



Application

**For A Non-Fishery Incidental Harassment Authorization (IHA)
And
Multi-Year Regulations
For An
Incidental Take Of California Sea Lions And Harbor Seals
In Accordance With
The Marine Mammal Protection Act And 50 CFR Subpart I**

Submitted to:

The Protected Species Division, Silver Spring, Maryland
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

Submitted by:

The Monterey Bay National Marine Sanctuary, Monterey, California
National Marine Sanctuary Program
National Ocean Service
National Oceanic and Atmospheric Administration

May 2002

A. INTRODUCTION

The order and content of this application's sections (below) are organized to mirror the informational requirements of Title 50 of the Code of Federal Regulations, section 216.104. In March 2001, the Monterey Bay National Marine Sanctuary (MBNMS) published an 86-page report entitled *Assessment of Pyrotechnic Displays and Impacts within the Monterey Bay National Marine Sanctuary 1993 – 2001* (see attachment A). This report comprises the sum of the information the MBNMS has assembled on the nature and impact of fireworks displays within the Sanctuary and contains most of the information required by the National Marine Fisheries Service (NMFS) for an incidental take request. The report is thus referenced frequently in the application sections below as *the Fireworks Assessment Report 2001*. The Sanctuary has also completed guidelines for minimizing impacts from fireworks within the Sanctuary. The guidelines will be used by the MBNMS to review fireworks requests. The 12-page *Monterey Bay National Marine Sanctuary Fireworks Guidelines April 2002* was drafted in cooperation with the USFWS and NMFS and are included as attachment B. They are referred to below as *the Fireworks Guidelines*.

B. INFORMATION

1. Description of Activity

The activity to be conducted is the display of commercial-grade fireworks in the atmosphere and at ground or sea level. The number of displays will be limited to not more than 20 events per year in four specific areas along 276 miles of coastline. See pages 1-8 of the *Fireworks Assessment Report 2001* for a more complete description of the activity and a profile of typical fireworks displays within the Sanctuary.

2. Dates, Duration, and Affected Areas

The MBNMS is requesting initial authorization for the period July 1, 2002 to June 30, 2003 and a subsequent long-term regulatory authorization for the period July 1, 2003 to June 30, 2008. The table on page 5 below includes the dates of past annual fireworks displays within the Sanctuary.

In general, fireworks displays will not exceed 20 minutes in duration and will occur with an average frequency = once every two months within each of four prescribed display areas. Fireworks will not be authorized during the primary spring breeding season for marine wildlife (March 1 to June 30). See page 8 of the *Fireworks Assessment Report 2001* for general information on frequency and duration of typical fireworks displays within the Sanctuary.

The MBNMS plans to confine future permitted fireworks to four prescribed areas of the Sanctuary depicted in maps 1-5 of the Fireworks Guidelines (see attachment B), while prohibiting displays along the remaining 95% of Sanctuary coastal areas. The conditional display areas are located at Half Moon Bay, the Santa Cruz/Soquel area, the northeastern Monterey Peninsula, and Cambria (Santa Rosa Creek). The rationale for delineation of the prohibited and conditional display areas is explained in pages 1-4 of the Fireworks Guidelines. Detailed descriptions of each display area are available on pages 15-22 and maps B-H and J of the Fireworks Assessment Report 2001.

3. Affected Species

The MBNMS has consulted with the Protected Species Division of the NMFS, Southwest Region and determined that the only marine mammal species (managed by the NMFS) likely to be impacted by fireworks displays within the Sanctuary are the California sea lion (*Zalophus californianus*) and the harbor seal (*Phoca vitulina richardsi*). Both are protected under the Marine Mammal Protection Act (MMPA), and are not listed under the Endangered Species Act. See pages 11-13 of the Fireworks Assessment Report 2001 for a further description of these and other nearshore marine mammal species in the affected area.

4. Status and Distribution of Affected Species

The Southwest Fisheries Science Center of the NMFS conducts regular surveys and studies to determine the status of marine mammal stocks in the western United States. The majority of the information below was compiled by the Center and published in its annual stock assessment (Forney et al, 2000).

