the cable. The cable would be laid and buried at low tide about 6 ft. deep through the intertidal zone. The trench across the beach would be a maximum of 250 ft. long and 2 ft. wide. From the beach, the cable would then be laid on the ground (uncovered) until it reached an existing distribution box and conduit. At that point, the cable would be placed in the 4-inch conduit and run through to the proposed shore station (Exhibit 3).

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 Diego 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. 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.*

Marine mammals rely on sound for communication, orientation, and detection of predators and prey. In reviewing the Navy's "LFA" research (Phases I and II, CD-95-97 and CD-153-97 respectively), the Commission noted: (1) the growing evidence that anthropogenic sounds can disturb marine mammals (Richardson et al. 1995); (2) that observed mammal responses to such sounds include silencing, disruption of activity and movement away from the source; and (3) that sound carries so well underwater that animals "... have been shown to be affected many tens of kilometers away from a loud acoustic source." The Commission agreed with the Navy in reviewing those research projects that there was a critical need for continuing research to expand the knowledge base concerning human noise impacts on marine mammals.

In its consistency determination the Navy analyzed a variety of effects on the entire spectrum of marine mammals and other species in the Southern California Bight. Effects analyzed included both physical and acoustic effects on marine resources. Physical effects include: physical releases through discharges, leakage, breakage, and corrosion of materials involved; cable trenching activities through the surf zone; and cable laying and placement on the seafloor. These effects would be minor, and the Navy will avoid cable laying during sensitive time periods (e.g., snowy plover nesting season) and will avoid cable placement on sensitive rocky or kelp bed habitat (Exhibit 9)).

The major issue raised by the project is its potential acoustic effects, particularly on marine mammals, and more particularly on gray whales. The gray whale is currently only found in the North Pacific (Rice at al., 1984). The southbound migration period for the gray whale generally begins in October and continues through February, and the northward migration occurs from February through April. North of Point Conception the gray whales migrate nearer to shore; south of Point Conception to Mexico their migration path is broader and is depicted generally as shown in Exhibit 8. Due to operational needs the Navy states it cannot commit to avoiding either the gray whale migration period or the migration path itself.

Gray whales are a concern for a number of reasons, including the fact that:
(1) mysticetes (baleen whales) are more likely to be affected by the towed sources' frequencies than odontocetes (toothed whales); (2) the sources could operate during the gray whale migration period and directly within the migration path (Exhibit 8); and (3) preliminary results from the Navy's Phase II LFA research have, at a minimum, confirmed the validity of the previously established notion that continuous noises greater than 120 dB can cause gray whales to deviate from their migration paths.[3] The proposed tests using continuous noise up to 170 dB could clearly include sounds loud enough to trigger gray whale avoidance behavior. [4]

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[3] Tyack and Clark, LFA Phase II Quick Look report notes: "Gray whales involved in these ... [Malme et al. (1983, 1984)] playbacks tended to avoid exposure to playback of continuous noises at levels of around 120 dB."

[4] Tyack and Clark, LFA Phase II Quick Look report also notes: "Whales avoided exposure to playbacks with source levels of 179 and 178 dB re 1 μPa at 1 m at ranges of several hundred meters, similar to avoidance responses reported by Malme at al. (1983, 1984) using a 163 dB source."

Other mysticete whale concentration areas are shown in Exhibit 7, and Exhibit 10 contains a complete list of marine mammal species in the area, including population estimates and seasonal commonalities. Concerning impacts to marine mammals in general, the Navy states (Consistency Determination, page 21-22):

> *Marine Mammals*
>
> *Issues of concern related to marine mammals include the potential for (1) changes in behavior due to impacts of underwater noise associated with the proposed ocean tests, (2) attraction/ingestion/entanglement/ collisions, and (3) chemical contamination. Of these, most attention is devoted to acoustic issues because marine mammals rely on hearing for foraging and communication. The main noise-producing aspects of the proposed tests are vessel operations, towed source operations, the use of an acoustic positioning system, and lightbulb implosions.*
>
> *The potential impacts of test activities are analyzed for three groups of marine mammals: mysticetes (baleen whales), odontocetes (toothed whales, dolphins and porpoises), and pinnipeds (seals and sea lions). Activities associated with the proposed tests will have essentially no impact on mustelids (sea otters), given their extremely low numbers in the proposed test area, their restricted/nearshore distribution in waters less than 66 ft. (20 m) deep (Estes and Jameson 1988, USFWS 1996,) and their habit of resting (rafting) at the surface with their ears above the water roughly 50 percent of the time.*
>
> *Potential Acoustic Impacts*
>
> *For purposes of the acoustic analysis, the proposed frequency range for the ADS ocean tests is 20-1,000 Hz. However, the majority of testing specifically for low frequency occurs above 50 Hz. When the frequency is below 50 Hz, the maximum sound source level would be limited to 130 dB re 1 μPa-m.*
>
> *As shown in Table 3* [see page 14] *using 20 log r (which is an accepted approximation of source level measures at a given distance), received sound levels at a maximum 170 dB re 1μPa-m continuous transmission would diminish to 160 dB re 1μPa-m at about 10 ft. (3 m), to 140 dB re 1μPa-m at 105 ft (32 m), and 120 dB re 1μPa-m at 1,050 ft (320 m). When the source level is at a maximum 175 dB re 1μPa-m for pulsed transmission, received sound levels would diminish to 160 dB re 1μPa at 20 ft (6 m), to 140 dB re 1μPa at 184 ft (56 m), and to 120 dB re 1μPa at 1,800 ft. (560 m).*

> *During ADS ocean tests, a sound source would be towed along predetermined paths. Potential impacts of sound on marine life depends partly on whether sounds are pulsed or continuous. An animal's response to a pulsed sound with a particular peak level can be quite different than its response to a continuous sound at the same level (Richardson et al. 1995). Corresponding zones of ensonification for maximum pulsed and continuous sound source levels for day and night operations that would affect fish and marine mammals are depicted on Figure 7* [Exhibit 16].
>
> *Potential acoustic impacts of ADS ocean test operations on marine mammals vary with hearing capabilities of each major group. Odontocetes and pinnipeds have relatively poor hearing at frequencies below 1 kHz, requiring levels near 80-100 dB for signal detection. Conversely, mysticete ear structure indicates good hearing at these relatively low frequencies (Ketten 1994). Thus, mysticetes are the marine mammals having the greatest potential to be affected by signals from the towed sound source. ...*

The Navy's consistency determination further states:

> *Based on the NOAA/NMFS recommendation, the harassment thresholds for mysticetes would then fall in the range from about 160 dB to 180 dB (re 1 μPa), depending on species, frequency, duration, waveform, etc. NMFS is re-examining sound pressure level thresholds in the context of the definition of harassment. For this EA, the Navy will take the conservative approach of mitigating to the range at which the level is estimated to be 120 dB or less for continuous sound and 160 dB for less for pulsed sound. In this case, the ADS program can meet the testing requirements while mitigating to these very conservative sound levels.*

Table 4-4. Potential Impacts of ADS Ocean Tests Acoustic Sources on Marine Mammals

		Acoustic Source (dominant frequencies)		
Marine Mammal	**Vessels (< 1kHz)**	**Towed Sources (50-1000 Hz)**	**Acoustic Position (15-18 kHz)**	**Light Bulbs (130-876 Hz)**
Mysticetes	possible	possible	unlikely	N/A
Odontocetes	unlikely	unlikely	possible	N/A
Pinnipeds	unlikely	unlikely	possible	N/A
Sea otters	unlikely	unlikely	unlikely	N/A

Note:
N/A = not applicable due to brevity of signal

The Navy maintains that the acoustic impacts from the proposed project "...are not predicted to result in a "take" by harassment of any marine mammal, based on the definitions contained in the Marine Mammal Protection Act (MMPA)."[5] The Navy states that historical National Marine Fisheries Service (NMFS) interpretation is that minor changes in behavior do not constitute harassment under the MMPA, and that:

> *Furthermore, since the 1994 MMPA amendments were adopted, the NMFS has not expressed an interest in requiring take permits for vessels and associated acoustics, or for common vessel devices that employ active acoustics such as fish finders.*

The Navy notes that:

> *... [A]lthough the behavioral responses of marine mammals to low-frequency anthropogenic noise has been the focus of recent study (e.g., Clark et al. 1998; Tyack 1998), there as yet are no firm conclusions as to specific noise levels that constitute "take" by harassment, as defined by MMPA. Based on the best available data, it seems that potential marine mammal reaction to the noise-producing elements of the ADS tests would be minimal.*

Determining the appropriate noise impact thresholds for marine mammals is an evolving science. The Commission notes that NMFS is currently in the process of conducting workshops and attempting to revise its procedures concerning threshold levels triggering "take" permits. Nevertheless, for the ADS project, NMFS stated in a recent letter to the Navy (dated October 23, 1998 (Exhibit 17)), that:

> *After reviewing the EA for the ADS ocean tests and the most recent available data regarding impacts of sound on marine mammals, I have concluded that the likelihood that a marine mammal will be incidentally taken (including harassed) by the action is low. Thus, I do not recommend that you obtain an incidental harassment authorization under the Marine Mammal Protection Act. In addition, due to the implementation of the mitigation measures, the proposed tests should not affect species under the jurisdiction of NMFS that are listed as threatened or endangered species under the Endangered Species Act.*

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[5] 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 harassment, harm, and mortality), unless under permit or authorization or exempted from the provisions of these Acts.

The Navy concludes that significant impacts to marine mammals would not occur as a result of the proposed ocean tests, that all potential impacts are expected to be below the threshold requiring incidental take authorization, and that the tests would be consistent with Coastal Act marine resource and sensitive habitat protection policies. At the same time the Navy has committed to including certain avoidance and minimization measures in the tests to further reduce concerns. These would include visual searches for mammals and avoidance/cessation/delays in certain situations, ramp-up of the towed sound sources, lowered nighttime sound levels, and exclusion areas around the Channel Islands Sanctuary, other islands, and areas shallower than 200 ft. According to the Navy, these measures are included because they "… would not have an overall adverse impact on ADS ocean test activities and they provide additional assurance that there would be no significant impacts on marine mammals." These measures are summarized in chart form below and further described in the subsequent text:

Table 4. Mitigation Measures for Marine Mammals during ADS Ocean Tests Acoustic Transmissions

Acoustic Source		Watch Type[1]		
Continuous	Pulsed	Visual	Dedicated	Operations Curtailed[2]
≤ 140 dB		√		Any marine mammal within 33 ft (10 m)
141-170 dB[3]			√	Mysticetes within: 1,050 ft (320 m) @ 170 dB 330 ft (100 m) @ 160 dB 105 ft (32 m) @ 150 dB 33 ft (10 m) @ 140 dB
141-170 dB[3]		√		Pinnipeds or odontocetes within 1,050 ft (320 m) for more than 0.5 hour
	160-175 dB	√		Any marine mammal within 33 ft (10 m)

[1]A visual or dedicated watch will begin 20 minutes before the start of any acoustic transmission and will continue for the duration of the transmission.

[2] Operations would also be curtailed if sea turtles are observed.

[3]Acoustic transmission during daylight hours only.

For further details on these measures, the Navy elaborates (Consistency Determination, page 39-40):

> *For the proposed ADS ocean tests, two types of visual searches for marine mammals would be conducted: (1) a* visual watch *by the ship personnel, and (2) a* dedicated watch *by personnel specifically trained in marine mammal identification. A visual watch of waters within 0.6 miles (1 kilometer [km]) of ADS support vessels would be conducted at least 20 minutes before and continue during any pulsed or continuous sound source transmission.*

> *For continuous sound source transmissions, a ship's watch by operations personnel would be conducted at all times during transmissions less than 140 dB. Operations would be curtailed only if marine mammals approach within 33 ft (10 m) of the towed source projector during continuous sound transmission when source level is below 140 dB.*
>
> *When active acoustics involve continuous sound source transmission greater than 140 dB, a dedicated watch by at least two personnel would be conducted. Continuous sound source transmission between 140 and 170 dB would be conducted only during daylight hours and when visibility is not limited by weather conditions (e.g., fog, adverse sea state). Transmissions would be curtailed in accordance with Table 4.* [page 13]
>
> *Because pinnipeds (seals and sea lions) and odontocetes (toothed whales: dolphins, porpoises, etc.) do not have good hearing below 1 kHz, transmissions between 140 and 170 dB would continue unless these animals remain with 1,050 ft (320 m) of the sound source for periods greater than one-half hour. If pinnipeds or odontocetes remain near the continuous source over one-half hour, transmissions would be stopped.*

The Navy has also committed to "ramp-up procedures" to allow any marine mammals near the sound source during the onset of test operations the opportunity to move away before being exposed to maximum levels. This process entails transmission levels being increased gradually, or ramped-up, from an overall level less than or equal to 140 dB to the desired operating level, at a rate not exceeding 6 dB per minute.

In analyzing received level thresholds the Navy differentiates between pulsed and continuous noises, stating: "Two received levels (160 dB and 120 dB) have been used in the past to define radii for potential "zones of responsiveness" for mysticetes to pulsed and continuous noise, respectively (Richardson et al. 1995; Richardson 1997)." Using a distance formula assuming even spherical spreading loss (20 log r), the Navy states a 175 dB pulsed source level will drop to 160 dB at 19 ft. (6 m) from the source. When the continuous sound source is transmitting at 170 dB, the range of ensonification to 120 dB will extend 1,050 ft. (320 m) from the source (see Table 3 below and Exhibit 16).

