

GOSA AQUATIC
162921

BEACH WATCH

ANNUAL REPORT: 1999

by
Jan Roletto, Joe Mortenson, Leslie Grella and David Osorio



San Francisco, CA
July 2000



The Gulf of the Farallones National Marine Sanctuary encompasses 948 square nautical miles of water off the California coastline west of San Francisco. Designated in 1981, the Sanctuary consists of an offshore marine region of the Gulf of the Farallones and the nearshore waters of Bodega Bay, Tomales Bay, Estero de San Antonio, Estero Americano, and Bolinas Lagoon.

The Farallones Marine Sanctuary Association (FMSA), established in 1995, is a marine conservation organization dedicated to protecting marine wildlife and conserving coastal and ocean resources in the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries. To further these conservation goals FMSA trains citizens to monitor Sanctuary resources; responds to emergencies in the Sanctuaries; and promotes public awareness, education, and involvement. FMSA is headquartered in the Presidio of San Francisco.

For more information about Beach Watch, to become a Beach Watch volunteer, or to order additional copies of the annual report, please contact the Gulf of the Farallones National Marine Sanctuary, Fort Mason, Building 201, San Francisco, CA 94123 (415) 561-6622.

Leah Culp did the design and layout of the final report.

Printed on 100% post-consumer, non-chlorine bleached recycled paper.

BEACH WATCH ANNUAL REPORT:

1999

by

Jan Roletto¹, Joe Mortenson², Leslie Grella² and David Osorio²

*¹Gulf of the Farallones National Marine Sanctuary, Fort Mason,
Building 201, San Francisco, CA 94123.*

*²Farallones Marine Sanctuary Association The Presidio, P.O.
Box 29386 San Francisco, CA 94129*

July 2000

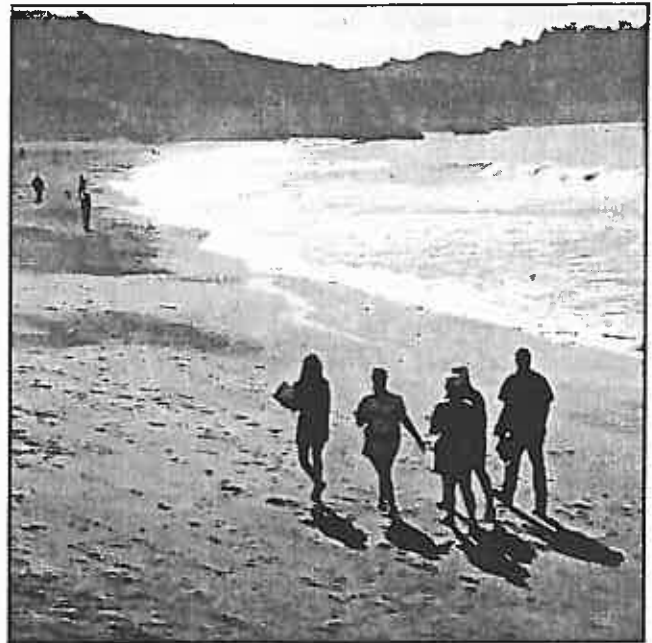
Suggested Citation: Roletto, J., J. Mortenson, L. Grella, and D. Osorio. Beach Watch Annual Report: 1999. 2000. Unpublished Report to the National Oceanic and Atmospheric Administration, Gulf of the Farallones National Marine Sanctuary, San Francisco, CA.



EXECUTIVE SUMMARY

In 1993, the Gulf of the Farallones National Marine Sanctuary began Beach Watch, a long-term shoreline monitoring program. The objectives of the program are to: 1) provide baseline information on the average presence of live and beached marine organisms along the shoreline; 2) assist Sanctuary management in the early detection of natural and human-caused environmental perturbations such as epizootics, El Niño-Southern Oscillation (ENSO) events and oil spills; 3) develop a network of expert shoreline surveyors who can respond during an oil spill and other unusual mortality events; 4) educate the public about the coastal environment; and 5) encourage the public to help protect their beaches. Beach Watch systematically surveys designated beaches once every two to four weeks. Encounter rates and levels of search effort are generated for beached marine animals. Encounter rates are then compared from year to year and from beach to beach. Surveyors document numbers of live and beached (dead) marine mammals and birds, oil and tarball deposition, and human activities along coastal beaches including natural resource violations.

In 1999, of the 86 designated beach segments (total of 241 km) between Bodega Head, Sonoma County and Año Nuevo State Reserve, San Mateo County, 34 beach segments (total of 55 km) were monitored every four weeks and 20 beach segments (94.4 km) were monitored every two weeks. During 1999 volunteer staff decreased from 114 to 99 and the volunteer retention rate was 87%. Volunteer hours increased from 10,288 hours in 1998 to 10,951 in 1999. From October 1993 through September 1999, we analyzed survey data from 13 randomly selected beaches for dead marine mammals, birds and tarball deposition patterns as well as encounter rates for live birds. Each selected beach had a minimum of 12 surveys completed each year. A total of 1,281 surveys were included in the analyses representing 2,749.1 km of shoreline surveyed. Data collected during oil spill response and boat grounding surveys were not included in this data set. Beached (dead) birds included waterfowl, shorebirds, seabirds and passe-



Beach Watch survey at Rodeo Beach, Marin Co. (GFNMS Library).

rine birds: a total of 85 species were documented. A total of 3,568 beached birds were found (1.298/km) and Common Murres were most frequently reported ($n = 1,125$ murres, 0.409/km). Alcids (all alcid species and birds identified to the Family Alcidae, inclusive) were the most commonly encountered family of beached birds at a rate of 0.500 birds/km surveyed ($n = 1,377$). Beached gulls (all gull species and birds identified to the Family Laridae, inclusive) were encountered at a rate of 0.202 gulls/km ($n = 1,125$). Western and Clark's Grebes species (all *Aechmophorus* sp.) were encountered at a rate of 0.105 grebes/km ($n = 291$). Cormorants (all *Phalacrocorax* sp., inclusive) were encountered at a rate of 0.069 birds/km ($n = 189$). Beached birds were most frequently encountered on the smaller beaches, Muir Beach and Rodeo Beach; 2.003 birds/km and 2.708 birds/km, respectively. Mammals were most frequently encountered at beaches near major pinniped rookeries, such as Gazos Creek, 0.443 mammals/km. Oiled birds were most frequently encountered at two small beaches, Muir Beach and Kirby Cove; 0.238 oiled birds/km and 0.008 oiled birds/km, respectively. There was no correlation between beaches

which had higher rates of tarballs on them and beaches that had higher rates of oiled beached birds. Tarballs were found most frequently at Limantour Beach West, near the mouth of Drakes Estero; 119 tarballs/km.

From October 1993 through September 1999 a total of 180 live avian species were noted within the survey area. Sanderlings, Western Gulls and Brown Pelicans were the most commonly documented species at the 13 selected beaches; encounter rates were 21 birds/km, 13 birds/km, and 18 birds/km surveyed, respectively. Abundant species found in the Gulf of the Farallones, such as Common Murres and Northern Fulmars, are infrequently seen near the shoreline and have low encounter rates.



Brown Pelicans resting on rocks are counted during a Beach Watch survey (J. Roletto).

Care must be taken when viewing the live data, understanding that the survey area is narrow (the width of the beach plus 90 m on either side) and common, offshore, seabird species may not be frequently documented, because they do not always use the beach.



Western Grebe found dead by Beach Watch volunteers (GFNMS Library).

During 1999, encounter rates for dead birds, mammals, oiled birds and tarballs were slightly lower than in previous years. In previous years, the total bird encounter rate was 1.414/km in previous years, decreased to 1.298/km during 1999. The encounter rate for beached Common Murres typically peaks during the post-breeding period, August through October (Figure 4). During 1999 the post-breeding mortals of murres did occur, but the overall encounter rate for murres decreased from 0.476/km to 0.409/km. The encounter rate for Western and Clark's Grebes (*Aechmophorus* sp.) decreased from 0.110 for previous years to 0.105/km during 1999; Brandt's Cormorants decreased from 0.060 to 0.051/km, and California sea lions decreased from 0.888/km to 0.881/km. A total of 197 oiled birds were found, at a rate of 0.072 birds per km surveyed. This is lower than the mean oiled bird encounter rate for previous years, 0.085 birds/km. Common Murres, the most frequently encountered beached bird species (0.409/km), was also the species most frequently found with oil on them (0.051/km; 71% of oiled birds were murres). Tarball distribution patterns for 1999 were similar to the patterns shown in previous years. Encounter rates at specific

beaches were lower than previous years at most locations. The tarball deposition rate at Limantour West, typically the highest deposition zone for tarballs, was 162 tarball/km in previous years, but in 1999 the rate decreased to 119 tarballs/km.

We can hypothesize as to why we counted fewer dead animals and oiled wildlife. Analyses should be done to correlate wind speed, current speed and direction to determine if the winds and currents play a role in the deposition rates of beached birds. Also a review of the deposition rates for beaches with similar attributes: beach length, substrate and configuration and aspect in regards to wave action, would be worthwhile. Other analyses to be reviewed include tanker and cargo vessel traffic, potential discharge of hydrocarbon products and correlation of tarball deposition and wind speed and currents. The encounter rates for live bird species were similar to those in previous years. This suggests that the environment was not overly productive (supporting more wildlife and less mortalities). Instead, this suggests that dead birds, mammals and tarballs which may arrive at beaches due to strong sustained winds and currents did not arrive at beaches not because there were fewer deaths but because the carcasses were not carried to the beaches to be counted.

Live animal counts are useful to resource managers to determine resources at risk during coastal oil spills. Volunteers who regularly conduct baseline surveys are able to efficiently respond during an oil spill and collect data to aid in response efforts and damage assessment. Volunteers who conduct baseline surveys have current knowledge of wildlife response procedures, data collection protocols, and are familiar with response and damage assessment personnel. Volunteers who collect baseline data are continuously trained and their skill level is continuously assessed. Therefore, resource managers can depend on the data being accurate and complete. By using volunteer surveyors, the GFNMS saves approximately \$260,000, annually.

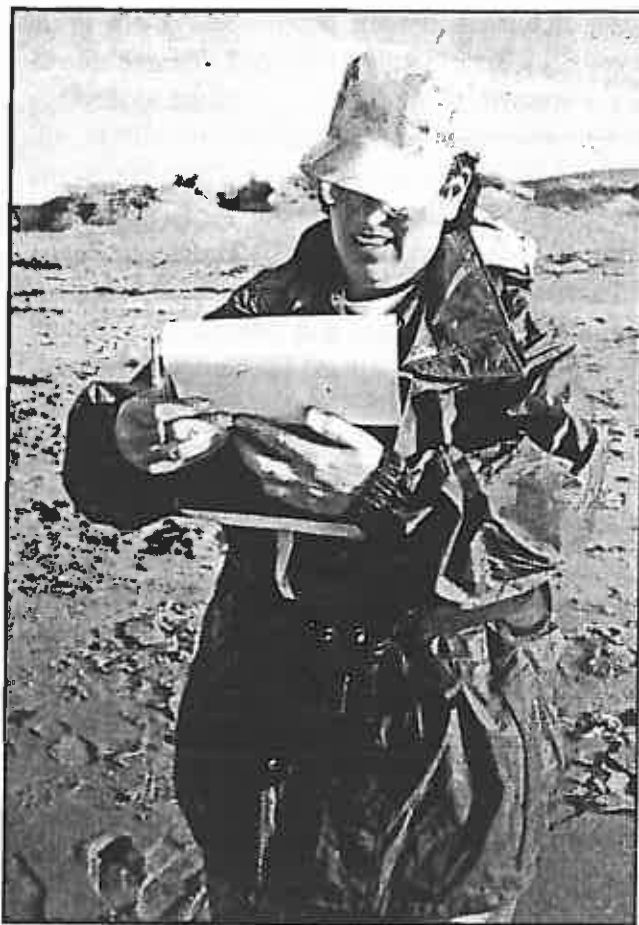


A juvenile gull with a dark spot of oil on its breast (J. Roletto).

INTRODUCTION

The Beach Watch program is a long-term, baseline monitoring project implemented by volunteers and administered through the Gulf of the Farallones National Marine Sanctuary (GFNMS). Our area of operation extends from Bodega Head to the San Mateo-Santa Cruz County border and includes the northern portion of the Monterey Bay National Marine Sanctuary. The objectives of the program are to: 1) provide baseline information on the average presence of live and beachcast marine organisms along the shoreline; 2) assist Sanctuary management in the early detection of natural and human-caused environmental perturbations such as epizootics, El Niño-Southern Oscillation (ENSO) events and oil spills; 3) develop a network of expert shoreline surveyors who can respond during an oil spill and other unusual mortality events; 4) educate the public about the coastal environment; and 5) encourage the public to help protect their beaches. The GFNMS has monitored the coastal beaches since 1993 and has developed a database on the activities and use of the beaches by natural resources and humans. Data collected, are compatible with pre and post-spill assessment programs implemented by federal and state resource trustees.

Shoreline surveys for beached (dead) birds have been conducted since the middle of the twentieth century (Bull and Boeson 1961, Veitch 1976, Page et al. 1982, Stenzel et al. 1988, Powlesland and Imber 1988, Carter and Page 1989, and Bayer 1991) but few efforts to systematically and periodically patrol for beached marine mammals have been conducted (Fay et al. 1977 and Roletto et al. 1997, 1998a, 1998b and 1999). Attempts have been made to search for live, injured, moribund and dead marine mammals by the various regional Marine Mammal Stranding Networks (Brown 1975, Sheldrick 1976, Geraci and St. Aubin 1979, Reynolds and Odell 1991, Wilkinson 1991, Gerber et al. 1993) coordinated through National Marine Fisheries Service, but the Networks neither schedule regular shoreline searches for these animals nor do they account for the level of search effort, as in some beached bird surveys. The Beach Watch sur-



A Beach Watch volunteer records data during a survey (L. Levy).

veys are structured to produce data and information on trends and indices of beached birds and mammals, eliminating the biases of increased survey effort which may occur during oil spill response efforts, die-offs, and the resulting increased search effort for debilitated marine mammals in areas of high human-use.