The California sea lion (*Zalophus californianus*) population is robust and growing at a current rate of 6.2% per year with an estimated “minimum” population (U.S. West Coast) of 109,854 animals. Actual population level may be as high as 200,000 animals. An Optimum Sustainable Population (OSP) level has not been established for California sea lions due to the lack of evidence of a density dependent signal. The population is not listed as “endangered” or “threatened” under the Endangered Species Act (ESA) or as “depleted” under the MMPA. California sea lions are not considered a “strategic stock” under the MMPA because total human-caused mortality (1,208 fishery-related mortalities plus 144 from other sources) is less than the Potential Biological Removal (PBR) threshold of 6,591 animals. A minimum of 12,000 California sea lions are probably present at any given time in the MBNMS region. Año Nuevo Island is the largest single haul-out site in the Sanctuary, hosting as many as 9,000 California sea lions at times (Weise, 2000 and Lowry, 2001). Most individuals of this species breed on the Channel Islands off southern California (100 miles south of the MBNMS) and off Baja and mainland Mexico (Odell 1981), although a few pups have been born on Año

Nuevo Island (Keith et al. 1984). Populations peak in the Monterey Bay area in fall and winter and are at their lowest numbers in spring and early summer.

The harbor seal (*Phoca vitulina richardsi*) population in California is healthy and growing at a current rate of 3.5% per year with an estimated “minimum” population (California) of 27,962 animals. Actual population level may be as high as 30,000 animals. An OSP level has not been established for harbor seals. The population is not listed as “endangered” or “threatened” under the Endangered Species Act (ESA) or as “depleted” under the MMPA. Harbor seals in California are not considered a “strategic stock” under the MMPA because fishing mortality is less than the PBR for this stock (1,678). Pupping within the Sanctuary occurs primarily during March and April followed by a molt during May and June. Harbor seals are residents in the MBNMS throughout the year, occurring mainly near the coast. Although harbor seals off California do not migrate, radio-tagged individuals have moved distances of 480 km from Point Reyes, California (Allen et al. 1987). In the MBNMS, harbor seals often move substantial distances (10-20 km) to foraging areas each night (Oxman 1995, Trumble 1995). An area off Sunset State Beach is used consistently by harbor seals tagged in Elkhorn Slough and off Monterey (Oxman 1995, Trumble 1995).

5. Type of Take

Take will be limited only to the temporary incidental harassment of California sea lions and harbor seals due to temporary evacuation of usual and accustomed haul-out sites for as little as 15 minutes and as much as 15 hours during any fireworks event. The primary causes of disturbance are light flashes and sound effects from exploding fireworks. As a fireworks presentation progresses, most marine mammals and birds generally evacuate the impact area. Increased recreational use (terrestrial and marine) in the fireworks display area during the hours immediately prior to the show may also prompt wildlife to temporarily evacuate the area. See pages 8-12 of the Fireworks Assessment Report 2001 and attachment C to this application for more details on how exploding fireworks impact marine mammals and how the animals respond.

6. Number and Frequency of Takes

Total number of take events will not exceed 20 per year along the entire Sanctuary coastline. Number of animals taken in individual events is expected to vary considerably due to factors such as tidal state, seasonality, shifting prey stocks, climatic phenomenon (e.g. El Niño events), and the number, timing, and location of future displays. The table on page 5 identifies the average and maximum number of sea lions and harbor seals expected to be taken by harassment for each event.

Twenty fireworks events per year would disturb an average of 2,630 California sea lions and a maximum of 6,170 California sea lions within the Sanctuary. Stage structure of

California sea lions within the Sanctuary varies by location, but generally, the majority are adult and sub-adult males. Weise (2000) reported the following statistics concerning stage structure at two historic fireworks display areas within the MBNMS:

A significantly greater proportion of sea lions observed on Santa Cruz Wharf were adult males (mean 83.1%, SD=11.4%; Kruskal-Wallis, $P<0.000$) than sub-adults/females (mean 12.4%, SD=6.3%) and juveniles (mean 4.4%, SD=6.2%). The greatest number of sea lions observed on the wharf was 186 animals in January 1998. On the Monterey jetty, a significantly greater proportion of sea lions counted were juveniles (mean 74.0%, SD=18.1%; Kruskal-Wallis, $P<0.000$) than sub-adults/females (mean 10.5%, SD=6.7%) or adults (mean 14.9%, SD=15.3%). The greatest number of sea lions counted on the Monterey jetty was 937 animals in February 1998.