Table 3. Predicted Received Sound Levels Relative to Distance from Sound Source

	Received Sound Source Levels		
Source Level	**120 dB**	**140 dB**	**160 dB**
175 dB (pulsed)	1,800 ft. (560 m)	184 ft. (56 m)	20 ft. (6 m)
170 dB (continuous)	1,050 ft. (320 m)	105 ft. (32 m)	10 ft. (3 m)

Thus, for the ADS program, the Navy is relying on a noise level of 120 dB as the impact threshold for impacts from continuous noise on marine mammals and has committed to avoiding exposure of marine mammals to sounds exceeding this threshold. When the source is transmitting continuously in the 140-170 dB range, a 320 meter radius around the continuous sound source will be visually inspected by trained personnel, and transmissions will be halted if any mysticete (baleen whale) approaches closer than 320 meters. For other marine mammals (e.g., odontocetes and pinnipeds), which the Navy states are less sensitive to noise in this frequency range (< 1 kHz), this area need only be cleared if the mammals are in the area for over ½ hour. For pulsed noises, the Navy considers a greater threshold applicable (i.e., 160 dB), and the Navy commits to ceasing pulsed transmissions when an animal is within 10 meters of the source. In addition, the Navy has committed to: (1) no nighttime transmissions greater than 140 dB; and (2) special restrictions for reduced-visibility conditions (e.g., fog, adverse sea states). The Navy states (Exhibit 11, page 2):

> *Continuous source level transmissions in low visibility weather will be limited to low transmission levels such that the visual search requirement does not exceed the visibility.*

The Navy has also committed to monitoring and reporting to the Commission the mammal sightings and avoidance measures taken. The Navy has agreed to provide the monitoring information at the conclusion of each of the four phases of the tests (see page 5 for a description of the four test phases). The Navy has not agreed to divulge specific ship location prior to or at the time of transmission, as it considers this information to be classified. However the Navy may be able to declassify that information sometime after the tests are completed, in which case it would provide the post-testing ship location information to the Commission.

In addition, while the Navy states that for operational reasons it cannot commit to avoiding either the gray whale migration period or the migration path itself, the Navy is willing to commit to avoiding transmissions within: (1) all areas shallower than 200 ft. (60 meters); (2) the Channel Islands National Marine Sanctuary (including waters 1 mi. beyond the Sanctuary boundary); and (3) 3 mi. around San Nicolas, San Clemente, and Santa Catalina Islands (Exhibit 6). Concerning the first of these commitments, an interesting lesson from the Navy's Phase II LFA research[6] is that if the source is located between the gray whales and the shoreline (i.e., shallower waters) it will have a greater impact than the same level source when located on the seaward side of the whales.

Finally, the Navy also analyzed effects on marine fish species, stating, for the towed sound sources:

---

[6] Quick Look – Playback of low frequency sound to gray whales migrating past the central California coast – January, 1998, Peter Tyack, Christopher Clark, 23 June 1998.

> *The sound source would generate sound levels below 175 dB. A sound source of 180 dB is the established threshold found to cause reduced catchability of fish or hearing damage to fish (Hastings et al. 1996).*

The Navy considers the effects on fish from the other noises (e.g., vessel positioning systems, vessel sounds, and lightbulb implosions) to be minimal.

Commission Conclusion: Marine Resources. As noted in its actions involving Navy LFA and Scripps ATOC[7] acoustic research activities, the Commission remains concerned over the lack of reliable information regarding the effects of underwater sounds on the marine environment. At the same time the Commission must consider the fact that the ADS test sound levels would be comparable to common existing, and for the most part unregulated, noise emitters such as ship traffic. In reviewing Navy LFA research the Commission noted that vessels, in some cases with poorly-maintained 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)." Exhibits 12 & 13 show a broader comparison of natural and human-induced underwater sounds. The Commission also notes that, in comparing Navy ADS testing with Navy LFA and Scripps ATOC activities, those activities did trigger NMFS "take" and/or "scientific research" permits, whereas the Navy maintains (and NMFS has confirmed) that the proposed tests would not exceed "take" thresholds. Finally, the Commission needs to weigh the Navy's commitments for additional avoidance and minimization measures, as described above, to further reduce marine mammal exposures. Considering all these factors, the Commission concludes that the acoustic aspects of the proposed tests would not cause significant adverse reactions or physiological effects on marine resources.

For non-acoustic impacts, the Commission finds that: (1) nearshore marine resources will be protected because the cable laying through nearshore waters will avoid kelp beds and other sensitive habitat; and (2) onshore, the cable trenching through the surf zone and beach will avoid the snowy plover nesting period. The Commission further hopes that, overall, the proposed testing might further military reliance on passive acoustic monitoring systems. Such an outcome could even benefit marine resources, in the event these passive systems were to replace or reduce the need for active high-intensity acoustic monitoring systems. The Commission concludes that, with the commitments the Navy has incorporated into the project, the project is consistent with the marine resource and environmentally sensitive habitat policies (Sections 30230 and 30240) of the Coastal Act.

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[7] Scripps Institution of Oceanography, Acoustic Thermometry of Ocean Climate (ATOC) Project and Marine Mammal Research Program (MMRP), CC-110-94/CDP 3-95-40.

B. Commercial and Recreational Fishing. Section 30230 of the Coastal Act, quoted on page 8 above, provides for the protection of economically (as well as biologically) significant marine species. Section 30234 provides that: "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."

The Navy states:

> *Although facilities serving the commercial fishing and recreational boating industries would not be affected under the proposed action, commercial fishing and recreational boating activities could be affected by the proposed ocean tests. Some recreational and commercial fishing vessels would potentially be restricted from entering open waters within a 1-mile-radius of the proposed tests during the test periods. A NOTMAR* [Notice to Mariners] *would be provided to these vessels 48 hours in advance, which would allow the boats to select alternate destinations without substantially affecting their activities. In addition, the proposed tests would be temporary and would not result in long-term access restrictions to open water areas; therefore, impacts to commercial and recreational fishing would not be significant.*

The Navy regularly conducts various military testing throughout the Pacific Missile Test Range and, on a short term basis, excludes commercial and recreational activities during these activities. The proposed activity is similar to these types of past activities, and the Navy states that for any particular operating area, the tests would be relatively short term. Thus, given the short term nature of the tests in any one location, combined with the fact that the maximum sound levels are comparable to common ship noises in the affected area, the Commission finds that the project will minimize adverse effects on commercial and recreational fishing in the area. The Commission concludes that the project is consistent with Sections 30234 and 30234.5 of the Coastal Act.

C. Public Access and Recreation. Sections 30210-30212 of the Coastal Act provide for the maximization of public access and recreational opportunities, with certain exceptions for, among other things, military security needs and public safety. Section 30213 provides that "Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided." Section 30220 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."

The proposed tests involve both onshore and offshore components, with onshore activities potentially affecting beach use and offshore activities potentially affecting recreational diving and boating. Concerning onshore impacts, in reviewing Marine Corps consistency determinations for activities on Camp Pendleton the Commission has recognized that many portions of the base are off limits to the public for both public safety and military security reasons. The Commission typically accepts these restrictions unless a proposed new project would generate burdens on public access, in which case further analysis would be needed. The Navy states (Consistency determination, page 16):

> *Public access to the shoreline is currently restricted at MCB Camp Pendleton in the interest of public safety and military security. The proposed action would not interfere with existing beach access at any public beach within the identified project footprint area.*

Concerning offshore recreation, the Navy states (Consistency determination, page 16):

> *Under the proposed action, public access to the shoreline would not be affected. To minimize the potential for disturbance to existing recreational resources, operational and environmental constraint areas were identified within southern California and were excluded from proposed testing. Currently, a 6 nautical mile (nm) boundary comprises the Channel Islands National Marine Sanctuary .... As part of the proposed project the existing 6 nm sanctuary boundary plus a 1 nm buffer area around the sanctuary has been established as an exclusion area. A 3 nm buffer around the other offshore islands (San Nicolas, Santa Catalina, and San Clemente islands) was also identified as an exclusion area. In addition, an exclusion area for acoustical testing would be established for diver safety so that no active acoustic transmissions associated with ADS acoustic testing would occur within waters less than 200 ft. (61 m) deep. In addition, all active acoustic transmission would cease if divers or dive flags are observed within 0.5 (1 km) of the test vessel.*
>
> *Implementation of the proposed action would potentially affect recreational uses on offshore coastal waters. Recreational uses would be temporarily restricted within a 0.5 mile radius of the test vessel while deploying cable and towing the sound source projector for purposes of public safety and military security; however a NOTMAR* [Notice to Mariners] *would be issued 48 hours before commencement of the tests to give regular boat traffic ample notice prior to testing in a given area. Although access would be temporarily restricted in the project area, notification of the proposed test area would substantially reduce potential impacts to recreational opportunities. Given the large area in which the ocean tests could occur and the limited duration of the tests, impacts to recreational uses would not be significant.*

Specifically concerning diving activities, as stated above the Navy has committed to avoiding active acoustic operations within 0.5 miles of diving activities. In reviewing LFA Phase I research (CD-95-97), the Commission concluded that Navy avoidance of exposing divers to sounds exceeding 130 dB would be adequate, based in part on advice and research from the Navy's Bureau of Medicine and Surgery. Concerns have been raised to the Commission that a swimmer exposed to sound levels around 125 dB during Navy LFA acoustic research in Hawaii experienced adverse reactions (Exhibit 14). However, in this case, maximum sound levels from both the continuous (170 dB) and pulsed (175 dB) sources would attenuate to below 120 dB within the 0.5 mile radius the Navy has committed to avoiding.[8]

The Commission concludes that proposed project will not generate onshore burdens on public access and recreation and is consistent with the public access and recreation policies (Sections 30210-30212) of the Coastal Act. The Commission also concludes that the offshore operations will minimize, and where necessary avoid, adverse effects on recreational boating and diving in the Southern California Bight, and that the project is consistent with Sections 30213 and 30220 of the Coastal Act.

D. <u>Public Views</u>. Section 30251 of the Coastal Act provides:

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. ...*

The Navy states (Consistency Determination, page 47):

> *Implementation of the proposed action would not affect the existing visual quality of coastal areas. Development of the proposed shore station and associated facilities would occur adjacent to existing development at the MCTSSA facility. The proposed shore station structure would be visually compatible with the character of the surrounding development and would not result in the alteration of natural land forms. The proposed test cable would not be a visually prominent feature in the area since it is placed above ground and would be entrenched along the open beach area. Vessel activity associated with the proposed ADS tests would be compatible with existing boating activities in the coastal waters. Therefore, the scenic and visual qualities of the coastal areas would be protected under the proposed action and visual impacts would not occur.*

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[8] Radius to 120 dB from 175 dB (max. pulsed sound) = 1,800 ft., which is less than 0.5 mi. (or 2,640 ft.).

The onshore support facilities would be located seaward of I-5, the main public thoroughfare through Camp Pendleton affording scenic coastal public views. However the facilities would be sited within an existing developed area and would not be visible from I-5. Therefore the Commission agrees with the Navy that these facilities would not affect existing scenic public views and that the project is consistent with Section 30251 of the Coastal Act.

VI. Substantive File Documents:

1. 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.

2. Consistency Determinations No. CD-95-97 and CD-153-97 (Navy, Low-Frequency Active (LFA) Sonar, Phases I and II).

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

4. 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).

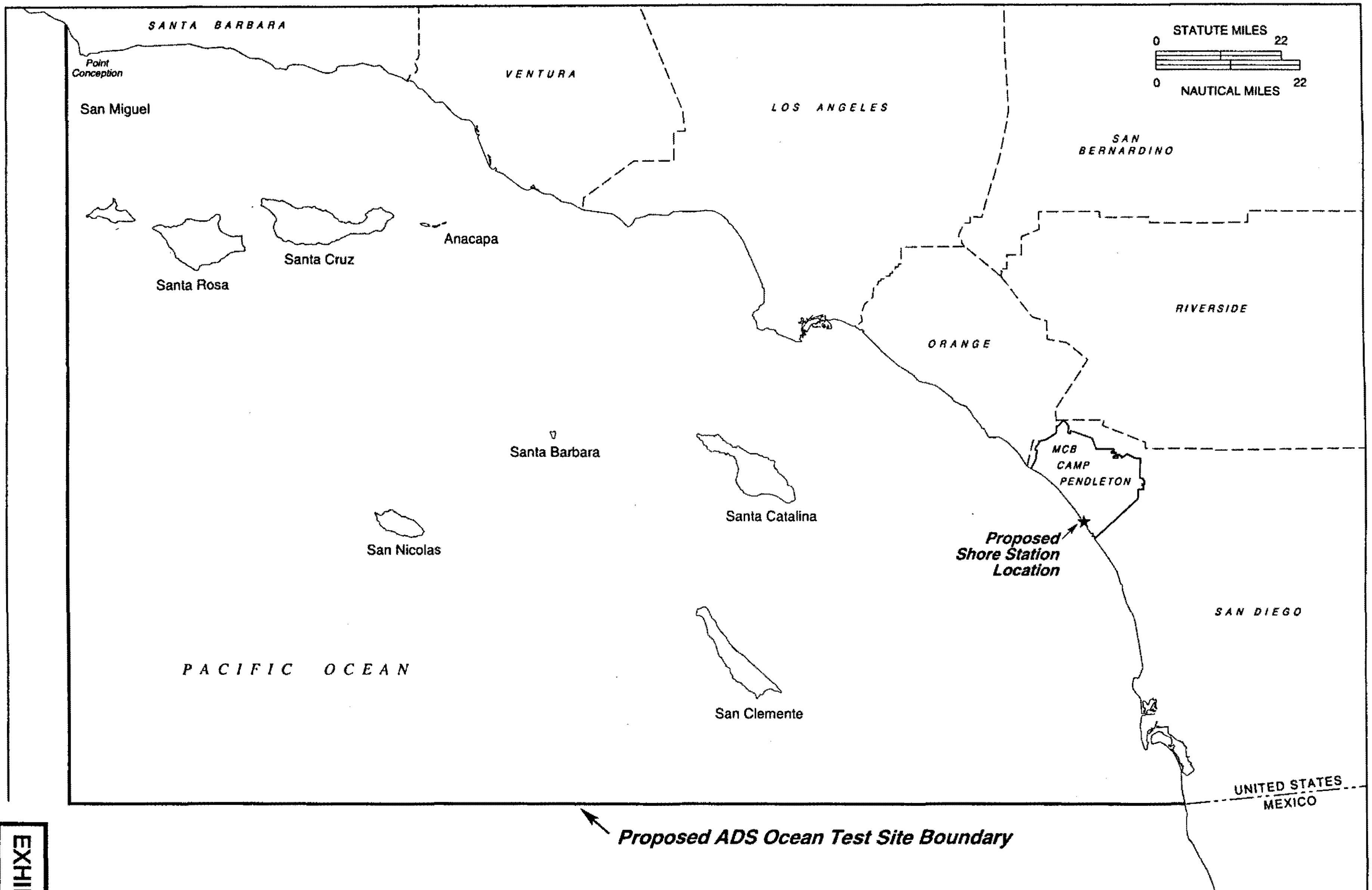
5. Malme CI, PR Miles, CW Clark, P Tyack and JE Bird (1984), Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration. Bolt Beranek and Newman Report No. 5586 submitted to Minerals Management Service,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

6. 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.

