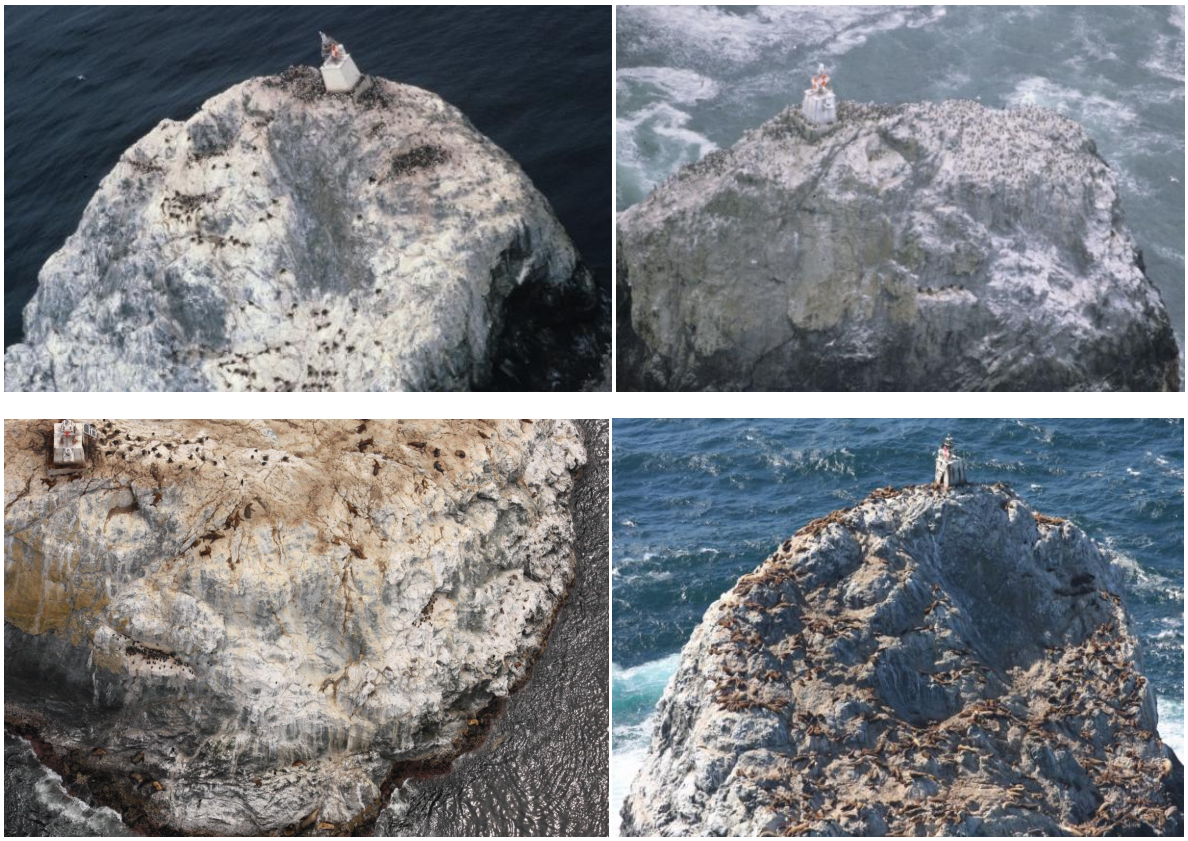
DECLINE OF THE COMMON MURRE COLONY AT REDDING ROCK, CALIFORNIA, AND RESTORATION OPTIONS

A Report to the *Stuyvesant* Trustee Council and U.S. Bureau of Land Management

Prepared by

U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex
and
Humboldt State University, Departments of Wildlife and Biological Sciences

Janet M. Thibault, Gerard J. McChesney, Richard T. Golightly,
P. Dawn Goley, and Harry R. Carter



FINAL REPORT
6 APRIL 2010

DECLINE OF THE COMMON MURRE COLONY AT REDDING ROCK, CALIFORNIA, AND RESTORATION OPTIONS

A Report to the *Stuyvesant* Trustee Council and U.S. Bureau of Land Management

Prepared by

U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex
and
Humboldt State University, Departments of Wildlife and Biological Sciences

Janet M. Thibault[1], Gerard J. McChesney[2], Richard T. Golightly[1], P. Dawn Goley[3], and Harry R. Carter[4]

[1]Humboldt State University, Department of Wildlife,
1 Harpst Street, Arcata, California 95521 USA

[2]U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex,
9500 Thornton Ave., Newark, California 94560 USA

[3]Humboldt State University, Department of Biological Sciences,
1 Harpst Street, Arcata, California 95521 USA

[4]Carter Biological Consulting,
1015 Hampshire Road, Victoria, British Columbia V8S 4S8 Canada

FINAL REPORT
6 April 2010

Suggested Citation: Thibault, J.M., G.J. McChesney, R.T. Golightly, P.D. Goley, and H.R. Carter. 2010. Decline of the Common Murre colony at Redding Rock, California, and restoration options. Unpublished report, U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California and Humboldt State University, Departments of Wildlife and Biological Sciences, Arcata, California. 169 p.

PROJECT ADMINISTRATION

Project Implementation

U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex:
Gerard J. McChesney, Co-Principal Investigator

Humboldt State University:
Richard T. Golightly, Co-Principal Investigator, Department of Wildlife
P. Dawn Goley, Co-Principal Investigator, Department of Biological Sciences
Janet M. Thibault, Wildlife Biologist
Allison Fuller, Wildlife Technician
Mallory Mlynarek, Wildlife Technician

Carter Biological Consulting:
Harry R. Carter, Technical Expert and Consultant

Natural Resource Trustees, Funding, Project Oversight

Stuyvesant Trustee Council:
U.S. Fish and Wildlife representative: Carolyn Marne (Sacramento Field Office)
U.S. Fish and Wildlife alternate representative: Lynn Roberts (Arcata Fish and Wildlife Office)
U.S. Fish and Wildlife (former representative): Janet Whitlock (Sacramento Field Office)
U.S. Fish and Wildlife (former alternate representative): Amedee Brickee (Arcata Fish and Wildlife Office)
California Department of Fish and Game representative: Laird Henkel (Office of Spill Prevention and Response)
California Department of Fish and Game alternate representative: Steve Hampton (Office of Spill Prevention and Response)

Redding Rock Management, Project Oversight

U.S. Bureau of Land Management, Arcata Field Office:
Dave Fuller

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACKNOWLEDGMENTS

The *Stuyvesant* Trustee Council sponsored this project, with additional support from the U.S. Bureau of Land Management (David Fuller and Arlene Kosic). Mendel Stewart (USFWS-San Francisco Bay National Wildlife Refuge Complex), Pia Gabriel (Humboldt State University [HSU]), and staff at the San Francisco Bay National Wildlife Refuge Complex and HSU Sponsored Programs Foundation assisted in administration. Special thanks to field technicians Allison Fuller and Mallory Mlynarek whose hard work and dedication were essential to the success of this project. Additional field assistance was provided by Aicha Ougzin and Elias Elias. Anthony Desch (HSU Wildlife Department) provided mechanical assistance. Sandy Rhoades and Phil Capitolo trained staff in counting seabirds and sea lions from aerial photographs. David Panzer (U.S. Mineral Management Service, Camarillo, California) transferred archived slides of Redding Rock from surveys conducted by University of California Santa Cruz (UCSC) in 1980-1982. Mike VanHouten (U.S. Coast Guard, 11th Coast Guard Prevention Division, Alameda, California) provided maintenance records of the Redding Rock Aid to Navigation. Mark Lowry (National Oceanic and Atmospheric Administration [NOAA], Southwest Fisheries Science Center, La Jolla, California) shared sea lion counts for Redding Rock and the NOAA National Marine Mammal Laboratory (Seattle, Washington) shared sea lion branding data. Marine mammal research was conducted under permits 434-1892 and 14326 from the NOAA-National Marine Fisheries Service. Aerial surveys in 2009 were flown by pilots Wayne Burnett and Jeff Veal of CDFG–Air Services (with additional assistance from Ron VanBenthuysen and Laird Henkel), and Barry Hansen of Aspen Helicopters, Inc. (Oxnard, California). Phil Capitolo (UCSC) conducted one survey and provided digital images. Craig Richardson and staff operated the boat launch at Trinidad Harbor in 2009.

This study benefited greatly from past surveys in 1979-2008 conducted by USFWS, CDFG, HSU, UCSC, and other cooperators, with lead staff M. Bonnell, Kenneth Briggs, Phil Capitolo, Harry Carter, Gerry McChesney, Mike Parker, Arthur Sowls, and Jean Takekawa. Since 1993, flight time for annual aerial photographic surveys has been provided by CDFG-Office of Spill Prevention and Response and CDFG-Air Services, with assistance from Paul Kelly, Julie Yamamoto, Steve Hampton, Laird Henkel, Larry Heitz, Ron VanBenthuysen, Wayne Burnett, and Robert Morgan. In 1996-2008, funding for G.J. McChesney, and H.R. Carter and other staff for conducting aerial surveys was provided by the *Apex Houston* Trustee Council through the Common Murre Restoration Project.

EXECUTIVE SUMMARY

The decline of the Common Murre (*Uria aalge*) colony on Redding (or "Reading") Rock, Humboldt County, California, was investigated and restoration options examined for preventing colony loss and increasing numbers of breeding birds to self sustaining levels. Restoring the Redding Rock murre colony was targeted in the *Stuyvesant* Oil Spill Restoration Plan, as well as the *Kure* and *Luckenbach* oil spill restoration plans, to partly repair impacts to the northern California murre population caused by mortalities of thousands of murres in these oil spills and their lost progeny. This assessment includes: 1) population trends of Common Murres, California sea lions (*Zalophus californianus*), Steller sea lions (*Eumatopius jubatus*), and other breeding seabirds on Redding Rock in 1979-2008 from nearly annual aerial photographic surveys; 2) status of the murre colony and sea lion haul-out in 2009 from more intensive boat and aerial photographic surveys; 3) potential long-term impacts to the murre colony from sea lions and maintenance of the Redding Rock Aid to Navigation (ATON); and 4) possible methods for restoring the Redding Rock murre colony.

In 1979-1990, Redding Rock supported about 1,600 breeding murres (800 pairs) per year. While annual variation occurred, colony size appeared to be fairly stable. After a two-year hiatus in surveys in 1991-1992, the colony was found to be nearly empty (29 birds) in 1993 during intense El Niño conditions when large numbers of California sea lions were first noted. Several distinct breeding areas were empty, including the largest breeding cluster on the top plateau of the rock. From 1994-2002, the murre colony continued to decline and by 2002 most historic nesting areas were abandoned; counts in breeding areas averaged only 204 birds (range = 83-375), a 79% decline from 1980-1990 average counts. The timing of this decline was associated with: 1) an increase in the numbers of California sea lions hauling out high up on the rock; 2) continued human disturbances during ATON maintenance; and 3) significant mortalities of murres during the 1997 *Kure* and 1999 *Stuyvesant* oil spills. Unlike threatened Steller sea lions which also haul-out on Redding Rock, California sea lions now regularly climb to the top plateau; this apparently displaces murres from traditional breeding areas. Between 1995 and 1999, murres initiated breeding at two new areas (Areas H and I) on cliff ledges inaccessible to sea lions and humans on foot maintaining the ATON. These have been the only known breeding areas since at least 2003. However, limited habitat on these ledges allows for only small numbers of breeding murres. In 2003-2008, annual counts in breeding areas averaged only 102 birds (range = 76-114 birds), 50% lower than in 1994-2002 and 89% lower than in 1980-1990. Between 2003 and 2008, numbers of sea lions (especially California) on Redding Rock remained high, and California sea lions hauled out in historic murre breeding areas nearly every year. Concurrent with the appearance of large numbers of sea lions was a decline in number and frequency of breeding by Brandt's Cormorants (*Phalacrocorax penicillatus*) and recent breeding of small numbers of Western Gulls (*Larus occidentalis*).

More intensive data collection in 2009 and the early part of 2010 confirmed and expanded upon information from previous annual surveys. Murres bred only on the cliff ledges of Areas H and I, where average peak season counts were101 birds (range = 77-125), similar to 2003-2008 counts. We estimated a breeding population of about 50 pairs of murres (100 breeding birds), or only 6% of the 1980-1990 average. Large numbers of sea lions consistently hauled out on the rock, including in historic murre breeding areas. Monitoring of sample nest sites confirmed successful breeding. Egg laying began about 1 May, peaked in mid-May, and continued until about mid-June. Chicks began departing from the rock in late June and the last chicks and adults departed between mid-July and early August. Breeding phenology appeared to be somewhat later at Redding Rock than other nearby reference colonies at Castle Rock and the Trinidad area. Brandt's Cormorants and Western Gulls also nested but had low breeding success.

Use of the rock as a sea lion haul out changed dramatically during the study period. In 1979-1990, the rock was frequently used by small numbers of Steller sea lions (average = 6) and rarely by small numbers of California sea lions (maximum = 7). After 1990, use increased for both species, especially California sea lions. Since 1993, both species have been consistently present but California sea lions became the dominant species. Although numbers of both species increased between all study periods, the most increase occurred between the 1979-1990 and 1993-2002 periods. Up to 2008, counts ranged as high as about 90 and 673 Steller and California sea lions, respectively. Surveys in 2009-2010 showed constant high use of the rock by sea lions; counts during the seabird breeding season were similar to other high-use years. While Redding Rock is not a pupping site, female Steller sea lions nursed pups (maximum = 19) in the fall and winter months. Coast-wide sea lion surveys in 2009 from Crescent City to Trinidad showed that Redding Rock was one of the most consistently used haul outs for Steller sea lions and the largest haul out for California sea lions in this region.

To prevent colony loss and increase murre numbers to self-sustaining levels on Redding Rock, restoration efforts are required. No action may result in loss of the currently very small colony in the near future. Key restoration issues of concern are: a) the degree of benefits to murres; b) the degree of impacts to sea lions; c) continued disturbance issues; and d) permanent addition of visible artificial structures including consideration of the cultural value of the rock to the local Yurok Tribe. We have identified two main restoration options for murres which would address the need to redevelop a self-sustaining murre colony:

1) *Sea Lion Barrier Option*: three approaches were provided to increase the current murre colony by 200 to 1,000 pairs by installing barriers (such as a concrete wall designed to visually blend into the rock) to block climbing access to California sea lions to portions of the top of the rock. Under these options, loss of California sea lion habitat varied but would be negligible and no loss of Steller sea lion habitat would occur. One option would limit re-population of murres to areas away from human foot access to the ATON.

2) *Artificial Ledge Option*: the murre colony would be increased by about 200 pairs by installing artificial ledges on the western cliffs adjacent to current breeding areas. Under this option, no loss of sea lion habitat would occur, artificial ledges would visually blend into the rock and be designed to exclude pelicans, and murres would not be accessible to humans on foot maintaining the ATON.

Under either option, we recommend that if breeding or significant attendance with breeding-related behaviors in restoration habitats have not occurred within two years, social attraction techniques should be considered to stimulate murre breeding. Also, it is necessary to address human disturbance issues to murres by preventing ATON maintenance during the breeding season and prohibiting boats from close approach to the rock.