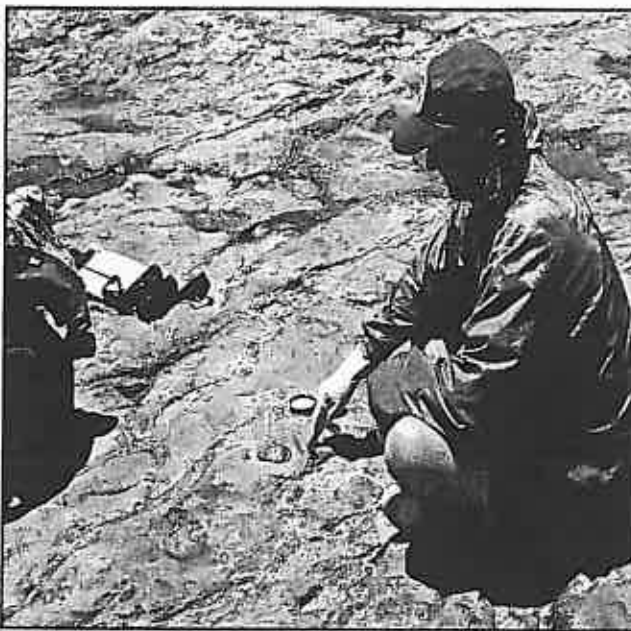
The GFNMS has experienced several major to moderate sized oil spills since its designation in 1981. On 31 October 1984, two explosions aboard the tanker vessel *PUERTO RICAN* resulted in an estimated release of 1,400,000 gallons of refined and crude petroleum products into the Sanctuary. In addition, the stern sank with approximately 8,500 gallons of vessel fuel on board. At least 3,000 birds were killed. In 1986, the barge *APEX HOUSTON* spilled an unknown amount of oil along the central California coast. It is estimated that over 10,000 birds were killed.

After each spill researchers from Point Reyes Bird Observatory undertook damage assessment for marine birds. They established a damage assessment procedure for seabirds in central California and were contracted by the GFNMS to write a post-spill assessment plan for birds within the GFNMS (Carter and Page 1989). The Beach Watch monitoring plan is a pre-spill assessment plan for marine birds, mammals and human-use. Beach Watch establishes baseline beached and live animal frequency, then documents the changes during oil spills and other mortality events. Beach Watch compliments and improves on the Carter and Page (1989) post-spill plan by including documentation of live animals, dead marine mammals and human activities. During 1997, the Monterey Bay National Marine Sanctuary began a shoreline monitoring program for the Monterey Bay area, called Beach COMBERS (Benson et al. 1999). The beached bird and mammal encounter rates for Beach COMBERS are comparable with Beach Watch data.

The Beach Watch monitoring plan was used in evaluating the three most recent spills in the Sanctuaries. On 28 October, 1996 the *CAPE MOHICAN* released an estimated 112,000 gallons of oil into the San Francisco Drydock Company drydock facility (SFDD). A portion of the oil (estimated 42,000 - 50,000 gallons) was released into San Francisco Bay and had reached the Gulf of the Farallones and Monterey Bay National Marine Sanctuaries by 30 October 1996. During the fall and winter of 1997 and 1998, another oil spill incident unfolded, designated as the Point Reyes Tarball Incident (PRTBI). During this period numerous tarballs washed up on the shores of the Sanctuaries and over 2,000 oiled birds were found. Damage assessment for this spill is still underway. On 27 September 1998, an oil slick, approximately ten miles long was reported off of Half Moon Bay, the *COMMAND* spill. Over 75% of the seabirds killed in this spill were Common Murres. This case was settled December 1999 for (\$4.05 million) to be used for restoration to natural resources and (\$98,100) in civil penalties to each of the Sanctuaries damaged by the spill (GFNMS and MBNMS). During each of these incidents the

GFNMS was able to quickly survey local beaches, collect oil and oiled wildlife, aid in the direction of response and clean-up efforts and assess the change in use of the beaches by many taxa of marine organisms and humans.

This Annual Report is intended to provide readers, resource managers, researchers, and educators, a summary of the indices of variation of coastal birds and marine mammals. The reader is also encouraged to review the selected data presented in this report and inquire with the Sanctuary about the availability and use of the data presented in this document as well data that have been collected but not presented in this report. Data collected through the Beach Watch program but not presented in this document include: bird and mammal counts from other beaches in the region; species list and encounter rates for wildlife at specified beaches; distribution and encounter rate of oyster rack separator tubes; human activities; presence of dogs and correlation of wildlife and the presence of humans and or dogs; Sanctuary violations; qualitative photo-documentation of beach erosion and deposition; relative abundance of vegetation wrack; and band and tag resightings for birds and mammals.



A surveyor collects an oil sample from the beach (J. Roletto).

DESIGN AND CONTENTS OF THE MONITORING PLAN

The monitoring plan covers the outer coast of central California between Bodega Head, Sonoma County, and the San Mateo-Santa Cruz County border. Estuarine shoreline included in the plan are Tomales Bay and Bolinas Lagoon. Altogether, 86 beach segments have been designated to be monitored within this program. Most of the shoreline access points are reachable by road, or by foot on trails less than 1 km from vehicular access. Beach monitors survey one or a series of pre-defined beach segments within seven regions of the coast. Surveys are conducted once every two to four weeks. A total of 54 beaches (102.4 km in length) were monitored during 1999. Currently, 34 beach segments are monitored once every four weeks and 20 beach segments are monitored every two weeks (Figure 1).

The GFNMS provides survey volunteers with 82 hours of mandatory training and a manual which reviews the procedures on how to survey and document a beach for live and dead marine organisms including seabirds, shorebirds, marine mammals, humans, and large wracks of invertebrates and marine plants. The manual describes methods for proper sampling of oil or oiled organisms and notification procedures in the event of a Sanctuary violation. An additional 48 hours of optional and advanced training were provided to the volunteers in 1999.

The beach monitor must possess skills in identifying live and dead aquatic birds, marine mammals, common invertebrates and marine plants. Many dead birds and mammals are decomposed, heavily scavenged, and/or covered with oil. Consequently, identification of dead animals is often more difficult. To aid this, the Sanctuary funded the revision of a beached bird and marine mammal identification book (Ainley et al. 1994) and issues this book to each surveyor. Other helpful books used to identify beachcast marine mammal are Kasper (1980) and Jefferson et al. (1993).

Figure 2 illustrates the forms and recorded data taken on each survey. Basic survey data include beach name, location, date, approximate tide

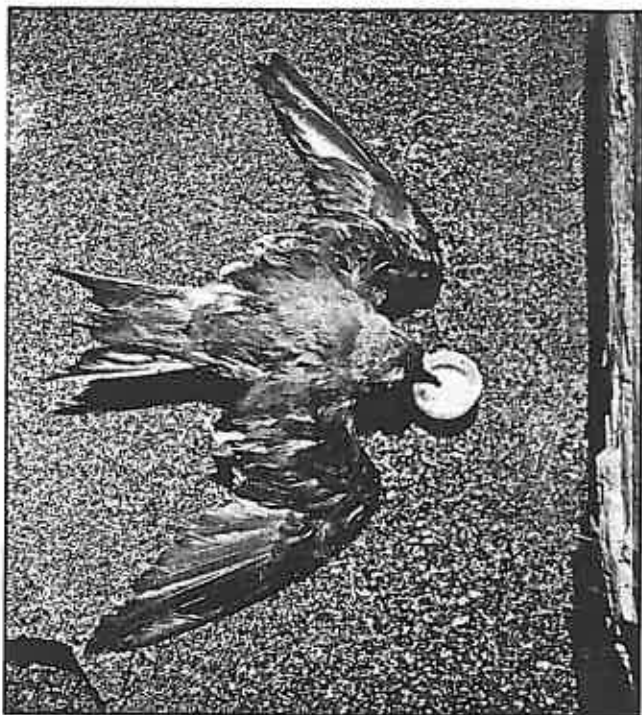


Volunteers study bird skins during a Beach Watch training class (J. Roletto).

height, the name of the person(s) making the observations, wind speed and visibility, and a photograph of the beach profile for erosion and deposition information. Live birds and marine mammals censused during each survey are tallied on the Live Animal Count form. Surveyors also note on this form if any of the animals were oiled. Surveyors document beachcast marine plants (wrack) and invertebrates using abundance codes as relative estimate of numbers along the entire beach segment. The presence and abundance of oil, typically found as tarballs, is documented on the Live Animal Count form. The presence and activity of humans and dogs are recorded in the Visitor Use section. Freshly deposited tarballs are also recorded on a separate form. Dead birds and mammals are photographed and the following information is recorded: species, age, sex (when possible), presence of bands or tags, evidence for cause of death, the presence of oil, stage of decomposition, and evidence of scavenging. The beaches are surveyed in a zig-zag fashion and the upper dune areas are checked for any hidden carcasses. Live birds and mammals seen on the beach and 90 m on either side of the beach are counted and identified to the most precise possible taxon. Any unusual conditions encountered are noted on the re-

verse side or on supplemental forms (e.g. oil on the beach and location, a heavy cover of debris on the beach that may possibly hide carcasses, possible intervention by people burying or piling up carcasses, Sanctuary violations, the status of lagoons and streams which seasonally flow across the beach, location and number of active nests, etc.).

If a live, stranded marine mammal or seabird is encountered, the volunteers notify the proper authorities and rehabilitation facility for the animal. Each beach has a designated Area Manager, who is associated with the county, state or federal agency managing a particular beach, such as the Point Reyes National Seashore and the Golden Gate National Recreation Area. When violations and oil spills are witnessed, the volunteers photograph the event, record their observations, and notify the designated Area and Sanctuary Managers.



A sick Fork-tailed Storm Petrel found in Point Reyes National Seashore, Marin Co. (L. Hug).



Supplies used to recover oil samples during Beach Watch surveys (J. Roletto).

Collection of oil samples, tarballs and oil from dead marine organisms is an important responsibility of the surveyors. Properly collected and stored samples can later be used to determine the origin and type(s) of oil, as well as serve as evidence during litigation against an alleged spiller. The surveyors do not sample free flowing oil due to its hazardous nature. But, in most circumstances any oil encountered is weathered tarballs, patties or tar, or is found on a bird or other marine organism. The Sanctuary works with the State Office of Spill Prevention and Response (OSPR) to collect oil samples. OSPR has provided the Sanctuary with oil sampling equipment, instruction and has trained surveyors to assure quality assurance/quality control to minimize interference with the analysis and "fingerprinting" of the oil. Volunteers collect three oil samples if oil is on the beach (increased from two samples per survey in 1994). Volunteers are instructed to remove old weathered tarballs, so they are not counted in future surveys. Sanctuary staff has received HazWHOPPER training and will collect whole, oiled birds during an oil spill or tarball events.

Raw survey data is reviewed for completeness and accuracy. Each dead vertebrate is photographed and assigned a specimen number. The species identification, age and sex are later checked

CURRENT STATUS



Live birds are recorded by volunteers (C. Corben).

against the photographs for accuracy and precision. Identification is made to family or group when species identification is not possible due to scavenging. Data are then entered into a relational data base, FileMaker Pro®. Encounter rates (i.e. sighting rates) are calculated as number of animals sighted per kilometer surveyed. This accounts for the varying level of survey effort which occurs between past and current beached bird programs (e.g. the 14-year beached bird program conducted by PRBO and the current Beach COMBERS program conducted by MBNMS). Seasonal and annual trends and indices can later be statistically calculated.

Of the 86 beach segments (total of 241 km) between Bodega Head, Sonoma County and Año Nuevo State Reserve, southern San Mateo County, 34 beach segments (55 km) were monitored every four weeks and 20 beach segments (94.4 km) were monitored every two weeks (Figure 1). Beaches monitored within the Point Reyes National Seashore include: McClure's Beach, Point Reyes Beach (segments A*, B, C and D), Chimney Rock to Drakes Beach, Drakes Beach West* and East*, Limantour Beach West* and East, Coast Camp to Point Resistance (Palomarin was inaccessible for most of 1999 due to storm damage), and RCA Beach. Beaches monitored within the Golden Gate National Recreation Area include: Bolinas Lagoon along the CalTrans mitigation area*, Muir Beach*, Tennessee Cove, Rodeo Beach*, Kirby Cove, Baker Beach*, China Beach, Lands End, Ocean Beach North, Central* and South, Thornton Beach North and South* segments. Researchers and resource managers may access data from these beaches after written request to the Sanctuary Research Coordinator.

During 1999, our volunteer retention rate was 87%. We did not recruit new volunteers, so our volunteer staff decreased from 114 to 99 (Table 1). Volunteer hours, however, increased from 10,288 hours in 1998 to 10,951 hours in 1999. Volunteer hours include the survey hours, survey preparation time, data entry, enrichment classes and advanced training. The number of volunteer hours increased in each National Park. The Golden Gate National Recreation Area (GGNRA) increased from 930 hours 1998 to 1,206 hours worked in 1999; Point Reyes National Seashore (PRNS) increased from 1,752 hours to 2,768 hours in 1999.