Estimated Incidental Take by Display Area and Event

Display Name*	Display Area	Display Date	Sea Lions		Harbor Seals	
			Avg.	Max.	Avg.	Max.
HMB Independence Day	HMB	July 4	20	100	15	65
HMB Public	HMB	TBD	20	100	15	65
HMB Private	HMB	TBD	20	100	15	65
HMB Private	HMB	TBD	20	100	15	65
Santa Cruz Bday	NMB	~October 5	100	190	0	5
NMB Public	NMB	TBD	100	190	0	5
NMB Public	NMB	TBD	100	190	0	5
Monte Foundation	NMB	~October 15	0	5	15	50
NMB Private	NMB	TBD	0	5	15	50
NMB Private	NMB	TBD	100	190	15	50
Monterey Independence Day	SMB	July 4	250	800	7	60
Monterey 1st Night	SMB	January 1	700	1500	15	60
Pacific Grove Feast Lanterns	SMB	~July 25	0	150	50	100
SMB Private	SMB	TBD	400	800	15	60
SMB Private	SMB	TBD	400	800	15	60
SMB Private	SMB	TBD	400	800	15	60
Cambria Independence Day	CAM	July 4	0	50	20	60
Cambria Public	CAM	TBD	0	50	20	60
Cambria Private	CAM	TBD	0	25	20	60
Cambria Private	CAM	TBD	0	25	20	60

* Public display titles appear in **bold**, and private display titles appear in plain text. Titles that include the words *public* or *private* indicate potentially permitted displays.

Numbers of estimated take at each location were calculated using the following primary data sources:

Half Moon Bay

Lowry, 2001
Read and Reynolds, 2001

North Monterey Bay

Lowry, 2001
Read and Reynolds, 2001
Hall, 2000
Weise, 2000

South Monterey Bay

Lowry, 2001
Read and Reynolds, 2001
Weise, 2000
Nicholson, 2000
Nicholson, 2002
Hall and Threlloff, 2001

Cambria

Lowry, 2001
Lowry, 2002
Read and Reynolds, 2001

Weise speculated that juveniles may haul out at the Monterey jetty in large numbers due to a need for a more protected haul-out location. He also reported that most animals on Año Nuevo Island appeared to be adult males and suggested that the stage structure may vary between mainland haul-out sites and offshore islands and rocks.

Twenty fireworks events per year would disturb an average of 302 harbor seals and a maximum of 1,065 harbor seals within the Sanctuary. Nicholson (2000) studied the stage structure of harbor seals on the northeast Monterey Peninsula (an area with the largest single concentration of animals within the Sanctuary) for two years and reported the following statistics for the final spring season of the study:

During spring 1997, population size using mark recapture methods based on re-sightings of recognizable individuals, was estimated as 520 seals (95% confidence interval: LL 478, UL 561): 200 adult females (95% confidence interval: LL 189, UL 210), 80 adult males (95% confidence interval; LL 76, UL 82), 175 sub-adults (95% confidence interval; LL 147, UL 217). The remaining seals were yearlings or juveniles.

The survey numbers thus equate to a stage structure comprising 38% adult females, 15% adult males, 34% sub-adults, and 13% yearlings or juveniles.

7. Impacts Upon Species

Past monitoring by the MBNMS has identified only a short-term harassment of animals by fireworks displays. Most animals depart affected haul-out areas at the beginning of the display and return to previous levels of abundance within 4 to 15 hours following the event. This information is based on observations made by Sanctuary staff over an eight year period (see appendices C through I of the Fireworks Assessment Report 2001) and a quantitative survey made in 2001 (see attachment C to this application). For a full assessment of fireworks effects within the Sanctuary, see *Discharges and Effects* on pages 5-7, *Environmental Impacts* on pages 8-10, *Potential Affected Species* on page 12, and maps B-H and J of the Fireworks Assessment Report 2001. The MBNMS coordinated a quantitative monitoring effort at Monterey in July 2001, which is discussed in more detail at the end of this section.