7. Environmental Assessment, Advanced Deployable System Ocean Tests, Program Definition and Risk Reduction Phase, U.S. Navy, October 1998.

8. Quick Look – Playback of low frequency sound to gray whales migrating past the central California coast – January, 1998, Peter Tyack, Christopher Clark, 23 June 1998.

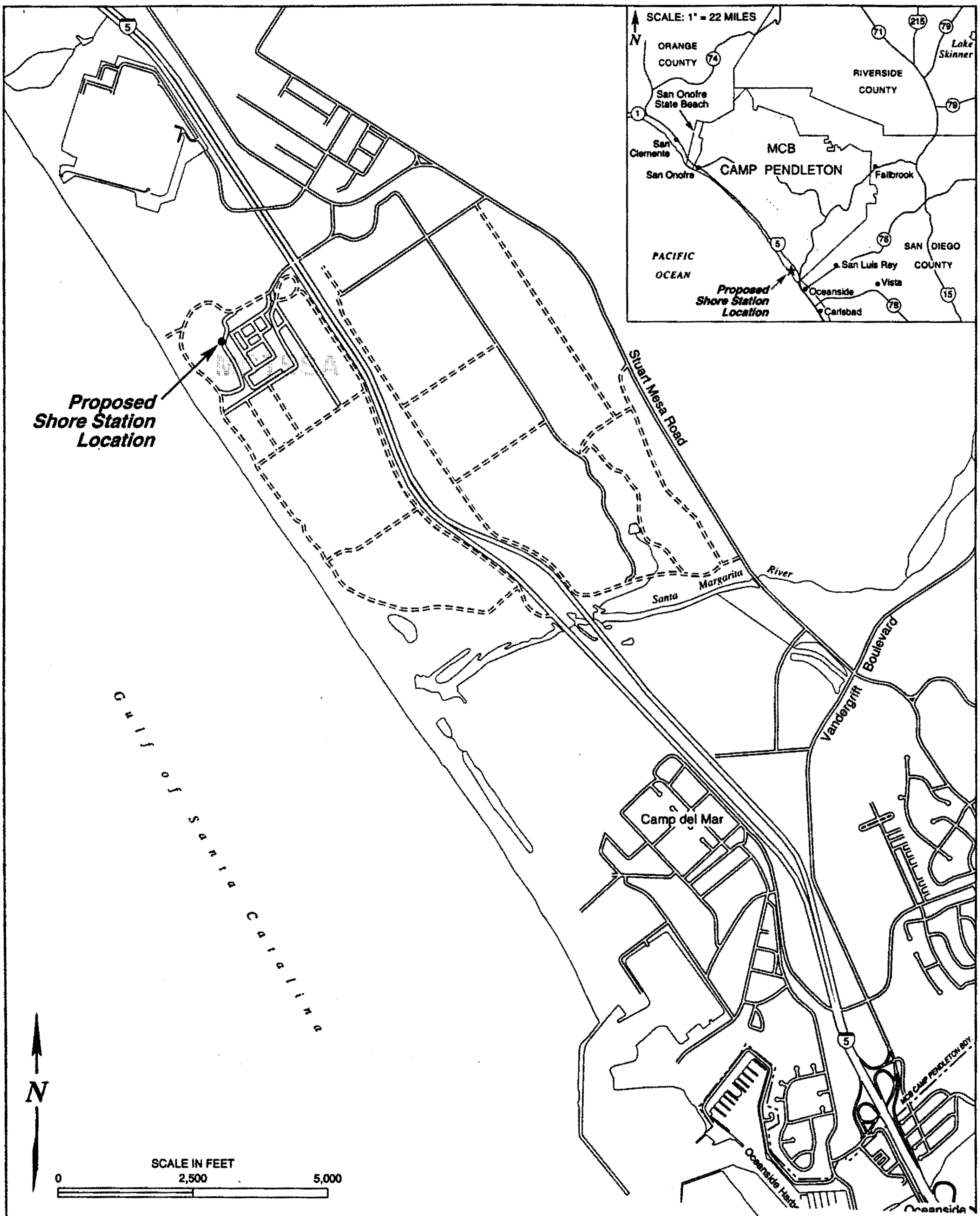
9. Summary Record and Report SACLANTCEN Bioacoustics Panel, NATO (A. D'Amico, Editor), El Spezia, Italy, 15-17 June 1998.



Proposed ADS Ocean Test Site

FIGURE 1

EXHIBIT NO. 1
APPLICATION NO. CD-109-98



Proposed Shore Station Site Map
MCB Camp Pendleton, California

EXHIBIT NO. 2
APPLICATION NO.
CD-109-98

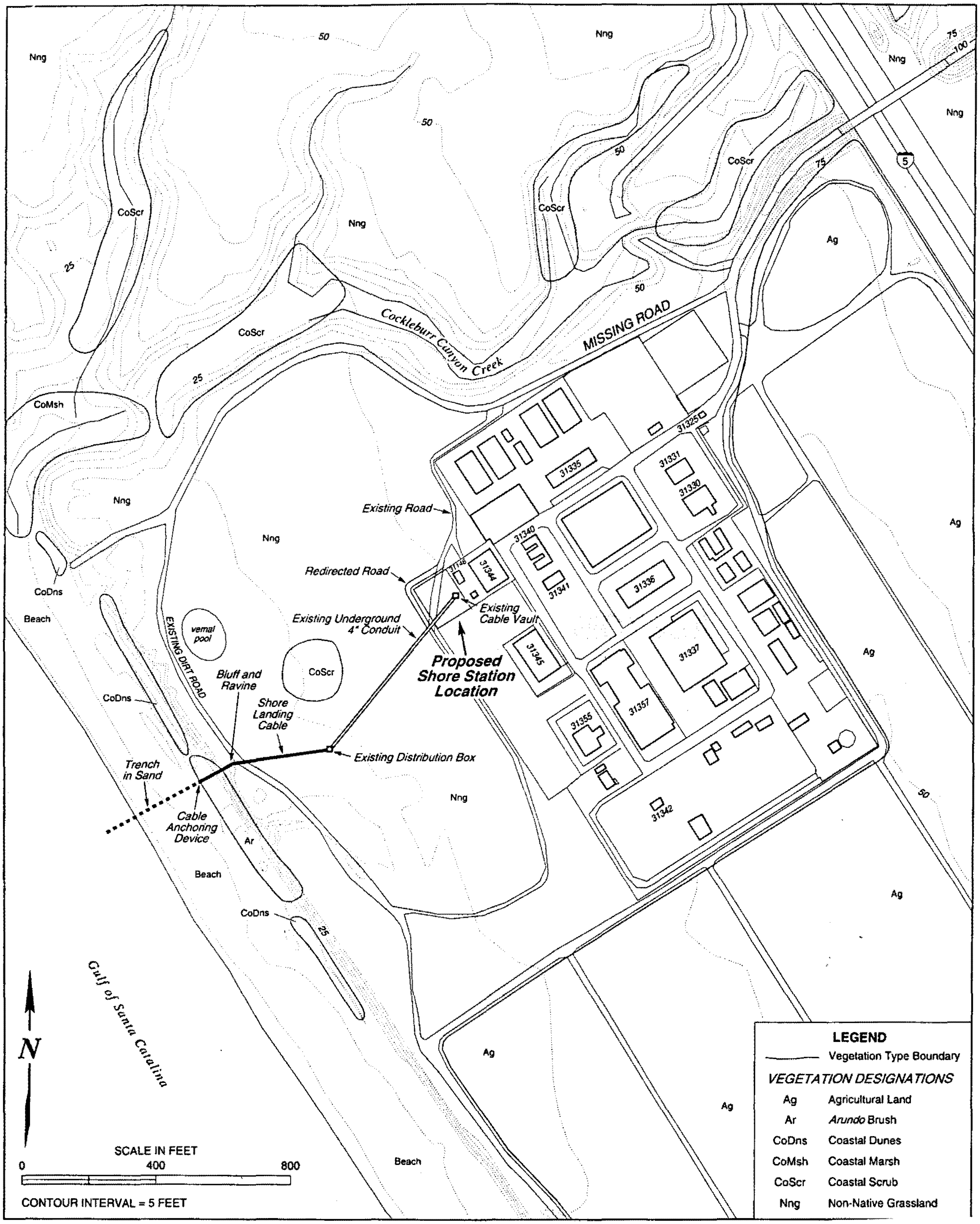
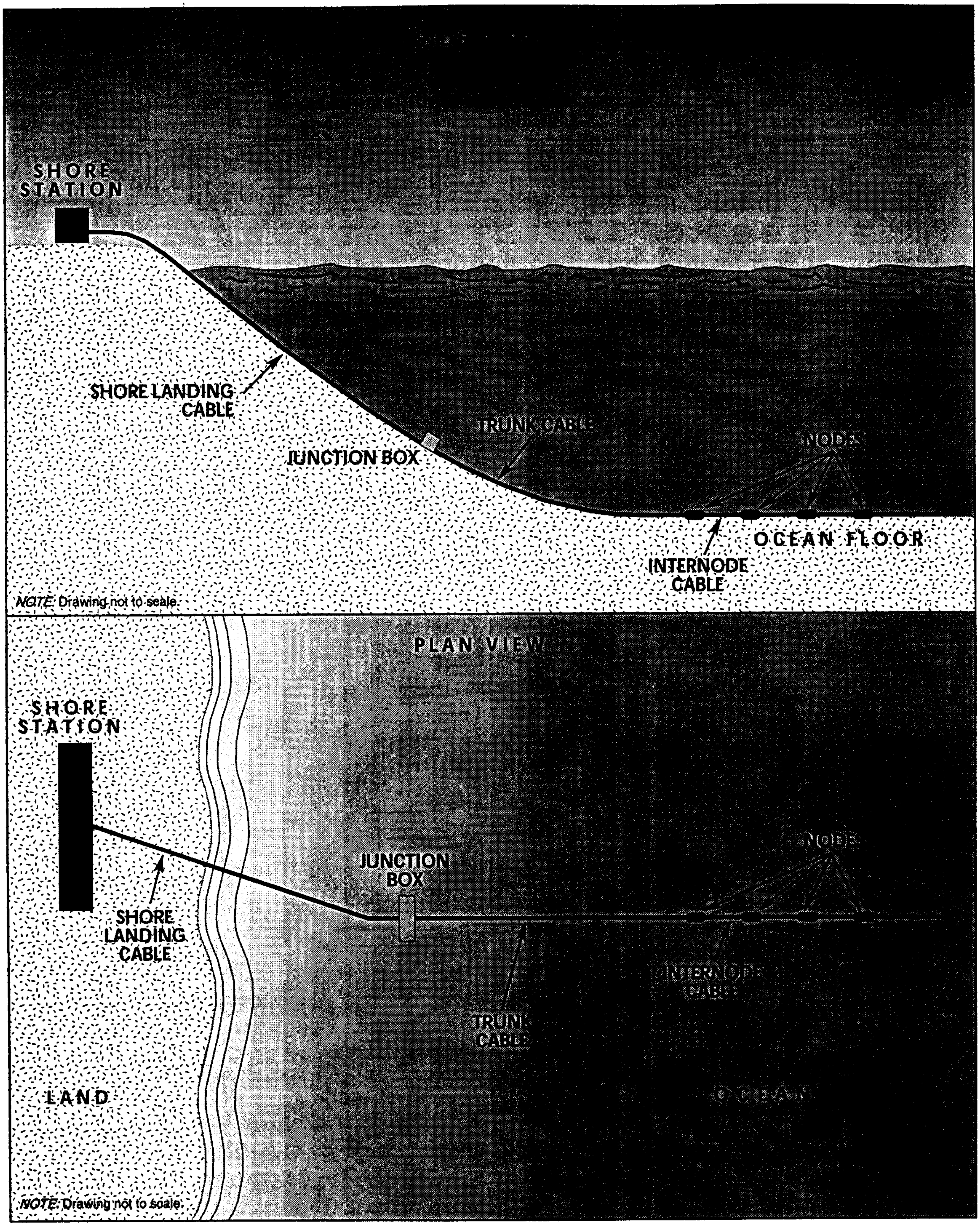