INTRODUCTION

On September 6, 1999, the dredge M/V *Stuyvesant* spilled approximately 2,000 gallons of Intermediate Fuel Oil 180 at the mouth of Humboldt Bay in northern California. The spill affected coastal beaches along the Humboldt County coast and killed approximately 2,405 birds including 1,600 Common Murres (*Uria aalge*; hereafter, murres) (*Stuyvesant* Trustee Council, 2007). As part of the natural resources damage assessment, the *Stuyvesant* Trustee Council (including representatives of the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG)) developed a plan to restore natural resources damaged in the spill. Because of relatively high mortality from the spill, murres were identified as a focal species for restoration. One identified project was to restore the murre colony on Redding Rock (also referred to as "Reading Rock"), located off the northern coast of Humboldt County. Additional funds for Redding Rock murre restoration were also identified in the *Luckenbach* and *Kure* oil spill restoration plans (*Luckenbach* Trustee Council 2006, *Kure* Trustee Council 2008). Redding Rock is owned and managed by the U.S. Bureau of Land Management (BLM) within the California Coastal National Monument (BLM 2005). Annual aerial survey monitoring indicated that the colony at Redding Rock had declined greatly, apparently due to human and sea lion disturbances (Carter et al. 2001; USFWS, unpubl. data). Trustee agencies considered that restoration could prevent colony loss and increase colony size to higher, more self-sustaining levels. Potential restoration techniques to reverse the murre decline included: a) reducing human disturbance by working with the U.S. Coast Guard (USCG) to limit their visits to the aid to navigation (ATON) on Redding Rock to the non-breeding season; b) constructing a barrier to sea lions to allow murre re-colonization on the upper portions of the rock; and c) using social attraction techniques to encourage murres to reuse historic breeding habitats on protected portions of the rock

The *Stuyvesant* Trustee Council commissioned this study to: 1) investigate the murre decline at Redding Rock and factors causing it; 2) determine the current status of this murre colony; and 3) assess the feasibility of restoring murres on this rock. To best describe and measure trends, we first collated and examined historical data on seabird and sea lion use of Redding Rock. Archived photographs from 1979 to 2008, as well as historic reports and data of Common Murres and sea lions were compiled and examined to assess trends in population sizes and distribution of murres and sea lions on the rock. To examine potential impacts of human disturbance to murres, we also reviewed available USCG maintenance records for the ATON on Redding Rock. In addition to conducting boat and aerial photographic surveys in 2009 and 2010 to examine the current status of murres and sea lions on Redding Rock, we gathered murre attendance data at reference colonies off Trinidad and Crescent City, California in 2009. After assessing the decline of the murre colony, we evaluated potential murre restoration options.

Historical Context of Redding Rock

The nearest Common Murre colonies to Redding Rock are False Klamath Rock 29 km to the north, and the Trinidad Colony Complex (Blank, White, Green, Pilot and Flatiron Rocks) 31 km to the south. Breeding population estimates for all murre colonies in the Del Norte-Humboldt counties region were about 250,000 birds in 1979-80 and 1989 (Sowls et al. 1980; Carter et al. 1992) and about 310,000 birds in 2004 (calculated from raw counts in Capitolo et al. 2006). Redding Rock comprised 8-10% of this population in 1979-80 and 1989. Preliminary analyses of murre breeding population trends showed an overall increase in this population but relatively small increases or no change at most colonies between 1979 and 2004 (Takekawa et al. 1990; Carter et al. 2001; Capitolo et al. 2006). Although it was a relatively small colony, Redding Rock was similar in size or larger than four other colonies in this region in 1979-1989. However, due to subsequent colony decline, Redding Rock was the smallest active colony in Del Norte and Humboldt counties by 1996 (Capitolo et al. 2006).

Prior to 1979, the only known documentation for murres on Redding Rock was an unverified report of breeding murres in the 1930s, and estimates of 200 and 300 pairs (400 and 600 breeding birds) in 1969 and 1970, respectively (Osborne and Reynolds 1971; Osborne 1972; Carter et al. 2001). However, upon re-assessment of the 1970 estimate for this report, murre numbers were found to be similar to the colony size in 1979-1990. As summarized by Carter et al. (2001), estimates ranged from 835 to 2,129 breeding birds in 1979-1982 (Sowls et al. 1980; Briggs et al. 1983), followed by 1,303 breeding birds in 1986 (Takekawa et al. 1990), and 2,741 breeding birds in 1989 (Carter et al. 1992).

Information collated in this report on use of Redding Rock by Common Murres, other breeding seabirds, and sea lions was obtained primarily from aerial photographic surveys of seabird breeding colonies conducted almost annually since 1979 by USFWS, CDFG, Humboldt State University (HSU), and University of California Santa Cruz (UCSC) (Sowls et a. 1980; Briggs et al. 1983; Takekawa et al. 1990; Carter et al. 1992, 1996, 2001; Capitolo et al. 2006; USFWS, unpubl. data). Aerial surveys were conducted annually since 1979 except for 1983-1985 and 1991-1992 (when no surveys were conducted at Redding Rock). However, because of funding limitations, counts of murres at Redding Rock were not regularly obtained from photographs. A recent large counting effort of northern California murre colonies formally documented the decline in the Redding Rock colony from 1996 to 2004 (Capitolo et al. 2006). Counts during that period ranged from only 229 birds in 1996, to 147 birds in 2001, and 88 birds in 2004. Using an average *k* correction factor of 1.67 breeding birds per bird counted to account for birds away from the colony and non-breeding birds (calculation derived at the South Farallon Islands; Sowls et al. 1980; Takekawa et al. 1990) these counts were adjusted to derive estimates of 382, 245, and 147 breeding birds in 1996, 2001, and 2004, respectively. Based on aerial photographs from 1980 (Sowls et al. 1980), murres occurred in high density groups on the flatter surfaces at or near the top of the rock. However, after 2001, murres have been confined to 2-3 narrow ledges on perimeter cliffs and no longer appeared to breed on top of the rock (Capitolo et al. 2006).

Human disturbance and sea lion disturbance were noted as factors likely resulting in variation in murre numbers at Redding Rock in 1979-1995 but the frequency of these disturbances was not known (Carter et al. 2001). The USCG was known to visit the rock periodically to maintain a small ATON that was installed in 1914. In recent decades, visits have been conducted by lowering personnel to the rock from a hovering helicopter. Some visits were known to occur during the seabird breeding season, when murres were flushed off breeding sites (Sowls et al. 1980; unpubl. survey archives; Carter et al. 1992, 2001). Given the sensitivity of murres and many other seabirds to low flying helicopters (Rojek et al. 2007), low hovering helicopters alone likely caused significant disturbance to the colony over the years but landing personnel in the colony for hours at a time further contributed to large-scale breeding failures.

Additionally, sea lions had occupied portions of the top area since 1993 in areas previously occupied by nesting murres (Carter et al. 2001; Capitolo et al. 2006). Aerial surveys of sea lion rookeries and haul-outs conducted quarterly in 1980-82 documented only small numbers of sea lions on Redding Rock. Most were identified as Steller sea lions (*Eumatopius jubatus*) with smaller numbers of California sea lions (*Zalophus californianus*). Peak abundance during this period occurred in winter ($n = 43$) with ≤ 10 individuals at other times of the year (Bonnell et al. 1983). Annual aerial photographic surveys for seabirds conducted in late May to early June and periodically in July for Steller sea lions have shown greater numbers of sea lions on Redding Rock since 1990. For example, between 1999 and 2005 an average of 114 ($\pm$ 79 SD) sea lions were counted in July, including an average of 71 ($\pm$ 103 SD) (range = 0-288) Steller sea lions (M. Lowry, National Marine Fisheries Service [NMFS]- Southwest Fisheries Science Center, unpubl. data). As part of a study on the population dynamics of Steller sea lions (a federally threatened species), sea lion pups have been branded at rookeries at Rogue Reef, Oregon (in 2001, 2003, 2005, and 2007) and at St. George Reef, California (in 2002, and 2004) (National Marine Mammal Laboratory [NMML]. Between 2006 and 2009, HSU has been conducting re-sighting surveys in northern California. During one pilot survey in August 2007, 5 branded individuals (P. D. Goley, unpubl. data) were seen among 153 Steller sea lions. These data suggest that Redding Rock has become an important haul out for Steller sea lions.

STUDY SITE

Redding Rock (41°20’29”N, 124°10’26”W) is a small steep-sided rock about 29 m high and located 11 km offshore of Orick, Humboldt County, California (Figure 1). The nearest harbors are Crescent City (45 km north), Trinidad (32 km south) and Humboldt Bay (64 km south). The rock is characterized by a relatively steep east slope, nearly vertical cliffs on the south, west, and north sides, and a relatively flat top. On the top, a USCG ATON (currently comprised of a light beacon and until 2005, a foghorn) was originally built in 1914 (Bearrs 1969) although more

substantial structures were likely expanded later (USCG, unpubl. data). Redding Rock also holds cultural significance to the Native American Yurok Tribe (Klamath, California).

METHODS

Common Murre and Sea Lion Abundance and Distribution

To standardize analysis of the spatial abundance and distribution of murres and sea lions on Redding Rock, a review of aerial photographs taken between 1979 and 2008 was conducted to identify historic and recent murre breeding areas and sea lion haul-out areas. The rock was partitioned into 10 zones that were delineated on a photograph of the rock and could be easily identified from both boat and aerial surveys (Figure 2). Within three of these zones, 7 discrete breeding areas for murres were also identified (Areas C through I). For all aerial and boat photographs in 1979-2010, the number of murres, other seabirds, and sea lions were counted in each zone and area.

Annual Murre and Sea Lion Attendance Patterns, 1979-2008

We collated historical counts and aerial photographs of seabirds and sea lions on Redding Rock conducted between 1979 and 2008. Past surveys were conducted by USFWS, HSU, CDFG, and UCSC for various purposes (Sowls et al. 1980; Bonnell et al. 1983; Briggs et al. 1983; Takekawa et al. 1990; Carter et al. 1992, 1996, 2001; Capitolo et al. 2006; USFWS, unpubl. data). In addition, sea lion counts were obtained from NMFS coast-wide sea lion surveys from 1998-2005 (NMFS, unpubl. data).

For aerial photographic surveys conducted in 1979-2007, original 35 mm photographic slides were scanned at high resolution and saved as digital images. Aerial photographs from 2008 were already available as digital images (see Capitolo et al. 2010). Counts of seabirds from aerial photographs were available for 1979-1982, 1986, 1989 and 1996-2004; murres were counted in each of these years but other species were counted inconsistently, including Brandt's Cormorants (*Phalacrocorax penicillatus*), Western Gulls (*Larus occidentalis*), and Brown Pelicans (*Pelecanus occidentalis*). In 1979-1982, at least two counts of murres per year were conducted (Sowls et al. 1980; Briggs et al. 1983). For these years, we chose the survey date that best represented the main breeding period for murres, generally following Carter et al. (2001). However, for 1980, we chose a revised 1 July count instead of a lower revised 9 July count (see below) because by 9 July more murre chicks and their parents had likely departed from the colony than by 1 July. Takekawa et al. (1990) also used the 1 July 1980 survey in their analyses of murre population trends.

For 1987-1995 and 2005-2008, we obtained counts for all seabirds and sea lions on Redding Rock. For seabird photographic surveys in 1989 and 1996-2004, we examined original archived data sheets and subdivided counts of seabirds into the designated zones and areas (Figure 2). We also proof checked historical counts of seabirds and corrected errors when found. For

photographs from 1979 and 1986-2008, no previous counts of sea lions existed; therefore, we counted sea lions from these years. For 1980-1982, only total counts of murres and sea lions were available (Briggs et al. 1983; Bonnell et al. 1983). To provide zone and subarea counts comparable to other years, we conducted new counts from those surveys. In this report, our new counts are provided, along with counts from original sources for comparison. For all years, we also counted nests and birds of other seabird species when not counted previously, including: Brown Pelican; Brandt's Cormorant; Pelagic Cormorant (*Phalacrocorax pelagicus*); Heermann's Gull (*Larus heermanni*); and Western Gull.

Status and Attendance Patterns of Seabirds and Sea Lions on Redding Rock, 2009 & 2010

To assess the current status, seasonal attendance patterns, and spatial distribution of murres, other seabirds, and sea lions on Redding Rock, we conducted boat and aerial photographic surveys from March 2009 to January 2010 (Table 1). Boat surveys were conducted to provide more systematic, frequent and detailed observations of seabird and sea lion attendance and behavior, breeding activities, and potential seabird and sea lion interactions. Aerial surveys were conducted to provide coverage of areas of the rock not visible from the water and to fill in temporal gaps between boat surveys.

Aerial Photographic Surveys

We conducted 17 aerial photographic surveys of Redding Rock between 18 March 2009 and 27 January 2010 (Table 1). Flights were conducted from a twin engine fixed-wing Partenavia aircraft operated either by CDFG-Air Services or Aspen Helicopters, Inc. Flights conducted in the murre non-breeding season (March, August-January) were flown in the early morning (0800-1000 h; PDT) when murres were more likely to be attending the colony. Flights during the murre breeding season (April-July) were typically conducted between 1000 and 1200 h (PDT) when daily murre attendance is less variable than earlier or later in the day (Takekawa et al. 1990; Nur and Sydeman 2002; USFWS, unpubl. data).

In May and June two flights per day were conducted for comparison. On 28 May, Redding Rock was surveyed during annual seabird colony surveys (Capitolo et al. 2010) on the same day as one of our scheduled flights. By coordinating this overlap, these surveys were conducted 1.5 h apart (1030 h and 1200 h) to examine variation in counts. On 6, 7, 21, and 22 June, surveys were conducted twice per day to take advantage of aircraft availability and to examine within-day variation in counts.

Flights departed from Murray Field in Eureka or Eureka/Arcata Airport in McKinleyville and lasted 40-60 min. The aircraft made several passes over Redding Rock to ensure complete photographic coverage with high quality photographs; survey time at the rock averaged 20 min (range 10-30 min). Survey altitude was primarily 213 m (700 ft) but ranged 213-305 m (700-1,000 ft). One to two personnel photographed through a hatch opening in the belly of the aircraft using 10 megapixel digital SLR cameras (Canon 40 D; Canon USA). Overview photographs of

the entire rock were taken with a 50 mm telephoto lens (Canon USA) and close up photographs of murres and sea lions were taken with a 200 mm telephoto lens or 70-300 mm zoom lens (Canon USA). Downloaded images were given standardized file names (that included date, location, survey method, and frame number), and files were stored on an external hard drive. Counts of seabirds and sea lions from aerial photographs were conducted later. In addition, while en route to or from Redding Rock, murre colonies in the Trinidad area (see below) were visually inspected for murre presence or absence.

Boat Surveys

Twenty-six boat surveys of Redding Rock were conducted between 24 March and 8 December 2009 (Table 1). Boat surveys were conducted from an open 6.7 m (22 ft) Zodiac "Hurricane" rigid hull inflatable craft powered by two 75-hp outboard motors. Surveys were launched from Trinidad Harbor or Crescent City Harbor. Weather permitting, boat surveys of Redding Rock were conducted about once per month during the murre non-breeding season and once or more per week during the breeding season. During the murre breeding season (May-August), surveys were usually conducted between 1000 and 1400 h, when murre attendance patterns were less variable. Boat surveys were conducted carefully with slow approaches at distances of 65 –150 m (213-492 ft.) from the rock, preventing any flushing and minimizing disturbance to birds and sea lions.

During each boat survey, all seabirds and sea lions were identified and counted using 10 x 42 image stabilizing binoculars (Canon, USA). To examine our potential disturbance to seabirds and sea lions, distance to the rock was recorded to the nearest 1 m from each count vantage point using a 7 x 26 Laser Range Finder (Bushnell, Overland Park, KS) with a maximum estimation distance of 914 m (3,000 ft.). Because of the relative difficulty of counting densely spaced murres, murres were counted three times by two observers within each zone or area; the means of both observers' counts were used. In addition, each portion of the rock was photographed with a 10 megapixel digital SLR camera (Canon USA) with either a 70-300 mm zoom lens or 300 mm telephoto lens (Canon USA). Photographs were reviewed at a later date and counts of seabirds and sea lions were obtained for comparison to counts conducted in the field. In most cases, counts from photographs were greater and were considered to be more accurate than counts in the field. Thus, all reported counts are from photographs.