Between 1980 and 1983, an intensive aerial survey effort was commissioned by the U.S. Minerals Management Service to record abundance and distribution of marine mammals throughout California (Bonnell et al. 1983). Over the three year survey, the number of sea lions present at the Monterey Breakwater in the week preceding July 4 averaged 10 animals. Between 1997 and 1998, a graduate researcher from Moss Landing Marine Laboratories conducted air and ground surveys at the Monterey Breakwater during July of each year and recorded a mean population of 270 animals (Weise 2000). Between 1998 and 1999, the NMFS, Southwest Region

conducted aerial surveys of major California sea lion haul-out sites in California and recorded a mean July census of 56 sea lions at the Monterey Breakwater (Lowry 2001). Though the sample sizes are low in number, they indicate a significant increase in the July population of sea lions at the Monterey Breakwater between the early 1980 surveys (prior to the commencement of annual fireworks displays by the City of Monterey in 1988) and the late 1990 surveys. This increased sea lion presence at the Monterey Breakwater during the month of July thus occurred despite the initiation and annual repetition of fireworks displays in the area.

The MBNMS has been unable to find any peer-reviewed research that specifically investigates the response of California sea lions and harbor seals to commercial fireworks displays. However, extensive studies have been conducted at Vandenberg Air Force Base (VAFB) to determine responses by California pinnipeds to the effects of periodic rocket launches. The light and sound effects of the launches would be roughly similar to the effects of pyrotechnic displays, but with much greater intensity.

An ongoing scientific research program has been conducted since 1997 to determine the long-term cumulative impacts of space vehicle launches on the haul-out behavior, population dynamics and hearing acuity of harbor seals at Vandenberg Air Force Base. In addition, when sonic boom prediction models projected that a sonic boom would hit one of the northern Channel Islands, pinniped populations were studied at identified haul-out sites in order to determine the impact of the boom on pinniped behavior.

The response of harbor seals to rocket launch noise depended on the intensity of the noise (dependent on the size of the vehicle and proximity) and the age of the seal. In order to obtain details on the launch noise reaching harbor seals on VAFB, acoustic measurements were collected near the haul-out site. Not surprisingly, the highest noise levels are typically from launch vehicles with launch pads closest to the haul-out sites. When launch noise was below an A-weighted sound exposure level of 100 decibels (re 20 μ Pa), not all seals fled the haul-out site, and those that remained were exclusively adults. Given the high degree of site fidelity among harbor seals, it is likely that those seals that remained on the haul-out site during rocket launches had previously been exposed to launches; that is, it is possible that adult seals have become acclimated to the launch noise and react differently than the younger inexperienced seals. Of the 20 seals tagged at VAFB, 8 (40%) were exposed to at least 1 launch disturbance but continue to return to the same haul-out site. Three of those seals were exposed to 2 or more launch disturbances. Most of the seals exposed to launch noise (n=6, 75%) appeared to remain in the water adjacent to the haul-out site and then returned to shore within 2 to 22 minutes after the launch disturbance. Of the 2 remaining seals that left the haul-out after the launch

disturbance, both had been on shore for at least 6 hours and returned to the haul-out site on the following day.

In order to further determine if harbor seals experience any change in their hearing sensitivity as a result of launch noise, researchers conducted Auditory Brainstem Response (ABR) testing on 10 harbor seals prior to, and after the launches of 3 Titan IV rockets (one of the loudest launch vehicles at the south VAFB haul-out site). Detailed analysis of the changes in waveform latency and waveform replication of the ABR measurements showed that there were no detectable changes in the seals' hearing sensitivity as a result of the launch noise (SRS Technologies, 2001).

The launches at VAFB do not appear to have had long-term effects on the harbor seal population in this area. The total population of harbor seals at VAFB is estimated to be 1,040 animals and has been increasing at an annual rate of 12.6%. Since 1997, there have been 5 to 7 space vehicle launches per year and there appears to be only short-term disturbance effects to harbor seals as a result of launch noise (SRS Technologies, 2001). Harbor seals will temporarily leave their haul-out when exposed to launch noise; however they generally return to the haul-out within one hour.