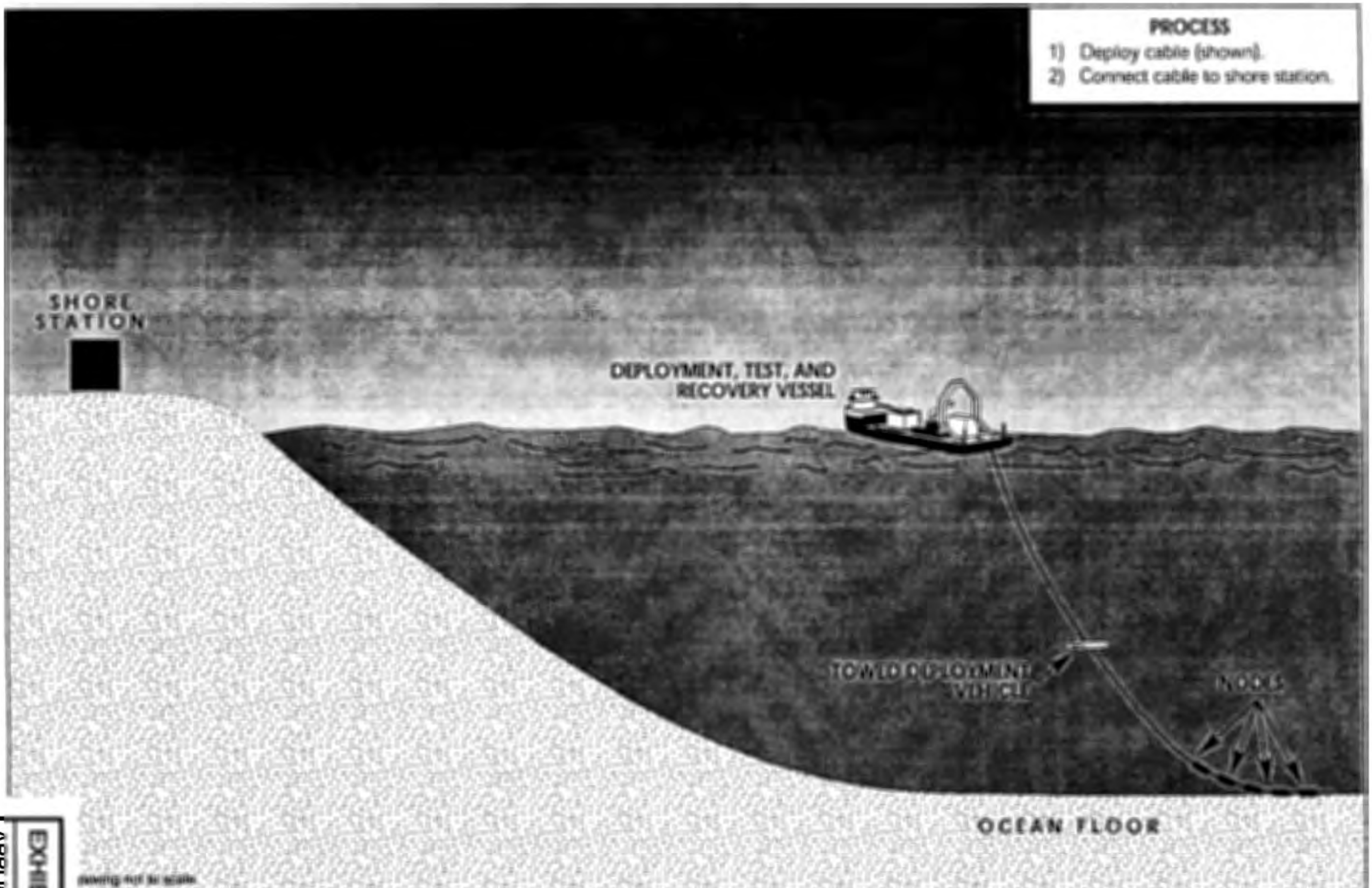
EXHIBIT NO. 3
APPLICATION NO.
CD-109-98

Proposed Shore Station Location Map
MCB Camp Pendleton, California



Advanced Deployable System Concept

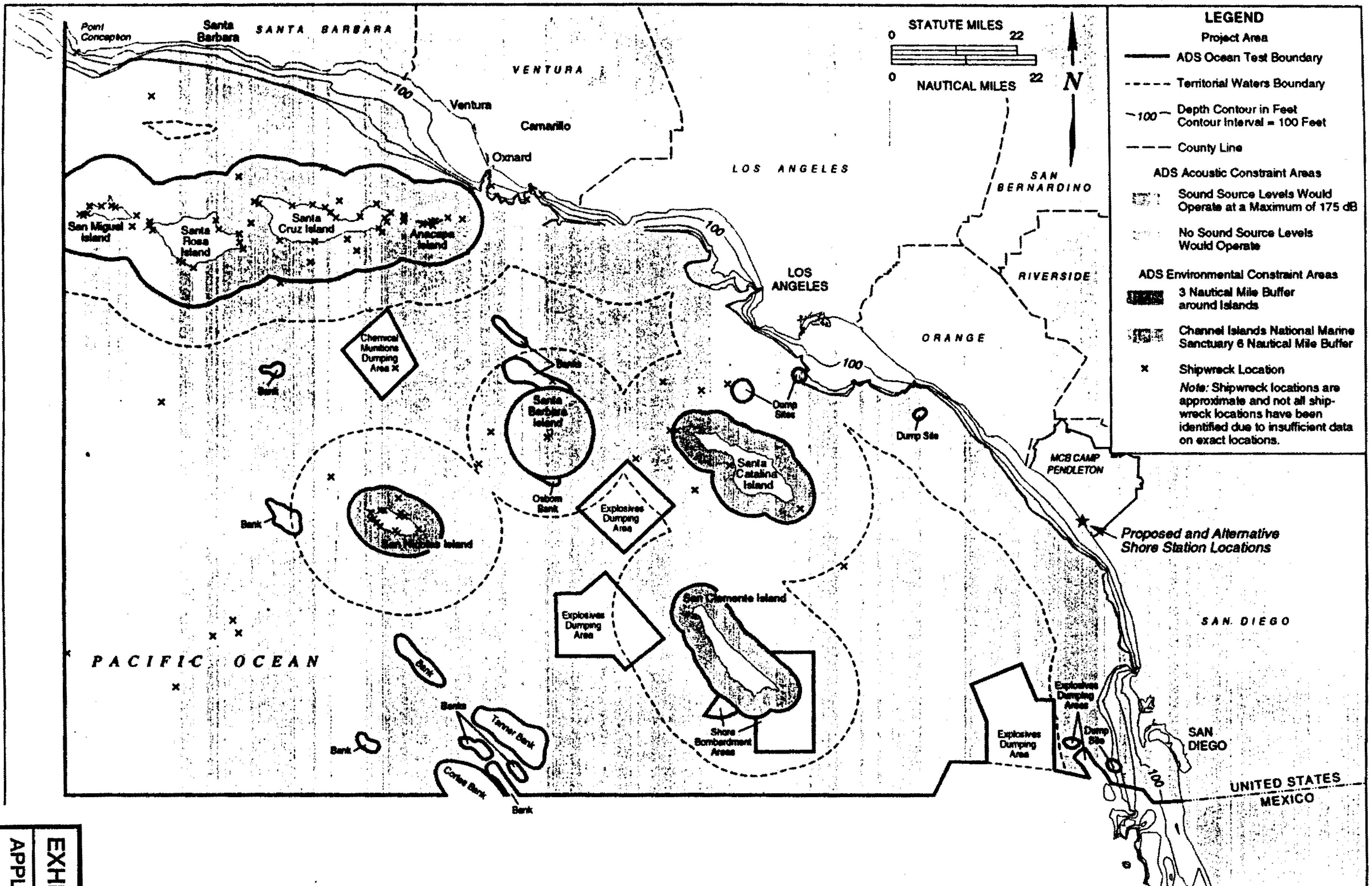
EXHIBIT NO.	4
APPLICATION NO.	
CD-109-98	



Typical Deployment for ADS Ocean Test

FIGURE 4

EXHIBIT NO. 5
APPLICATION NO.
CD-109-98



Proposed ADS Ocean Test Location

FIGURE

2-5

EXHIBIT NO. 6
APPLICATION NO. CD-109-98

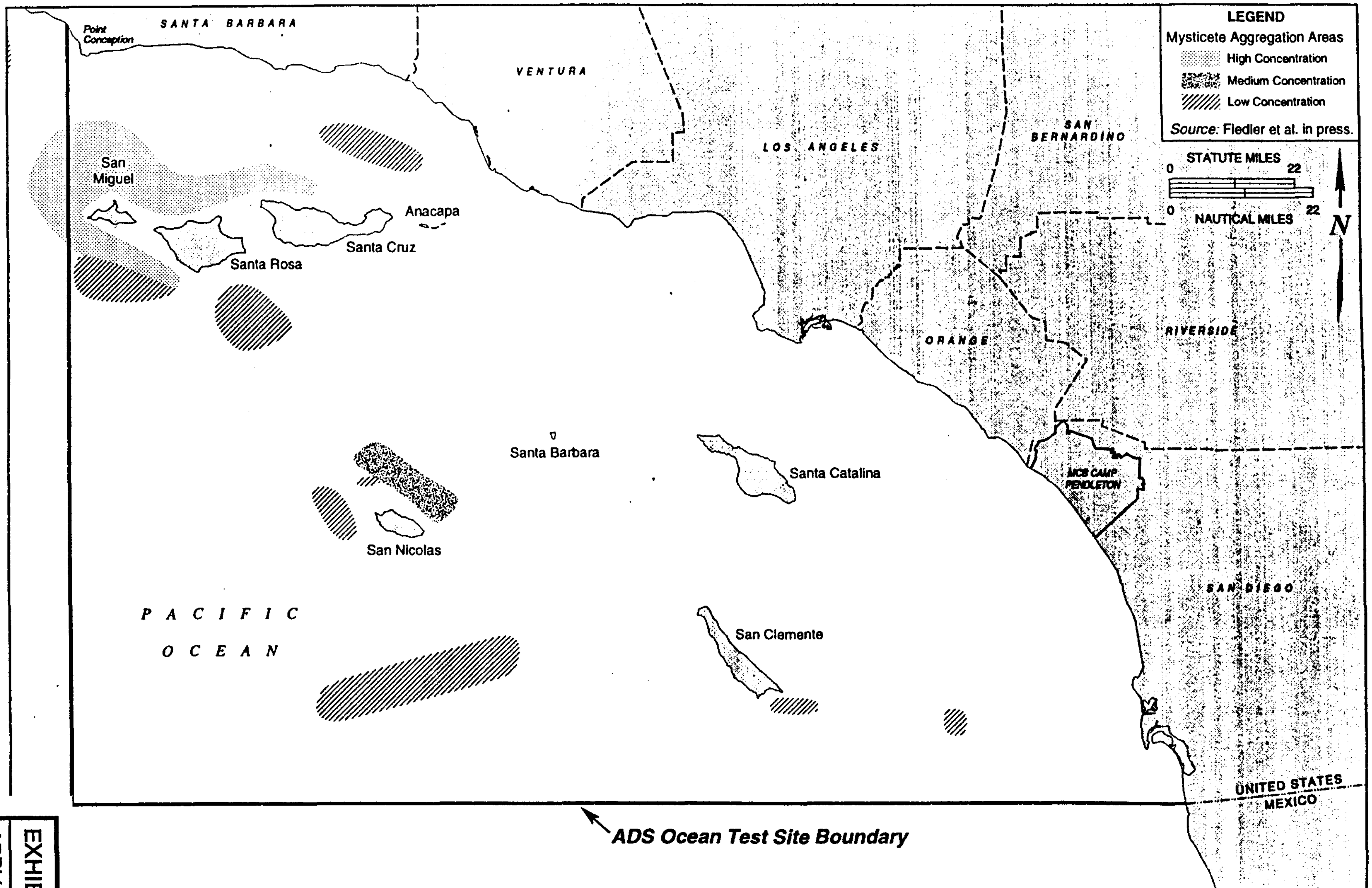
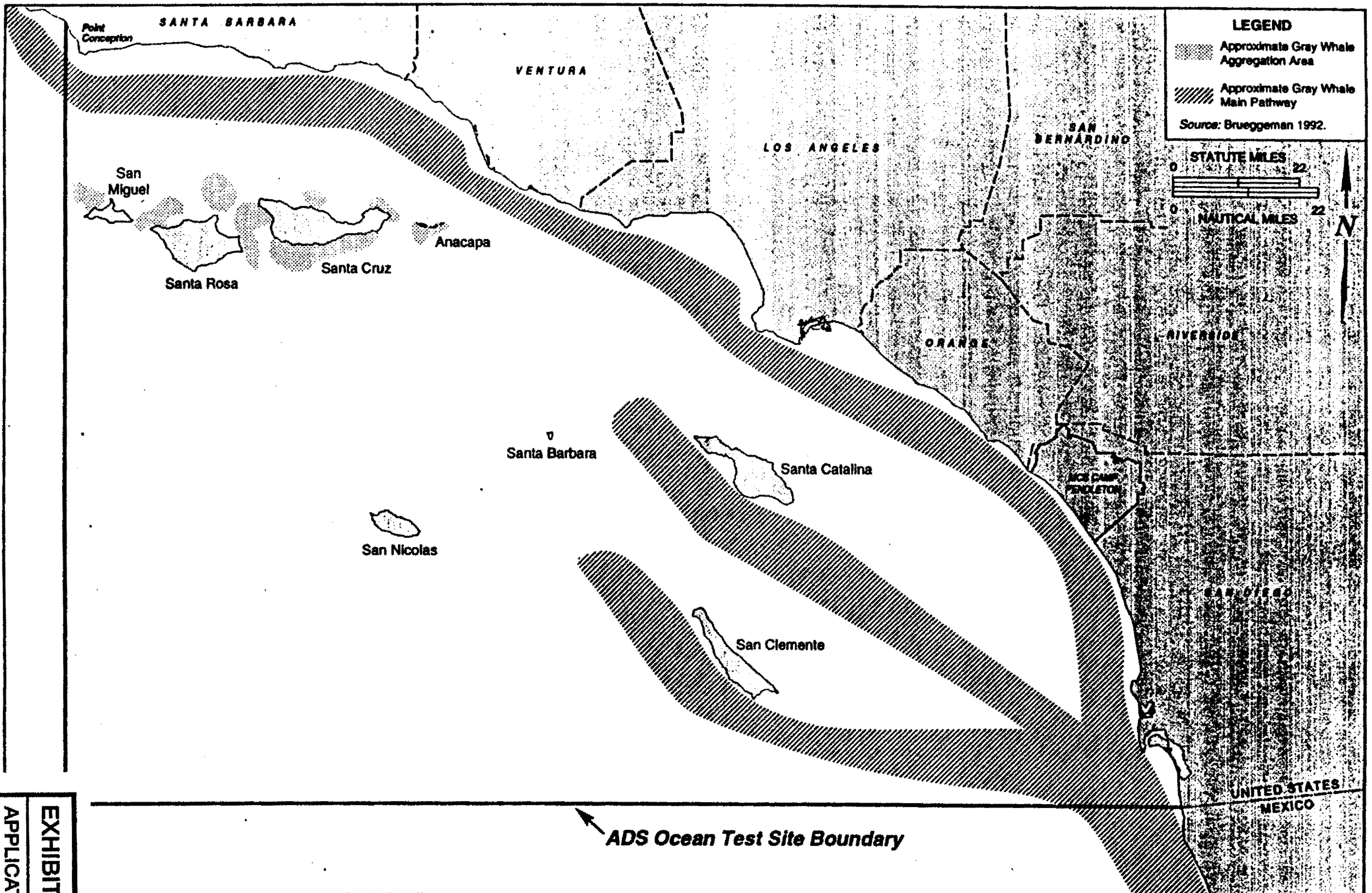