Counts Obtained from Photographs

All seabird and sea lion counts were tallied for each designated zone and area on Redding Rock. Counts from digital images were conducted on a computer using *Image Pro* Image Processing and Analysis Software program (MediaCybernetics, Inc., Bethesda, MD) which allows the user to zoom in and out, crop images, and tag items (i.e., seabirds or sea lions) for automatic count tallying. The images, along with "tags" and other drawn features, were then archived.

Seabirds

For Common Murres, individual birds were counted. Birds were identified as being within an actively breeding or non-actively breeding group based on bird postures observed during the breeding season. If murres were tightly clustered, with many in apparent incubation/brooding postures, they were considered to be an actively breeding group. If all or nearly all murres were obviously standing upright (usually combined with wide spacing between birds), they were categorized as a non-actively breeding group. Murres that were not actively breeding most likely included non-breeding immatures and adults and possibly failed breeders.

Brandt's Cormorants were the second most abundant seabird on Redding Rock in years when they nested. These cormorants build fairly large nests made mainly of marine plant material. We counted birds and nests in potential nesting areas, as well birds in non-nesting (mainly roosting) areas. Potential nests were categorized as follows:

1) Territorial site: little or no nesting material, possible courtship display (without eggs);
2) Poorly-built nest: disorganized mound or flat pile of nesting material (likely without eggs);
3) Fairly-built nest: well-defined, roughly circular pile of nesting material with partially formed nest bowl (likely without eggs, but eggs possible); and
4) Well-built nest: substantial (> 15 cm height) amount of nesting material, forming a clearly defined circular nest structure and well-developed nest bowl (likely with eggs or chicks).

Pelagic Cormorants and Western Gulls were the only other surface nesting seabird species confirmed to breed on Redding Rock in 1979-2009. For these species, birds and well-built nests were counted. In addition, birds of all other species identified in 1979-2009 surveys were counted, including Brown Pelicans and Heermann's Gulls.

Sea Lions

All sea lions were counted within each zone and totals determined. California sea lions do not currently breed in the study area. Steller sea lions are resident, breed and pup in northern California, and are listed as a federally threatened species. To determine reproductive activities on Redding Rock, Steller sea lions were categorized as follows (Mark Lowry pers. com.):

1) Bull: very large size, with distinctive "mane", large head, and very broad shoulders;
2) Subadult Male/Adult Female: large size, fairly large head and fairly broad shoulders;
3) Immature: medium-sized animals with relatively small heads and narrow shoulders;
4) Yearling: small size but obviously not a pup; and
5) Pup: born this season, very small (112 cm), black coat.

In addition to counting sea lions, Steller sea lions that had been branded in Oregon and California by NMML were identified. Branded Steller sea lions were photographed and matched to NMML's data base.

Behavioral observations of sea lions were noted including: a) any interactions between California sea lions, Steller sea lions and murres; and b) reproductive behaviors of Steller sea lions, including nursing by adult females and territorial defense by males. Access points to Redding Rock and movement corridors on the rock were also recorded.

Documentation of Common Murre Breeding on Redding Rock, 2009

During boat and aerial photographic surveys, potential murre breeding areas on Redding Rock were identified. Murres in these areas were photographed and probable murre breeding or territorial sites were identified from close-up photographs. A potential breeding site was identified as a location on the rock where a murre was present on at least three surveys during the breeding season. On each survey, all identified sites were checked for attendance and categorized as:

1) bird (e.g. adult) in incubation/brooding posture;
2) bird and egg;
3) bird and chick;
4) bird(s) standing (i.e., not in incubation/brooding posture);
5) bird present but posture undetermined;
6) site vacant (bird absent); or
7) undetermined (bird possibly obscured).

We also searched for other eggs and chicks that may have been associated with unmonitored sites. Chicks were aged based on size and plumage characteristics according to a protocol developed for monitoring murre breeding at central California colonies (USFWS, unpubl. data).

Following the breeding season, each site was categorized as breeding, territorial, or undetermined. Breeding sites either had confirmed breeding or were attended consistently during the breeding season. Territorial sites were frequently or periodically unattended such that breeding seemed unlikely. Undetermined sites either: 1) were obscured from view too often to make an informed determination; or 2) had a gap(s) in attendance during the peak of the breeding season that suggested that the site had either failed at breeding or was only territorial.

Brandt's Cormorant and Western Gull Nesting on Redding Rock, 2009

Breeding phenology and reproductive success of Brandt's Cormorants and Western Gulls were monitored from both boat and aerial photographic surveys. Small numbers of gull nests were followed individually. Numbers of nests and chicks of Brandt's Cormorants were counted over the course of the season.

Common Murre Seasonal Attendance Patterns at Reference Colonies, 2009

Seasonal attendance patterns and breeding success of murres also were examined at four reference colonies: a) Flatiron Rock, Blank Rock, and Pilot Rock off Trinidad, Humboldt County, and b) Castle Rock National Wildlife Refuge (NWR) off Crescent City, Del Norte County (Figure 3). The Trinidad colonies are part of the California Coastal National Monument managed by BLM while Castle Rock is managed by USFWS.

Trinidad Colonies

Weather permitting, counts were conducted from vantage points on Trinidad Head once per week between 0800 and 1400 h prior to the breeding season and primarily between 1000 and 1400 h during the breeding season. Surveys began on 23 April and continued to 23 July when birds were no longer present. All murres visible on Blank and Pilot Rocks were counted. Because of the large size of the Flatiron Rock colony (> 30,000 breeding birds), a sample plot was established on the southeastern portion of the rock. Using 45X or 26-60X spotting scopes, two observers counted each colony three consecutive times and counts were averaged per observer; combined observer averages are reported.

Castle Rock

Murre counts at Castle Rock were conducted using a robotic video camera mounted on the rock. Because of the large size of the Castle Rock colony (>100,000 breeding birds; Capitolo et al. 2006) and restricted vantage of the video camera, a sample plot was established within 10 m of the camera in which murres could be easily counted. This plot corresponded to the same area of the colony followed for murre reproductive performance in 2007-2009 (Eigner 2009; R. Golightly, unpubl. data). Counts of Castle Rock were conducted about once per week between 1000 and 1400 h (usually between 1100 and 1300 h). One to two observers counted the plot three consecutive times and counts were averaged per observer. Combined observer averages are reported.

Coast-wide Sea Lion Surveys

Coast-wide surveys of Steller sea lion haul-out sites between Trinidad Head and St. George Reef were conducted to establish the significance of Redding Rock to Steller sea lions in northern Humboldt and Del Norte counties. These surveys were conducted twice a month during the sea lion breeding season (May-September) weather permitting. For logistical reasons, coast-wide surveys were split into northern and southern routes. The southern route included inshore rocks around the Trinidad area (Otter Rock, Other Rock, Sea Lion Rock, Lost Whale Inn Rock and Palmer's Point) and offshore rocks (Turtle Rock and Redding Rock). The northern route included Castle Rock, Southwest Seal Rock and Northwest Seal Rock (Figure 3). The southern route was surveyed more frequently than the northern route as sea lions were also recorded during more frequent Redding Rock seabird surveys. During all surveys, haul-out sites were approached down wind and from a distance to avoid disturbance to sea lions. Steller and

California sea lions were counted at haul-out sites using 10 x 42 image stabilizing binoculars (Canon USA). Branded Steller sea lions were identified and photographed per NMML and HSU protocols.

Maintenance of the Redding Rock Aid to Navigation

To assess the potential impacts to seabirds on Redding Rock from maintenance of the ATON, we obtained copies of USCG records from 1983 to 2008 from the 11th Coast Guard Prevention Division (Alameda, California). Maintenance records, reports of ATON damage or malfunction, and USCG correspondence regarding the ATON were reviewed to determine dates of trips.

Potential Human Disturbance, 2009 & 2010

During boat and aerial surveys in 2009 and 2010, we recorded any vessel that approached within 460 m (1,500 ft) of Redding Rock. We recorded activities aboard the vessel and used a laser range finder to report distance to the rock (or roughly estimated distance to the rock). We also recorded any potential disturbances to seabirds and sea lions from our boat surveys of Redding Rock. During aerial surveys, we watched for any visible disturbance to seabirds and marine mammals. No other low-flying aircraft were observed at Redding Rock during aerial or boat surveys from March 2009 to January 2010.

RESULTS

Common Murre Annual Attendance on Redding Rock 1979-2008

The Redding Rock murre colony declined substantially during the study period. Although decline was not linear throughout this period, counts in breeding areas (see definitions below) showed a substantial decline between 1980 and 2008, using linear regression ($r^2 = 0.769$). To depict major changes in the murre colony, three time periods (1979-1990, 1993-2002, 2003-2008) were examined in more detail.

1979-1990 — No aerial photographic surveys were conducted in 1983-1985, but surveys were annual in 1979-1982 and 1986-1990; murre attendance was similar between the earlier and later portions so they were combined into one major period. From 1979 to 1990, murres bred in several distinct clusters on the upper portion of the rock. The largest and most dense cluster occurred on the top plateau (Top) surrounding the ATON beacon, with birds nesting both on the rock surface and on the concrete ATON foundation (Table 2; Figures 2, 4; Appendix A). Smaller clusters of nesting birds occurred on Shoulder, a cliff ledge on the west side of the rock just below the top (Area C), and on four other ledges high on the eastern portion of the rock (Areas D-G). On nine surveys, non-breeding groups of murres also occurred on the East Arm, Southwest Middle or other zones adjacent to clusters of breeding murres.

To assess trends, only counts from the peak of the breeding season (*ca.* 20 May to 5 July) were used (i.e., bold values in Table 2). Counts from earlier and later in the breeding season may have been more variable because many birds either had not laid eggs yet or had departed the colony for the season.

Earlier sources had reported high variability between counts in 1979-1982 (Briggs et al. 1983). However, this re-evaluation found much more limited interannual variability, with numbers of murres counted being fairly stable through the 1979-1990 period. Although counts in 1979 were not used to assess trends because of poor survey timing, murre distribution on the rock was similar to other years. Total numbers of birds in 1980-1990 averaged 1,011 $\pm$ 250 SD (range = 700-1,408 birds; n = 8 years). If only breeding areas are included, then counts averaged 957 birds $\pm$ 191 SD (range = 700-1,213 birds; n = 8 years). No linear trend was apparent in breeding area counts ($r^2 = 0.011$). The ratio of average breeding: average total was 0.96 (975:1011). Adjusting breeding area counts with an average correction factor of 1.67 developed at Southeast Farallon Island (Sydeman et al. 1997) resulted in breeding population estimates ranging from 1,169-2,026 birds, or an average of 1,598 ± 318 SD for the 1980-1990 period.

We also examined a photograph of the Redding Rock colony taken on 12 May 1970 (in Osborne 1972, page 83). While we could not conduct a comparable count from this photograph, murre distribution and numbers appeared similar to 1979-1990. Thus, we believe Osborne's estimate of 300 pairs of murres from that survey was low. Thus, it is also likely that the estimate of 200 pairs in 1969 (Osborne and Reynolds 1971) also was low.

1993-2002 — No aerial photographic surveys were conducted in 1991-1992 but were annual in 1993-2002. In 1993 (part of the strong 1992-93 El Niño), fewer murres occurred at Redding Rock with only a cluster of 29 birds present in the Shoulder zone (Table 2; Appendix A). Of those present, only 2 birds were sitting in incubation-like postures; the remainder were standing upright (i.e., not incubating eggs or brooding chicks). We could not determine if sitting birds were actually incubating or brooding. In the Top zone, 39 California and 8 unidentified sea lions were hauled out in the murre breeding area (Appendix A).

Between 1994 and 2002, breeding murres did not return to Areas D, E, F or G but birds continued attending Shoulder and Area C. On the Shoulder, murres were present in variable numbers (range = 0-194 birds; n = 8 years) from 1994 to 2001. In some years (1997; 1999-2001), a high proportion of birds present appeared to be in incubation postures (i.e. actively breeding); in other years, most birds were present in a loose aggregation and did not appear to be actively breeding, although earlier breeding was possible. Very low numbers (n = 33 birds) in 1998 (a strong El Niño year) further indicated poor attendance during strong El Niño events, possibly related to poor foraging conditions and enhanced sea lion numbers on the rock. Breeding murres no longer attended Shoulder after 2001. On Top, murres were present in 1994, 1995 and 2000 but did not appear to be breeding.

Murres attended Area C in fairly stable numbers from 1994 to 2002, with most counts ranging from 31 to 89 birds (Table 2). However, in 2003, only six birds were counted; thereafter, this cliff ledge was no longer attended.

While murres no longer attended certain historic nesting areas (Areas D through F) after 1990, two new breeding areas were established on narrow cliff ledges of the steep western portion of the rock (Areas H and I; Figure 2). Small numbers of murres (n = 8 birds in H; n = 7 birds in I) were first noted in these areas in 1994, when almost 250 standing (i.e. not actively breeding) murres were scattered throughout much of the western side of the rock. Prior to 1994, only Brandt's Cormorants occasionally nested in small numbers in these areas (Appendix A). Due to poor photograph angles, we could not assess murre postures and probable breeding status in Areas H and I in 1994. In 1995-2002, a dense cluster of murres attended Area H in fairly consistent numbers (range = 31-76 birds; n= 8 years) and appeared to be incubating or brooding birds. In Area I between 1995 and 1998, murres were observed only in 1996 (11 birds). In 1999-2002, Area I was attended every year, apparently by breeding murres, with counts ranging from 8 to 21 birds (Table 2).

Excluding extremely low attendance during strong El Niño's in 1993 and 1998, total counts of murres averaged 252 birds $\pm$ 126 SD (range 83- 469 birds; n = 8 years). Counts within breeding areas averaged 204 birds $\pm$ 85 SD (range = 83-375 birds; n = 8 years). These average counts (252 and 204) were 75% and 79% lower than the 1980-1990 averages, respectively. Although breeding area counts showed a declining trend from 1994 to 2002, using linear regression (r^2 = 0.479), the biggest actual change occurred between 1994 and 2008. The ratio of average breeding: average total was 0.80 (204:252). Using the correction factor of 1.67, estimated breeding population sizes ranged from 139 to 626 birds, or an average of 340 ± 142 SD. However, given that the proportion of non-breeding birds may have been relatively high even in breeding clusters, actual numbers of breeding individuals may have been overestimated.

2003-2008 — Aerial photographic surveys were annually conducted in 2003-2008. After 2002, only the narrow cliff ledges of Areas H and I appear to have been used by breeding murres. In Area H, numbers appeared to be relatively stable through the period, with counts ranging from 48 to 87 birds. Numbers of murres in Area I roughly doubled in size from 22-23 birds in 2003-2005 to 40-45 birds in 2006-2008 (Table 2). Total counts within breeding areas averaged 102 birds $\pm$ 16 SD (range = 76-114 birds) for the period, 40% lower than in 1993-2002 and 89% lower than in 1980-1990.

Increased numbers of murres attended the rock in 2006-2008 (range = 530-952 birds) compared to 2003-2005 (range = 76-110 birds). Lowest numbers occurred during a minor El Niño event in 2003 but numbers were not as depressed as in earlier strong El Niño's in 1993 and 1998. Numbers in breeding areas also were greater in 2006-2008 (range = 110-114 birds) than in 2003-2005 (range = 76-110), mostly due to growth in numbers using Area I (see above). However, higher numbers in 2006-2008 were mainly due to attendance of fairly large numbers of non-

actively breeding murres ranging from 420 to 841 birds. These birds were mainly scattered among the steep western cliffs of the rock. These standing birds spilled over into Top and Shoulder but did not appear to be associated with those former breeding areas.