There are fewer studies that document disturbances to sea lions. However, sea lions in general are more tolerant to noise and visual disturbances compared to harbor seals. In addition, pups and juveniles are more likely to be harassed when exposed to disturbance compared to the older animals. Adult sea lions have likely habituated to many sources of disturbance and are therefore much more tolerant to human activities nearby.

On San Miguel Island, when California sea lions and elephant seals were exposed to sonic booms from vehicles launched on VAFB, sea lion pups were observed to enter the water, but usually remained playing in the water for a considerable period of time. Some adults approached the water, while elephant seals showed little to no reaction. This short-term disturbance to sea lion pups has not caused any long-term effects to the population.

The conclusions of the five-year VAFB study are almost identical to our observations of pinniped response to commercial fireworks displays. Observed impacts have been limited to short-term disturbance only.

In 2001, the MBNMS and U.S. Fish and Wildlife Service (USFWS) monitored the July 4 Monterey fireworks display with the most thorough effort to date (see attachment C). Monitors recorded species abundance before, during, and after the event and measured the decibel level of exploding fireworks. A hand-held decibel meter was located aboard a vessel adjacent to the Monterey Breakwater, approximately one

half mile from the fireworks launch site. The highest reading observed on the decibel meter during the fireworks display was 82 decibels, 18 decibels lower than the A-weighted sound exposure level of 100 decibels (re 20 μ Pa) measured in the VAFB studies, where only short-term effects were detected. The typical decibel levels for the display ranged from 70 to 78 decibels, and no “salute” effects were used in the display. An ambient noise level of 58 decibels was recorded at the survey site 30 minutes following the conclusion of the fireworks display.

In the 2001 Monterey survey, most animals were observed to evacuate haul-out areas upon the initial report from detonated fireworks. Surveys continued for 4.5 hours after the initial disturbance and numbers of returning California sea lions remained at less than 1% of pre-fireworks numbers. When surveys resumed the next morning (13 hours after the initial disturbance), sea lion numbers on the breakwater equaled or exceeded pre-fireworks levels. Thus, the sea lions returned within 4 to 13 hours following the end of the fireworks display.

Only two harbor seals were observed on and near the rocks adjacent to Fisherman’s Wharf prior to the display. Neither were observed to haul out after the initial fireworks detonation, but remained in the water around the haul-out. The haul-out site was only surveyed until the conclusion of the fireworks display, therefore, no animal return data is available. However, the behavior of the seals after the initial disturbance and during the fireworks display is similar to the response behavior of seals during the VAFB rocket launches, where they loitered in the water adjacent to their haul-out site during the launch and returned to shore within 2 to 22 minutes after the launch disturbance.

8. Impacts Upon Subsistence Use

Not applicable. There is no subsistence take of California sea lions or harbor seals within or adjacent to the MBNMS.

9. Impacts Upon Habitat

Not applicable. Fireworks displays do not alter ocean areas or haul-out sites used by California sea lions and harbor seals. See pages 6-10 of the Fireworks Assessment Report 2001 for a description of the debris and residue resulting from fireworks displays.

10. Impacts of Habitat Changes

Not applicable. See 9. Above.

11. Proposed Measures To Limit Impacts

The MBNMS has worked with the USFWS and the NMFS for over a year to craft Sanctuary permitting guidelines that protect Sanctuary resources and qualities, while allowing the continuation of traditional coastal fireworks displays. See attachment B (*Monterey Bay National Marine Sanctuary Fireworks Guidelines April 2002*) for a detailed description of the Sanctuary's strategy for minimizing impacts.

The guidelines implement five broad approaches for managing fireworks displays:

- establish four conditional display areas and prohibit displays along the remaining 95% of Sanctuary coastal areas,
- create a per-annum limit on the number of displays allowed in each display area,
- establish a Sanctuary-wide seasonal prohibition to safeguard reproductive periods,
- retain permitting requirements and general and special restrictions for each event,
- institute a 5-year permit system for displays that will occur annually at a fixed location and in a consistent manner, such as municipal Independence Day shows.