RESULTS

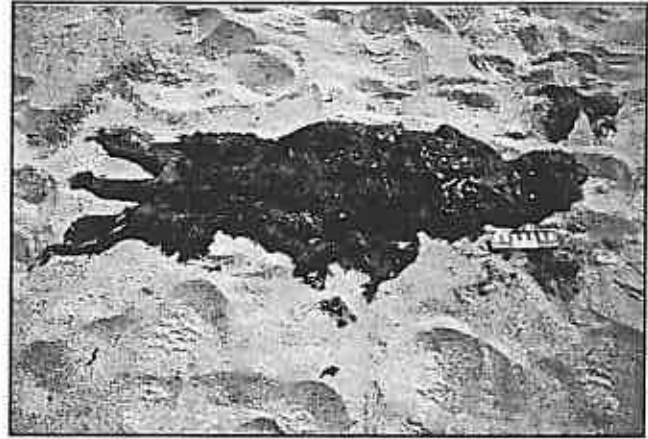
The following analyses provide an overview of the resource use of the central California beaches. Examples of analyses of bird and mammal encounter rates for individual beaches, and annual trends are presented in this report. This report suggests the kinds of data available from the Beach Watch program. Further data may be available to researchers who can provide funding to support data entry and analyses.

Representative Analyses of Survey Data from Thirteen Selected Beaches, October 1993 Through September 1999

We analyzed data from 13 randomly selected beaches for all dead marine mammals, birds and tarball deposition patterns and encounter rates for live birds, from October 1993 through September 1999. Each beach selected had a minimum of 12 surveys completed each year (Figure 3). A total of 1,281 surveys were included in the analyses representing a total of 2,749.1 km of shoreline surveyed. Data collected during oil spill response and boat grounding surveys have not been included in this data set. Some results of these analyses have appeared in a report on an unusual mortality event of birds and sea lions fall 1998 (Gulland et al. 1999). These analyses also served as the basis of a report on Snowy Plover populations, requested by the Point Reyes National Seashore (Appendices I and II) and sea otter sightings along the central California coast, requested by US Fish and Wildlife Service (Appendix III).

Beached Bird and Mammal Encounter Rates

Beached (dead) birds included waterfowl, shorebirds, seabirds and passerine birds: a total of 85 species were documented (Table 2). A total of 3,568 beached birds were documented (1.298/km). Common Murres were most frequently reported at a rate of (0.409 birds/km ($n = 1,125$ murres). Alcids (all alcid species and birds identified to the Family Alcidae, inclusive) were the most commonly encountered family of beached birds at a rate of 0.500 birds/km surveyed ($n = 1,377$). Beached gulls (all gull species and birds identified



Dead sea otters are sometimes found on survey beaches (GFNMS Library).

to the Family Laridae, inclusive) were encountered at a rate of 0.202 gulls/km ($n = 565$). Western and Clark's Grebes species (all *Aechmophorus* sp.) were encountered at a rate of 0.105 grebes/km ($n = 291$). Cormorants (all *Phalacrocorax* sp., inclusive) were encountered at a rate of 0.069 birds/km ($n = 189$).

Beached marine mammals include all species of cetaceans (whales, dolphins and porpoises), pinnipeds (sea lions, fur seals and true seals) and sea otters. A total of 33 marine mammal species have been documented in the Gulf of the Farallones (Roletto in prep.). Beached marine mammal species at the selected beaches include minke and gray whales, Dall's and harbor porpoise and five (California sea lion, Steller sea lion, northern elephant seal, harbor seal and northern fur seal) of the six

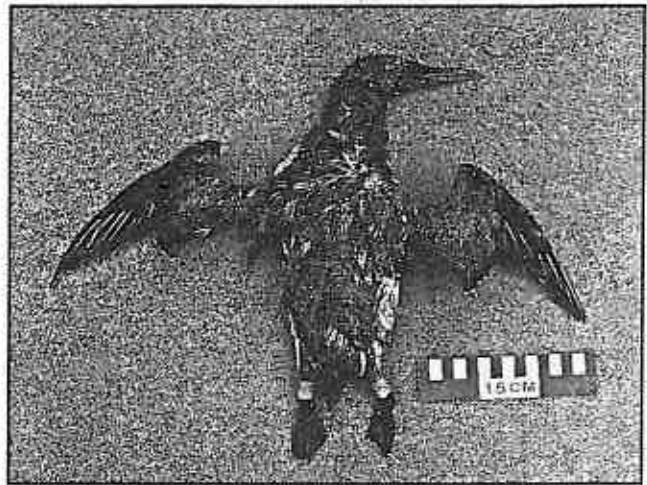


California sea lions were common marine mammals stranded during 1999 (G. Corning).

pinniped species found along central California. Other marine mammal species were encountered at other beaches, but the data for those beaches were not entered and analyzed for this report. For a complete list of beached mammals encountered for all shoreline surveys conducted since 1993, see Table 3. California sea lions were the most frequently encountered marine mammal species (Table 2); 222 sea lions were found at a rate of 0.081 per km. Marine mammals are occasionally removed prior to a beach survey by members of the Marine Mammal Stranding Network, in particular small cetaceans and uncommonly found small pinnipeds such as northern fur seals, but the numbers are negligible. For further information see Roletto et al. 1998a.

Deposition rates for beached birds and mammals at each of the selected beaches are listed in Table 4. Beached birds were most frequently encountered on the smaller beaches, Muir Beach and Rodeo Beach; 2.003 birds/km and 2.708 birds/km, respectively. See Table 4 for length of beach segments. Mammals were most frequently encountered at beaches near major pinniped rookeries, such as Gazos Creek, 0.443 mammals/km. Pinnipeds, cetaceans and deer were also frequently encountered at Pescadero (0.254/km), a moderately long beach (1.2 km). Figure 5 illustrates the encounter rates for Common Murres and California sea lions for the selected beaches.

The beached bird and mammal encounter rates for the whole series of observations through 1999 decreased slightly from the mean encounter rates for previous years for nearly all of the species observed. In previous years, the total bird encounter rate was 1.414/km; it decreased to 1.298/km during 1999. The encounter rate for beached Common Murres typically peaks during the post-breeding period, August through October (Figure 4). During 1999 the post-breeding mortalities of murres did occur, but the overall encounter rate for murres decreased from 0.476/km to 0.409/km. The encounter rate for Western and Clark's Grebes (*Aechmophorus* sp.) decreased from 0.110 for previous years to 0.105/km during 1999; Brandt's Cormorants decreased from 0.060 to 0.051/km, and California sea lions decreased from 0.888/km to



A dead Common Murre with both legs banded (J. Roletto).

0.881/km. A few species were encountered at a rate above the mean for previous years. Those were: Forked-tailed Storm Petrels (increased from 0.002 to 0.007/km), Willets (increased from 0.002/km to 0.007), and Marbled Godwits (increased from 0.003/km to 0.004/km).

Oil Pollution Events and Oiled Samples Collected, 1999

No specific oil spills or heavy tarball events were detected during 1999.

Beached animal data collected during the shoreline surveys include information on the degree of oiling found on each specimen. Table 5 lists all species that had oil on the plumage, documented from the selected beaches. One oiled harbor seal was documented during Beach Watch surveys. A total of 197 oiled birds were found, at a rate of 0.072 birds per km surveyed. This is lower than the mean oiled bird encounter rate for previous years, 0.085 birds/km. Common Murres, the most frequently encountered beached bird species (0.409/km), was also the species most frequently found oiled bird (0.051/km; 71% of oiled birds were murres). Oiled birds were most frequently encountered at two small beaches, Muir Beach and Kirby Cove; 0.238 oiled birds/km and 0.008 oiled birds/km, respectively. In previous years oiled birds were higher, 0.260 oiled birds/km at Rodeo Beach and 0.159 oiled birds/km at Muir Beach.

We recorded a high occurrence of tarballs



Feather samples are collected from oiled wildlife and analyzed by OSPR (GFNMS Library).

during the winter of 1996-97 at the small beaches near the Golden Gate Bridge and entrance to the San Francisco Bay. During this time residual tarballs from the *CAPE MOHICAN*-SFDD oil spill, were deposited on those nearby, small beaches. Because of the short-term, high deposition of tarballs, we had an elevated rate of tarball deposition at Rodeo Beach, Kirby Cove and Land's End. Tarball distribution patterns for 1999 were similar to the patterns shown in previous years. Encounter rates at the 13 beaches that were analyzed were lower than previous years at most locations. The tarball deposition rate at Limantour West, typically the highest deposition zone for tarballs (162 tarball/km in previous years), decreased to 119 tarballs/km in 1999. The majority of the tarballs found at Limantour were old, weathered tarballs found after storm events had uncovered them.

There was no correlation between beaches which had higher rates of tarballs on them and beaches that had higher rates of oiled beached birds. From October 1993 through September 1998, we did not observe any tarballs at Pescadero and Cove Beach. Most interesting is that in three years of surveys (1993-96) prior to the *CAPE MOHICAN* oil spill, no tarballs or oiled birds were documented at Land's End, which has each year 800 to 1,100 oil tankers pass within 2 km of this beach. During the *CAPE MOHICAN*-SFDD oil spill (October

1996) Land's End was observed with oil and oiled birds on the beach. Throughout 1997 and 1998, each of the small beaches near the Golden Gate Bridge, Rodeo Beach, Kirby Cove and Land's End, continued to concentrate tarballs originating from the *CAPE MOHICAN* (Unpub. data, CDFG-OSPR, 1997). During 1999 an oil sample found at Rodeo Beach was fingerprinted to be from the *CAPE MOHICAN* oil spill.

Tarballs and feathers from oiled birds were collected during 1999 from the beaches listed in Table 7. This list indicates areas of tarball and dead bird deposition and where tarballs may be retained on the beaches through the process of sand deposition, later to be found after the winter storm erosion.

Uncommon Strandings and Sightings of Interest

Live and beached seabirds are by far the most abundant group of animals encountered during any beach survey. But during 1999 several beached sharks were documented. shark) Drakes Beach during September (blue shark), Muir Beach and Thronton Beach during September. Shark identifications still to be confirmed: lemon shark, white shark and salmon shark. Several dead Forked-tailed Storm-petrels were found at Doran



A dead salmon shark found on Gazos Creek beach, San Mateo Co. (L. Patrick).

and Point Reyes Beaches during January, April, May and June. Dead Horned Puffins were recorded at Point Reyes Beach during March and at Gazos Creek during October. A Dead Thick-billed Murre was found at Kirby Cove during June. One

dead Guadalupe fur seal was documented at the beach between Pomponio and San Gregorio beaches during June. The longest California sea lion to be recorded by California Academy of Sciences (275 cm), was found dead at Muir Beach during July. A dead beaked whale (*Mesoplodon* sp.) was found at Drakes Beach during July.

Jim Smith and Steve Franks documented and photographed a Red-headed Woodpecker at Chimney Rock during July. This is the first sighting recorded for Marin County. A Tufted Duck was spotted at Tomasini Creek Beach along Tomales Bay during January. Several Oldsquaw were sighted at Doran Beach during May, July and August. Black Skimmers were sighted at Limantour Beach during August. Up to 26 live sea otters were counted by the Reserve staff and USFWS at Fitzgerald Marine Reserve throughout the year.

Live Bird Sightings and Encounter Rates

A total of 180 live species were noted within the survey area (Table 8). The survey area is a narrow band along the shoreline, 90 meters on either side of the beach. Because of the edge effect, avian biodiversity in the Sanctuaries is maximal on the shoreline. However, beach surveys do not sample offshore species that are abundant in the Sanctuaries. Therefore, abundant species in the Gulf of the Farallones, such as Common Murres and Northern Fulmars, are infrequently seen near the shoreline and have a low encounter rate for live sightings. Sanderlings, Western Gulls and Brown Pelicans were the most commonly documented species at the selected beaches; encounter rates were 21 birds/km, 13 birds/km, and 18 birds/km surveyed, respectively (Table 8). Encounter rates for all live bird species were similar to those found in previous years.

SUMMARY

The Beach Watch program along central California coast quantifies rates by determining the number of animals per kilometer surveyed. Beach Watch surveys are undertaken at regular intervals, permitting a temporal analysis of mortality events. Unusual mortality events can thus be seen against a seasonal baseline of strandings. This more informative method should be adopted by the marine mammal stranding networks, even if done at only a few selected beaches. Selected beaches should be small (≤ 1 km), sandy cove beaches, which face prevailing winds or sandy beaches near rookeries and haul-outs (Carter and Page 1989, Roletto et al. 1997, 1998b and 1999).

Often during environmental events such as ENSO events and die-offs due to red tides, pathogens or oil spills, the general public is informed of the increased number of sick animals coming into rehabilitation centers. The public not only is made aware of who to contact if they find a sick animal on the beach, but may intensify the baseline search effort for stranded animals. Geraci and St. Aubin 1979 and Roletto 1988 found that the number of stranded marine mammals were higher on beaches near human population centers, which have higher concentration of pollutants in the water, and high



Human activities are documented during a Beach Watch survey (GFNMS Library).

public-use beaches. Public reports of distressed animals increase on weekends and summer holidays. All of this suggests that the general public, on an ad hoc basis, are finding many dead or moribund marine mammals on selected beaches near high public-use areas. However, since their search effort is intense, local, and unquantified, it is difficult for resource managers to interpret their findings, since little is known about ordinary stranding rates for marine mammals. By accounting for search effort, thus assessing the stranding rate instead of counts of stranded or beached animals, resource managers can better understand the natural variability of stranded and beached animals, over seasons and years. Rates most likely will be different for different species, age classes and sex.

Beach Watch survey data can be analyzed for seasonal and geographical trends for both live and dead animals. Care must be taken to view the live count data, understanding that the survey area is narrow (the width of the beach plus 90 m on either side) and common, offshore, seabird species may not be frequently documented, because they do not always use the beach. Live animal counts are useful to resource managers to determine resources at risk during coastal oil spills. Also, beaches are the most intensely used resource in coastal Sanctuaries. Therefore, direct evidence about human impacts is vital to the protection of the Sanctuaries.