In 2003-2008, total counts of murres on the rock averaged 385 birds $\pm$ 355 SD (range 76 - 952 birds; n = 6 years). Counts within breeding areas averaged 102 birds $\pm$ 16 SD (range = 76-114 birds). These average counts (385 and 102) were: a) 62% and 89% lower than 1980-1990 averages, respectively; and b) 53% higher and 50% lower than 1994-2002 averages, respectively. Breeding area counts showed an increasing trend, using linear regression ($r^2 = 0.747$). The ratio of average breeding: average total was 0.27 (102:385). Breeding population estimates ranged from 127 to 190 birds, or an average of 170 ± 26SD. However, like the 1993-2002 period, actual numbers of breeding individuals may have been overestimated.

Sea Lion Annual Attendance on Redding Rock, 1979-2008

Total counts of Steller, California, unidentified, and all sea lions from aerial photographic surveys of Redding Rock are reported in Table 3 and Figures 4-5, and counts by each zone and area are reported in Appendix A. Below we summarize the trends in abundance for the same time periods that were analyzed for the murres.

Steller sea lion

1979-1990 - Steller sea lions were present in relatively small numbers on the rock when aerial photographic surveys began in 1979 (Figure 5, Table 3). In 1980-1982, Bonnell et al. (1983) reported the highest numbers of Steller sea lions in winter months, with 43 counted in January 1980 and 11 in January 1981. However, visual inspection of photographs from 1980-82 found that most sea lions were in the water adjacent to the rock when photographed (but were obviously associated with the rock). Steller sea lion numbers were low during aerial photographic surveys conducted in May and June from 1979 to 1989, with fewer than 10 sea lions recorded. When considering only those counts obtained around the peak seabird breeding season (May to early July) an average of 6 ± 18 SD Steller sea lions (range = 0-55) was recorded between 1979 and 1990, possibly exhibiting a slight increase during this time period but no trend was apparent using linear regression ($r^2 = 0.23$). In 1990, the highest count of 55 Steller sea lions was recorded (Table 3). Prior to 1990, all observations of Steller sea lions in May and June occurred in the Intertidal zones (Figure 6). In 1990, 2 Steller sea lions were observed higher on the rock in East Arm zone and 11 were observed in the East Middle zone (Figure 6).

1993-2002 — In 1993 (part of the strong 1992-93 El Niño), only 5 Steller sea lions were present in early June. Numbers increased after 1993, ranging from 9 to 90 per survey (average 39, ± 27 SD), a 550% increase from the 1979-1990 average. Numbers were low in 1998, another El Niño year, with only 9 sea lions counted (Figure 4). Steller sea lion numbers increased noticeably during this period ($r^2 = 0.59$), primarily on the lower one-third to one-half portion of the rock in the Intertidal and East Middle zones (Figure 6).

2003-2008 — Numbers of Steller sea lions oscillated after 2002 averaging 44 ± 36 SD, a 13% increase from the 1993-2002 average and 633% higher from the 1979-1990 average. However, there was no noticeable trend in counts within the period ($r^2 = 0.0002$). In 2004 and 2005, poor quality images and inadequate photo coverage of certain portions of the rock made identification of sea lion species difficult and therefore many sea lions were categorized as unidentified. Many unidentified sea lions likely were California sea lions and few likely were Stellers. Regardless, numbers of both species were low in 2006, when 61 total sea lions were counted on the rock (Table 3). Again, Steller sea lions occurred primarily in the Intertidal zones and other lower portions of the rock. In only a few circumstances, small numbers of Steller sea lions occurred above the East Middle zone, mostly in East Arm (below historic murre nesting areas) and twice (2003, 2007) in Top (historic murre nesting area; Figure 6).

Age Classification — Most (79%) Steller sea lions on the rock in 1979-2008 were classified as immature (Figure 7). Bulls were present (≤ 6) on each survey post-1989, suggesting establishment of territories. No pups were identified; however, the majority of these surveys were conducted prior to average Steller sea lion pupping in California and Oregon (mid-June; Pitcher et al. 2001).

California sea lion

1979-1990 — Prior to 1993, California sea lions were only identified in small numbers on two surveys: 3 May 1982 (n = 7 sea lions) and 6 June 1990 (n = 3 sea lions) (Figure 5, Table 3, Appendix A); no trend was apparent during this period, using linear regression ($r^2 = 0.07$). All of these sea lions were on the lower half of the rock (Figure 8).

1993-2002 — In 1993 (part of the strong 1992-93 El Niño), 109 California sea lions were present on the rock, was much higher numbers than previously recorded. This reflected a major change in use of the rock, with California sea lions present in substantial numbers on every survey thereafter. From 1993 to 2002, counts averaged 174 ± 143 SD (range = 87-472) but no trend was apparent within this period using linear regression ($r^2 = 0.09$). Counts were highest during the severe 1998 El Niño (n = 376 sea lions) and in 2002 (n = 472 sea lions). Numbers were distinctly lower in 1999-2000 during a strong La Niña (cold water) event with 76 and 125 sea lions counted, respectively. Unlike Steller sea lions, California sea lions mainly hauled out on the upper one-third to one-half of the rock (Figure 8). When they first appeared in large numbers in 1993, California sea lions were primarily in the East Middle and Top zones. Since 1994, their distribution expanded to include Shoulder and East Arm. Use of these areas by sea lions was associated with the absence of breeding murres.

2003-2008 — The highest number of California sea lions counted during this time period (n = 673 sea lions) occurred in 2003, when a minor El Niño event took place. In 2006-2007 (the latter year at the start of a La Niña event), the number of sea lions were again low with 44 and 75 counted, respectively (Table 3). The average number of California sea lions during this period was 252 ± 259 SD (range = 44- 673), a 45% increase from the 1993-2002 average. Within the

period, however, there was a decreasing trend in numbers on the rock ($r^2 = 0.55$). California sea lions were regularly documented hauling out on the upper portions of the rock including Top, Shoulder and East Arm as well as East Middle. In 2006, no California sea lions were present in Top, but visible sea lion fecal stains indicated recent sea lion use of this part of the rock. In 2003-2008, the percentage of California sea lions occupying former murre breeding areas in Top and Shoulder averaged 11% (range = 0-17%; n = 6 years) of total numbers on the rock.

Common Murre Seasonal Attendance Patterns on Redding Rock, 2009

In 2009, we documented murre seasonal attendance patterns on the rock with both boat and aerial photographic surveys (Figure 9). Given the small numbers of birds present and relatively good accuracy of counts obtained from boat survey photographs, we combined boat and aerial surveys to provide a more complete temporal description of murre attendance patterns.

No murres were present during our first surveys in mid-March (Figure 9, Appendix C), but little is known about winter colony attendance in northern California. At central California colonies, murre colony attendance during the winter tends to be sporadic; birds typically land at the colony at first light and may only stay for a few minutes to a few hours (Hastings et al. 1999; Ainley et al. 2002; USFWS, unpubl. data). Murres may have visited Redding Rock in March but were absent during our surveys. Murres were first seen attending the rock (both Areas H and I) on 5 April and were observed on each survey from 30 April until 16 July. As in past years, Area H had greater numbers of murres than Area I.

Counts of attending murres were more variable from April to early June and less variable from mid-June to early July (Area H) or mid-July (Area I). Numbers in Area H were lower after 6 July, where four birds were last observed on 16 July. In Area I, numbers declined sometime after 16 July. Both areas were empty by 5 August, signifying the end of colony attendance for the season. Highest counts for Area H (82 birds), Area I (51 birds), and total birds (133 birds) occurred on 17 April (before egg-laying began). Peak annual counts typically occur in the late pre-egg laying period (mid-April to early May) at central California colonies (USFWS, unpubl. data).

Within breeding areas (Areas H and I), aerial survey counts conducted in the standard 1000-1400 h period between 28 May and 22 June (i.e., during the peak breeding period) averaged 101 birds $\pm$ 18 SD (range = 77-125; n = 8 counts), nearly identical to the average of 2003-2008 counts (102 birds), suggesting little change in numbers using current breeding areas from 2008-2009. Applying the correction factor of 1.67 to this average count yields an estimate of 169 breeding birds. However, actual numbers of breeding birds may have been overestimated using this technique (see below).

Outside of current breeding areas, only small numbers of murres (range = 16–41 birds) were observed (Appendix B and C). In most cases, individuals or small groups landed for brief periods on the cliff face between Areas H and I or other portions of the cliff near these breeding areas.

Counts from these other areas were very small compared to 2006-2008 (see above); no courtship or breeding activities were observed by these birds, and none were observed attending former breeding areas on the upper portions of the rock.

Common Murre Breeding on Redding Rock, 2009

In 2009, murres bred in the same two areas that had been consistently attended in recent years: Areas H and I (Figure 2). Murres have consistently attended Area H since 1994 and Area I since 1999 (Table 1). By 28 April murres were constantly attending breeding areas, and birds were first observed in incubation postures on 10 May. Birds in incubation or brooding postures were observed on each subsequent survey until only large chicks remained in mid-July.

As a rough indicator of the number of breeding and territorial sites present, high counts from boat surveys of birds in incubation or brooding postures combined to obtain a total of 41 attended sites (Table 4). Given that not all sites were breeding sites and all sites were not visible from the boat, we estimate about 50 active breeding pairs (or 100 breeding birds) on the rock in 2009. This estimate represented 94% lower numbers than the 1980-1990 average of 1,598 breeding birds.

From boat and aerial photographs, we identified and monitored 35 unique breeding or territorial sites: 27 in Area H and 8 in Area I (Table 4). Other breeding or territorial sites likely existed in these areas, especially in the denser Area H, but they could not be identified consistently because of poor viewing angles. As expected, we found that following individual sites was difficult given techniques used and frequency of surveys. Many sites were difficult to view or distinguish among dense clusters of neighboring murres, rock overhangs, and other obstructions. Eggs were extremely difficult to observe. However, four eggs were observed: one egg was seen in an aerial photograph from 6 June in Area H, and eggs were observed in boat photographs at three other sites in Area H on 11 June and 16 June. Observations of twelve large chicks were made between 22 June and 12 July: 8 in Area H and 4 in Area I (Table 4). All chicks observed were old enough to depart the colony with adults (minimum 15 days old; Boekelheide et al. 1990; USFWS, unpubl. data) to complete the remainder of chick rearing at sea. Two sites in Area H had both eggs and chicks observed.

Of 35 sites monitored, at least 25 were considered to be breeding sites, including 19 in Area H and 6 in Area I. From observations of eggs and chicks, we confirmed at least 12 total breeding sites: 10 in Area H and 2-4 in Area I. Totals in Area I depended on whether chicks observed on different days were the same or not. Four breeding sites in Area H were probably unsuccessful; fates of the remainder were either successful or undetermined.

Breeding phenology was roughly determined from egg and chick observations (assuming correct assignment of chicks to individual breeding sites). For eggs (n = 2), lay dates were estimated based on bird attendance up to the egg observation. For chicks (n = 12), lay dates and hatch dates were back-calculated assuming that all 12 chicks were about 20 days of age when first observed,

using an average incubation period of 32 days (Boekelheide et al. 1990). Average lay dates for Areas H and I were 19 May (range = 12 May-11 June; n = 10 sites) and 15 May (range = 1–22 May, n = 4 sites), respectively. For both areas combined, the average lay date was 18 May (range = 1 May-11 June; n = 14 sites). From these data, little or no difference in timing of breeding occurred between areas but rough calculations and low sample sizes prevented statistical comparisons.

Earlier seasonal departure by birds in Area H suggested either: a) birds in Area H bred earlier; b) adults had higher rates of failure than birds in Area I; or c) chicks departed the rock at a younger age. Several instances of murres copulating were observed on 11 June in Area H. Based on nest monitoring data and data from other colonies (see below), the courtship and egg-laying periods should have been largely completed by this time. Several copulating pairs at this late date reflected either: a) late breeding; b) some pairs failed and were attempting to relay; or, c) several prospecting birds were present and conducting courtship. Interestingly, attendance patterns on Redding Rock were more variable prior to early June than afterward (Figure 11). Less variable attendance is typical in the mid incubation to early chick period, or about mid-May to late June in central California (Takekawa et al. 1990; USFWS, unpubl. data).

Attendance data suggested that some birds may have laid eggs in early or mid-June, roughly matching the two latest estimated lay dates (i.e., 8 and 11 June) in Area H from site monitoring. If so, these chicks (if successful) would have departed the rock in very late July or early August. However, no data were collected between 16 July and 5 August, and the colony was empty on the latter date. While we may have missed documenting some chicks during this period, the two monitored sites with the latest estimated lay dates failed between late June and early July. Thus, some late egg laying may have occurred and been successful or failed without detection.

Disturbances by roosting Brown Pelicans may have affected breeding murres. On several occasions during boat surveys, pelicans were observed disturbing murres, especially in Area I, causing “head bobbing” and flushing of birds from breeding areas. For example, on 9 July, 2 pelicans flushed 10 murres from Area I. Pelicans roosting close to breeding areas on 5 and 7 June may have flushed murres prior to our arrival, possibly explaining the relatively low numbers of murres present on those dates (Figure 9). Pelican disturbance could partially explain differences in attendance patterns between Areas H and I, such as possible abandonment in Area H or more relaying in Area I.

Common Murre Seasonal Attendance Patterns at Reference Colonies, 2009

Trinidad Colonies — At Flatiron, Blank and Pilot Rocks, murres were present sporadically in late March based on observations during aerial photographic and boat surveys, but no counts were conducted. Standardized counts from Trinidad Head were conducted from 23 April to 23 July (Figure 10); on the latter date, colonies were empty and no longer attended.

Flatiron and Pilot Rocks were attended constantly from 23 April until 23 July. At Pilot Rock on 23 April, murres began leaving the rock just after counts started, and nearly all had left by the time counts were completed, indicating that egg laying had not yet begun. Blank Rock was attended constantly from 29 April until the colony was found empty on 23 July. At all three colonies, higher counts in late April, at or near initiation of egg laying, matched attendance patterns at murre colonies in central California (USFWS, unpubl. data). Increased variability in counts between late June and mid-July also was similar to central California colonies. As adults (males) begin departing with chicks and other adults (especially females) stop attending breeding sites, some adults and immatures continue to visit the colony for a short period of time before the colony is no longer attended at the end of the breeding season (Birkhead and Nettleship, 1987). Fairly consistent attendance patterns suggest that breeding phenology was similar between these three colonies.

Castle Rock — Attendance counts began on 1 May after egg laying had begun (first egg recorded 22 April; R. T. Golightly, unpubl. data). Counts were similar from early May through mid-June (Figure 10). Counts were lower in late June until the plot was empty on the last survey on 21 July (Figure 10). Lower numbers in the late breeding season were associated with chicks departing the colony. From another study, chicks monitored within study plots began departing with adults on 19 June; the last monitored chick departed on 10 July, and the last chick on the portion of the rock visible with video cameras was observed on 12 July (R. T. Golightly, unpubl. data).

Sea Lion Attendance Patterns at Redding Rock, 2009 & 2010

Most of the positively identified sea lions on the rock in 2009 and January 2010 were California sea lions (average 385 ± 238 SD per survey), although Steller sea lions (average 57 ± 28 SD per survey) were also present regularly (Figures 11-5; Appendices B and C). Aerial photographic surveys tended to provide better coverage of the rock, while photographs from the boat were often more clear permitting easier identification of species and Steller sea lion age categories. Given the many surveys within the study period, we consider that any bias in these methods would be minimal. Overall (from both aerial and boat surveys), only 3% of sea lions counted were not identified to species.