An equal number of private and public displays will be considered for authorization within each display area. The Sanctuary will continue to assess displays on a case-by-case basis, using standard permit conditions to address concerns unique to each planned display. These conditions have evolved over the past nine years, as the Sanctuary has sought to improve its understanding of the potential impacts that fireworks displays have upon marine wildlife and the environment.

Displays will not be authorized between March 1 and June 30 of each year, since this period is the primary reproductive season for many marine species. Remote areas and areas where professional fireworks have not traditionally been conducted will not be considered for fireworks approval. MBNMS fireworks guidelines are designed to prevent an incremental proliferation of fireworks displays and disturbance throughout the Sanctuary and minimize area of impact by confining displays to primary traditional use areas. Traditional display areas are located adjacent to urban centers where wildlife has often acclimated to human disturbances, such as low-flying aircraft, emergency vehicles, unleashed pets, beach combing, recreational and commercial fishing, surfing, swimming, boating, and personal watercraft operations.

If properly managed, a limited number of fireworks displays conducted in areas already heavily impacted by human activity can occur with sufficient safeguards to prevent any long-term or chronic impacts upon local natural resources.

12. Impacts to Arctic Subsistence Hunting

Not applicable.

13. Monitoring and Reporting

Of all the past authorized fireworks display sites within the Sanctuary, the City of Monterey site has received the highest level of Sanctuary monitoring effort (see *Environmental Impacts* on pages 8-10 of the Fireworks Assessment Report 2001). The City of Monterey has hosted a marine fireworks display each July 4th since 1988. The display is the longest running and largest annual commercial fireworks display within the Sanctuary.

The Monterey Breakwater (approximately one half statute mile from the pyrotechnic launch site) was constructed in the 1930s and has been a regular haul-out site for California sea lions for many decades. Natural rock formations within Monterey Harbor serve as a regular haul-out site for a number of harbor seals. Both haul-out sites have been studied and censused by government and academic researchers for over 20 years. Consequently, the Monterey site has the best background data available for assessing status and trends of key marine mammal populations relative to annual fireworks displays. For this reason, we propose that Monterey be monitored as an indicator site to further determine how local California sea lion and harbor seal distribution and abundance are affected by an annual fireworks display.

The Sanctuary proposes conducting a visual census of the Monterey Breakwater and Harbor Rocks on July 4 and July 5 of each year to determine annual abundance, demographic response patterns, and departure and return rates for California sea lions and harbor seals relative to the July 4 fireworks display. Data will be collected by observers aboard kayaks or small boats and from ground stations (where appropriate). Observers will use binoculars, counters, and data sheets to census animals. The pre and post fireworks census data will be analyzed to identify any significant temporal changes in abundance and distribution that might be attributed to impacts from the annual fireworks display. The data will also be added to past research statistics on the abundance and distribution of stocks at Monterey Harbor.

It should be noted however that annual population trends at any given pinniped haul-out site can be influenced by a myriad of environmental and biological factors, ranging from predation upon pups at distant breeding colonies to fluctuating prey stocks due to El Niño events. These many variables make it difficult to measure and differentiate the potential impact of a single stimulus on long-term population trends.

The MBNMS does not have the funding or resources to monitor and survey each of the potential twenty annual displays within the Sanctuary, nor do we believe that such an effort is necessary. We believe that continued monitoring of the Monterey July 4 display is sufficient to determine whether fireworks displays cause more than a negligible impact upon the species of concern.

14. Research Coordination

The MBNMS will continue to incorporate updated census data from government and academic surveys into its analysis and will make its information available to other marine mammal researchers upon request. The Sanctuary coordinates a Research Activities Panel comprised of 21 marine research institutions and organizations adjacent to the Sanctuary and receives constant updates of ongoing research within the Sanctuary that might be related to this issue. The MBNMS is coordinating with researchers at the NMFS, the USFWS, the California Department of Fish, Game, and various specific research institutions concerning the status and local trends of pinnipeds in the Sanctuary. As stated previously, the MBNMS has identified no other directed research or monitoring efforts (within California or elsewhere) that specifically address the impacts of fireworks on pinnipeds.