During 1999, encounter rates for dead birds, mammals and tarballs were slightly lower than in previous years. The encounter rates for live bird species were similar to those in previous years. This suggests that the environment was not overly productive relative to those years supporting more wildlife and fewer mortalities. Instead, dead birds, mammals and tarballs did not arrive at the beaches because the strong winds and currents carrying the carcasses were diminished. Analyses should be done to correlate wind speed, current speed and direction to determine if the winds and currents play a role in the deposition rates of beached birds. Also, a review of the deposition rates for beaches with similar attributes: beach length, substrate and configuration and aspect in regards to wave action, would be worthwhile.

Other analyses to be reviewed include tanker and cargo vessel traffic, potential discharge of hydrocarbon products and correlation of tarball deposition and wind speed and currents.

Surveys can be accomplished through the training and use of volunteers. Volunteers who are from the local constituency are concerned citizens and often want to be involved in the protection and monitoring of our natural resources. Organized surveys can involve concerned citizens as well as control for search effort, resulting in a stranding rate for target species. There are other benefits to using volunteers as citizen-scientists and surveyors. Volunteers who regularly conduct baseline surveys are able to respond efficiently during an oil spill and collect data to aid in response efforts and damage assessment. Volunteers who conduct baseline surveys have knowledge of current wildlife response procedures, data collection protocols, and are familiar with response and damage assessment personnel. Volunteers who collect baseline data are continuously trained and their skill level is continuously assessed. Therefore, resource managers can depend on the data being accurate and complete. By using volunteer surveyors, the GFNMS saves approximately \$260,000, annually.

ACKNOWLEDGEMENTS

The shoreline surveys are conducted by numerous volunteers, who not only survey the beaches every four weeks but also are available for emergency response surveys during oil spills, boat groundings and die-offs. Their services are invaluable to the Sanctuary Program. Data for this report was made available through the extra help and attention from the following data entry volunteers: Barbara and Bill VanderWerf. Without their help the live animal sightings would still be in raw survey data. Many thanks to Susan McComb who continues to produce the volunteer newsletter, NOAA's Bark, and Rich Stallcup who helps with difficult bird identifications. They have been an inspiration to the staff and volunteers of Beach Watch. The California Department of Fish and Game, Office of Spill Prevention and Responses (OSPR) provided the oil spill sampling supplies, laboratory analyses and fingerprinting, and training in proper collection and storage of oil samples. John Tarpley, OSPR, continues to provide training, encouragement and support to the Beach Watch Program. The Sanctuary also wishes to express our gratitude to the Farallones Marine Sanctuary Association, whose staff, volunteers and interns make it possible to staff and manage the Gulf of the Farallones, Cordell Bank and the northern portion of the Monterey Bay National Marine Sanctuaries. Leah Culp did the design and layout for the final production of this report. This report was completed through funding from the Gulf of the Farallones National Marine Sanctuary and partially fulfills contract requirements for contract number 50ABNC800064, NOAA, WASC, Seattle, WA.

LITERATURE CITED

- Ainley, D.G., R.E. Jones, R. Stallcup, D.J. Long, G.W. Page, L.T. Jones, L.E. Stenzel, R.L. LeValley and L.B. Spear. 1994. Beached Marine Birds and Mammals of the West Coast: a Guide to Their Census and Identification, With Supplemental Keys to Beached Sea Turtles and Sharks. Government Printing Office, Benecia, CA.
- Bayer, R.D., R.W. Lowe and R.E. Loeffel. 1991. Persistent summer mortalities of Common Murres along the Oregon central coast. *Condor* 91: 516 - 525.
- Benson, S.R., A.P De Vogelaere and J.T. Harvey. 1999. Establishing a Beach Monitoring Program to Assess Natural and Anthropogenic Changes in Populations of Birds, Mammals and Turtles in the Monterey Bay National Marine Sanctuary. Moss Landing Marine Laboratories Technical Publication No. 99-03. Unpubl. Rept. to the California Urban Environmental Research and Education Center, Moss Landing, CA.
- Brown, S.G. 1975. Relation between stranding mortality and population abundance of smaller cetacea in the northwest Atlantic Ocean. *J. Fish. Res. Bd. Canada* 32(7): 1095 - 1099.
- Bull, P.C. and B.W. Boeson. 1961. Preliminary analysis of records of "storm-killed" sea birds from New Zealand, 1939 - 59. *Notornis* 9: 185 - 199.
- Carter, H.R. and G.W. Page. 1989. Central California oilspill Contingency plan: assessment of numbers and species composition of dead beached birds. NOAA Tech. Memo. NOS MEMD 25. For the Gulf of the Farallones National Marine Sanctuary, San Francisco, California.

- Fay, F.H., R.A. Dieterich and L.M. Shults. 1977. Morbidity and mortality of marine mammals - Bering Sea. In Environmental Assessment of the Alaskan Continental Shelf. Vol. I Receptors - Mammals. Administrative Report for National Oceanic and Atmospheric Administration and the Bureau of Land Management, Fairbanks, AK.
- Geraci, J.R. and D.J. St. Aubin (Eds.). 1979. Biology of marine mammals: insights through strandings. National Technical Information Service, Springfield, VA. NTIS PB-293 890.
- Gerber, J.A., J. Roletto, L.E. Morgan, D.M. Smith and L.J. Gage. 1993. Findings in pinnipeds stranded along the central California coast, 1984 - 1990.
- Gulland, F., S. Benson, M. Busman, J. Cordaro, R. DeLong, A. DeVogelaere, D. Doucette, J. Harvey, M. Haulena, M. Lander, G. Langlois, K. Lafebvre, T. Lipscomb, L. Lowenstien, J. Mortenson, C. Powell, J. Roletto, T. Rowles, C. Scholin, T. Spraker, V. Trainer, and F. Van Dolah. In Press. Domoic Acid Poisoning in California Sea Lions, 1998. NOAA Technical Memorandum NMFS-OPR-8, National Marine Fisheries Service, Department of Commerce, Seattle, WA. 89 pp.
- Jefferson, T.A., S. Leatherwood and M.A. Webber. 1993. FAO Species Guide. Marine Mammals of the World. Food and Agriculture Organization of the United Nations (FAO), Rome, 320 pp.
- Kasper, J.C. 1980. Skeletal Identification of California Sea Lions and Harbor Seals for Archaeologists. Ethnic Technology Notes No. 17. San Diego Museum of Man, San Diego, CA, pp. 34.
- Page, G.W., L.E. Stenzel and D.G. Ainley. 1982. Beached bird carcasses as a means of evaluating natural and human caused seabird mortality. Unpublished report, Point Reyes Bird Observatory, Stinson Beach, California. For the Department of Energy, CX No. DE-AC03-79RV10254.
- Powlesland, R.G. and M.J. Imber. 1988. Osnz beach patrol scheme: information and instructions. *Notornis* 35: 143 - 153.
- Reynolds, J.E., III and D.K. Odell (Eds.). 1991. Marine mammal strandings in the United States: proceedings of the second marine mammal stranding workshop. Miami, FL, December 3 - 5, 1987. NOAA Technical Report NMFS 98.
- Roletto, J. 1988. The hematology and blood serum chemistry of clinically healthy and sick pinnipeds. Master's Thesis, San Francisco State University, San Francisco, CA.
- Roletto, J. Marine Mammals in the Gulf of the Farallones. In prep. In Karl, H.A., J.L. Chin, P.H. Stauffer and J.W. Hendley, J.W., II, eds., *Beyond the Golden Gate—Oceanography, Geology, Biology, and Environmental Issues in the Gulf of the Farallones*: U.S. Geological Survey Circular 1198.
- Roletto, J., J. Mortenson and L. Grella. 1999. Beach Watch Annual Report: 1998. Unpubl. Rept. to the Gulf of the Farallones National Marine Sanctuary, National Oceanic and Atmospheric Administration, San Francisco, CA.
- Roletto, J., L. Grella, J. Mortenson, and L. Hug. 1998a. Beached marine mammal surveys along the central California coast. Unpubl. Report. to The World Marine Mammal Conference, 20 - 24 January 1998, Monte Carlo, Monaco.

Roletto, J., L. Grella, J. Mortenson and L. Hug. 1998b. Beach Watch Annual Report: 1997. Unpubl. Rept. to the Gulf of the Farallones National Marine Sanctuary, National Oceanic and Atmospheric Administration, San Francisco, CA.

Roletto, J., L. Grella and T. Ryan. 1997. Beach Watch Annual Report: 1996. Unpubl. Rept. to the Gulf of the Farallones National Marine Sanctuary, National Oceanic and Atmospheric Administration, San Francisco, CA.

Sheldrick, M.C. 1976. Trends in the strandings of Cetacea on the British coasts, 1913 - 1972. *Mammal Rev.* 6(1): 15 - 23.

Stenzel, L.E., G.W. Page, H.R. Carter and D.G. Ainley. 1988. Seabird mortality in California as witnessed through 14 years of beached bird censuses. Unpublished report, Point Reyes Bird Observatory, Stinson Beach, California. For the Gulf of the Farallones National Marine Sanctuary, San Francisco, California.

Veitch, C.R. 1976 Seabirds found dead in New Zealand in 1974. *Notornis* 23: 168 - 178.

Wilkinson, D. 1991. Report to: assistant administrator for fisheries. Program review of the marine mammal stranding networks. US Department of Commerce, NOAA, National Marine Fisheries Service, Washington DC

Table 1. Volunteer hours, 1999.

Total number of volunteers	99
Total number recruited	2
Number of Volunteers Lost	15
Retention rate	87%
Total volunteer mileage	56,039 miles
Total volunteer survey hours	6,275 (includes survey, prep & drive time)
Volunteer hours in PRNS	(2,768)
Volunteer hours in GGNRA	(1,206)
Total volunteer training hours	4,626
Total volunteer data entry hours	50
Total volunteer hours	10,951
(includes survey, training & travel)	

Table 2. Beached birds and mammals encountered on 13 selected beaches, October 1993 - September 1999. Does not include survey data collected during oil spill response efforts and data from Cove Beach (5-09) for 1999.

<u>Taxon</u>	<u>Number Encountered</u>	<u>Number Per Km Surveyed</u>
Family Diomedidae: Albatross		
Black-footed Albatross	3	0.001
Family Procellariidae: Petrels, Shearwaters		
Northern Fulmar	344	0.125
Pink-footed Shearwater	4	0.001
Black-vented Shearwater	2	0.001
Buller's Shearwater	1	<0.001
Sooty Shearwater	83	0.030
Short-tailed Shearwater	21	0.008
Shearwater Species Unknown	9	0.004
Family Hydrobatidae: Storm-petrels		
Leach's Storm-petrel	3	0.001
Ashy Storm-petrel	5	0.002
Fork-tailed Storm-petrel	19	0.007
Family Gaviidae: Loons		
Red-throated Loon	28	0.010
Pacific Loon	102	0.037
Common Loon	44	0.016
Loon Species Unknown	8	0.003
All Loons	182	0.066
Family Podicipedidae: Grebes		
Eared Grebe	14	0.005
Eared/Horned Grebe	7	0.003
Red-necked Grebe	3	0.001
Horned Grebe	17	0.006
Pied-billed Grebe	1	<0.001
Western Grebe	157	0.057
Clark's Grebe	27	0.010
Western/Clark's Grebe	107	0.039
Grebe Species Unknown	18	0.007
All Western and Clark's Grebes	291	0.105
Family Pelecanidae: Pelicans		
Brown Pelican	44	0.016
Family Phalacrocoracidae: Cormorants		
Double-crested Cormorant	3	0.001
Brandt's Cormorant	140	0.051

Table 2. Continued

<u>Taxon</u>	<u>Number Encountered</u>	<u>Number Per Km Surveyed</u>
Family Ardeidae: Egrets & Herons		
Black-crowned Night-Heron	1	<0.001
Snowy Egret	1	<0.001
Egret/Heron Species Unknown	1	<0.001
Family Anatidae: Ducks		
Greater White-fronted Goose	1	<0.001
Brant	2	0.001
Gadwall	1	<0.001
Mallard	1	<0.001
Green-winged Teal	5	0.002
Greater Scaup	4	0.001
Lesser Scaup	1	<0.001
Scaup Species Unknown	1	<0.001
Bufflehead	12	0.004
Ruddy Duck	1	<0.001
Black Scoter	4	0.002
Surf Scoter	139	0.051
White-winged Scoter	27	0.010
Scoter Species Unknown	6	0.003
All Scoters	176	0.064
Family Cathartidae: Vultures		
Turkey Vulture	2	0.001
Family Accipitridae: Hawks		
Sharp-shinned Hawk	1	<0.001
Family Falconidae: Falcons		
Peregrine Falcon	1	<0.001
Family Strigidae: Typical Owls		
Owl Species Unknown	1	<0.001
Family Rallidae: Rails		
Virginia Rail	2	0.001
American Coot	8	0.003
Family Scolopacidae: Sandpipers		
Black-bellied Plover	2	0.001
Willet	19	0.007
Whimbrel	1	<0.001
Sanderling	3	0.001
Marbled Godwit	12	0.004
Black Turnstone	3	0.001
Surfbird	1	<0.001
Red Phalarope	14	0.005
Red-necked Phalarope	5	0.002
Shorebird Species Unknown	5	0.002
Family Laridae: Jaegers, Gulls & Terns		
Pomarine Jaeger	2	0.001
Caspian Tern	1	<0.001
Elegant Tern	2	0.001
Common Tern	1	<0.001
Arctic Tern	1	<0.001
Sabine's Gull	1	<0.001
Bonaparte's Gull	3	0.001
Heermann's Gull	31	0.011
Mew Gull	4	0.001
Ring-billed Gull	11	0.004
California Gull	38	0.014
Herring Gull	13	0.005
Western Gull	276	0.100
Glaucous-winged Gull	64	0.023
Glaucous Gull	3	0.001
Western-Glaucous-winged Gull Hybrid	17	0.006
Black-legged Kittiwake	26	0.009
Gull Species Unknown	76	0.028
All Gulls	565	0.202