FIGURE 4-1

Mysticete Aggregation Areas – Summer/Fall
Southern California Bight

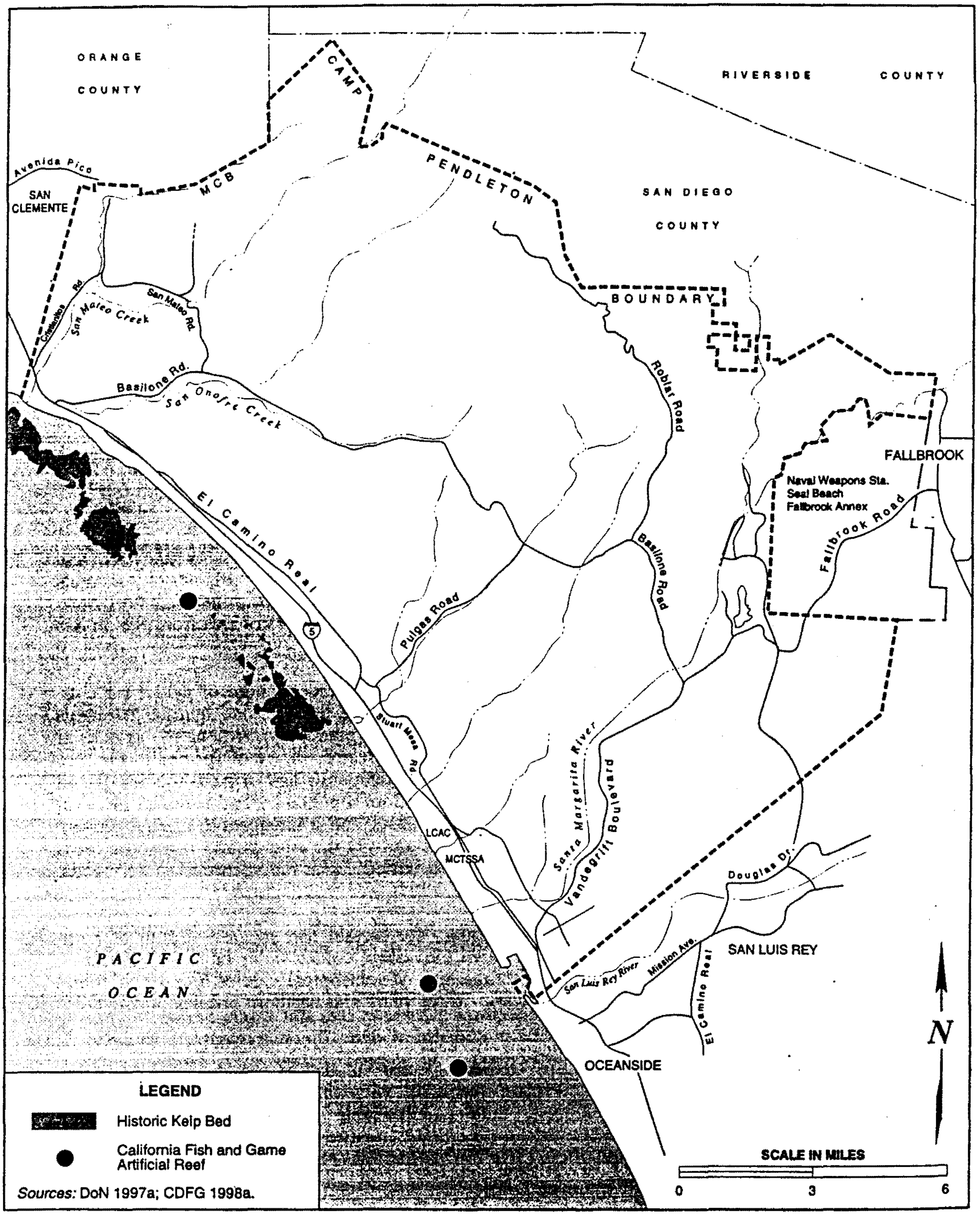
EXHIBIT NO. 7
APPLICATION NO. CD-109-98



Gray Whale Aggregation Areas and Main Pathways -- Winter/Spring
Southern California Bight

FIGURE 4-2

EXHIBIT NO. 8
APPLICATION NO.
CD-109-98



FIGURE

MCB Camp Pendleton Historic Kelp Beds and Location of California Department of Fish and Game Artificial Reefs

EXHIBIT NO.	9
APPLICATION NO.	
CD-109-98	

Table 3-2. Marine Mammals Common to Waters Offshore California

Common Name	Scientific Name	Stock	Status[1]	Pop. Estimate (CV)[2]	Winter/ Spring	Summer/ Fall
Mysticetes						
Gray whale	*Eschrichtius robustus*	East. N. Pacific	NL	22,263 (0.09)*	Common	Uncommon
Blue whale	*Balaenoptera musculus*	CA	E	2,146 (0.23)	Uncommon	Common
Fin whale	*Balaenoptera physalus*	CA	E	1,896 (0.59)	Uncommon	Common
Minke whale	*Balaenoptera acutorostrata*	CA	NL	446 (0.44)	Uncommon	Common
Humpback whale	*Megaptera novaeangliae*	CA	E	1,701 (0.33)	Uncommon	Common
Bryde's whale	*Balaenoptera edeni*	CA (1991/93)	NL	24 (2.0)	Uncommon	Uncommon
Sei (or Bryde's) whale	*Balaenoptera borealis*	CA (1991/93)	E	36 (0.71)	Uncommon	Uncommon
Northern right whale	*Eubalaena glacialis*	N. Pacific	E	16 (1.11)**	Uncommon	Uncommon
Odontocetes						
Sperm whale	*Physeter macrocephalus*	CA	E	503 (0.42)	Common	Common
Pygmy (or dwarf) sperm whale	*Kogia breviceps*	CA (1991/93)	NL	3,145 (0.54)	Uncommon	Uncommon
Killer whale	*Orcinus orca*	CA	NL	323 (0.60)	Uncommon	Uncommon
Baird's beaked whale	*Berardius bairdii*	CA	NL	157 (0.53)	Uncommon	Common
Cuvier's beaked whale	*Ziphius cavirostris*	CA	NL	2,162 (0.55)	Uncommon	Uncommon
Beaked whales spp.	*Mesoplodon spp.*	CA(1991/93)	NL	1,378 (0.58)	Uncommon	Uncommon
Risso's dolphin	*Grampus griseus*	CA	NL	7,366 (0.52)	Common	Uncommon
Short-finned pilot whale	*Globicephala macrorhynchus*	CA(1991/93)	NL	1,004 (0.37)	Common	Uncommon
Northern right whale dolphin	*Lissodelphis borealis*	CA	NL	9,131 (0.77)	Common	Uncommon
Long-beaked common dolphin	*Delphinus capensis*	CA	NL	72,251 (0.83)	Uncommon	Common
Short-beaked common dolphin	*Delphinus delphis*	CA	NL	326,815 (0.42)	Common	Common
Striped dolphin	*Stenella coeruleoalba*	CA	NL	5,734 (0.55)	Uncommon	Common
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	CA	NL	60,026 (0.84)	Common	Uncommon
Bottlenose dolphin	*Tursiops truncatus*	CA	NL	320 (0.43)	Common	Common
Dall's porpoise	*Phocoenoides dalli*	CA	NL	60,756 (0.50)	Common	Uncommon
Pinnipeds						
California sea lion	*Zalophus c. californianus*	U.S.	NL	167,000-188,000	Common	Common
Harbor seal	*Phoca vitulina richardsi*	CA	NL	30,293-188,000	Common	Common
Northern elephant seal	*Mirounga angustirostris*	CA Breeding	NL	84,000-188,000	Common	Uncommon
Guadalupe fur seal	*Arctocephalus townsendi*	CA/Mexico	T	7,408-188,000	Uncommon	Uncommon
Northern fur seal	*Callorhinus ursinus*	San Miguel Is.	NL	10,036-188,000	Common	Uncommon
Mustelids						
Southern sea otter	*Enhydra lutris neresis*	Experimental population	T	< ~50	Uncommon	Uncommon

Sources: Population Estimates
Cetaceans - Barlow 1997 Pinnipeds - Barlow et al. 1997
* Hobbs et al. in press
** Forney et al. 1995

[1]Status: E = Endangered
T = Threatened
NL = Not Listed

[2]CV = Coefficient of variation

EXHIBIT NO. 10
APPLICATION NO.
CD-109-98

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

September 15, 1998

Mr. Mark Delaplaine
California Coastal Commission
45 Freemont Street, Suite 2000
San Francisco, California 94105-5200

RE: CD-109-98, U.S. Navy, Consistency Determination for Advanced Deployable Systems Ocean Tests.

Dear Mr. Delaplaine:

On September 3, 1998, you addressed a letter to John Cannon requesting additional information on the above referenced consistency determination. A copy of the Environmental Assessment (EA) is provided as enclosure (1) for your review. A revision is scheduled to be released on September 28, 1998. A list of the modifications currently being implemented into the document is provided in enclosure (2). The information you requested is provided below.

1. The Space and Naval Warfare System Command (SPAWAR) has determined that this is of local interest. The two interested parties and their addresses are as follows:

Laura Hunter
Environmental Health Coalition
1717 Kettner Blvd., Suite 100
San Diego, CA 92101
Tel. (619) 235-0281
Fax (619) 232-3670

Surfrider Foundation
122 S. El Camino Real, Suite #67
San Clemente, CA 92672
Tel. (949) 492 8170
Fax (949) 492 8142

2. In response to item two in your letter, visual renderings of the proposed shore station and their relationship to existing development is provided in enclosure (3). The facility is not visible from I-5.

3. There are two sensitive resources in the nearshore waters off Camp Pendelton, shipwrecks and kelp beds. Although shipwrecks are relatively abundant within the area of potential effect for the ocean tests, documented shipwrecks would be avoided not only to avoid potentially historical sensitive resources, but also to avoid complicating the Advanced Deployable System (ADS) retrieval process upon test completion. Approximate shipwreck locations are provided in the EA, Figure 2-5 on page 2-15. The laydown of the proposed ADS tests would not occur in any kelp bed locations, as shown in Figure 3-4 on page 3-14 of the EA.

EXHIBIT NO. 11
APPLICATION NO.
CD-109-98

RE: CD-109-98, U.S. Navy, Consistency Determination for Advanced Deployable Systems Ocean Tests.

4. General Renke and Colonel K.W. Quigley, Deputy, Natural Resources, Environmental Security at Camp Pendelton were briefed on the proposed action on May 11, 1998. We were directed to work with the Environmental Security office. We have had two meetings at Camp Pendelton, one of which was a brief to the Environmental Impact Working Group. A letter of concurrence will be submitted to the Environmental Security office shortly.

5. A letter of concurrence, dated August 18, 1998, was received from the Fish and Wildlife Service and it is provided in Appendix E of the EA. As per the direction of Chief of Naval Operations code N456 (Environmental/NEPA Compliance), since we are below the threshold for "take" we are not required to consult for a "take" permit with the National Marine Fisheries Service (NMFS).

6. The Gray Whale Aggregation and Main Pathways are shown in Figure 4-2 on page 4-19. The proposed ADS tests will occur in the Gray whale migration path during migration season. We are not able to avoid migration season because we are participating in a military exercise. We have proposed appropriate mitigation measures to minimize any possible impacts. These measures are defined in the EA (page 4-34) but they are currently being refined as indicated in enclosure (2).

7. The Mysticete aggregation areas are shown in Figure 4-1 on page 4-18 and Pinnipeds of the Channel Islands are shown in Figure 3-6 on page 3-23 of the EA. The potential impacts on marine mammals from vessel operations and towed sources are discussed in Section 4.5 of the EA. We are not implementing acoustic monitoring.

8. We are doing both continuous and pulsed transmissions at night. However, the source level will be no greater than 140 dB for continuous transmissions at night. A continuous sound transmission of 140 dB attenuates to 120 dB at a distance of 10 m and a pulsed sound transmission of 175 dB attenuates to 160 dB at 6 m. Given that the ship's deck lighting illuminates beyond this range, we would be able to continue to perform a visual search at night. Continuous source level transmissions in low visibility weather will be limited to low transmission levels such that the visual search requirement does not exceed the visibility.