Steller sea lion

Steller sea lions were present on the rock year round. Spring attendance (March – May) was characterized by ≤ 80 sea lions (average 46 ± 16 SD per survey). Steller sea lion numbers peaked in June (average 81 ± 24 SD), with a high count of 123 on 2 June. Numbers were lower and more variable between July and September with higher numbers seen in November through January 2010 (Figure 11). Steller sea lions were primarily located in the Intertidal zones and were most abundant in East Intertidal throughout the year (Figure 13). On 4 occasions (5 April, 21 June, 16 November, 27 January), 1-6 Stellers were located in Top. On only one occasion (2 December), 3 Stellers were located in Shoulder.

Of all Steller sea lions counted from aerial photographic and boat surveys, 72% were immature, 20% were subadult males/adult females, 3% were bulls, 3% were pups, and <1% were yearlings (Figure 14). A single pup was observed briefly during a boat survey on 24 June. The pup was by itself and no female was associated with it. No pups were observed again until the post-breeding season. Between 8 and 19 pups were observed each survey between September 2009 and January 2010.

Steller sea lion behavior

Bulls were first seen actively defending territories on 30 April. A large bull consistently defended a section of Southeast Intertidal from 30 April through 12 July. A yearling Steller sea lion was observed nursing on 25 March. Pups were observed nursing on surveys between September and January.

California sea lion

California sea lions were present year round on Redding Rock. Between mid-March and mid-June, an average of 257 ± 97 SD sea lions were hauled out per survey (Figure 11). Larger numbers of sea lions hauled out from mid-June through November, with a peak count of 746 sea lions on 22 June (average 511 ± 135 SD). Fewer sea lions were present in December (average 365 ± 6 SD) than between June and November. More sea lions were seen in January (27 January 1,504) than had ever been recorded previously, mainly hauling out in East Intertidal and East Middle, with lower numbers in East Arm, Top and Shoulder (Figure 15).

Sea Lion Access and Movement Patterns

All sea lions regularly accessed the rock from three points along the East, Northwest and Southwest Intertidal zones. California sea lions were regularly seen climbing up ridges on the East Arm and Shoulder zones to reach the top of the rock (Figure 16).

Other Seabirds on Redding Rock, 1979-2009

Brandt's Cormorant

Population Trends, 1979-2009 — Brandt's Cormorants often nest in the same habitats as Common Murres and often breed in mixed assemblages. On Redding Rock, Brandt's Cormorants frequently have nested in relatively small numbers (Sowls et al. 1980; Carter et al. 1992). Highest nest counts occurred during the 1979-1990 period, when cormorants nested nearly every year (Figure 17, Table 5, Appendix A). During that time, nest counts averaged 34 (range = 1-90), with the high count in 1980. Cormorants nested on various portions of the rock, but mostly on the slope of East Middle (Figure 2). In 1993-2009, cormorants nested more sporadically and generally in lower numbers than in 1979-1990, with an average count of 8 nests (range = 0-32). Also, nesting areas have been mainly limited to the upper portions of the rock. Redding Rock also has been used as a small to moderately sized cormorant roost.

Nesting in 2009 — Nests, territorial sites, and birds were counted from aerial and boat surveys, and large chicks were counted from boat surveys. Cormorant nests were noted in Top, East Arm, Shoulder, and Area D (Table 6; Figure18; Appendices B and C). Earliest poorly-built nests were observed in Top and Shoulder on 13 May and earliest well-built nests were observed on 28 May (Figure 18).

Reproductive success of individual nests was not monitored but we were able to confirm breeding and determine a minimum number of chicks visible in or beside nests during boat surveys (Table 6). Only nine nests (32%) were confirmed to hatch one or more chicks. Chicks were first seen on 8 July in Shoulder, on 9 July in Top, and on 12 July in East Arm. Later in the breeding season, only 14 large, wandering (≥ about 30 days old) chicks were observed. Chicks at this stage are usually considered to survive to independence (Carter and Hobson 1988; Jones et al. 2008). Reproductive success was roughly estimated to be 0.5 chicks per pair, which is relatively low (Boekelheide et al. 1990; Jones et al. 2008). Productivity was especially lowest in East Arm, Area D, and Top.

California sea lions regularly hauled out and moved among nesting Brandt's Cormorants. During 3 boat surveys, we observed defensive behavior elicited by nesting cormorants towards sea lions. In particular, cormorants jabbed their bills at sea lions when they attempted to enter the cormorant colony in East Arm or Top. We also documented at least one cormorant nest in Shoulder that was most likely abandoned due to sea lion disturbance between the afternoon of 21 June and the morning of 22 June during an unusually large incursion of sea lions on the rock. Several sea lions were hauled out next to this nest site on both days.

Western Gull

Population Trends, 1979-2009 — In 1980 and 1989, 20 and 15 breeding birds were estimated, respectively (Sowls et al. 1980; Carter et al. 1992). The 1980 estimate was based on an "estimate" of 10 nests from a boat survey on 30 June, but it was unclear if any nests were actually observed (Sowls et al. 1980; unpubl. survey archives). Another estimate of 20 nests was made during an aerial survey in 1979 (date unspecified – either 15 May or 12 July) based on "adults seen in vicinity" (Sowls et al.1980; unpubl. survey archives). The 1989 estimate was based on a boat survey conducted on 25 June; no nests were counted and the estimate was based on 11 birds counted in potential nesting areas (Carter et al. 1992; unpubl. survey archives).

We counted gull nests and birds from 1979-2008 aerial photographs (Appendix A) and during 2009 boat and aerial photographic surveys (Appendices B and C). No gull nests were observed in 1979-1990 photographs. The first single gull nest was documented in 1993 and 1-6 gull nests were recorded each year afterwards except in 1999, 2004, and 2008. Redding Rock has also been used for roosting by small to moderate numbers of Western Gulls.

Nesting in 2009 — Three pairs of gulls nested in East Middle and East Arm in 2009 (Table 7, Appendices B and C). Nests were discovered in East Middle on 19 and 31 May, and in East Arm

on 2 June. One nest in East Middle hatched at least two chicks. Both chicks were observed until they were > 23 days old and were considered to have fledged. Other nests failed to fledge young although chicks may have hatched that were not observed. Overall reproductive success of 0.67 chicks/pair was relatively low (Penniman et al. 1990).

Other Species

Past surveys recorded nesting Pelagic Cormorants and inferred nesting by Pigeon Guillemots (*Cepphus columba*), Rhinoceros Auklets (*Cerorhinca monocerata*) and Tufted Puffins (*Fratercula cirrhata*) from birds observed on or near the rock (Sowls et al. 1980; Carter et al. 1992). From aerial photographs, Pelagic Cormorants nested on the steep north or southwestern cliffs in 1989 (4 nests), 1990 (15 nests), and 1994 (11 nests) (Appendix A). We did not detect any of the other species on Redding Rock, although they are difficult to detect in aerial photographs. Although Pigeon Guillemots and Rhinoceros Auklets were observed on the water or flying nearby in 2009, none were clearly associated with the rock. Inspection of the rock during boat surveys indicated little or no potential habitat for these crevice-nesting species.

Coast-wide Sea Lion Surveys, 2009

Coast-wide surveys were conducted from March to December 2009 (Table 8). Seven southern sites were surveyed more frequently than the 3 northern sites. Three of the southern sites were large sea lion haul-outs with yearly averages of over 100 Steller and California sea lions: Turtle Rocks (466); Redding Rock (857); and Otter Rock (200). Of these, Turtle Rocks and Otter Rock were dominated by Steller sea lions during the peak breeding season in June (average 128 ± 35 SD on Turtle Rocks; average 147 ± 86 SD on Otter Rock) while other sites were dominated by California sea lions throughout the year (Figure 19). California sea lions were more abundant than Stellers on Redding Rock both during the breeding season (California sea lion average 243 ± 78 SD; Steller sea lion average 72 ± 21 SD) in June and at other times of year (year round California sea lion average 738 ± 140 SD; year round Steller sea lion average 119 ± 22 SD). Other rocks in the southern survey group supported averages of less than 100 sea lions and were less regular sea lion haul-out sites.

All northern survey sites were large sea lion haul outs with year round averages of over 200 Steller and California sea lions: Castle Rock (315); Southwest Seal Rock (230); and Northwest Seal Rock (207). Haul outs on Southwest Seal Rock and Northwest Seal Rock were dominated by Stellers into the early fall after which California sea lions became more abundant. Haul outs on Castle Rock were dominated by Californias throughout the year (Figure 19). Largest numbers of Steller sea lions were observed at Southwest Seal Rock (n = 255 on 12 June) and Turtle Rocks (n = 293 on 30 April). Largest numbers of California sea lions were seen at Turtle Rocks (n = 384 on 9 September) and Castle Rock (n = 461 on 12 June) (Figure 19).

Steller Sea Lion Brand Re-sight

Branded Steller sea lions were observed at Turtle Rocks (n = 19), Redding Rock (n = 18), and Southwest Seal Rock (n = 17) (Figure 20). Sea lions branded at St. George Reef, California, were seen more frequently throughout the area than those branded at Rogue Reef, Oregon (51:24), and females were seen more frequently than males (43:31) (Figure 21; Appendix D).

Of branded sea lions observed at Redding Rock, about 55% (10 of 18) were only seen once during the entire study (Figure 22). Eleven sea lions were re-sighted more than once: 3 (27%) on Redding Rock multiple times; 5 (45%) only on Turtle or Otter Rocks; and 3 on Turtle Rocks and northern rocks such as Southwest Seal Rock or Klamath River Rock (Table 9). Sea lions branded at St. George Reef, California, were seen more frequently on Redding Rock than those branded at Rogue Reef (13:5); an almost equal ratio of branded males and females were seen (8:10) (Figure 22).

Aid to Navigation Maintenance

In 1914, the ATON was first established. However, the current structure was built sometime later (Bearss 1969). From 1914-1939, the ATON was maintained by the U.S. Lighthouse Service (USLS). In 1939, the USLS merged with USCG. Since 1939, the USCG has been responsible for ongoing maintenance. We obtained maintenance records from USCG dating back to 1983. During the period from 1983 to 2008, the ATON was serviced by hovering a helicopter over the rock and lowering personnel onto the rock by line and basket (USCG personnel, pers. comm.). The Redding Rock ATON formerly consisted of a light and foghorn that were maintained twice a year, with additional servicing as necessary. In 2005, USCG considered removing the beacon entirely, but public comments persuaded them to leave the beacon in place for boater safety. In 2005 the foghorn was removed and the light was replaced with a more energy efficient LED lamp that is expected to reduce the frequency of maintenance and servicing.

At least 49 maintenance visits (at least once per year) were made to Redding Rock from 1983 to the 2008 (Table 10). Primarily, trips were made for scheduled maintenance. Servicing was also performed when malfunction or damage was reported, which occurred nine times between 1984 and 2002. Of all trips performed during this period, 18 (37%) occurred between 25 April and 15 August when Common Murre eggs or chicks may have been present.

During servicing trips, the helicopter alone almost certainly caused substantial disturbance, causing most if not all seabirds and sea lions to flush from the rock. Downdraft from the helicopter also likely caused many eggs to be blown away from breeding sites. Personnel landing on the rock likely flushed off any additional murres, cormorants, and sea lions not flushed by the helicopter. During flushing, many murre eggs likely were lost due to being broken by flushing murres or rolling away from their breeding sites. When murres still nested in the Top zone of the rock (i.e., prior to 1993), maintenance required personnel to land and work among the largest concentration of nesting murres on the rock. Avoiding destruction of eggs and displacement of

chicks (if present) would have been nearly impossible, although the numbers of eggs and chicks affected in other areas of the rock likely varied between years, maintenance activities and personnel. In 1989, one USCG personnel in Trinidad told G. J. McChesney (pers. comm.) that, when recently landing on the rock to maintain the ATON, he could not avoid stepping on and breaking murre eggs (see also Carter et al. 1992).

In 1987, 1989, 1993, 2000 and 2001, annual aerial surveys occurred 14, 20, 24, 21, and 28 days after a USCG visit had occurred during the incubation period in May (see Table 2 for survey dates). In areas not affected by sea lions, murres were still present in breeding areas with many in incubation postures. While at least some birds were still breeding, many likely lost their first eggs and had laid replacement eggs. Under non-disturbed conditions at the South Farallon Islands, replacement eggs are laid at 32% of sites about 15 days after egg loss, and tend to have lower hatching success (67% versus 85%) and lower fledging success (72% versus 95%) than first eggs (Boekelheide et al. 1990). Under disturbance conditions experienced at Redding Rock, we suspect that most eggs were lost during helicopter drop offs, replacement eggs were laid at a relatively high rate of failed nests, and reproductive success was reduced for most birds that re-laid.

In 1993 one murre breeding area not accessible to sea lions (Area C) was not attended by murres on the aerial survey (8 June) after USCG visited the rock 15 days prior (25 May). Although California sea lions were first documented hauled out in murre nesting areas in Top (just above Area C) in 1993, Area C was attended by murres in 1994-2003 when sea lions were also present until this area was no longer attended for unknown reasons in 2004 (Table 1). We suspect that disturbance from USCG activities, possibly exacerbated by strong El Niño conditions in may have led to complete murre abandonment in Area C in 1993.

Continued visitation by USCG to Redding Rock during the seabird breeding season has occurred despite a recently established (6 June 2005) Right-of-Way Grant/Temporary Use Permit prohibiting such visits. The Right-of-Way Grant from the BLM covers both Redding ("Reading") and Mooring rocks. In the Stipulations (Exhibit A) of the Grant, it states that: "Maintenance of both facilities will be accomplished by helicopter outside the Common Murre nesting period. Regular maintenance will be scheduled between September 1 and March 31 of each year (if birds are found to be using the rocks as nesting sites)." The agreement further stipulates that "In the interest of public safety, access to the rock will be permitted during periods of emergency (outages, an oil tanker running aground on the rocks, etc.)." However, from records obtained from USCG, a visit on 30 April 2008 was for scheduled maintenance and not due to a light outage.

Other Potential Human Disturbance

Fifteen vessels were documented in the vicinity of Redding Rock from April to August in 2009 but no disturbances were observed (Table 11). All boats within 400 m of the rock were engaged in recreational fishing. Possible disturbance to sea lions and seabirds also was monitored during

our own boat and aerial surveys. On 5 April, 2 adult Steller sea lions flushed from the rock during our survey (distance unknown). On a 9 July boat survey, our boat drifted within 76 m of the rock and we observed some "head bobbing" of murres in Area I. No other disturbances of sea lions or seabirds on the rock were observed.

DISCUSSION

Changes in Seabirds and Sea Lions at Redding Rock, 1979-2008

Annual aerial photographic surveys of seabird breeding colonies in California since 1979 have documented numbers of murres, Brandt's Cormorants, other seabirds and sea lions on Redding Rock during the peak of the seabird breeding season. From these archived photographs, we were able to describe annual historical attendance patterns and spatial distribution of murres and sea lions and examine possible factors leading to the reduction of this murre colony. By re-assessing, and in certain years re-counting or correcting aerial photographic survey data, we were able to describe these patterns more accurately.

Changes in Murre Numbers:

During the peak of the seabird breeding season, total numbers of murres did not show any clear trend from 1970 to 1990, including our counts and the Osborne (1972) photograph of the colony in 1970. In 1980-1990, counts in breeding areas averaged 957 birds (or about 1,600 breeding birds).