Table 2. Continued

<u>Taxon</u>	<u>Number Encountered</u>	<u>Number Per Km Surveyed</u>
Family Alcidae: Auks, Murres & Puffins		
Common Murre	1125	0.409
Thick-billed Murre	1	<0.001
Pigeon Guillemot	68	0.025
Ancient Murrelet	4	0.001
Marbled Murrelet	6	0.002
Xantus' Murrelet	1	<0.001
Craveri's Murrelet	1	<0.001
Cassin's Auklet	98	0.036
Parakeet Auklet	2	0.001
Rhinoceros Auklet	39	0.014
Horned Puffin	3	0.001
Tufted Puffin	1	<0.001
Alcid Species Unknown	28	0.010
All Alcids	1377	0.500
Family Columbidae: Pigeons & Doves		
Rock Dove	13	0.005
Band-tailed Pigeon	1	<0.001
Family Corvidae: Jays & Crows		
Common Raven	7	0.003
Western Scrub Jay	1	<0.001
Family Paridae: Chickadees & Titmice		
Bushtit	1	<0.001
Class Aves: Birds		
Seabird Species Unknown	8	0.003
Bird Species Unknown	41	0.015
All Birds	3568	1.298
Order Cetacea		
Suborder Mysticeti: Baleen Whales		
Gray Whale	2	0.001
Minke Whale	1	<0.001
Baleen Whale Species Unknown	3	0.001
Suborder Odontoceti: Toothed Whales		
Harbor Porpoise	8	0.003
Dall's Porpoise	2	0.001
Pacific White-sided Dolphin	1	<0.001
Dolphin/Porpoise Species Unknown	1	<0.001
Cetacean Species Unknown	4	0.001
All Cetaceans	21	0.008
Family Otariidae: Sea Lions & Fur Seals		
California Sea Lion	222	0.081
Steller Sea Lion	10	0.004
Northern Fur Seal	2	0.001
Otariid Species Unknown	22	0.008
All Otariids	256	0.093
Family Phocidae: Seals		
Northern Elephant Seal	46	0.017
Harbor Seal	90	0.033
Phocid Species Unknown	2	0.001
All Phocids	138	0.050
Pinniped Species Unknown	12	0.004
All Pinnipeds	390	0.141
Family Mustelidae		
California Sea Otter	2	0.001
Marine Mammal Species Unknown	4	0.001
All Marine Mammal Species	418	0.152

Table 2. Continued

<u>Taxon</u>	<u>Number Encountered</u>	<u>Number Per Km Surveyed</u>
Class Mammalia		
Opossum	1	<0.001
Raccoon	2	0.001
Skunk	1	<0.001
Muskrat	1	<0.001
Horse	1	<0.001
Jackrabbit	3	<0.001
Rabbit	1	<0.001
Mouse	1	<0.001
Cow	1	<0.001
Fox Species Unknown	1	<0.001
Deer Species Unknown	3	<0.001
Black-tailed deer	3	<0.001
Terrestrial Mammal Species Unknown	19	0.006

Table 3. Dead mammal species encountered during all shoreline surveys, October 1993 - September 1999. Not all survey data is available.

<u>Pinnipeds</u>	<u>Cetaceans</u>	<u>Marine Fissipeds</u>	<u>Terrestrial Mammals</u>
California Sea Lion	Beaked Whale	Southern Sea Otter	Ringtail Cat
Northern Fur Seal	Cuvier's Beaked Whale		Cow (domestic)
Steller Sea Lion	Harbor Porpoise		Black-tailed Mule Deer
Harbor Seal	Gray Whale		Dog (domestic)
Northern Elephant Seal	Humpback Whale		Botta's Pocket Gopher
Guadalupe Fur Seal	Killer Whale		Horse (domestic)
	Minke Whale		Field Mouse
	Short-beaked Common Dolphin		Muskrat
	Pacific White-sided Dolphin		Opossum
	Striped Dolphin		Pig (domestic)
	Bottlenose Dolphin		Brush-tailed Rabbit
			Jackrabbit
			Raccoon
			Sheep
			Striped Skunk
			Woodrat
			Tule Elk
			Cat (domestic)
			Mole

Table 4. Encounter rates of beached birds, mammals and tarballs at 13 selected beaches, October 1993 - September 1999. No dead oiled mammals were documented on these selected beaches. Does not include survey data collected during oil spill response efforts.

<u>Beach Name & Segment No.</u>	<u>Length (km)</u>	<u>Total Birds</u>	<u>Birds /km</u>	<u>Total Mammals</u>	<u>Mammals /km</u>	<u>Total Oiled Birds</u>	<u>Oiled Birds/km</u>	<u>Tarballs /km</u>
Doran Beach, 1-06	3.2	632	1.899	54	0.162	22	0.066	0.550
Pt. Reyes Beach A, 1-14	5.0	553	1.301	51	0.120	24	0.057	1.637
Pt. Reyes Beach B, 1-15	4.3	710	1.543	68	0.148	42	0.091	3.500
Drakes Beach East, 2-04	2.5	239	1.074	37	0.166	17	0.076	8.400
Limantour West, 2-05	4.6	367	0.659	47	0.084	36	0.065	118.930
Muir Beach, 2-19	0.6	143	2.003	10	0.140	17	0.238	0.174
Rodeo Beach, 2-23	0.9	329	2.708	29	0.239	1	0.008	0.924
Kirby Cove, 2-30	0.2	25	1.689	2	0.135	2	0.135	18.611
Land's End, 3-06	0.1	1	0.128	1	0.128	1	0.128	5.357
Pescadero, 4-17	1.2	201	1.188	43	0.254	5	0.030	0.274
Pebble Beach, 4-20	2.1	63	0.429	26	0.177	10	0.068	10.238
Gazos Creek, 5-03	1.8	256	1.513	75	0.443	16	0.095	5.021
Cove Beach, 5-09	0.8	37	0.723	26	0.508	5	0.098	0

Table 5. Oiled beached animal species found on 13 selected beaches, October 1993 - September 1999. Table does not include survey data collected during oil spill response efforts.

	<u>Total Found Oiled</u>	<u>% of Total # Found</u>	<u>#/km Surveyed for Each Species</u>
Common Loon	1	2.3	<0.001
Pacific Loon	5	4.6	0.002
Red-throated Loon	1	3.6	<0.001
Eared Grebe	3	21.4	0.001
Western Grebe	10	6.4	0.004
Western/Clark's Grebe	1	0.9	<0.001
Grebe Species Unknown	1	6.7	<0.001
Northern Fulmar	13	3.8	0.005
Pink-Footed Shearwater	1	25.0	<0.001
Pelagic Cormorant	1	2.6	<0.001
Red Phalarope	1	7.1	<0.001
Sooty Shearwater	1	1.2	<0.001
Black Kittiwake	4	15.4	0.002
Western Gull	3	1.1	0.001
Common Murre	141	12.5	0.051
Rhinoceros Auklet	1	2.6	<0.001
Ancient Murrelet	1	25.0	<0.001
Cassin's Auklet	1	1.0	<0.001
Pigeon Guillemot	2	2.9	0.001
Grebe Species Unknown	1	5.6	<0.001
Shorebird Species Unknown	1	20.0	<0.001
Seabird Species Unknown	1	12.5	<0.001
Bird Species Unknown	2	5.6	0.001
All Birds	197	5	0.072
Harbor Seal	1	1.1	<0.001

Table 6. All beaches where tarballs, oiled birds and other oil samples were collected during 1999. Data does not reflect results from OSPR lab analyses.

<u>Beach Name</u>	<u>Beach No.</u>	<u>Sample Type and Number Collected</u>
Dillon Beach*	1-10	COMU 3, BRCO 1
Tomasini Ck to Millerton*	7-07	WE/CLGR 3
Pt Reyes A*	1-14	tarball 9, NOFU 1, SOSH 1, WEGR 3, CAAU 1, BLKI 1, PIGU 1, alcid 1
Pt Reyes B	1-15	tarball 7, BLKI 1
Drakes E	2-04	tarball 5
Limantour W*	2-05	tarball 1
Limantour E*	2-06	tarball 2
RCA	2-12	tarball 2
Muir*	2-19	tarball 2
Rodeo*	2-23	COMU 1
Ocean Central*	3-09	tarball 1, COMU 1
Thornton So.*	3-12	tarball 6
Sharp Park	3-15	tarball 6
So. Montara*	3-27	COMU 1, PALO 1
Tunitas Creek*	4-10	BLKI 1
Pescadero*	4-17	tarball 1, COMU 1
Pebble Beach	4-20	tarball 5
Gazos Creek*	5-03	COMU 1

*Beaches that are surveyed every two weeks.

BLKI = Black-legged Kittiwake, BRCO = Brandt's Cormorant, CAAU = Cassin's Auklet, COMU = Common Murre, NOFU = Northern Fulmar, PALO = Pacific Loon, , PIGU = Pigeon Guillemot, SOSH = Sooty Shearwater, WEGR = Western Grebe, WE/CLGR = Western or Clark's Grebe

Table 7. Encounter rates of live bird species documented within 90 m of the shoreline, from all beaches surveyed, October 1993 - September 1999. Encounter rates of family and group-type identifications, e.g. gull, scoter, peep, etc. are not included. DNA = data not available.

Order	Family	Species	Encounter Rate
Gaviiformes	Gaviidae	Loon, Red-throated	0.150
		Loon, Pacific	0.239
		Loon, Common	0.348
		Loon, Yellow-billed	DNA
Podicipediformes	Podicedidae	Grebe, Pied-billed	0.005
		Grebe, Horned	0.065
		Grebe, Red-necked	0.014
		Grebe, Eared	0.034
		Grebe, Western	0.586
		Grebe, Clark's	0.028
Procellariiformes	Procellariidae	Fulmar, Northern	<0.001
		Shearwater, Sooty	0.667
		Shearwater, Black-vented	0.002
Pelicaniformes	Pelecanidae	Pelican, American White	0.238
		Pelican, Brown	18.394
	Phalacrocoracidae	Cormorant, Double-crested	0.591
		Cormorant, Brandt's	3.284
		Cormorant, Pelagic	0.390
Ciconiiformes	Ardeidae	Heron, Great Blue	0.023
		Egret, Great	0.044
		Egret, Snowy	0.066
		Heron, Green-backed	<0.001
		Night-heron, Black-crowned	0.003
Anseriformes	Cathartidae	Vulture, Turkey	0.671
	Anatidae	Goose, Canada	0.003
		Brant	0.989
		Teal, Green-winged	0.001
		Mallard	0.279
		Pintail, Northern	0.026
		Teal, Cinnamon	DNA
		Shoveler, Northern	0.001
		Gadwall	0.001
		Wigeon, Eurasian	<0.001
		Wigeon, American	0.012
		Duck, Ring-necked	DNA
		Scaup, Greater	<0.001
		Scaup, Lesser	0.001
		Duck, Harlequin	DNA
		Eider, King	DNA
		Scoter, Surf	9.274
		Scoter, Black	0.013
		Scoter, White-winged	0.276
		Oldsquaw	0.003
		Goldeneye, Common	0.003