9. The thresholds established for ADS were based on the observed responses of gray whales and bowhead whales to actual and played-back anthropogenic noise as documented in "Low Frequency Sound and Marine Mammals: Current Knowledge and Research Needs" National Research Council, 1994.

10. Regarding diver safety, a notice to mariners will be published prior to each proposed test. In addition, if dive flags or dive boats are spotted within 0.5 miles of the support vessel, active acoustic operations will be curtailed.

RE: CD-109-98, U.S. Navy, Consistency Determination for Advanced Deployable Systems Ocean Tests.

11. The test sites, test dates, and specific transmit frequencies are classified to ensure the safety, security, and integrity of the ADS program and equipment.

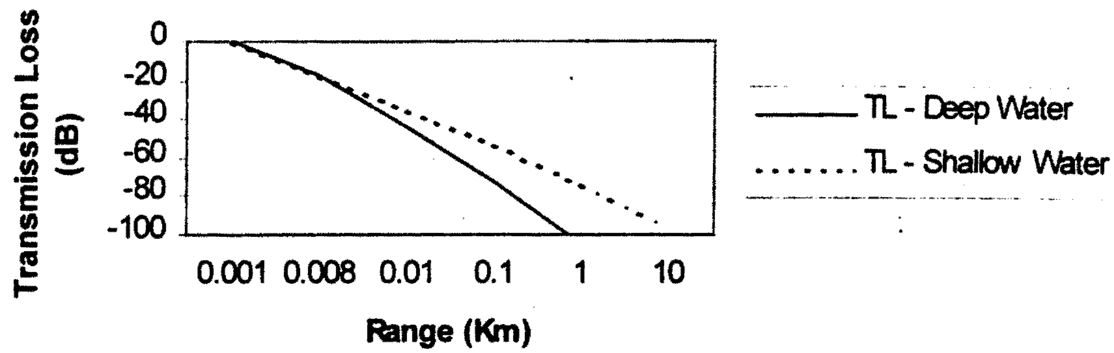
If you have any questions or if you require additional information, please do not hesitate to contact Ms. Shawn Hynes. She can be reached by phone at (805) 982-1170, by fax at (805) 982-5204, by email at hynessm@nfesc.navy.mil, as well as by regular mail at Commander, NFESC/Code ESC51 S. Hynes, 1100 23rd Avenue, Port Hueneme, CA 93043. Your cooperation and assistance are greatly appreciated.

Sincerely,

ROBIN SKINNER
Environmental, Safety, and Health Manager

Encl: (1) Environmental Assessment
(2) Modifications to the EA
(3) Visual renderings of the shore station.

Figure 3-10. Theoretical Underwater Transmission Loss (TL)



Source: Richardson et al. 1995.

Table 3-13. Typical Natural Underwater Noise Sources and Levels

Noise Source	Noise Level (dB)
Wind and waves	85
Earthquake/magma movement	95-135
Bottlenose dolphin	125-173
Humpback whale call	175
Gray whale call	185
Killer whale call	160

Source: Scripps Institution of Oceanography (Scripps) 1997b.

Table 3-14. Typical Man-Made Underwater Noise Sources and Levels

Noise Source	Noise Level (dB)	Noise Characteristics
Large tanker	177	A continuous noise on shipping pathways worldwide
Icebreaker	183	A cycling noise primarily in Arctic Ocean, north of Canada, Alaska, and Russia
Supply ship	174	Continuous sound emitted along shipping lanes worldwide
Seismic oil exploration	210	Low-pitched pulses of sound, generated in oil-rich ocean areas worldwide
Dredging boat	167	Continuous, low frequency grinding, in nearshore construction areas

Source: Scripps 1997b.

EXHIBIT NO. 12
APPLICATION NO.
CD-109-98

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-m 'e source noise comparisons.

April 8, 1995

SOURCE: ATOC EIS/EIR

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should be below the 125dB level that caused the negative reactions in Ms. Reid. I would suggest the 120dB isopleth indicated in the California ATOC EIS/EIR as a reasonable level at this time.

In no way am I suggesting a received level of 120dB will cause no harm in humans or other species, either marine or terrestrial.

If Scripps/APL published a transmission schedule prior to the fact, the "Human Exclusion Zone" could be placed in effect during transmission periods only.

The only question posed to me by Scripps concerning this situation was, "Jay, how many people dive near Pioneer Seamount anyway?" I responded that I personally don't dive there, but that doesn't guarantee other divers won't. With the evidence already presented it would seem imperative that the agencies in charge of the ATOC experiment protect themselves from future litigation by implementing these zones of influence immediately. Just sitting there, continuing to transmit and hoping nobody else gets hurt is a recipe for disaster.

I suggest the "Human Exclusion Zone" should be made public worldwide in several different ways as to notify as many humans as possible. A public release in the Federal Register will not be sufficient.

Sincerely,

Jay R. Murray

Jay R. Murray
369 El Caminito
Carmel Valley, Ca. 93924
408-659-4729

RECEIVED
JUN 03 1998
CALIFORNIA
COASTAL COMMISSION

California Coastal Commission
45 Fremont St. Suite 2000
San Francisco, Ca.

6-3-98

Attention: Mr. Mark DeLaplaine

Dear Commissioners: I am writing this letter to document recent occurrences involving testing of the U.S. Navy Low Frequency Active SONAR system, and how these occurrences relate to the Scripps/Applied Physics Lab A.T.O.C. experiment.

During Phase III LFAS testing done in Hawaiian waters the vessel Cory Chouest was responsible for an incident that involved extremely negative impacts on a dolphin researcher, Ms. Chris Reid. As you may be aware, the Cory Chouest was prohibited from conducting LFAS transmissions if humans were in the water near the source. Due to this restriction many scheduled Phase III transmissions were either terminated or not conducted. The particulars of the incident were reported to me directly from Ms. Reid via phone communication. On one day during Phase III, Ms. Reid was observing the dolphins she studies which regularly enter Captain Cook Bay, and she realized they were acting very irregularly. She decided to hop in the water and when she held her breath and descended she could hear a very unusual sound. She said it sounded like a loud hum. When she surfaced she complained of dizziness, disorientation, nausea and other maladies. She was taken to a physician who described her condition as resembling that of "an acute trauma victim." She said there were no vessels in sight. In truth, the Cory Chouest and possibly another ship, the U.S. Navy SWATH LFAS vessel Victorious were conducting transmissions nearby.

During one of the court cases filed against Chris Clark and the LFAS Phase III experiment in Hawaii recently, Mr. Clark admitted Ms. Chris Reid was ensonified by the LFAS transmit vessel Cory Chouest at a received level of 125dB. There was no evidence presented that rebuked the fact Ms. Reid suffered the negative impacts she and the attending physician reported and observed. All Chris Clark said was 125db was the equivalent of being 400 yards from a singing Humpback Whale. In my personal experiences, being near a singing Humpback is one of the greatest experiences, while being ensonified by testing of the full power U.S. Navy LFAS system and the high power low frequency sine waves it transmits is by far the worst experience of my life.

The lack of a denial by chief "scientist" Chris Clark in court that low frequency sound transmissions can cause such negative impacts in humans leads me to our local ATOC experiment. Pages 17 & 18, Section 2 of the California ATOC Final EIS/EIR shows the predicted soundfield around the ATOC soundsource. The 120dB isopleth is 18km heading toward shore and 12km heading out to sea.

As I suggested to the CCC's Mr. DeLaplaine and Scripps Suzy Pike, it would seem clear that since Scripps/APL refuses to publish a transmission schedule before they begin ocean basin scale ATOC/MMRP 195dB 75Hz transmissions, there should be an area around the sound source where humans are excluded due to possible negative reactions. The lack of a transmission schedule prior to the fact would make this "Human Exclusion Zone" a 24 hour a day, 365 day per year restriction. At this time, with the evidence already presented in court, the received level

EXHIBIT NO. 14
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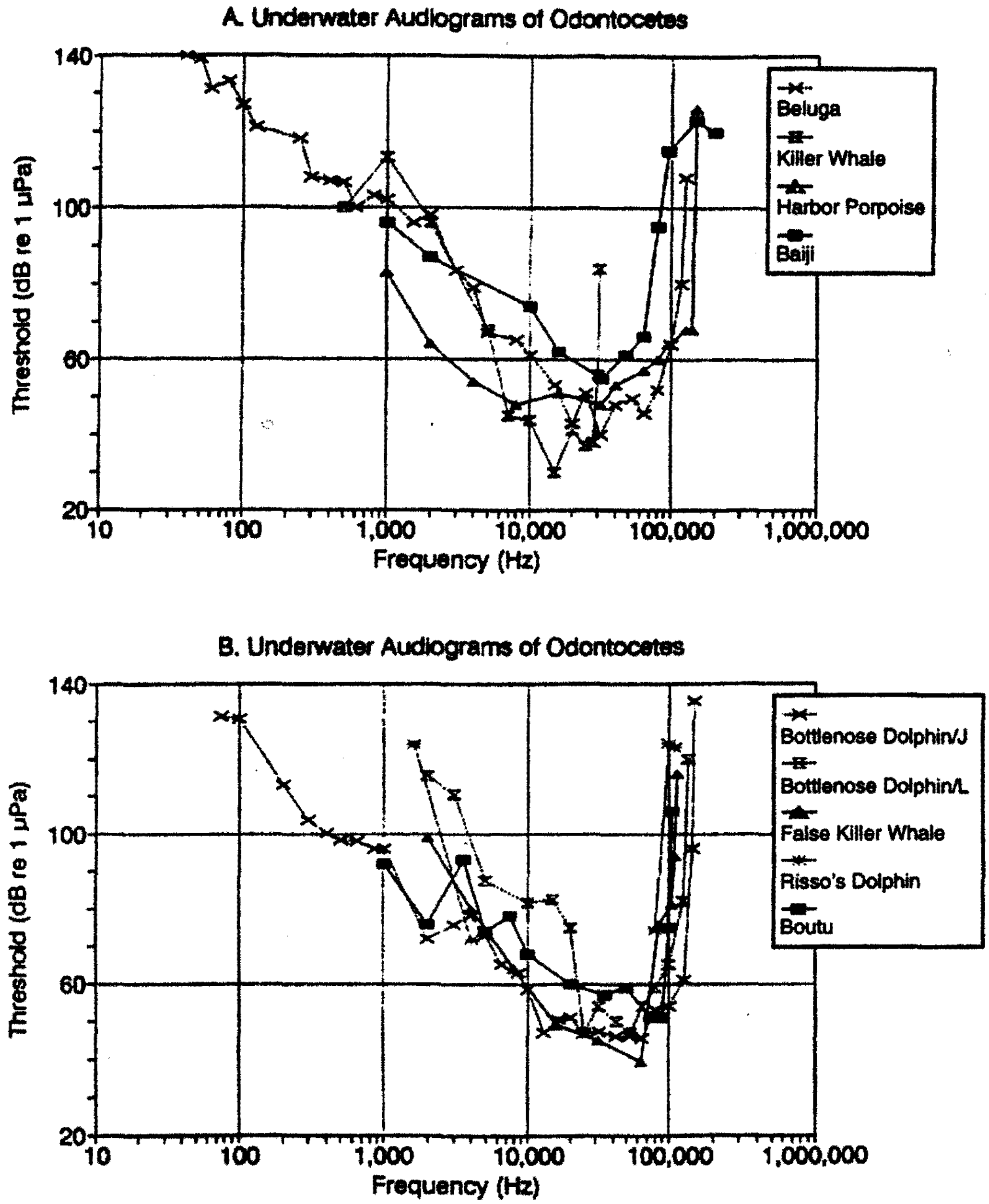
CD-109-98



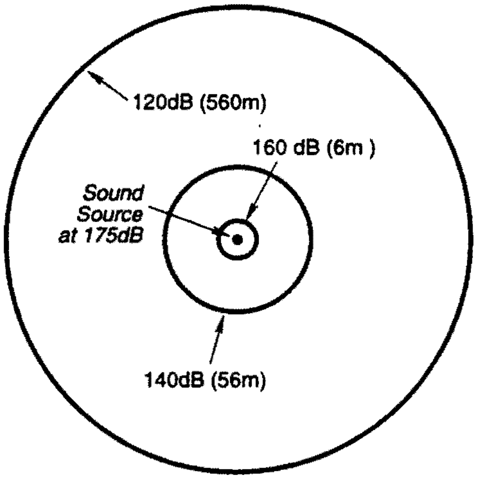
SOURCE: Reproduced from Richardson et al. 1995.

EXHIBIT NO. 15
APPLICATION NO.
CD-109-98

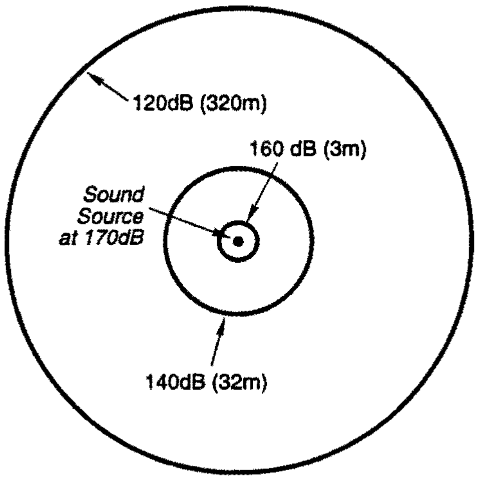
Underwater Audiograms of Odontocetes

3-8

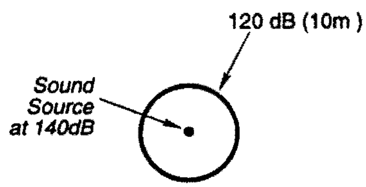
Estimated Zones of Ensonification at 175dB Pulsed Sound Source (Day/Night Operations)



Estimated Zones of Ensonification at 170dB Continuous Sound Source (Day-Only Operations)



Estimated Zones of Ensonification at 140dB Continuous Sound Source (Night Operations)



Note: All radial distances based on 20 log r.