In 1979-1990, murres nested within several discrete clusters, with the largest cluster on the relatively flat top and shoulder portion of the rock including the base of the ATON beacon. At this time, numbers of sea lions on the rock were small (< 80), primarily Steller sea lions hauled out on the lower portions of the rock. After a two-year hiatus in aerial survey coverage in 1991-1992, distributions and numbers of murres and sea lions changed dramatically. In 1993, during the second year of the strong 1992-93 El Niño event (Hayward et al. 1994), more California sea lions hauled out on the rock, with many in the largest murre breeding area within the Top zone of the rock. No murres were present in that area or in five other discrete breeding areas (Areas C, D, E, F and G) just below Top which had been occupied in 1979-1990. Another murre breeding area, Shoulder, had low numbers of murres with only 29 birds present.

From 1994 to 2002, numbers of murres were somewhat larger than found in 1993 but average numbers in breeding areas (204) were still 79% lower than in 1980-1990, with a major change in distribution on the rock from upper areas (that had become used regularly by sea lions) to two previously unused ledges on the lower west side that were inaccessible to sea lions and humans. Average breeding area counts in 2003-2008 were 50% lower than in 1994-2002, and 62% lower

than in 1980-1990 with continued low-level breeding confined to two ledges. In 2009, this murre colony held only about 100 breeding birds, or 6% of 1980-1990 average breeding estimate.

Decreased Proportion of Breeding Murres

The proportion of murres counted that were actively breeding during surveys dropped dramatically after 1990. The ratio of average breeding: average total changed from 0.90 (1980-1990) to 0.80 (1994-2002) to 0.27 (2003-2008). Relatively large numbers of non-actively breeding birds were noted in the latter two periods, especially in 2003-2008, and likely included: a) immatures from the previous larger colony or other nearby colonies that were attending the rock (e.g., prospecting); b) adults that did not breed due to a developing shortage of suitable breeding habitat; and c) adults that had failed and not re-laid eggs due to displacement and disturbance by sea lions (1994-2002 and 2003-2008), or human disturbance related to ATON maintenance (1994-2002 only). However, a large proportion of the murre breeding population present in 1979-1990 was simply not present in the latter two periods. Most of these birds likely either: a) left the rock and joined other colonies; or b) no longer attempted to breed but occasionally still attended the rock in small numbers.

Loss of Murre Breeding Habitat

Beginning in 1993, California sea lions were observed hauled out on the upper portions of the rock, including Top, nearly every year, clearly impacting murre breeding in historic nesting areas. Although small numbers of murres were observed in Top (the former largest breeding area) in 1994, 1995, and 2000, they were not actively breeding during the survey. Some of these birds were likely former breeders or progeny from past years returning to natal nesting areas; some may have laid eggs earlier in the survey year and failed prior to the survey. Nesting areas on east side ledges just below Top (Areas D-G) have not been attended since 1993, possibly indicating earlier or more sustained impacts to these smaller breeding groups from California sea lions (e.g., during 1992 El Niño when no surveys were conducted) or USCG landings. In Area C, a west-facing cliff ledge just below Top, similar numbers (range = 31-89 birds) were present nearly every year from 1993 to 2003 (except during strong El Niño conditions in 1998); only six birds were counted in 2003, and Area C has been empty ever since 2003. Although reduced in numbers, Shoulder also was attended each year from 1993 to 2001 (except 1998). During that time, sea lion use of Shoulder appeared to be low, likely permitting some level of murre attendance. However, increased use of Shoulder by California sea lions since 2002 coincided with the absence of murres in that area.

Newly Established Murre Breeding Areas

By 1994, murres had established new breeding areas (Areas H and I) on two narrow cliff ledges low on the western portion of the rock. These ledges, which are inaccessible to sea lions and humans on foot, likely have been the only murre breeding areas on the rock since 2001 and possibly earlier. Establishment of these breeding areas roughly co-occurred with the expansion of California sea lions on the rock into historic murre breeding areas by 1993 or possibly earlier.

Although these cliff ledges have allowed murres to continue to breed on Redding Rock, the limited space permits only small numbers of breeding sites.

Sea Lion Impacts

Prior to 1993, numbers of sea lions on Redding Rock never exceeded 78 and almost all were Steller sea lions, which remained on the lower portions of the rock. Increased numbers were first noted in 1993, especially for California sea lions, which regularly were observed on the upper portions the rock. From 1993 to 2008, counts $\geq$ 50 California and $\geq$ 150 total sea lions were typical and often were much higher. In central California, brief or extended haul-out use of murre breeding habitats by single or small numbers of California sea lions (especially noted during years of prey shortages) has caused breeding failures of murres at certain colonies but without long-term reduction or abandonment of those breeding areas (Parker et al. 1999; Carter et al. 2003b; McChesney et al. 2009). However, at Redding Rock, regular use by larger numbers of sea lions over multiple years apparently led to long-term abandonment of all historic nesting areas on the upper portions of the rock in the mid-1990s. Inferences from annual aerial survey data from 1993 to 2008 were confirmed by more intensive surveys in 2009 and 2010, which showed constant presence of California sea lions on the upper portions of Redding Rock.

Brandt's Cormorants

Numbers of Brandt's Cormorants nests were highest between 1979 and 1990 (maximum 90 nests) when nesting occurred annually (Sowls et al. 1980; Carter et al. 1992; this study). During that period, most cormorants nested on the eastern slope of the rock. Since 1990, cormorants have only sporadically nested on the rock and counts never exceeded 32 nests (Capitolo et al. 2004; this study). Since 2003, nesting occurred mainly among hauled-out California sea lions but above areas with highest sea lion use. In 2009, some nest failure was attributed to sea lion disturbance. Although, these cormorants appear to be better able to fend off sea lions than murres (McChesney 1997; Carter et al. 2003b), increased sea lion use of the rock apparently has caused a reduction in cormorant breeding.

Western Gulls

Nesting by small numbers of gulls developed after 1990. Previous estimates of 20 and 15 breeding birds in 1980 and 1989, respectively, were based only on birds observed in potential breeding areas of Redding Rock (Sowls et al. 1980; unpublished survey archives; Carter et al. 1992). However, no direct evidence of gull nesting was found prior to 1993. Since then, gulls have nested in small numbers ($\leq$ 6 nests) nearly every year. Possible explanations for recent gull nesting include: a) past competition for nesting space with murres and cormorants prohibiting gulls from nesting on the rock prior to 1993; b) increased number of sea lions attracting gulls to nest at the rock; or c) increased numbers of gulls at other colonies in northern California with limited nesting habitats leading to emigration by some birds (Capitolo et al. 2009). Although gulls have been able to establish a few nest sites, reproductive success was relatively low in 2009.

Common Murre Breeding, 2009

Detailed observations in 2009 allowed better assessment of the current status of this depleted colony. Murres might not have returned to attend the rock prior to 2009 surveys which began in March, even though murres were recorded attending Trinidad colonies at this time. However, pre-breeding colony attendance at California colonies often is sporadic (Hastings et al. 1999; Manuwal and Carter 2001), and birds may simply have not attended the rock on the earliest survey dates. Colony attendance was first noted in early April. Monitoring of a sample of nest sites confirmed successful breeding by several pairs. Egg laying began by early May, peaked in mid-May, and lasted at least through mid-June. Chicks began departing from the rock about the third week of June, with the last chicks and adults departing between mid-July and early August. Murres bred only at the same two recently active breeding ledges: Areas H and I. Despite some Brandt's Cormorant nesting, no murres were observed in other historic breeding areas on the upper portions of the rock where almost continuous use by California sea lions may have prevented it. In California, Brandt's Cormorants often nest in mixed assemblages with murres and are often associated with murre prospecting and establishment or re-establishment of murre breeding (McChesney et al. 1998, 1999; Carter et al. 2001; Capitolo et al. 2005; Parker et al. 2007).

Breeding phenology at Redding Rock appeared to be about 10-14 days later than at Castle Rock, 45 km to the north, and somewhat later than at the Trinidad colonies, 32 km to the south. However, these differences also may have reflected differences in methods of monitoring between these colonies.

Although small numbers of non-actively breeding murres sometimes were observed outside of breeding areas in 2009, numbers were much lower than the hundreds observed during annual aerial surveys in 2006-2008.

Brown Pelicans were often observed roosting on the knobby rock ledges of the western cliffs, in close proximity to murre breeding areas, especially Area I. While only a few minor pelican disturbances to murres were witnessed, disturbance by pelicans that was not observed may have caused some impacts to breeding murres, including breeding failures. Pelican disturbance has caused major breeding failures in recent years at several central California murre colonies (USFWS, unpubl. data).

Past Anthropogenic Factors Affecting Murres and Sea Lions

Various past anthropogenic (or human-related) factors have affected sea lion and murre numbers and distribution on Redding Rock over the last two centuries. After great past population reduction due to impacts from early settlers since 1850, the murre population in northern California has been increasing since the mid-20th century with apparent recolonization of at least some colonies (Carter et al. 2001; Manuwal and Carter 2001). Harvesting of murre eggs occurred widely, with documentation on islands probably off Trinidad in 1897-1901 (Carter et al. 2001).

Sea lion (especially California) populations also have been increasing during the 20th century following decimation from hunting in the 19th and early 20th centuries (Angliss and Allen 2007; Carretta et. al. 2007).

While California sea lion hunting was most extensive and better described at rookeries in central and southern California (Scammon 1874), extensive hunting likely occurred widely in northern California, including Redding Rock. Detailed documentation of sea lion hunting in northern California is lacking, except for Sugarloaf Rock where Captain Smith extensively hunted sea lions for oil probably in the early 20th century (Thornbury 1923). In the early to mid 20th century, oil pollution also occurred widely in northern California and likely impacted murres to a great degree (especially off Eureka and Crescent City where several oil spills were documented). In 1914, the navigational light was built on Redding Rock which may have involved leveling the top of the rock. Some murre breeding habitat may have been either removed or created by this potential change, although some artificial habitat was created (i.e., perimeter of ATON foundation) which was used later for breeding by murres.

Although it is unknown whether numbers of murres at Redding Rock in the 1980s were higher or lower than earlier times, numbers in the 1970s-1980s indicated a relatively stable colony that may have been recovering (or recovered) from past human impacts. Increased use of Redding Rock by California sea lions since the early 1990s reflects recovery of the California stock, which has increased 5.6% per year since 1975 (Carretta et al. 2007), with expanded non-breeding use of the northern California coast. Whether or not sea lion use of Redding Rock is indicative of pre-exploitation conditions is uncertain.

Climate Change Effects

Changing ocean climate factors may also have influenced changes in sea lion and murre numbers on Redding Rock over the last 30 years (Trenberth 1990). Strong El Niño events in 1982-83, 1992-93, and 1997-98 dramatically disrupted ocean productivity in the northeastern Pacific Ocean (e.g., Roemmich and McGowan 1995; Hayward et al. 2004). In 2005 and 2006, El Niño-like conditions contributed to reduced upwelling, high sea surface temperatures, and low prey availability in the California Current system. Many seabird and marine mammal species bred in reduced numbers and suffered low productivity during strong El Niño or El Niño-like events (Ainley et al. 1988; Ainley and Boekelheide 1990; Carter et al. 1996; McChesney 1997; Parker et al. 1999; Sydeman and Allen 199; Sydeman et al. 2001; Saenz et al. 2006; Carretta et. al. 2007; Lee et al. 2007; Jones et al. 2007). Strong El Niño events in 1993 and 1998, as well as a weak El Niño in 2003, likely contributed to low attendance of murres recorded on Redding Rock in those years due to poor foraging conditions. More importantly, recent strong El Niño events corresponded to surges in the numbers of California sea lions on the rock. In 1993, 109 California sea lions were recorded when sea lions were first documented within murre breeding areas. Much higher counts in 1998 (376) and 2003 (673) may have resulted from earlier and greater northern movements from breeding areas off of southern California and Baja California,

Mexico. Surveys at Redding Rock were not conducted during other strong El Niño years in 1983 or earlier; it is not clear whether surges in sea lion numbers occurred at these times, although smaller California sea lion population sizes did occur at these times.

Disturbance from Aid to Navigation Maintenance

Human disturbance from maintenance of the ATON has impacted breeding murres on Redding Rock possibly since the ATON was first built in 1914. However, the degree of impacts from these disturbances over time likely has changed and is difficult to quantify. Available maintenance records demonstrate that USCG made trips to the rock annually between 1983 and 2003 to maintain the ATON. These maintenance trips were conducted using helicopter drop offs and many trips occurred when murres, other seabirds and sea lions were present on the rock. Breeding murres would have flushed from eggs or chicks and eggs around the structure would have been damaged. This must have led to much breeding failure but many birds likely laid replacement eggs such that overall reproduction was only partly reduced, based on relatively stable and substantial numbers of apparently breeding murres in 1970-1990, including several years when USCG visits occurred prior to surveys. However, because of reduced breeding success, such disturbance likely reduced recruitment and colony growth to some extent. Continued helicopter drop offs during the breeding season are still a great concern for disturbance, reduced reproductive success, and long-term viability of the small remaining colony on the lower western ledges.

In earlier years, USLS and USCG personnel landed on the rock by boat and climbed up the rock; such landings may have occurred over periods of several days. Depending on the timing of visits, this form of visitation may have caused even greater disturbance to murres and sea lions. Murre breeding at Redding Rock was first well documented in 1969-1970, although unconfirmed breeding was noted in the 1930s (Osborne 1972). ATON servicing likely reduced murre reproductive success and caused temporary abandonment during this period (if visits were conducted during the murre breeding season). Unfortunately, little historical information is available to explore the level of past impacts. Future examination of pre-1983 USCG and USLS maintenance records, historical documents on the building of the ATON, and other historical information on activities of sea lion hunters and other early settlers (possibly including egging) may provide revealing insight into such earlier impacts to breeding seabirds, breeding habitats, and sea lions at Redding Rock.

Significance of Redding Rock to Steller Sea Lions in Northern California

Sea lion surveys conducted in 2009 helped to describe movement patterns of individual Steller sea lions and the importance of Redding Rock to the local population. Over 700 pups have been branded during the past 7 years at rookeries in southern Oregon and northern California. In 2009, the majority of these branded individuals were therefore young adults or juveniles. Based on brand re-sighting of 71 brands, most Steller sea lions at northern California haul-outs originated from the nearest rookery at Southwest Seal Rock, with smaller numbers from Rogue Reef,

Oregon. This indicates that some juveniles and young adults are staying closer to their natal site than dispersing widely. Some young Steller sea lions may also have originated from other rookeries where no branding has occurred, such as Sugarloaf Island off Cape Mendocino. Branded individuals did not consistently show high site fidelity to a given haul out, tending to travel between sites throughout northern California in a given year and between years. Some individual variation was consistent with two previous years of brand re-sighting surveys in the northern part of the study area (P. D. Goley, unpubl. data). Branded individuals do not appear to rely solely on Redding Rock or any particular non-breeding haul out based on these preliminary data.

Highest numbers were seen at Otter Rock, Turtle Rocks, Northwest Seal Rock and Southwest Seal Rock. Pupping was only observed at Southwest Seal Rock. Although numbers were smaller at Redding Rock than at these other major haul outs, Steller sea lions were consistently present throughout the year, suggesting that Redding Rock is significant to at least a portion of the population. We did not confirm Redding Rock as a breeding rookery for Steller sea lions although a lone pup observed briefly in June 2009 may have been born on the rock. In addition, bulls were regularly observed defending territories in spring and summer and females with pups that had dispersed from nearby rookeries hauled out and nursed pups on the rock in late summer and fall. Thus, although Redding Rock is not an active rookery, it appears to serve significantly in the development of pups after they leave rookeries. Redding Rock's relative isolation may provide an important stop-over between other coastal haul outs, and closer distance to offshore feeding areas may enhance feeding near Redding Rock.