Table 7. Continued

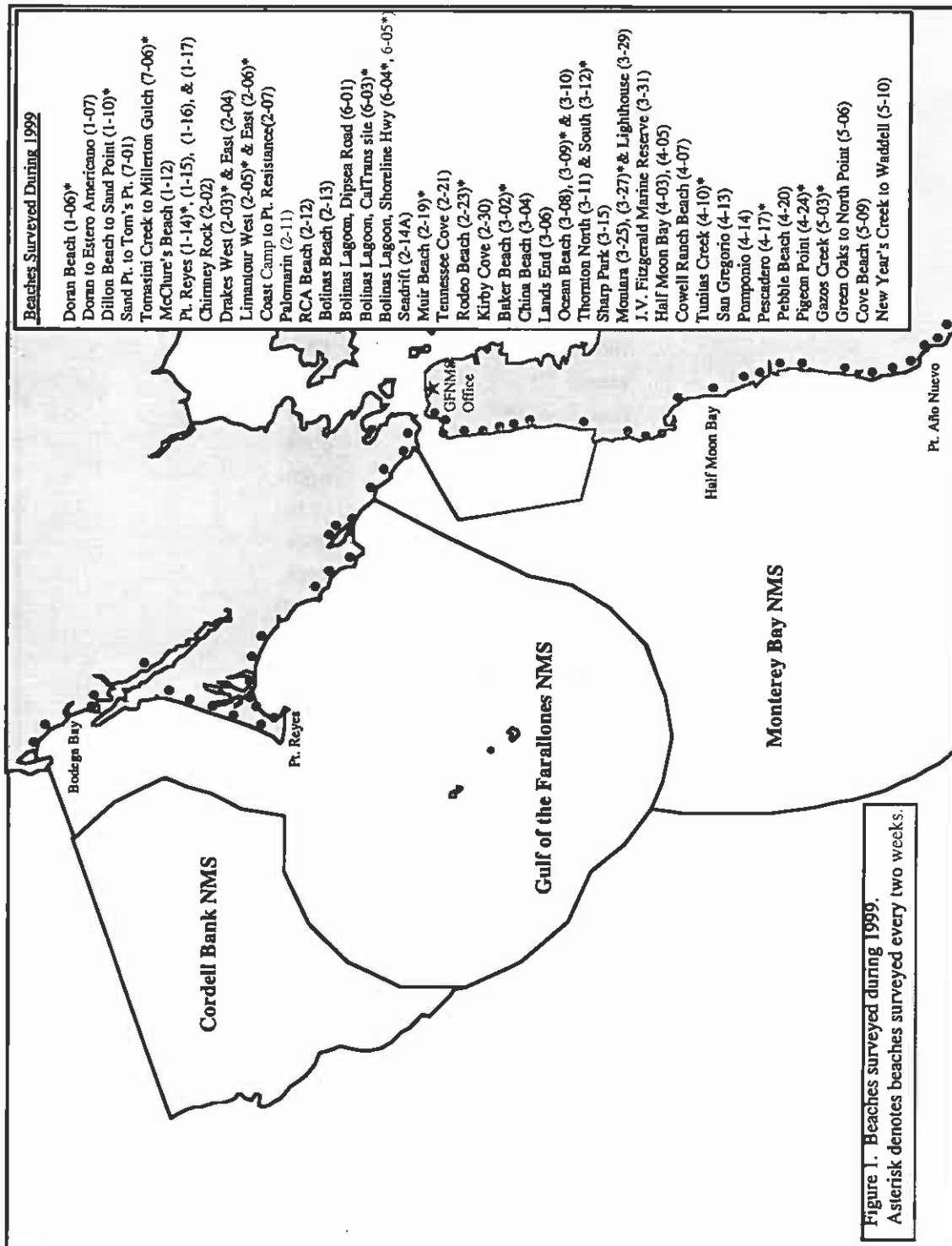
<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Encounter Rate</u>
Anseriformes	Anatidae	Bufflehead	0.083
		Merganser, Hooded	<0.001
		Merganser, Common	0.007
		Merganser, Red-breasted	0.046
		Duck, Ruddy	0.010
Falconiformes	Accipitridae	Osprey	0.067
		Kite, White-tailed	0.002
		Harrier, Northern	0.021
		Hawk, Sharp-shinned	DNA
		Hawk, Cooper's	<0.001
		Hawk, Red-shouldered	<0.001
		Hawk, Red-tailed	0.057
		Eagle, Golden	<0.001
	Falconidae	Kestrel, American	0.006
		Merlin	0.001
		Falcon, Peregrine	0.009
Galliformes	Phasianidae	Quail, California	0.033
Gruiformes	Rallidae	Rail, Virginia	DNA
		Coot, American	0.034
Charadriiformes	Charadriidae	Plover, Black-bellied	1.806
		Plover, American Golden	0.002
		Plover, Snowy	2.045
		Plover, Semipalmated	0.707
		Killdeer	0.179
	Haematopodidae	Oystercatcher, Black	0.230
	Recurvirostridae	Avocet, American	0.004
	Scolopacidae	Yellowlegs, Greater	0.008
		Yellowlegs, Lesser	0.001
		Willet	5.881
		Tattler, Wandering	0.012
		Sandpiper, Spotted	0.002
		Whimbrel	1.537
		Curlew, Long-billed	0.051
		Godwit, Marbled	2.669
		Turnstone, Ruddy	0.026
		Turnstone, Black	0.954
		Surfbird	0.189
		Knot, Red	0.011
		Sanderling	20.785
		Sandpiper, Western	9.112
		Sandpiper, Least	6.130
		Sandpiper, Baird's	0.004
		Sandpiper, Pectoral	0.001
		Dunlin	3.985
		Dowitcher, Short-billed	0.024
		Dowitcher, Long-billed	0.001

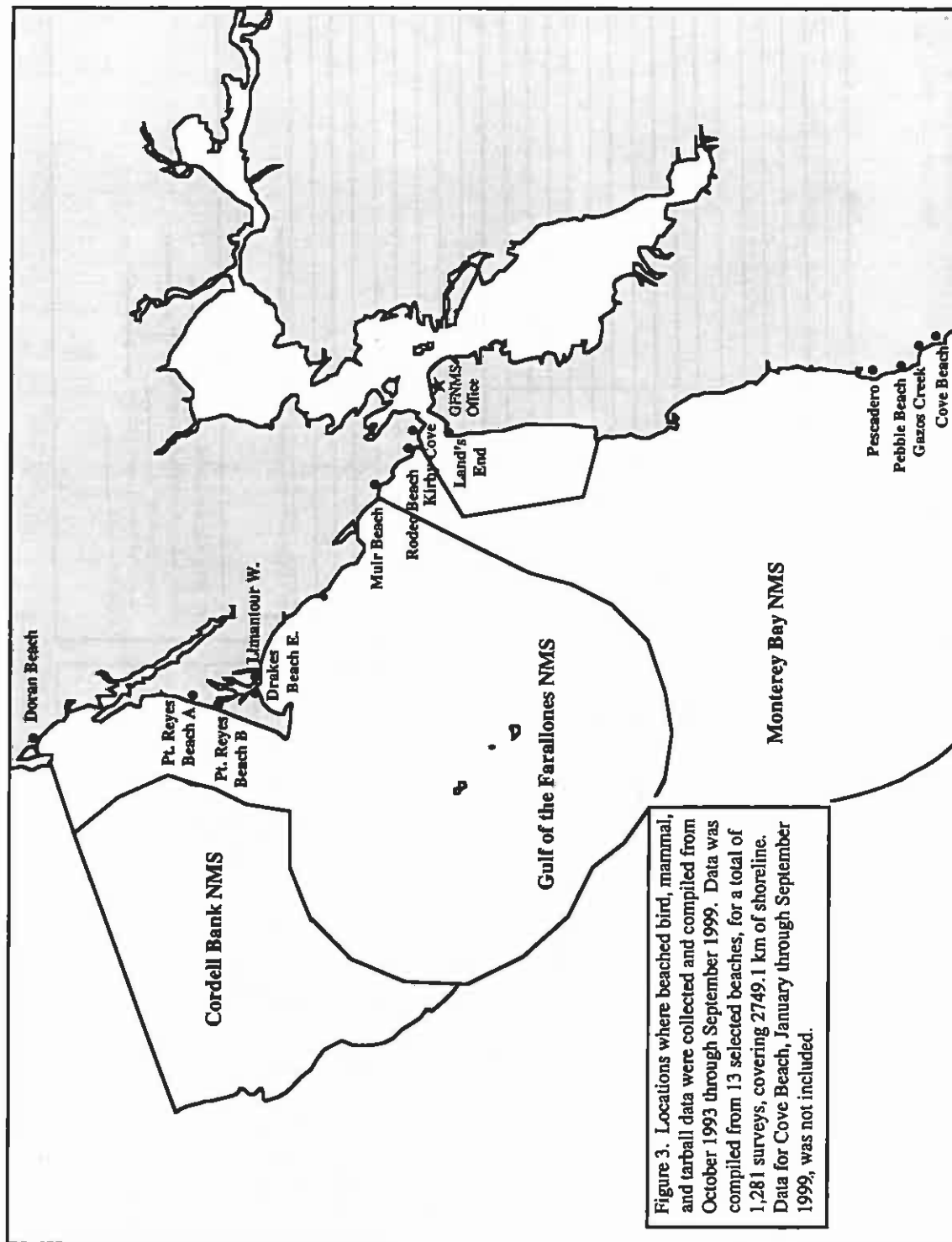
Table 7. Continued

<u>Order</u>	<u>Family</u>	<u>Species</u>	<u>Encounter Rate</u>
Charadriiformes	Scolopacidae	Phalarope, Red-necked	0.073
		Phalarope, Red	0.012
		Phalarope, Wilson's	0.003
	Stercorariidae	Jaeger, Parasitic	DNA
	Laridae	Gull, Bonaparte's	0.151
		Gull, Heermann's	10.831
		Gull, Mew	0.917
		Gull, Ringed-billed	2.357
		Gull, California	6.170
		Gull, Herring	0.128
		Gull, Thayer's	0.009
		Gull, Western	12.523
		Gull, Glaucous-winged	0.838
		Gull, Glaucous	0.004
		Gull, Franklin's	<0.001
		Kittiwake, Black-legged	0.061
		Tern, Caspian	0.835
		Tern, Elegant	0.806
		Tern, Forster's	0.107
		Tern, Royal	0.001
	Alcidae	Murre, Common	0.706
		Guillemot, Pigeon	0.114
		Murrelet, Marbled	<0.001
		Auklet, Cassin's	0.001
		Auklet, Rhinoceros	<0.001
		Puffin, Horned	DNA
Columbiformes	Columbidae	Dove, Rock	0.019
		Dove, Mourning	0.006
Strigiformes	Strigidae	Owl, Great-horned	DNA
		Owl, Short-eared	DNA
Apodiformes	Trochilidae	Hummingbird, Anna's	0.002
		Hummingbird, Allen's	0.001
	Apodidae	Swift, Vaux's	0.001
		Swift, White-throated	0.001
Coraciiformes	Alcedinidae	Kingfisher, Belted	0.010
Piciformes	Picidae	Flicker, Northern	0.005
Passeriformes	Tyrannidae	Phoebe, Black	0.118
		Phoebe, Say's	0.024
	Laniidae	Shrike, Loggerhead	DNA
		Shrike, Northern	0.001
	Vireonidae	Vireo, Hutton's	0.001
	Alaudidae	Lark, Horned	0.037
	Hirundinidae	Swallow, Tree	0.013
		Swallow, Violet-green	0.003
		Swallow, Northern Rough-winged	0.003
		Swallow, Bank	0.021

Table 7. Continued

Order	Family	Species	Encounter Rate
Passeriformes	Hirundinidae	Swallow, Cliff	0.445
		Swallow, Barn	0.315
	Corvidae	Jay, Steller	0.004
		Jay, Scrub	0.003
		Crow, American	0.043
		Raven, Common	0.670
	Paridae	Chickadee, Chestnut-backed	DNA
	Aegithalidae	Bushtit	DNA
	Troglodytidae	Wren, Bewick's	<0.001
		Wren, Marsh	0.001
	Muscicapidae	Kinglet, Ruby-crowned	DNA
	Turidae	Robin	0.002
		Thrush, Hermit	0.001
		Thrush, Swainson's	DNA
	Motacillidae	Wrentit	0.008
		Pipet, American	0.184
	Sturnidae	Starling, European	0.159
	Emberizidae	Warbler, Audubon's	0.001
		Warbler, Yellow	<0.001
		Warbler, Yellow-throated	DNA
		Warbler, Yellow-rumped	0.008
		Warbler, Townsend's	<0.001
		Blackbird, Red-winged	0.419
	Icteridae	Blackbird, Tricolored	0.001
		Meadowlark, Western	0.002
		Blackbird, Brewer's	1.581
		Cowbird, Brown-headed	0.003
		Oriole, Northern	DNA
		Oriole, Bullock's	DNA
	Fringillidae	Towhee, Rufous-sided	0.001
		Towhee, California	0.001
		Sparrow, Savannah	0.017
		Sparrow, Fox	<0.001
		Sparrow, Song	0.060
		Sparrow, White-crowned	0.048
		Sparrow, Golden-crowned	0.007
		Junco, Dark-eyed	DNA
		Finch, Cassin's	DNA
		Finch, Purple	0.006
		Finch, House	0.134
		Siskin, Pine	DNA
		Goldfinch, Lesser	0.002
		Goldfinch, American	0.019





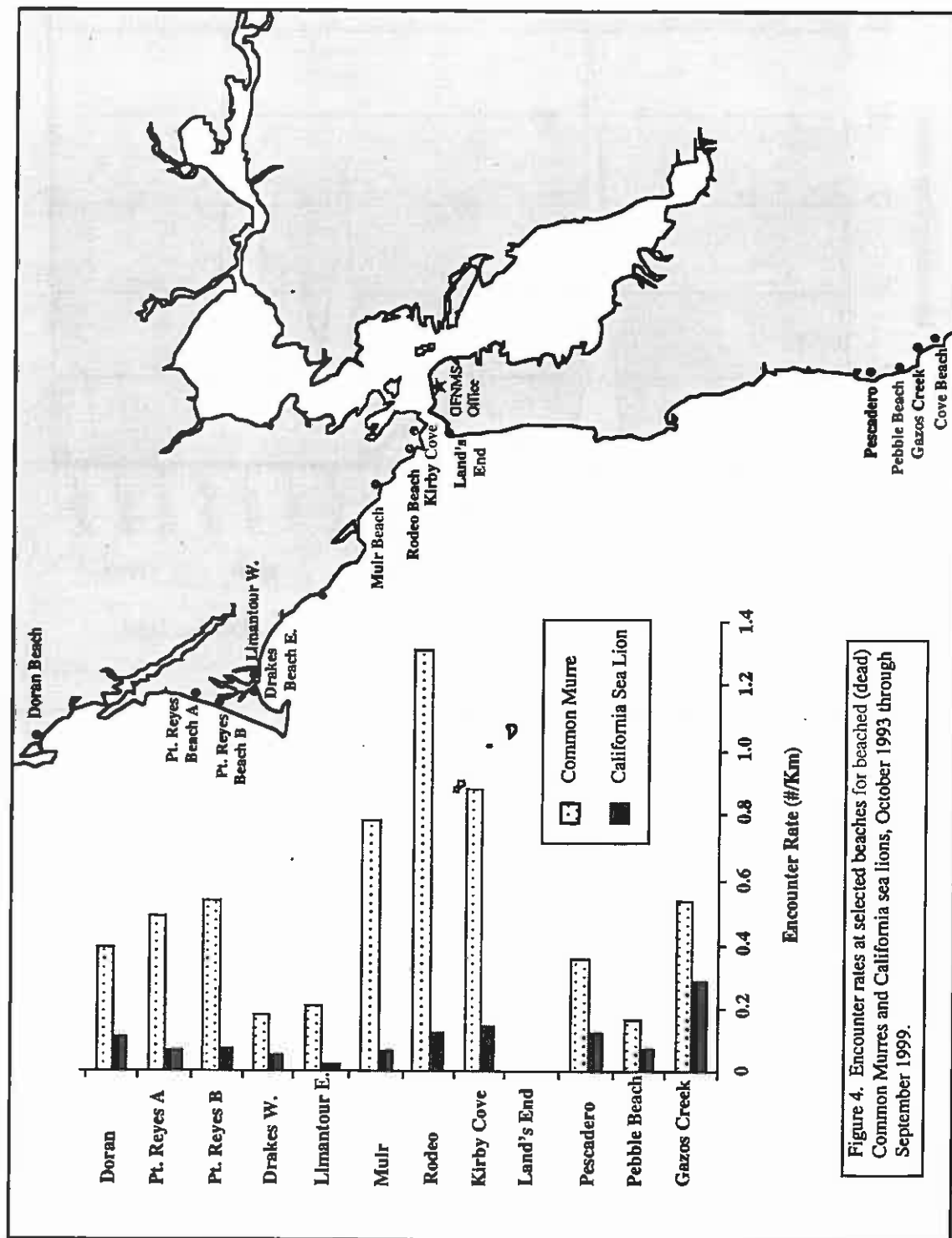


Figure 4. Encounter rates at selected beaches for beached (dead) Common Murres and California sea lions, October 1993 through September 1999.