NOT TO SCALE

FIGURE

Estimated Zones of Ensonification for ADS Ocean Tests at Maximum Levels

EXHIBIT NO.	16
APPLICATION NO.	
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

OCT 23 1998 F/SW031:CCF

Ann E. Rosenberry
Senior Environmental Protection Specialist
Department of the Navy
Naval Facilities Engineering Command
San Diego, California 92132-5190

Dear Ms. Rosenberry:

This letter responds to your September 28, 1998, request for the National Marine Fisheries Service (NMFS) to review an Environmental Assessment (EA) for the Advanced Deployable System (ADS) ocean tests. The EA concludes that the acoustic source used in the proposed tests will not cause any adverse impacts to any marine mammals at the power level (maximum 175 dB re 1 uPa) that will be used. The EA also describes mitigating measures to be incorporated into the test plan to further minimize the potential for acoustic impact on marine mammals.

After reviewing the EA for the ADS ocean tests and the most recent available data regarding impacts of sound on marine mammals, I have concluded that the likelihood that a marine mammal will be incidentally taken (including harassed) by the action is low. Thus, I do not recommend that you obtain an incidental harassment authorization under the Marine Mammal Protection Act. In addition, due to the implementation of the mitigation measures, the proposed tests should not affect species under the jurisdiction of NMFS that are listed as threatened or endangered species under the Endangered Species Act.

Thank you for coordinating with our office. If you have any questions regarding these comments, please contact Ms. Christina Fahy at (562) 980-4023.

Sincerely,

William T. Hogarth, Ph.D.
Regional Administrator

cc: F/PR – K. Hollingshead

EXHIBIT NO.	17
APPLICATION NO.	
CD-109-98	

3.8.3.2 Alternative Shore Station Locations

Pacific City Alternative

This alternative shore station site would be located within the unincorporated boundaries of Pacific City (refer to Figure 2-9). The site is presently used as a telecommunications facility and is located in a fenced area with limited public access. Implementation of this alternative would also require some trenching activities within a public beach area. No residential areas or schools are located within the immediate vicinity.

MCB Camp Pendleton Alternative

The alternative MCB Camp Pendleton shore station site would be located adjacent to the LCAC facility approximately 1 mile (1.6 km) north of the proposed shore station location (refer to Figure 2-7). The site is presently utilized for LCAC vehicle military operations; no permanent population centers or schools exist within areas surrounding the site. Public access is limited on base.

3.9 NOISE

Noise is defined as undesirable or unwanted sound. Noise exposure can occur in two general media: air and water. The following discussion focuses on noise sources, sound transmission characteristics in these media, and background (ambient) noise. Ambient noise sources are an important parameter because they can mask other sounds (i.e., make them less detectable) as they propagate away from the source of disturbance. Typically, ambient noise is produced by a number of sources. In the ocean, ambient noise is produced by geological, oceanographic, and meteorological processes such as earthquakes, volcanos, wind, rain, waves, swells, and surf. Noise is also produced by various marine organisms and marine mammals. Man-made noise is produced by a number of sources such as motorized vessels, sonar, and seismic and oil explorations.

3.9.1 Background

Noise Terminology

Sound is composed of waves of energy that travel through air or water as vibrations of fluid particles. The rate at which the vibrations occur is referred to as sound frequency, and is measured in cycles per second or hertz (Hz). Sound exists in the environment even though it may not be audible to a given receptor; for example, humans cannot detect sounds below a frequency of 20 Hz or above a frequency of 20,000 Hz (or 20 kilohertz [kHz]).

The intensity of sound is expressed in decibels and is measured on a logarithmic scale; on the decibel scale, an increase of 10 units represents a 10-fold increase in sound energy. The decibel scale is a relative measure and, therefore, to express intensity in decibels, there needs to be a reference pressure. Accordingly, sound studies commonly acknowledge the "reference pressure" of a given sound. For example, the conventional reference pressure for airborne sounds is 20 μPa and the sound level is described in terms of dB re 20 μPa (decibels relative to a pressure of 20 micropascals). Alternatively, underwater sounds are referenced to 1 μPa, and described in terms of dB re 1 μPa.

The distinction made between airborne noise and underwater noise is based upon the very different sound propagation characteristics of the two media. In general, sound is transmitted much more efficiently in water than in air. This is due primarily to the higher

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density of water over air and the substantially lower absorption capacity of water molecules over their air counterparts. Sources of noise in either of these acoustical environments may be natural (e.g., wind, waves, biological organisms, etc.).

Airborne Noise Characteristics

Airborne noise in offshore areas typically consists of ambient noise levels from natural and man-made sources. Airborne sound decreases with magnitude as it moves away from the noise source due to spreading and absorption losses. These sound decreases are primarily dependent on the types of interaction surfaces (e.g., water, sand, and vegetation) and on atmospheric conditions (e.g., temperature inversions, wind speed and direction, and relative humidity). A common source of airborne noise in offshore areas is marine vessels. Noise sources associated with marine vessels include engine noise, intake and exhaust noise, auxiliary equipment such as pumps and winches, and onboard public address systems.

Underwater Noise Characteristics

Underwater Noise Propagation

Sound in water propagates more efficiently than sound in air but is subject to similar types of transmission loss (TL) (e.g., spherical spreading and attenuation). When sound spreads spherically, sound intensity from the source diminishes as the square of the distance from the source ($1/r^2$ or 6 dB per range doubling). This is based on the accepted approximation for transmission loss: TL = 20 Log r (Kinsler and Frey 1982). In the underwater environment, sound typically spreads spherically from the sound source until it is reflected by a surface, such as the ocean bottom or a submerged object, and multiple propagation paths are established. Sound can also reflect off various surfaces in the underwater environment resulting in cylindrical spreading (1/r or 3 dB per range doubling).

Reflections at the water-air boundary result in minimal sound loss. Noise levels resulting from reflections at the ocean bottom depend on the composition of the bottom (i.e., material properties) and the angle with which the wave strikes the surface (i.e., angle of incidence). Under hard bottom conditions, reflection losses are low and, as the direct and reflected sound paths combine, cylindrical spreading occurs. Typically, underwater sound attenuation in shallow ocean environments is described by a combination of spherical and cylindrical spreading. Figure 3-10 shows theoretical underwater transmission loss when the sound source and/or receiver are near the surface. In general, transmission loss is higher in shallow-water environments because the onset of cylindrical spreading occurs at much shorter ranges.

[Exhibit 12]

Underwater Ambient Noise Conditions

Underwater ambient noise can have several sources. Naturally occurring noise can be caused by wind and waves at the ocean surface (the primary source); biological noise from marine mammals, snapping shrimp, and fish; and subsurface geologic events such as earthquakes and magma movement. Table 3-13 provides a list of typical natural underwater noise sources and their associated levels.

Man-made ocean noise has increased steadily since the beginning of the industrial age. The predominant source of noise is from shipping traffic and underwater exploration. Most of these sounds are low frequency in nature (i.e., less than 250 Hz) and can travel considerable distances. Typical man-made underwater noise sources and their associated levels are shown in Table 3-14. [Exhibit 12]

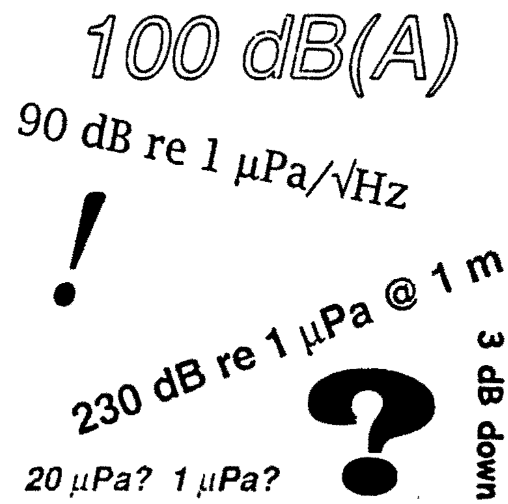
Exhibit 18, p. 2

Accepted by Canadian Acoustics for publication in the 1998 June issue

THE ELUSIVE DECIBEL: THOUGHTS ON SONARS AND MARINE MAMMALS

David M.F. Chapman and Dale D. Ellis
Defence Research Establishment Atlantic, P.O. Box 1012, Dartmouth, N.S., B2Y 3Z7

INTRODUCTION



A few years ago, there was considerable controversy over the effects of a proposed global acoustic experiment designed to measure the temperature of the world's oceans[1]. The focus of concern was the possible effect of the acoustic signals on whales and other marine life. There is continued interest in the effects of underwater sound on marine animals, according to a recent news item in *The Economist*[2] based on related scientific correspondence in *Nature*[3]. The thesis is that loud signals from experimental sonars harm marine mammals, or at least harass them enough to unacceptably alter their behaviour patterns. In the various discussions of this important issue that can be found in the press and on the internet, one often sees questionable comparisons being made, such as the acoustic output of a naval sonar being compared with the noise from a jet aircraft. Some misunderstandings between professionals in different fields can be traced to the multiple uses of the term "decibel". Acoustical terms can be confusing, even for experts. It is not at all surprising that well-intentioned articles sometimes fail to present situations clearly. By definition, the decibel is a relative unit, not an absolute unit with a physical dimension; unless the standard of comparison is cited, the term "decibel" is to all intents and purposes useless. The confusion is not helped by the use of the decibel to specify distinctly different physical quantities, or the same physical quantity with different reference levels. Some reporters—and even some scientists—are getting their "apple" decibels mixed up with their "orange" decibels, as it were.

The decibel (abbreviated dB) is simply a numerical scale used to compare the values of like quantities, usually power or intensity. Acousticians introduced the decibel to devise a compressed scale to represent the large dynamic range of sounds experienced by people from day to day, and also to acknowledge that humans—and presumably other animals—perceive loudness increases in a logarithmic, not linear, fashion. An intensity ratio of 10 translates into a level difference of 10 decibels[4]; a ratio of 100 translates into a level difference of 20 dB; 1000 into 30 dB; and so on. (The term "level" usually implies a decibel scale.) In a uniform acoustic medium, the magnitude of the acoustic intensity is proportional to the square of the pressure for a freely-propagating sound wave. Accordingly, the level difference in decibels associated with two sound pressure values (measured in the same medium) is determined by calculating the ratio of the pressures, squaring this number, taking the logarithm (base 10), and multiplying by 10.[5] If one chooses a standard reference pressure value, then sound pressure levels can be specified in decibels relative to that reference, but this should be stated along with the number, for clarity[4].

The following is a typical erroneous statement found in the press, on radio, on television, and on internet discussion groups. Referring to an experimental sonar source that produces very loud low-frequency sound, *The Economist* wrote: "It has a maximum output of 230 decibels, compared with 100 decibels for a jumbo jet." Regardless of the author's intention, the implication is that a whale would experience an auditory effect from the sonar that would be substantially greater than that of a person exposed to the jet aircraft. However, this type of comparison is misleading for at least three reasons: (1) the reference sound pressures used in underwater acoustics and in-air acoustics are not the same; (2) it compares a source level with a received level; and (3) there is no obvious connection between an annoying or harmful sound level for a human in air and an annoying or harmful sound level for a marine animal in water. In the remainder of this note, we will expand on these topics somewhat, attempt to correct the mistaken impression, and try to direct attention to the real issue at the heart of the controversy.

1. STANDARD REFERENCE SOUND PRESSURES IN AIR AND IN WATER

The standard reference pressures used in underwater acoustics and in-air acoustics are not the same. In water, acousticians use a standard reference sound pressure of 1 micropascal (i.e. 10^{-6} newtons per square metre), abbreviated μPa. In air, acousticians use a higher standard reference sound pressure of 20 μPa. The in-air standard was chosen so that the threshold of hearing for a person with normal hearing would correspond to 0 dB at a frequency of 1000 Hz. Adopting different standards for air and water inevitably leads to a confusing consequence: the same sound pressure that acousticians label 0 decibels in air would be labelled 26 decibels in water. Presumably, both factions of acousticians had equally good reasons for proposing their respective standards, and this dichotomy is now entrenched in an ANSI standard[6], which is unlikely to change. Accordingly, the following dictum should always be observed, especially when dealing with cross-disciplinary issues: *It is essential that sound levels stated in decibels include the reference pressure.*

2. SOURCE LEVEL AND RECEIVED LEVEL

The erroneous statement compares a *source* level with a *received* level. In underwater acoustics, a source level usually represents the sound level at a distance of one metre from the source, while a received level is the sound level at the listener's actual position, which could be considerably more distant with a correspondingly reduced sound level. In an unbounded uniform medium, loudness decreases rapidly with increasing source-receiver distance, 6 dB less per doubling of distance. For example, *The Economist* (and even *Nature*), in referring to the 230 dB sonar source level, neglected to mention the reference distance of 1 metre. In contrast, the 100 dB number that *The Economist* associated with a jumbo jet is not a source level at all, but is typical of a received noise level measured during jet airplane take-off, averaged over several microphones situated several hundred to some thousands of metres from the runway[7]. *It is incorrect to compare a source level at 1 metre with a received noise level at an unspecified (and probably much larger) distance.*

Combining these two remarks, the output of the sonar source should have been written as 230 dB re 1 μPa at 1 m, while the jumbo jet noise level should have been written as 100 dB re 20 μPa. The inclusion of the reference values shows that these are not like quantities, and that the numbers are not directly comparable. *The Encyclopedia of Acoustics*[8] offers 120 dB re 20 μPa as a typical noise level associated with jet aircraft take-off measured at 500 m distance (although there is sure to be a wide variation about this number, depending on the type of aircraft, etc.). With the assumption of spherical spreading, referencing this level back to 1 metre distance adds 54 dB. Switching to the 1 μPa standard reference adds another 26 dB. Accordingly, the source level of a large jet looks more like 120 + 54 + 26 = 200 dB re 1 μPa at 1 m, compared with 230 dB re 1 μPa at 1 m for the sonar. Both of these are loud sources, but now at least the comparison is sensible. The ratio of sound pressures is around 32, rather than over 3 million, as some commenters would have you believe!