Significance of Redding Rock to California Sea Lions in Northern California

Through most of the 2009-2010 study period, Redding Rock served as the largest California sea lion haul out in the study area. Obviously, the rock has grown in prominence as a haul out since the early 1990s. Yet, few historical records document the extent of the historical California sea lion population in northern California. However, since implementation of the Marine Mammal Protection Act in 1972, California sea lions along California's coast have become more abundant. The 2007 California sea lion stock estimate for the U.S. stock was 141,842. An annual increase of 5.6% per year, excluding El Niño years, has occurred since 1975 (Carretta et. al. 2007). The California sea lions found along the northern California coast are not breeding individuals, but ones that have either completed breeding at rookeries in southern California and Mexico, or are non-breeding males. Whether or not sea lions regularly used all upper portions of Redding Rock in the 19th century or earlier is not clear. Current use of these areas may have been encouraged or facilitated in the 1990s and 2000s by: 1) larger numbers of sea lions than in the early 20th century; 2) possible alterations of the rock by ATON construction; or 3) a greater frequency of strong El Niño events in the 1980s and 1990s, possibly related to climate change which may have led to surges in sea lion numbers in northern California (Trenberth 1990).

Potential Murre Restoration at Redding Rock

Redding Rock currently has little suitable murre breeding habitat that during the breeding season is free of sea lion disturbance. Recently-used ledge habitats are small and are at or near saturation, and other unused ledges on the steep western cliffs may be unsuitable for nesting. Unless management actions are taken, the remaining murre colony on Redding Rock will likely be limited to very small numbers of breeding birds and vulnerable to colony loss (see below). If the murre colony on Redding Rock experiences frequent breeding failures, remaining breeding murres will eventually abandon the rock. In addition to sea lion disturbances, other factors that have impacted or could impact this murre colony include: pelican disturbance; human disturbance from ATON maintenance, boats, and low-flying aircraft; future oil spill mortalities; and possible declines in prey availability.

The susceptibility of small murre colonies to extirpation has been documented in central California. At Devil's Slide Rock in central California a colony of up to 2,900 breeding murres was extirpated within just a few years in the mid-1980s as a result of mortality in gill-nets and oil spills (Takekawa et al. 1990; Carter et al. 2001, 2003a). Significant declines of other larger central California colonies also were recorded at this time, but without extirpation. Apparently, the smaller Devil's Slide colony could not withstand the relatively high losses. At Prince Island in southern California, a colony of about 100 pairs of murres was extirpated sometime in the early to mid-20th century apparently because of extensive egg gathering by collectors, disturbance, and possibly other factors (summarized in Carter et al. 2001).

Newly colonized murre colonies, or subcolonies, also are susceptible to extirpation before they reach larger population sizes. For example, at certain central California colonies where murres breed on several rocks and cliffs, new subcolonies frequently appear in association with nesting Brandt's Cormorants (e.g., McChesney et al. 1998, 1999; Carter et al. 2001; USFWS, unpubl. data). While some of these subcolonies become well-established, most are short-lived (1-3 years).

The adjacent Newport and Kibesillah Rocks (Newport-Kibesillah Complex), Mendocino County, were colonized by murres in the mid-1990s. Annual murre counts at this colony complex increased from 163 to 800 birds between 1994 and 2004 (Carter et al. 2001; Capitolo et al. 2006), were noted in 2005-2006 surveys in numbers apparently similar to 2004, but were not attended during surveys in 2007-2009 for unknown reasons (USFWS, unpubl. data). At Goat Island Area, Mendocino County, murres were first observed in 1989 (Carter et al. 1989). This colony grew substantially through at least 2004 (Capitolo et al. 2006). However, a large decline was noted during 2008 surveys and the main subcolony was empty during the 2009 survey. Sudden losses of these breeding areas could reflect human disturbance, predation, or other factors. Sea lion disturbance does not seem to be a factor at these rocks (USFWS, unpubl. data). More work is needed to assess factors affecting these colonies

Despite massive impacts from sea lions since 1993 and continued human disturbance from ATON maintenance (currently reduced but still involving flushing and egg loss from helicopter landings during the breeding season), murres have continued to breed successfully at Redding Rock by moving to inaccessible ledges but at only about 10% of numbers recorded in the 1979-1990 period. Prey availability apparently is still suitable for murres at Redding Rock. Fairly large numbers of non-actively breeding murres observed at Redding Rock in 2006-2008 also suggest that if suitable breeding habitat were made available in the near future, many more birds would readily breed at Redding Rock. However, rapid success with developing a larger colony can be best expected only while these "surplus" birds still attend the colony, which may occur for only a few more years (if at all). Technical feasibility and cost aside, all available evidence suggests Redding Rock would host a self sustaining colony if a large enough colony can be developed and maintained in low disturbance habitats.

With avoidance of all impacts to California sea lions, reoccupation of murre breeding areas used in the 1980-1990 period simply is not achievable. With minor impacts to California sea lions, development of a relatively large self sustaining murre colony can be achieved with partial re-occupation of historic breeding areas through use of sea lion barriers. Another option that avoids all long-term impacts to California sea lions is the development of a moderate-sized colony through the use of relatively small artificial ledges on the western cliffs. The former option is preferred because a larger colony would result which would be less susceptible to loss. However, the latter option would still increase colony size, reducing susceptibility to colony loss. Both options have no impacts on Stellers sea lions and further require reduction of human disturbance and adequate prey availability. Depending on the initial level of success, social attraction techniques may or may not be added to encourage re-establishment of breeding in restored habitats.

Sea lion barriers

A barrier(s) to prevent sea lion access to the upper portions of the rock will be essential to restoring murres to a relatively high population size, within the same rough order of magnitude as formerly recorded numbers (i.e., 800 pairs). Fortunately, such a barrier(s) would need to prevent sea lion access only to the Top and/or Shoulder (7% of rock used by sea lions) and not those sections used most extensively by California and especially Steller sea lions (i.e., intertidal zones, East Middle zone). Most importantly, such a barrier(s) would not significantly impact use of the rock by threatened Steller sea lions, which very rarely climb to the upper portions of the rock. On-site inspection of breeding areas and climbing paths is needed to best determine where barriers should be placed for greatest efficacy at blocking sea lion access and best provision of suitable breeding habitats for murres. Barrier lengths could be relatively short in width but must be high enough to prevent sea lions from climbing over them. Actual height will depend on the style of barrier selected and exact points of installment. Since barriers would be possibly as high as 2-3 m, it may be desirable to cover barriers with natural-appearing materials that would allow the barrier to visually blend into the rock.

Barrier placement could be done in one of three potential ways, with each providing different amounts of habitat protection for murres:

1) Protection of nearly all historic murre breeding habitats. This design would permit restoration of the murre colony to close to former numbers in 1980-1990 (about 800 breeding pairs). Barriers would block sea lion climbing routes on both the north and south sides of the rock (Figure 16), just below former murre breeding areas in Top and Shoulder. However, re-established breeding areas in Top would be susceptible to foot traffic disturbance during ATON maintenance.

2) Protection of murre breeding habitat south of the ATON. This design would permit re-use of most of the historic murre breeding habitats in Top as well as east and west side ledges (Areas C, D, E, F, and G), providing habitat for about 600 pairs of murres or 75% of former numbers. Barriers would block: a) the sea lion climbing route on the south edge of the rock only, just below the former murre breeding area in Top; and b) access around the cement base of the ATON (placement on the north side of the ATON). However, re-established breeding areas in Top would be susceptible to impacts from helicopter hovering, drop offs, and foot traffic during ATON maintenance.

3) Protection of murre breeding habitat north of the ATON. This design would permit re-use of relatively small portion of historic murre breeding habitats in Shoulder providing habitat for about 150-200 pairs of murres or 20-25% of former numbers. Barriers would block: a) the sea lion climbing route on the north edge of the rock, just below the former murre breeding area in Shoulder; and b) sea lions climbing from south of the ATON to north of the ATON. Benefits of this design include: a) foot access by USCG personnel to the door on the south side of the ATON would not pass through the restored murre colony; b) helicopter drop offs likely occur on the larger and flatter south side of the top area, reducing impacts to some breeding murres on the north side of the ATON; and c) less reduction of space for sea lions use, since only small numbers haul out in Shoulder mainly in certain years when numbers on the rock are higher.

To withstand sea lion climbing attempts, high seas, and ensure only rare maintenance needs, we suggest a barrier design that would result in permanent structures made of concrete or another long-lasting and extremely durable material. Limits to availability of long-term funding and logistical difficulties accessing the rock to perform maintenance of barriers would make short-term structures impractical.

Steller sea lions are protected under the federal Endangered Species Act and California sea lions are protected under the federal Marine Mammal Protection Act. Under these Acts, disturbance to these species without a permit is prohibited. Both species are managed by the National Marine Fisheries Service (NMFS). Any human activity on Redding Rock would result in disturbance to sea lions, and construction of sea lion barriers would have small effect on the amount of haul out

habitat for sea lions. However, preliminary discussions with NMFS personnel indicated that an incidental take permit for barrier construction likely could be obtained. Concerns expressed by NMFS included: 1) a barrier design that would not injure sea lions upon contact; and 2) a barrier design that allowed safe sea lion escape if an animal somehow bypassed a barrier. Any barrier design or other human activity on Redding Rock must be done in consultation with NMFS.

Actual construction and implementation of barriers will require permits, substantial planning, and carefully conducted field activities, but we do not imagine any major logistical difficulties with this work. A potential drawback to assess further is that construction of barriers may be viewed as addition of artificial materials to a "natural" habitat, including concerns of the local Yurok Tribe about development on this culturally significant rock, even though a relatively large non-natural ATON has been present since 1914. Overall, we believe that disguised sea lion barriers could be successfully employed and protected areas would be used by murres, with little effect on California sea lions and no effect of Steller sea lions, resulting in a self sustaining murre colony of substantial size.

Artificial breeding ledges

By constructing artificial breeding ledges on the steep western cliffs of the rock, the amount of suitable ledge habitat and number of suitable breeding sites can be expanded. This restoration action would allow the murre colony to increase to 200-300 breeding pairs, or 25% of former numbers, without impacts to sea lions and safe from foot access during ATON maintenance. However, helicopter hovering would likely still cause flushing and egg loss in these habitats. On-site inspection of the cliffs is needed to best determine how ledges could be expanded for greatest efficacy at providing murre breeding sites.

Currently, two cliff ledges host the only remaining breeding murres on the rock, even though the western cliffs also have hosted hundreds of non-actively breeding birds in recent years. Murres may have saturated the only natural ledges suitable for breeding. To ensure that these ledges are not impacted, separate ledge areas would be selected for alteration and expansion. Artificial ledges would enhance existing ledges by creating relatively flat ledges with depressions to reduce egg rolling and provide sufficient space for groups of at least 20-30 adjacent breeding sites, including space for attending mates, courtship, and landing/departures. Additional design consideration, such as ledge overhangs, would exclude most pelicans and gulls from ledges. Higher ledges would be selected to reduce possible impacts to the ledges themselves from high seas during winter storms and sea lions.

To withstand high winter spray and ensure only rare maintenance needs, we suggest a ledge design that would result in permanent structures made of concrete or another long-lasting and extremely durable material. Limits to availability of long-term funding and logistical difficulties accessing the rock to perform maintenance of ledges would make short-term structures impractical.

Actual construction and implementation of ledges will require permits, substantial planning, and carefully-conducted field activities. Ledges would likely need to be installed in the fall, after seabird breeding, after sea lion pups have grown substantially, and before unfavorable winter seas which can more frequently prevent access. In addition to the earlier concern about addition of artificial materials to a "natural" habitat, potential drawback to assess further are: a) high ledges may still be susceptible to impacts from high seas during winter storms; b) logistical difficulties and safety concerns relating to accessing cliffs with climbing equipment to perform construction of ledges; and c) if murres do not colonize ledges soon after ledges are built, greater logistical difficulties would be involved with accessing cliffs to implement social attraction techniques (see below). Overall, we believe that artificial ledges could be successfully employed and would be used by murres, with no sea lion issues and reduced human disturbance but resulting in a smaller self sustaining colony that may still be susceptible to some impacts from pelicans, gulls, and boat disturbances.

Social attraction

Social attraction techniques employ decoys, sound playback of vocalizations, and mirrors to attract seabirds to attend and breed at desired locations, usually historic colonies where breeding is no longer occurring (Kress and Nettleship 1988; Kress, 1997, 1998). This technique has been used to restore colonies of various species of seabirds, notably the successful restoration of the Devil's Slide Rock murre colony in central California (Parker et al. 2007). Murres respond to high levels of social stimuli that attract them to potential breeding sites and to initiate breeding. With high breeding site fidelity and high natal philopatry, they do not often initiate new colonies or re-use extirpated colony habitats (Carter et al. 2001; Manuwal and Carter 2001). Thus, restoring or establishing new breeding sites may require artificial social stimuli mimicking an actual established colony.

Because murres still breed at Redding Rock, some natural social stimuli for prospecting birds already exists. These current breeders may be at least partly responsible for attracting high attendance of non-actively breeding birds in 2006-2008. Given an active colony of murres on the rock, and recent attendance from large numbers of non-actively breeding birds, murres may use restored habitats shortly after being provided with protection from sea lion and other disturbance. Under this scenario, social attraction may not be needed to restore murres to a larger population size at Redding Rock. However, such success is not guaranteed and all factors affecting the achievement of larger population sizes may not have been fully assessed.

We suggest that social attraction not be conducted for at least two breeding seasons after sea lion barriers or artificial ledges are built. If breeding or extensive attendance by murres occurs within two years, sufficient evidence of restoration success will have been obtained to avoid the need for social attraction, saving much cost and effort. Close monitoring of murre attendance at the rock would be needed to: a) determine if murres are visiting or breeding in historic nesting areas or new ledges; b) to ascertain the effectiveness of sea lion barriers and assess any harm to sea

lions; and c) to detect any other forms of disturbance. If murres do not begin breeding or exhibiting behavior strongly suggestive of impending breeding in these areas within two years and no other factors are preventing attendance or breeding, then social attraction may become an option to assist more rapid development of breeding in these areas. If necessary, a social attraction design would entail plots of murre decoys (adults, eggs, and chicks) placed in desired breeding areas, a solar-powered sound system playing vocalizations recorded at a large murre colony, and mirrors. To visiting murres, reflections of decoys in mirrors make the colony appear larger, and reflections of moving live birds (including themselves) provide even greater apparent movement of birds among immobile decoys. Each decoy would be placed by drilling a hole in the rock and inserting a metal rod attached to the decoy into the hole. Other equipment, such as solar arrays and mirrors, must be bolted to the rock to prevent loss.

Maintenance of social attraction equipment requires at least two visits per year. Initial deployment of decoys, mirrors and the sound system would occur in late winter (January-February) weather permitting. Following the breeding season (August-September), decoys are removed for cleaning and repairs and the sound system is disconnected. In some cases, malfunctions or loss of power can result in sound system loss. If a malfunction is discovered, additional trips can be required (if possible without impacting attending murres) to restore sound. However, landings on the rock cannot occur once egg laying has been initiated because of the potential for substantial disturbance to murres, other breeding seabirds, and sea lions.

Reduction of human disturbance

If either sea lion barriers or artificial ledges are employed, prevention of human disturbance is critical for the successful restoration of murres on Redding Rock. In particular, USCG personnel must not land on the rock during the breeding season for basic maintenance of the ATON. Communications with USCG prior to the breeding season in March each year are needed to remind USCG personnel of the terms of the Right-of-Way agreement with BLM. The terms of the Right-of-Way also should be revisited to consider prohibiting access during the breeding season even when the ATON malfunctions. In addition, low over flights need to be prevented and if artificial ledges are chosen for restoration than a special boat closure within 200 m of the rock is needed to help prevent disturbance to those more susceptible low lying areas.