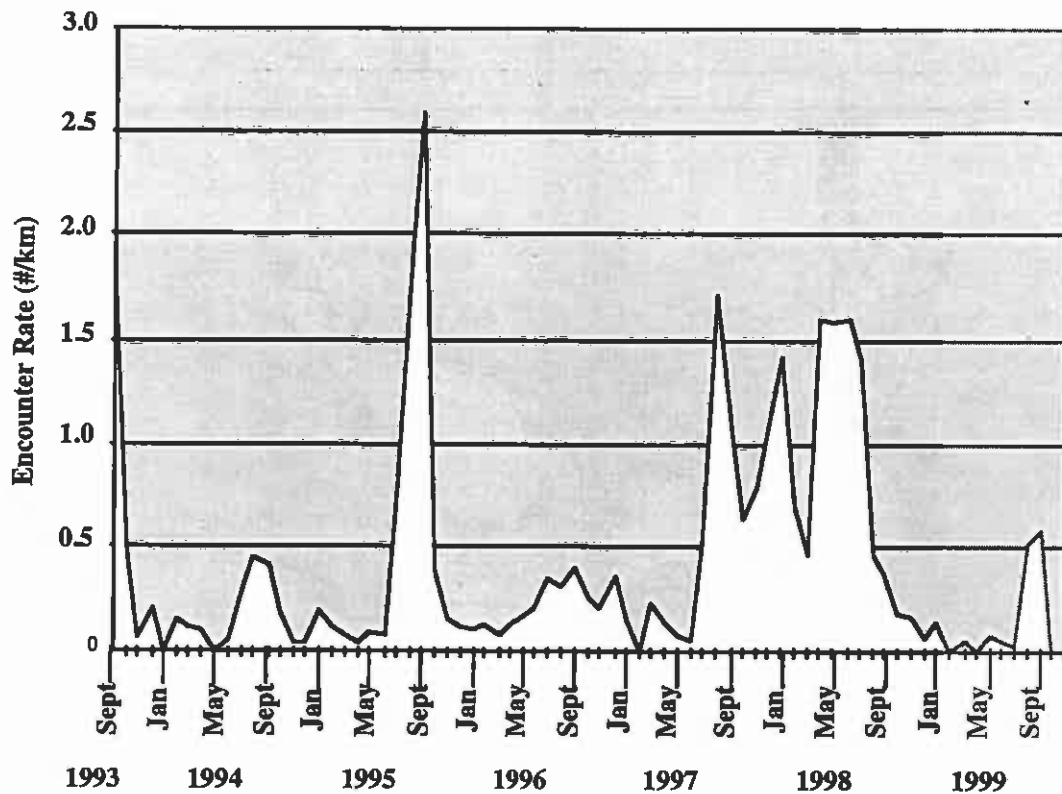


Figure 5. Encounter rate for beached (dead) Common Murres, October 1993 through September 1999.

Appendix I. Available Snowy Plover counts conducted within the Point Reyes National Seashore. Not all survey data is available. See Figure 1 for beaches surveyed within the Seashore.

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>	<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Pt Reyes A (1-14)	10/24/93	0	Pt Reyes A	2/11/96	0
	11/20/93	6	(1-14)	3/9/96	0
	12/18/93	8		4/6/96	0
	1/16/94	3		5/5/96	0
	2/12/94	14		6/1/96	0
	3/13/94	6		6/29/96	0
	4/9/94	19		7/27/96	0
	5/9/94	3		8/26/96	0
	6/5/94	0		9/22/96	18
	7/2/94	0		10/19/96	0
	7/28/94	0		11/16/96	0
	8/27/94	7		12/15/96	4
	9/25/94	25		1/19/97	7
	10/22/94	29		2/8/97	0
	11/19/94	38		3/9/97	0
	12/17/94	16		4/9/97	0
	1/22/95	0		11/15/98	8
	2/20/95	0		11/26/98	1
	3/12/95	10		12/4/98	28
	4/9/95	0		12/10/98	3
	5/6/95	2		12/24/98	8
	6/3/95	0		1/11/99	2
	5/4/97	4		1/22/99	0
	6/1/97	0		2/6/99	0
	6/29/97	0		2/21/99	0
	9/21/97	27		5/27/99	2
	10/17/97	25		6/12/99	0
	12/13/97	17		6/27/99	0
	1/8/98	3		7/10/99	0
	4/4/98	22		7/23/99	1
	5/2/98	2		8/8/99	0
	6/1/98	2		8/22/99	0
	6/27/98	0		9/3/99	5
	7/24/98	4		9/20/99	0
	8/22/97	8		10/17/98	25
	8/21/98	0		3/8/99	0
	9/18/98	21		3/20/99	2
	7/4/95	0		3/28/99	0
	7/29/95	3		4/30/99	1
	8/26/95	0		5/15/99	3
	9/24/95	11		4/17/99	0
	10/22/95	7	Pt Reyes B	10/2/93	28
	11/25/95	2	(1-15)	10/31/93	54
	1/13/96	0		11/27/93	22

Appendix I. Continued

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>	<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Pt Reyes B	12/26/93	10	Pt Reyes B	9/13/97	31
(1-15)	1/23/94	17	(1-15)	10/25/97	2
	2/20/94	74		11/8/97	1
	3/20/94	0		11/23/97	0
	4/16/94	0		12/8/97	10
	5/15/94	8		12/20/97	2
	7/9/94	25		1/3/98	18
	8/7/94	15		2/1/98	1
	10/1/94	1		2/15/98	0
	10/29/94	0		3/1/98	11
	12/4/94	188		3/15/98	5
	12/31/94	71		3/29/98	10
	1/29/95	0		4/24/98	14
	2/26/95	2		5/21/98	6
	3/26/95	0		6/23/98	8
	4/22/95	2		7/16/98	22
	5/21/95	0		3/29/97	4
	6/18/95	1		4/12/97	7
	7/16/95	0		7/5/97	11
	8/12/95	15		7/19/97	28
	9/10/95	11		9/11/98	33
	10/14/95	0		8/14/98	15
	11/5/95	0		6/12/94	0
	1/28/96	0		12/3/95	0
	2/25/96	0		12/30/95	2
	3/24/96	0		7/21/96	16
	4/21/96	8		8/10/96	2
	5/19/96	1		9/2/96	0
	6/15/96	0		9/29/96	10
	11/24/96	0		11/3/96	0
	12/8/96	0		9/21/97	5
	12/29/96	19		10/9/98	6
	1/4/97	0		11/6/98	6
	1/18/97	4		11/23/98	2
	2/1/97	0		12/6/98	6
	2/16/97	0		12/20/98	7
	3/1/97	0		1/4/99	2
	3/23/97	5		1/18/99	0
	4/27/97	8		1/31/99	4
	5/11/97	10		2/15/99	0
	5/26/97	3		2/28/99	35
	6/8/97	11		3/13/99	7
	6/22/97	8		3/26/99	18
	8/7/97	10		4/11/99	5
	8/17/97	6		4/26/99	11
	8/30/97	6		5/9/99	15

Appendix I. Continued

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Pt Reyes B (1-15)	5/21/99	9
	6/5/99	23
	6/17/99	10
	7/5/99	16
	7/15/99	16
	8/1/99	36
	8/12/99	30
	8/28/99	82
	9/13/99	37
	9/25/99	54
Pt Reyes C (1-16)	10/17/93	0
	11/20/93	0
	12/19/93	0
	1/16/94	0
	2/20/94	0
	3/20/94	1
	4/16/94	0
	5/15/94	1
	6/9/94	1
	7/16/94	0
	8/21/94	1
	9/18/94	0
	10/27/96	0
	11/23/96	0
	12/22/96	0
	1/19/97	0
	2/15/97	0
	3/16/97	0
	4/12/97	0
	5/11/97	0
Pt Reyes D (1-17)	11/20/94	0
	12/17/94	0
	1/16/95	0
	2/12/95	0
	3/12/95	0
	4/9/95	0
	5/7/95	0
	6/4/95	0
	7/2/95	0
	7/30/95	0
	8/26/95	0
	10/22/95	0
	12/17/95	0
	1/14/96	0
	2/11/96	0
	3/11/96	0

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Pt Reyes D (1-17)	4/6/96	0
	5/5/96	0
	6/1/96	0
	7/1/96	0
	7/27/96	0
	8/25/96	0
	9/28/96	0
	10/27/96	0
	11/24/96	0
	12/23/96	0
Chimney Rock (2-02)	3/17/97	0
	5/15/97	0
	9/27/97	0
	11/13/93	0
	12/12/93	0
	1/9/94	0
	2/6/94	0
	12/19/94	0
	11/22/96	0
	12/22/96	0
	1/18/97	0
	2/18/97	0
	10/17/93	0
	11/13/93	0
	12/12/93	0
	1/9/94	0
	2/5/94	0
	3/5/94	0
	4/2/94	0
	4/30/94	0
	5/28/94	0
	6/25/94	0
	7/26/94	0
	8/20/94	0
	9/17/94	0
	11/13/94	0
	12/10/94	0
	4/8/95	0
	5/6/95	0
	6/3/95	0
	7/3/95	0
	7/30/95	0
	8/27/95	0
	10/1/95	0
	10/15/95	0
	11/12/95	0

Appendix I. Continued

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Chimney Rock (2-02)	11/26/95	0
	1/14/96	0
	1/20/96	0
	2/11/96	0
	2/17/96	0
	3/16/96	0
	3/17/96	0
	4/14/96	0
	4/14/96	0
	5/18/96	0
	6/24/96	0
	7/21/96	0
	8/18/96	0
	9/15/96	0
	10/13/96	3
	10/28/96	0
	11/9/96	0
	12/15/96	18
	1/12/97	0
	2/10/97	0
	3/9/97	0
	4/6/97	0
	4/19/97	0
	5/3/97	0
	6/1/97	0
	6/29/97	0
	7/26/97	0
	8/24/97	0
	9/19/97	0
	10/21/97	0
	12/14/97	0
	12/27/97	0
	1/11/98	0
	1/27/98	0
	2/28/98	0
	3/10/98	0
	3/22/98	0
	4/5/98	0
	4/19/98	0
	5/10/98	0
	5/16/98	0
	11/15/98	0
	11/28/98	0
	12/14/98	0
	12/27/98	0
	1/10/99	0

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Chimney Rock	1/24/99	0
Drakes West (2-04)	2/15/95	4
	10/16/93	4
	11/12/93	0
	12/12/93	38
	1/9/94	54
	2/5/94	0
	3/5/94	23
	4/3/94	7
	5/1/94	9
	5/28/94	0
	6/25/94	0
	7/23/94	0
	8/21/94	0
	9/19/94	25
	10/16/94	45
	11/12/94	35
	12/10/94	0
	1/6/95	0
	1/16/95	72
	3/3/95	10
	4/3/95	0
	5/1/95	0
	5/27/95	0
	6/22/95	0
	7/23/95	0
	8/20/95	5
	9/14/95	0
	10/14/95	30
	11/10/95	35
	12/8/95	0
	1/8/96	7
	2/6/96	4
	3/1/96	0
	3/28/96	0
	4/25/96	0
	5/27/96	0
	6/23/96	0
	7/19/96	0
	7/26/96	4
	8/17/96	5
	10/14/96	2
	11/9/96	13
	12/6/96	48
	1/6/97	0
	1/31/97	0

Appendix I. Continued

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Drakes West (2-04)	3/1/97	0
	3/29/97	0
	4/24/97	0
	5/22/97	0
	6/22/97	0
	6/28/97	0
	7/26/97	4
	8/16/97	0
	9/12/97	0
	10/11/97	3
	11/7/97	0
	12/6/97	0
	1/5/98	0
	2/4/98	0
	2/27/98	0
	3/26/98	0
	4/25/98	4
	5/22/98	0
	6/22/98	0
	7/20/98	0
	8/14/98	0
	9/11/98	0
	10/12/98	0
	10/25/98	5
	11/9/98	3
	11/22/98	16
	12/6/98	1
	12/19/98	1
	1/4/99	19
	1/16/99	0
	2/1/99	0
	2/12/99	0
	3/2/99	0
	3/14/99	2
	4/10/99	0
	4/27/99	4
	5/9/99	0
	5/24/99	0
	6/6/99	0
	6/18/99	0
	7/17/99	0
	7/31/99	0
	8/20/99	0
	9/12/99	0
Limantour W (2-05)	4/6/97	9
	1/14/94	0

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Limantour W (2-05)	2/22/94	0
	3/10/94	0
	4/8/94	22
	5/8/94	1
	6/4/94	0
	7/1/94	0
	7/29/94	0
	8/26/94	13
	9/23/94	0
	10/21/94	2
	11/19/94	76
	12/16/94	8
	1/16/95	0
	2/11/95	0
	4/9/95	0
	6/3/95	0
	7/3/95	0
	7/28/95	8
	8/25/95	17
	10/21/95	1
	11/24/95	25
	1/20/96	41
	2/11/96	0
	3/9/96	46
	4/6/96	9
	5/4/96	15
	6/1/96	0
	6/29/96	0
	7/27/96	22
	8/23/96	16
	9/21/96	40
	10/18/96	3
	11/15/96	48
	12/14/96	112
	1/10/97	16
	1/26/97	10
	2/8/97	52
	3/7/97	5
	5/4/97	2
	5/30/97	5
	6/27/97	4
	8/10/97	14
	9/7/97	39
	7/25/97	10
	7/14/97	11
	6/15/97	2