There are other minor issues that could be discussed. The signal from the sonar source is narrowband, and the concentration of all the signal at one frequency may be particularly troublesome for an animal who has a cavity that resonates at that frequency. On the other hand, the jet noise is broadband, and the acoustic signal was probably passed through a filter that approximately matches the sensitivity of the human ear before the measurement was made, so this measurement would be meaningless for an animal with a different hearing sensitivity curve. Much more could be said about these issues, but the principal reason for raising them is to underscore the message that the sonar / jet plane comparison has little validity.

3. WHAT HURTS?

There is no clear connection between a harmful sound level for a human in air and that for an animal in water. All creatures have evolved and adapted to their respective environments and there is no reason why human hearing characteristics should apply to any other animal, including whales. If a given sound pressure hurts a human, would the same sound pressure level in water hurt a whale (or a fish, or a shrimp)? Is the threshold of pain higher? Is it lower? Particularly when comparing acoustic effects in media of widely different impedance, is acoustic pressure the relevant acoustic quantity, or is it acoustic intensity?[9] In the end, it is the answers to these and related questions that really matter, not juggling decibels. To properly answer these questions and to determine the "community" noise standards for marine animals, scientific research is necessary—just as it was for humans. Some of this work has already been done, and an excellent review[10] of the state of knowledge up to 1995 is a good starting point for acousticians and biologists interested in deepening their understanding. A single example cannot represent the whole range of species under consideration, but is typical: The response threshold (determined through behavioural studies) of a Beluga at 1000 Hz is just over 100 dB re 1 μPa. Of course, this says nothing about the Beluga's threshold of pain, and says nothing about what sound level would unacceptably alter its behaviour. *It is unwise to assume that the auditory*

Exhibit 19, p. 2

experience of any animal would be the same as that of a human exposed to the same sound level.

CONCLUSION

As sonar engineers, marine biologists, and environmentally conscious citizens continue to discuss these important issues, we should at least agree to use the same acoustical units to convey our points of view, to avoid confusion and misrepresentation. Some sensible acousticians have advocated abandoning the use of the decibel—which is partly to blame for our woes—in favour of good old SI (i.e., metric) units for sound pressure, acoustic intensity, power, etc. Until that happy day dawns, let us include reference values with our decibels, so we don't end up with fruit salad dBs. Ultimately, what is important is to determine what underwater sound levels are harmful to marine life. We must develop mitigation measures to allow underwater acoustic systems to be operated while ensuring the protection of the marine environment with due diligence.

ACKNOWLEDGEMENT

The authors thank Harold M. Merklinger for his helpful comments on the manuscript.

REFERENCES

[1] Whitlow W.L. Au *et al.*, "Acoustic effects of the ATOC signal (75 Hz, 195 dB) on dolphins and whales", J. Acoust. Soc. Am. **101**, 2973–2977 (1997).

[2] "Quiet, please. Whales navigating", *The Economist*, 1998 March 7, page 85.

[3] R. Frantzis, "Does acoustic testing strand whales?", *Nature* 392, 1998 March 5, page 29.

[4] In fact, this defines 1 bel, named after Alexander Graham Bell. The bel turned out to be too large for practical purposes and the decibel—which is 1/10 of a bel—is the preferred unit. Also, one decibel is about the smallest incremental change of sound pressure level a person can sense.

[5] Mathematically, this is equivalent to taking the logarithm of the pressure ratio and multiplying by 20, but knowing when to multiply by 10 or 20 in such calculations is an endless source of confusion to the neophyte, so we advocate the definition in the main text.

[6] *American National Standard Preferred Reference Quantities for Acoustical Levels*, ANSI S1.8-1969, page 8.

[7] Malcolm J. Crocker, editor, *The Encyclopedia of Acoustics* (John Wiley and Sons, Inc., New York, 1997), page 1095.

[8] Malcolm J. Crocker, editor, *The Encyclopedia of Acoustics* (John Wiley and Sons, Inc., New York, 1997), page 11.

[9] The suggestion that acoustic intensity has more bearing than sound pressure in this context has been seriously proposed by some acousticians; however, the available evidence gives the nod to sound pressure, not intensity.

[10] W. John Richardson *et al.*, *Marine Mammals and Noise* (Academic Press, New York, 1995).

EXHIBIT 19, p. 3

W 12b

20 November 1998

California Coastal Commission
45 Fremont Street, Suite 2000
San Francisco, CA 94105-2219

SUBJECT: NAVY ADVANCED DEPLOYABLE SYSTEM (ADS)

Dear Commissioners:

The Navy Advanced Deployable System (ADS) is designed as a passive recording system to detect submarines and military surface ships. The passive aspect of the operational ADS benefits both the Navy and the marine ecosystem. Passive detection and surveillance systems, especially of submarines, optimizes the mission and survivability of the system. The passive aspect also prevents disruptive and potentially fatal impacts on marine life, especially acoustically sensitive marine mammals.

However, the ocean tests proposed by the Navy to verify the ADS capability include the transmission of acoustic sounds ranging in frequency from 20 Hz to 1000 Hz; and source level range of 120-175 dB for pulsed sound source and range of 130-170 dB for continuous sound source. There is recent evidence that such active acoustic transmissions are harmful to marine mammals and to humans (when in the water). The two examples discussed below involve the Navy's Low Frequency Active Sonar (LFAS), a new active system for the detection of quiet diesel and nuclear submarines that is still being tested. The LFAS generates extremely high dB sounds up to 230 dB in a range of 250 to 3000 Hz.

A. In May 1996 a mass stranding of Cuvier's beaked shale coincided closely in time and location with LFAS tests in the Mediterranean Sea. This species is a deep-diving, pelagic cetacean that rarely mass-strands. Twelve whales were found alive stranded along 38 km of coast from the morning of May 12 to the afternoon of May 13. This spread in time and location was atypical, as whales usually mass-strand at the same place and at the same time. Another beaked whale was found decomposing two weeks later on an island 57 km from the mainland stranding. The LFAS research vessel, Alliance, had been conducting active acoustic tests from about 1 a.m. May 12 to midnight May 15. Three previous atypical mass strandings of Cuvier's beaked whales in the vicinity of the Canary Islands were also associated with military ship operations. These whale stranding studies were published in NATURE (5 March 1998), a very reputable and well known research journal.

B. A dolphin researcher was ensonified by the LFAS test vessel, Cory Chouest, in Hawaiian waters off the coast of the Big Island. The researcher, Chris Reid, descended into the water when she observed that the dolphins she studied regularly were acting abnormally. She heard an unusual sound underwater, and when she surfaced she complained of dizziness, disorientation, nausea and other maladies. A physician described her condition as resembling "an acute trauma victim". In a recent Hawaiian court case against the LFAS, Christopher Clark (who works for the Navy as an acoustic/marine mammal expert) admitted that Ms Reid had been ensonified at a received level of 125 dB. (Source: Jay Murray letter to CCC dated 3 June 1998)

In the ADS EA the Navy repeatedly denies that their active acoustic systems can cause harm to marine mammals. For example, on page 4-31: (a) "In summary, acoustic impacts from the ADS ocean tests are not predicted to result in a 'take' by harassment of any marine mammal as defined by the MMPA". Whale stranding deaths certainly exceeds 'take' by harassment. (b) "Based on the best-available data, marine mammal reaction noise-producing elements of the ADS tests would not be significant and all potential impacts would be below the threshold requiring incidental take authorization." The Navy is either ignoring evidence unfavorable to ADS, or has not adequately researched readily available and pertinent data for the EA.

During the ADS ocean tests the Navy proposes to exclude SCUBA divers from a 0.5 mile radius of the test vessel to avoid acoustic exposure. However, is that a sufficient distance to prevent bodily harm? Impacts on SCUBA divers on the Monterey Coast indicate otherwise regarding the ATOC active low frequency, high dB acoustic transmissions.

The critical question regarding potential harm to marine mammals, fish, and humans, apparently is not confined to hearing damage or loss, which is discussed in detail in the ADS EA, but also to impaired physical and mental functions, which directly or indirectly could cause permanent injury or death. In both the marine mammal researcher case and several SCUBA diver cases, the audible sound was not loud but the acoustic signal caused a variety of adverse bodily impacts. Based on this evidence, marine mammals would not associate a low sound with internal distress and impaired functioning -- thus would not know to swim away from the injury-causing acoustic source, or be able to if disoriented.

The Navy's rationale for the ADS is the need for detection and surveillance of newer, quieter submarine and military surface vessels. The Navy's proposal to use active low frequency, very high dB, acoustic sound sources to ocean test the ADS is not acceptable. The ADS is a passive system. One of the criteria stated in the EA is to "obtain realistic testing conditions". Thus, the logical solution is to use real submarines and military vessels.

Navy vessels operate routinely in Southern California waters (including the proposed ADS test region) for various Navy purposes (page 3-48). The Navy should use those vessels to ocean test the ADS.
(a) Modern submarines are designed and constructed to minimize detection. Consequently they are quieter. Thus the objective is to determine how sensitive ADS is, i.e., how low a dB source it can detect, not how high. So why are the ADS tests proposing to use very loud active source sounds? Any advantage of the active towed sound sources to systematically test through a controlled range of frequencies and sound levels is more than off-set by the disadvantages.
(b) Also, recent evidence indicates that ships generating a range of dB do not produce the kind of harmful effects that the LFAS and ADS do. Using Navy vessels rather than the active high dB towed sound sources would provide truly realistic sound sources and would not threaten to impair, injure or kill marine creatures and humans (when in the water).

The proposed ADS test site characteristics have pros and cons:
The Southern California site is a good choice for the ADS tests because of complex bathymetry that affects underwater sound transmisson per se, and it also complicates ocean currents and water temperature regimes that also affect acoustic transmissions. If ADS capability can be verified

at this site, then it has passed the acid test. However, the site is not characteristic of the west and east coasts of the United States. The alternate Pacific Northwest site is more characteristic of U.S. coastal bathymetry.

Conversely, the proposed California site is a bad choice for the marine ecosystem because it also provides a diverse habitat and upwelling of water and nutrients that result in a high concentration and diversity of marine life, including acoustically sensitive marine mammals.

Consequently the California site supports many human activities including commercial and recreational fishing, scuba diving, commercial and recreational boating, etc. It also contains a concentration of islands that are important birthing and haul out habitats for marine mammals. These islands are off shore from a highly developed mainland coast, thus reducing habitat options.

The proposed ADS test period of 3 years is too long. Seasonal variations in ocean parameters (e.g., currents, water temperature) affect acoustic transmissions through ocean water -- especially in coastal areas. The first year would provide data that reflects the seasonal variations. A second year would be justifiable to revise tests or verify the seasonal variations. However the third year should be deleted because of the gray whale migration through the area and concentrated use of the area by marine life and human commercial and recreational activities.

The ADS EA contains other flaws, inconsistencies, and erroneous information. A few examples are:

o The vessel-towed sound sources would be turned off if SCUBA divers or their dive flags are spotted within 0.5 mi (2640 ft) of the vessel. Yet on page 4-33 a statement is made that the sound from towed sound sources 26-89 ft behind the vessel would likely not be detectable by dolphins if bow-riding the tow vessel. If it is not safe for humans within 2640 ft, how can it be safe for dolphins within 26-89 ft? Figure 2-4 (p 2-11) indicates that marine mammals within 30-90 ft (about 10-30 m) of the maximum 175 dB pulsed sound source would be ensonified by about 150 dB. This is considerably higher than the 125 dB that caused erratic behavior of the Hawaiian dolphins ensonified by the LFAS transmissions.

o Based on the theoretical models shown in Figure 2-4, which over simplifies the source level of ensonification (i.e., not accurate in an area of complicated bathymetry and ocean temperatures and currents), operations would be curtailed if theoretically estimated ensonification levels would exceed 120 dB. The 120 dB sound level is rather arbitrary based on limited and inconclusive marine mammal hearing/ear anatomy studies. The recent evidence from the Hawaii case cited above seems to invalidate the strictly hearing aspect of low frequency, high dB harmful effects on marine mammals.

o It is stated in the EA that "due to comparatively low source levels, visual mitigation during continuous transmission, and shore exposure times during pulsed transmission, there is no possibility of TTS or PTS to mysticate whales during the ADS tests" (page 4-28). The short exposure time is explained that even the relatively slow swimming migrating gray whales and the endangered northern right whales (swim speed range of 2-5 kts) would pass through the greater than 120 dB circle centered around the sound source of 170-175 dB in about 10 minutes (Fig.4-3) This scenario assumes the tow vessel is stationary. However, the tow vessel is also moving at speeds of 2-5 kts. Although the cable locations and patterns are classified, it is not difficult to envision the tow vessel traveling subparallel to the coast on multiple passes at varying distances from the shore and keeping pace with the southward and northward migrating gray whales that number more than 20,000. The distance from Pt Conception to the Mexican border exceeds 200 n mi (Fig. 22-16). Thus whales could be ensonified at levels above 120 dB for a very long time. (The circle depicted in Fig 4-3 is curious in that it has both a radius of 320 m and 350 m).

Lack of time prevents giving more examples at this writing.

Sincerely yours,

Deane Oberste-Lehn

Deane Oberste-Lehn, PhD
Research Scientist
P.O. Box 369
Menlo Park, CA 94026