C. REFERENCES AND INFORMATION SOURCES

Allen, S.G., J.F. Penniman, and D.G. Ainley. 1987. Movement and activity patterns of harbor seals at Drakes Estero, California, 1986-1987. Unpublished report. Point Reyes National Seashore, U.S. Department of the Interior.

Bonnell, M.L., M.O. Pierson, and G.D. Farrens. 1993. Pinnipeds and sea otters of Central and Northern California, 1980-1983: status, abundance, and distribution. Part of investigator's final report: marine mammal and seabird study, central and northern California, contract #14-12-0001-29090. Prepared for OCS Region, Minerals Management Service, U.S. Department of the Interior.

Keith, E.O., R.S. Condit, and B.J. LeBoeuf. 1984. California sea lions breeding at Ano Nuevo Island, California. *Journal of Mammology*, Vol. 65, Iss. 4 (1984).

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J.V. Carretta. 2002. U.S. Pacific marine mammal stock assessments: 2000. U.S. Department of Commerce. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-300, December 2000.

Hall, D.. 2000. Permit monitoring report for permit MBNMS-2000-030. U.S. Department of Commerce. Monterey Bay National Marine Sanctuary.

Hall, D. and D. Threlhoff. 2001. Permit monitoring report for permit MBNMS-2001-013. U.S. Department of Commerce. Monterey Bay National Marine Sanctuary.

Lowry, M.. 2001. Unpublished aerial survey data from Point Piedras Blancas to Bodega Rock. U.S. Department of Commerce. National Marine Fisheries Service, Southwest Fisheries Science Center.

Lowry, M.. 2002. Personal Communication. Notes from telephone conversation between Scott Kathey (MBNMS) and Mark Lowry on February 27, 2002.

Nicholson, K.A.. 1986. The movement patterns of California sea lions at the Monterey Coast Guard breakwater. Master's Thesis. California State University at San Francisco, San Francisco, California 94132.

Nicholson, T.E.. 2000. Social structure and underwater behavior of harbor seals in southern Monterey Bay, California. Master's Thesis. California State University at San Francisco, San Francisco, California 94132.

Nicholson, T.E.. 2002. Personal Communication. Notes from telephone conversation between Scott Kathey (MBNMS) and Teri E. Nicholson on February 26, 2002.

Odell, D.K., S.H. Ridgeway, and R.J. Harrison. 1981. California sea lion *Zalophus californianus* (Lesson, 1828); Handbook of Marine Mammals: Volume 1: The Walrus, Sea Lions. Academic Press, London.

Oxman, D.. 1995. Seasonal abundance, movements and food habits of Harbor seals (*Phoca vitulina richardsii*) in Elkhorn Slough, California. Master's Thesis. California State University at Stanislaus, Turlock, California 95382.

Read, R.B. and K. Reynolds. 2001. Final report: survey of harbor seals in California. California Department of Fish and Game, Marine Region, San Diego, California. Prepared for the Pacific States Marine Fisheries Commission.

Research Planning Incorporated. 1994. Sensitivity of coastal environments and wildlife to spilled oil: central California. Prepared for Office of Oil Spill Prevention

and Response, California Department of Fish and Game and Hazardous Materials Response and Assessment Division, National Oceanic and Atmospheric Administration.

Trumble, S.. 1995. Food habits, dive behavior, and mother-pup interactions of harbor seals (*Phoca vitulina richardsi*) near Monterey Bay, California. Master's Thesis. California State University at Fresno, Fresno, California 93740.

Weise, M.J.. 2000. Abundance, food habits, and annual fish consumption of California sea lions (*Zalophus californianus*) and it's impact on salmonid fisheries in Monterey Bay, California. Master's Thesis. California State University at San Jose, San Jose, California 95192.

ODDS AND ENDS

Research Resources.

- MBNMS monitoring reports
- Annual NMFS Barlow/Forney stock assessment surveys
- Teri Nicholson Hopkins Marine Station harbor seal research (2000)
- Research at USCG Breakwater by Nicholson (1986) and Weise (1998)
- Census updates (ESI Maps) by SiMON
- Potential surveys of selected sites by Team Ocean
- Potential surveys of selected sites by BayNet Monterey and Santa Cruz
- Potential survey support by USCG Auxiliary