Appendix I. Continued

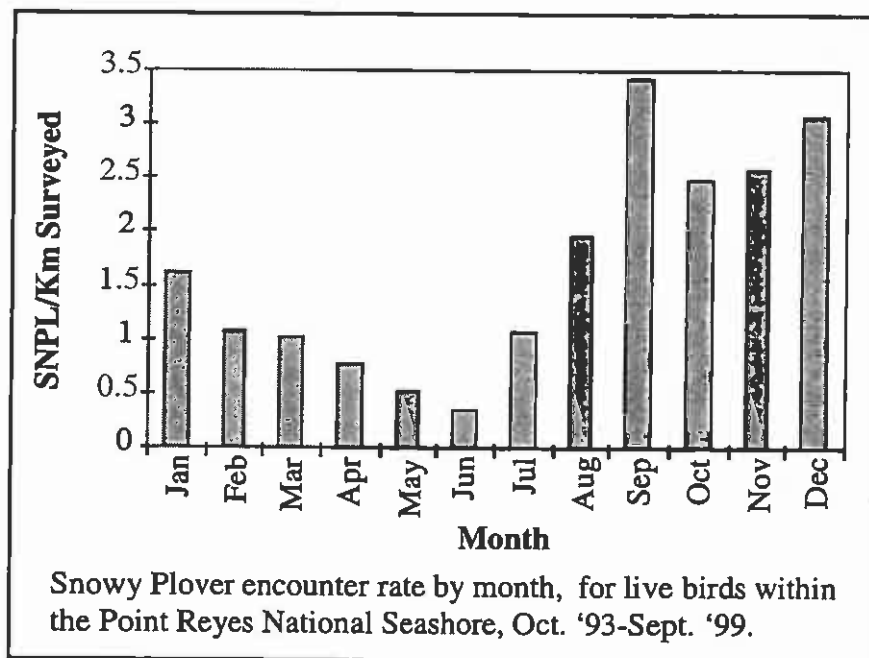
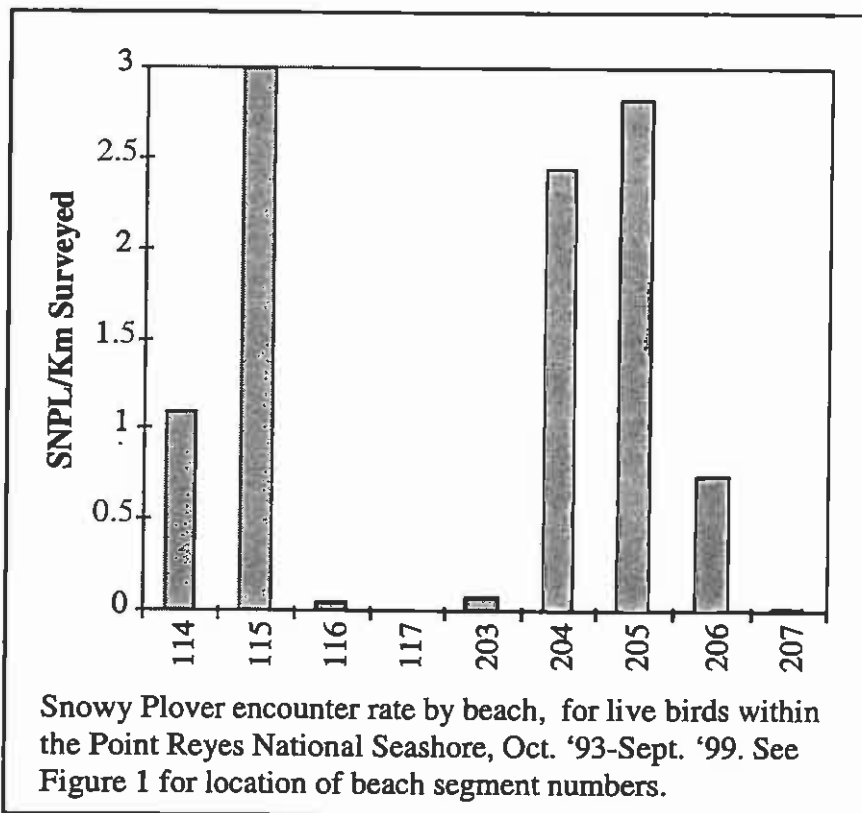
<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Limantour W	4/20/97	1
(2-05)	5/17/97	4
	8/21/97	16
	9/20/97	53
	10/5/97	45
	10/17/97	40
	11/2/97	83
	11/16/97	37
	12/13/97	32
	12/28/97	0
	1/8/98	0
	1/25/98	20
	2/23/98	12
	3/6/98	1
	3/30/98	0
	4/4/98	0
	4/22/98	0
	5/1/98	0
	5/18/98	1
	5/31/98	0
	6/15/98	0
	6/26/98	0
	7/14/98	1
	7/25/98	17
	8/8/98	9
	8/22/98	26
	9/3/98	19
	9/18/98	10
	3/12/95	0
	5/7/95	1
	5/19/96	4
	9/25/95	11
	11/5/95	37
	12/4/95	0
	1/1/96	41
	1/28/96	0
	2/26/96	0
	3/24/96	20
	4/22/96	5
	6/17/96	0
	7/15/96	0
	8/12/96	6
	9/7/96	40
	10/6/96	2
	11/2/96	0
	12/6/96	2

<u>Location</u>	<u>Date of Survey</u>	<u>Snowy Plover Count</u>
Limantour W	12/30/96	4
(2-05)	2/26/97	6
	3/23/97	17
	12/1/97	70
	10/4/98	30
	10/18/98	35
	11/1/98	30
	11/18/98	24
	11/28/98	0
	12/12/98	0
	12/27/98	0
	1/8/99	0
	1/22/99	0
	2/11/99	4
	2/21/99	0
	3/5/99	12
	3/21/99	11
	4/2/99	0
	4/18/99	2
	5/10/99	0
	5/18/99	1
	5/31/99	0
	6/13/99	1
	6/25/99	0
	7/24/99	0
	8/10/99	0
	8/20/99	1
	9/2/99	38
	1/29/94	0
	2/26/94	0
	11/13/94	0
	12/11/94	0
	1/16/95	46
	12/16/95	0
	1/15/96	0
	2/11/96	0
	11/16/96	0
	12/15/96	0
	1/12/97	0
	2/8/97	0
	11/23/97	0
	12/4/97	0
	12/12/97	0
	1/10/98	0
	1/28/98	0
	11/1/98	0

Appendix I. Continued

Location	Date of Survey	Snowy Plover Count
Limantour W (2-05)	11/14/98	0
	11/26/98	0
	12/12/98	0
	1/9/99	0
	2/6/99	0
Coast Camp (2-07)	11/10/94	0
	11/12/95	0
	2/4/95	0
	12/10/95	0
	1/7/96	2
	2/4/96	0
	11/9/96	0
	12/9/96	0
	1/3/97	0
	2/1/97	0
	11/8/97	0
	12/4/97	0
	1/4/98	0
	11/5/98	0
	12/6/98	0
	1/4/99	0
	1/30/99	0
	2/27/99	0

Appendix I. Continued



Appendix II. Available Snowy Plover mean encounter rates for all beaches. Not all survey data is available. See Figure 1 for beaches surveyed.

<u>Beach</u>	<u>Start Date</u>	<u>Last Date Entered</u>	<u>Number of Surveys</u>	<u>Encounter Rate (#/km)</u>
106	10/19/93	9/17/99	102	1.238
107	11/12/93	2/26/99	16	0.000
110	2/5/94	5/29/95	16	5.082
114	10/24/93	9/20/99	85	1.087
115	10/2/93	9/25/99	105	2.999
116	10/17/93	5/11/97	20	0.048
117	11/20/94	9/27/97	29	0.000
202	11/13/93	2/18/97	9	0.000
203	10/17/93	1/24/99	71	0.074
204	10/16/93	9/12/99	89	2.431
205	1/14/94	9/2/99	122	2.826
206	1/29/94	2/6/99	23	0.741
207	11/10/94	2/27/99	18	0.033
207A	12/10/94	3/27/99	38	0.000
212	8/29/96	1/28/99	30	0.000
213	11/10/95	2/20/99	14	0.000
214	2/23/96	2/28/98	7	0.062
214.5	10/21/96	5/8/97	7	
219	10/29/93	9/29/99	113	0.000
221	11/20/93	2/27/99	25	0.000
223	7/8/89	9/24/99	132	0.000
230	10/16/93	8/22/99	75	0.000
301	9/29/98	9/29/98	1	0.000
302	11/6/94	2/28/99	29	0.000
306	9/15/93	9/22/99	76	0.000
308	1/22/94	2/16/98	16	0.221
309	1/14/98	2/27/99	11	2.813
310	11/16/94	11/2/98	70	0.171
311	11/12/94	9/19/99	72	0.000
311.5	11/24/96	11/24/96	1	
312	12/10/94	2/27/99	43	0.000
315	12/26/94	2/13/99	16	0.000
319	6/25/98	6/25/98	1	0.000
321	6/25/98	6/25/98	1	0.000
327	7/14/95	12/7/98	30	0.000
329	11/19/94	12/13/98	14	0.000
403	10/16/93	12/14/98	50	0.100
405	10/31/93	2/18/99	53	9.862
406	12/3/93	2/3/97	15	0.033
410	11/14/93	2/13/99	80	5.931
413	6/13/94	6/16/98	36	0.000
414	10/31/93	10/13/99	71	0.000
414.5	12/16/96	12/16/96	1	
417	9/26/93	9/17/99	106	4.332
420	10/30/93	9/3/99	69	0.000

Appendix II. Continued

<u>Beach</u>	<u>Start Date</u>	<u>Last Date Entered</u>	<u>Number of Surveys</u>	<u>Encounter Rate (#/km)</u>
424	11/26/95	2/26/99	17	0.464
503	12/31/93	10/12/99	110	3.303
506	11/16/93	2/13/99	22	2.066
509	10/9/93	9/27/98	62	0.000
510	11/4/95	2/7/99	16	0.000
601	12/8/95	3/28/98	18	0.000
603	11/24/96	2/27/99	17	0.000
604	8/17/94	2/27/99	31	0.000
605	11/12/97	2/27/99	13	0.000
701	2/6/97	1/30/99	10	1.325
706	12/10/94	5/16/99	44	0.000

Appendix III. Available mean encounter rate for live sea otter sightings for all available beaches. Not all survey data is available; data from some key beaches, e.g. Fitzgerald Marine Reserve, Princeton Harbor and Sharp Park are not available. See Figure 1 for beaches surveyed.

<u>Beach</u>	<u>Start Date</u>	<u>Last Date Entered</u>	<u>Number of Surveys</u>	<u>Encounter Rate (#/km)</u>
106	10/19/93	9/17/99	102	0
107	11/12/93	2/26/99	16	0
110	2/5/94	5/29/95	16	0
114	10/24/93	9/20/99	85	0
115	10/2/93	9/25/99	105	0.002
116	10/17/93	5/11/97	20	0
117	11/20/94	9/27/97	29	0
202	11/13/93	2/18/97	9	0
203	10/17/93	1/24/99	71	0
204	10/16/93	9/12/99	89	0
205	1/14/94	9/2/99	122	0.002
206	1/29/94	2/6/99	23	0
207	11/10/94	2/27/99	18	0
207A	12/10/94	3/27/99	38	0
212	8/29/96	1/28/99	30	0.009
213	11/10/95	2/20/99	14	0
214	2/23/96	2/28/98	7	0
214.5	10/21/96	5/8/97	7	0
219	10/29/93	9/29/99	113	0
221	11/20/93	2/27/99	25	0
223	7/8/89	9/24/99	132	0
230	10/16/93	8/22/99	75	0
301	9/29/98	9/29/98	1	0
302	11/6/94	2/28/99	29	0
306	9/15/93	9/22/99	76	0
308	1/22/94	2/16/98	16	0
309	1/14/98	2/27/99	11	0
310	11/16/94	11/2/98	70	0

Appendix III. Continued

<u>Beach</u>	<u>Start Date</u>	<u>Last Date Entered</u>	<u>Number of Surveys</u>	<u>Encounter Rate (#/km)</u>
311	11/12/94	9/19/99	72	0
311.5	11/24/96	11/24/96	1	0
312	12/10/94	2/27/99	43	0
315	12/26/94	2/13/99	16	0
319	6/25/98	6/25/98	1	0
321	6/25/98	6/25/98	1	0
327	7/14/95	12/7/98	30	0
329	11/19/94	12/13/98	14	0
403	10/16/93	12/14/98	50	0
405	10/31/93	2/18/99	53	0
406	12/3/93	2/3/97	15	0
410	11/14/93	2/13/99	80	0
413	6/13/94	6/16/98	36	0
414	10/31/93	10/13/99	71	0
414.5	12/16/96	12/16/96	1	0
417	9/26/93	9/17/99	106	0.024
420	10/30/93	9/3/99	69	0.069
424	11/26/95	2/26/99	17	0
503	12/31/93	10/12/99	110	0.030
506	11/16/93	2/13/99	22	0.165
509	10/9/93	9/27/98	62	0.040
510	11/4/95	2/7/99	16	0.020
601	12/8/95	3/28/98	18	0
603	11/24/96	2/27/99	17	0
604	8/17/94	2/27/99	31	0
605	11/12/97	2/27/99	13	0
701	2/6/97	1/30/99	10	0
706	12/10/94	5/16/99	44	0