LITERATURE CITED

Ainley, D.G. and R.J. Boekelheide (Eds.). 1990. Seabirds of the Farallon Islands: ecology and dynamics of an upwelling system community. Stanford University Press, Stanford, California.

Ainley, D.G., H.R. Carter, D.W. Anderson, K.T. Briggs, M.C. Coulter, F. Cruz, J.B. Cruz, C.A. Valle, S.I. Fefer, S.A. Hatch, E.A. Schreiber, R.W. Schreiber, and N.G. Smith. 1988. Effects of the 1982-1983 El Niño-Southern Oscillation on Pacific Ocean bird populations International. Ornithology Congress 1986:1747-1758.

Ainley, D. G., D. N. Nettleship, H. R. Carter, and A. E. Storey. 2002. Common Murre (*Uria aalge*). *In* A. Poole and F. Gill (Eds.). The Birds of North America, No. 666, The Birds of North America, Inc., Philadelphia, Pennsylvania.

Angliss, R.P. and B. M. Allen. 2007. Steller Sea Lion (*Eumetopius jubatus*) Eastern U.S. Stock. NOAA-TM- AFSC-193.

Bearss, E.C. 1969. History basic data: Redwood National Park, Del Norte and Humboldt Counties, California. U.S. Department of Interior, National Park Service, Washington, D.C.

Birkhead, T.R., and D.N. Nettleship. 1987. Ecological relationships between Common Murres, *Uria Aalge*, and Thick-billed Murres, *Uria lomvia*, at the Gannet Islands, Labrador. I. Morphometrics and timing of breeding. Canadian Journal of Zoology 65:1621-1629.

Boekelheide, R.J., D.G. Ainley, S.H. Morrell, H.H. Huber, and T.J. Lewis. 1990. Common Murre. Pages 245-275 *in* D.G. Ainley and R.J. Boekelheide (eds.), Seabirds of the Farallon Islands: ecology and dynamics of an upwelling system community. Stanford University Press, Stanford, California.

Bonnell, M.L., M.O. Pierson, and G.B. Farrens. 1983. Pinnipeds and sea otters of central and northern California: status, abundance, and distribution. Unpublished report, Center for Marine Studies, University of California, Santa Cruz, California.

Briggs, K.T., W.B. Tyler, D.B. Lewis, and K.F. Dettman. 1983. Seabirds of central and northern California, 1980-1983: Status, abundance, and distribution. Unpublished report, Center for Marine Studies, University of California, Santa Cruz, California.

Bureau of Land Management. 2005. California Coastal National Monument, Resource Management Plan. U.S Department of the Interior, Bureau of Land Management, California State Office, Sacramento, California.

Capitolo, P.J., G.J. McChesney, H.R. Carter, M.W. Parker, J.N. Hall, R.J. Young, and R.T. Golightly. 2006. Whole-colony counts of Common Murres, Brandt's Cormorants and Double-crested Cormorants at sample colonies in northern and central California, 1996-2004. Unpublished report, Department of Wildlife, Humboldt State University, Arcata,

California; and U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California. 40 pp.

Capitolo, P.J., G.J. McChesney, H.R. Carter, and S.J. Rhoades. 2009. Breeding population estimates for sample colonies of Western Gulls, California Gulls, and Caspian Terns in northern and central California, 2006-2008. Unpublished report, Humboldt State University, Department of Wildlife, Arcata, California and U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California. 22 p.

Capitolo, P.J., G.J. McChesney, J.N. Davis, W.B. Tyler and H.R. Carter. 2010. Aerial photographic surveys of breeding colonies of Brandt's Cormorants, Double-crested Cormorants, Common Murres, and other seabirds in California, 2008-2009. Unpublished report, University of California, Institute of Marine Sciences, Santa Cruz, California. 26p.

Capitolo, P.J., H.R. Carter, G.J. McChesney, and M.W. Parker. 2005. Common Murres prospecting within cormorant colonies in Del Norte and Humboldt Counties, California, 1996-2004. Northwestern Naturalist 86:144-150.

Carter, H.R. and K.A. Hobson. 1988. Creching behavior of Brandt's Cormorant chicks. Condor 90:395-400.

Carter, H.R., G.J. McChesney, D.L. Jaques, C.S. Strong, M.W. Parker, J.E. Takekawa, D.L. Jory, and D.L. Whitworth. 1992. Breeding populations of seabirds in California, 1989-1991. Vols. 1 and 2. Unpublished draft report, U. S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Dixon, California.

Carter, H.R. G.J. McChesney, J.E. Takekawa, L.K. Ochikubo, D.L. Whitworth, T.W. Keeney, W.R. McIver, and C.S. Strong. 1996. Population monitoring of seabirds in California: 1993-1995 aerial photographic surveys of breeding colonies of Common Murres, Brandt's Cormorants, and Double-crested Cormorants. Unpublished report, U.S. Geological Survey, Biological Resources Division, California Science Center, Dixon, California. 213 pp.

Carter, H.R., U.W. Wilson, R.W. Lowe, D.A. Manuwal, M.S. Rodway, J.E. Takekawa, and J.L.Yee. 2001. Population trends of the Common Murre (*Uria aalge californica*). Pp. 33-133 *in* Manuwal, D.A., H.R. Carter, T.S. Zimmerman, and D.L. Orthmeyer (eds.), Biology and conservation of the Common Murre in California, Oregon, Washington, and British Columbia. Volume 1: Natural History and population trends. U.S. Geological Survey, Information and Technology Report, USGS/BRD/ITR-2000-0012, Washington, D.C.

Carter H.R., V.A. Lee, G.W. Page, M.W. Parker, R.G. Ford, G. Swartzman, S.W. Kress, B.R. Siskin, S.W. Singer, and D.M. Fry. 2003a. The 1986 *Apex Houston* oil spill in central California: seabird injury assessments and litigation process. Marine Ornithology 31:9-19.

Carter, H.R., P.J. Capitolo, M.W. Parker, R.T. Golightly, and J.L. Yee. 2003b. Population Impacts to Common Murres at the drake's Bay Colony Complex, California. Pages 43-67

in H.R. Carter, and R.T. Golightly (Eds.). Seabird injuries from the 1997-1998 Point Reyes Tarball Incidents. Unpublished report, Humboldt State University, Department of Wildlife, Arcata, California.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, and M Muto. 2007. U.S. Pacific marine mammal stock assessments: 2007. NOAA Tech. Memo. NMFS-SWFSC-414.

DeLong, R.L., G.A. Antonelis, C.W. Oliver, B.S. Stewart, M.S. Lowry, and P.K. Yochem. 1991. Effects of the 1982-1983 El Niño on several population parameters and diet of California sea lions on the California Channel Islands. Pages 166-172 *in* F. Trillmich and K.A. Ono (eds.), Pinnipeds and El Niño: Responses to environmental stress. Springer-Verlag, Berlin Heidelberg New York.

Eigner, L.E. 2009. Spatial and temporal variation in prey use of Common Murres at two disjunct colonies in the California Current system. Unpublished M.A. thesis, Humboldt State University, Arcata, California.

Hastings, K., M. Hester, J. Nusbaum, P. Pyle, and W. Sydeman. 1999. Common Murre (*Uria aalge*) attendance patterns on the South Farallon Islands during the non-breeding season, 1996-1999. Unpublished report, Point Reyes Bird Observatory, Stinson Beach, California.

Hayward, T. A., A.W. Mantyla, R.J. Lynn, P.E. Smith, and T.K. Chereskin. 1994. The state of the California Current in 1993-1994. California Cooperative Oceanic Investigations Reports 35:19-35.

Jones, N.M., G.J. McChesney, M.W. Parker, J.L. Yee, H.R. Carter, and R.T. Golightly. 2008. Breeding phenology and reproductive success of the Brandt's Cormorant at three nearshore colonies in central California, 1997-2001. Waterbirds 31:505-519.

Kress, S. W. 1997. Using animal behavior for conservation: case studies in seabird restoration from the Maine Coast, USA. Journal of the Yamashina Institute for Ornithology 29: 1-26.

Kress, S. W. 1998. Applying research for effective management: case studies in seabird restoration. Pages 141-154 in Avian Conservation (J. M. Marzluff and R. Sallabanks, Eds.). Island Press, Washington, DC.

Kress, S. W. and D. N. Nettleship. 1988. Re-establishment of Atlantic Puffins (*Fratercula arctica*) at a former breeding site in the Gulf of Maine. Journal of Field Ornithology 59: 161-170.

Kure Trustee Council. 2008. *Kure*/Humboldt Bay oil spill: final damage assessment and restoration plan/environmental assessment. Prepared by California Department of Fish and Game and U.S. Fish and Wildlife Service.

Lee, D., Nur, N., and W.J. Sydeman. 2007. Climate and demography of the planktivorous Cassin's Auklet, *Ptychoramphus aleuticus* off northern California: implications for population change. Journal of Animal Ecology 76:337-347.

Luckenbach Trustee Council. 2006. *S.S. Jacob Luckenbach* and Associated Mystery Oil Spills Final Damage Assessment and Restoration Plan/Environmental Assessment. Prepared by California Department of Fish and Game, National Oceanic and Atmospheric Administration, United States Fish and Wildlife Service, National Park Service.

Manuwal, D.A., and H.R. Carter. 2001. Natural history of the Common Murre (*Uria aalge californica*). Pages 1-32 *in* D. A. Manuwal, H. R. Carter, T. S. Zimmerman, and D. L. Orthmeyer (Eds.). Biology and conservation of the Common Murre in California, Oregon, Washington, and British Columbia. Volume 1: Natural history and population trends. U.S. Geological Survey. U.S. Geological Survey, Information and Technology Report USGS/BRD/ITR-2000-0012, Washington, D.C.

McChesney, G.J. 1997. Breeding biology of the Brandt's Cormorant (*Phalacrocorax penicillatus*) at San Nicolas Island, California. Unpublished M.S. thesis, California State University, Sacramento, California.

McChesney, G.J., H.R. Carter, M.W. Parker, J.E. Takekawa and J.L. Yee. 1998. Population trends and subcolony use of Common Murres and Brandt's Cormorants at Point Reyes Headlands, California, 1979-1997. Unpublished report, U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, Dixon, California; Humboldt State University, Department of Wildlife, Arcata, California; and U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California.

McChesney, G.J., H.R. Carter, M.W. Parker, P.J. Capitolo, J.E. Takekawa, and J.L. Yee. 1999. Population trends and subcolony use of Common Murres and Brandt's Cormorants at the Castle/Hurricane Colony Complex, California 1979-1997. Unpublished report, U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, Dixon, California; Humboldt State University, Department of Wildlife, Arcata, California; and U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California.

McChesney, G.J., D.N. Lontoh, S.J. Rhoades, K.A. Borg, E.L. Donnelly, M.E. Gilmour, P.J. Kappes, L.E. Eigner, and R.T. Golightly. 2009. Restoration of Common Murre colonies in central California: annual report 2008. Unpublished report, U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California.

Nur, N. and W.J. Sydeman. 2002. Statistical analysis of the 'k' correction factor used in population assessments of murres: implications for monitoring. Unpublished report, PRBO Conservation Science, Stinson Beach, California.

Osborne, T.O. 1972. Ecology and avian use of the coastal rocks of northern California. Unpublished M.A. thesis, Humboldt State University, Arcata, California.

Osborne, T.O., and J.G. Reynolds. 1971. California seabird breeding ground survey 1969-1970. Unpublished report, California Department of Fish and Game, Wildlife Management Branch Administrative Report 71-3, Sacramento, California.

Parker, M. W., J.A. Boyce, E.N. Craig, H. Gellerman, D.A. Nothhelfer, R.J. Young, S.W. Kress, H.R. Carter, and G.A. Moore. 1999. Restoration of Common Murre colonies in central coastal California: annual report 1998. Unpublished report. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California.

Parker, M.W., S.W. Kress, R.T. Golightly, H.R. Carter, E.B. Parsons, S.E. Schubel, J.A. Boyce, G.J. McChesney, and S.M. Wisely. 2007. Assessment of social attraction techniques to restore a Common Murre colony in central California. Waterbirds 30:17-28.

Parker, M.W., J.A. Boyce, E.N. Craig, H. Gellerman, D.A. Nothhelfer, R.J. Young, S.W. Kress, H.R. Carter, and G. Moore. 1999. Restoration of Common Murre Colonies in Central Coastal California: Annual Report 1998. Unpublished report, U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California.

Penniman, T.M., M.C. Coulter, L.B. Spear, and R.J. Boekelheide. 1990. Western Gull. Pages 218-244 *in* D.G. Ainley and R.J. Boekelheide (eds.), Seabirds of the Farallon Islands: ecology and dynamics of an upwelling system community. Stanford University Press, Stanford, California.

Pitcher, K.W., V.N. Burkanov, D.G. Calkins, B.J. Le Boeuf, E.G. Mamaev, R.L. Merrick, and G.W. Pendleton. 2001. Spatial and temporal variation in the timing of births of Steller Sea Lions. Journal of Mammalogy 82:1047-1053.

Rojek, N.A., M.W. Parker, H.R. Carter, and G.J. McChesney. 2007. Aircraft and vessel disturbances to Common Murres at breeding colonies in central California, 1997-1999. Marine Ornithology 35:67-75.

Roemmich, D. and J. McGowan. 1995. Climatic warming and the decline of zooplankton in the California Current. Science 267:1324-1326.

Saenz, B.L., J.A. Thayer, W.J. Sydeman, and D.A. Hatch. 2006. An urban success story: breeding seabirds on Alcatraz Island, California. Marine Ornithology 34:43-49.

Scammon, C.M. 1874. The marine mammals of the north-western coast of North America, described and illustrated: together with an account of the American whale fishery. John H. Carmany and Company, San Francisco, California.

Sowls . A.L., A.R. Degange, J.W. Nelson, and G.S. Lester. 1980. Catalog of California seabird colonies. U.S. Department of Interior, Fish and Wildl. Serv., Biol. Serv. Prog. FWS/OBS/37/80.

Stuyvesant Trustee Council. 2007. *Stuyvesant*/Humboldt coast oil spill: final damage assessment and restoration plan/environmental assessment. Prepared by California Department of Fish and Game, California State Lands Commission, and U.S. Fish and Wildlife Service.

Sydeman, W.J., H.R. Carter, J.E. Takekawa, and N. Nur. 1997. Common Murre (*Uria aalge*) population trends at the South Farallon Islands, California, 1985-1995. Unpublished report, Point Reyes Bird Observatory, Stinson Beach, California; U.S. Geological Survey, Dixon, California; and U.S. Fish and Wildlife Service, Newark, California.

Sydeman, W.J., and S.G. Allen. 1999. Pinniped population dynamics in central California: correlations with sea surface temperature and upwelling indices: Marine Mammal Science 15: 446-461.

Sydeman, W.J., M.M. Hester, J.A. Thayer, F. Gress, P. Martin and J. Buffa. 2001. Climate change, reproductive performance and diet composition of marine birds in the southern California Current system, 1969-1997. Progress in Oceanography 49: 309-329.

Takekawa, J.E., H.R. Carter, and T.E. Harvey. 1990. Decline of the Common Murre in central California, 1980-1986. Pages 149-163 *in* S. G. Sealy, (ed.), Auks at Sea. Studies in Avian Biology No. 14.

Thayer, J.A., W.J. Sydeman, N.P. Fairman, and S.G. Allen. 1999. Attendance and effects of disturbance on coastal Common Murre colonies on Point Reyes, California. Waterbirds 22: 130-139.

Thornbury, D.L. 1923. California's redwood wonderland Humboldt County. Sunset Press, San Francisco, California.

Trenberth, K.E., 1990. Recent observed interdecadal climate changes in the Northern Hemisphere. Bulletin of the American Meteorological Society 71: 988-993.

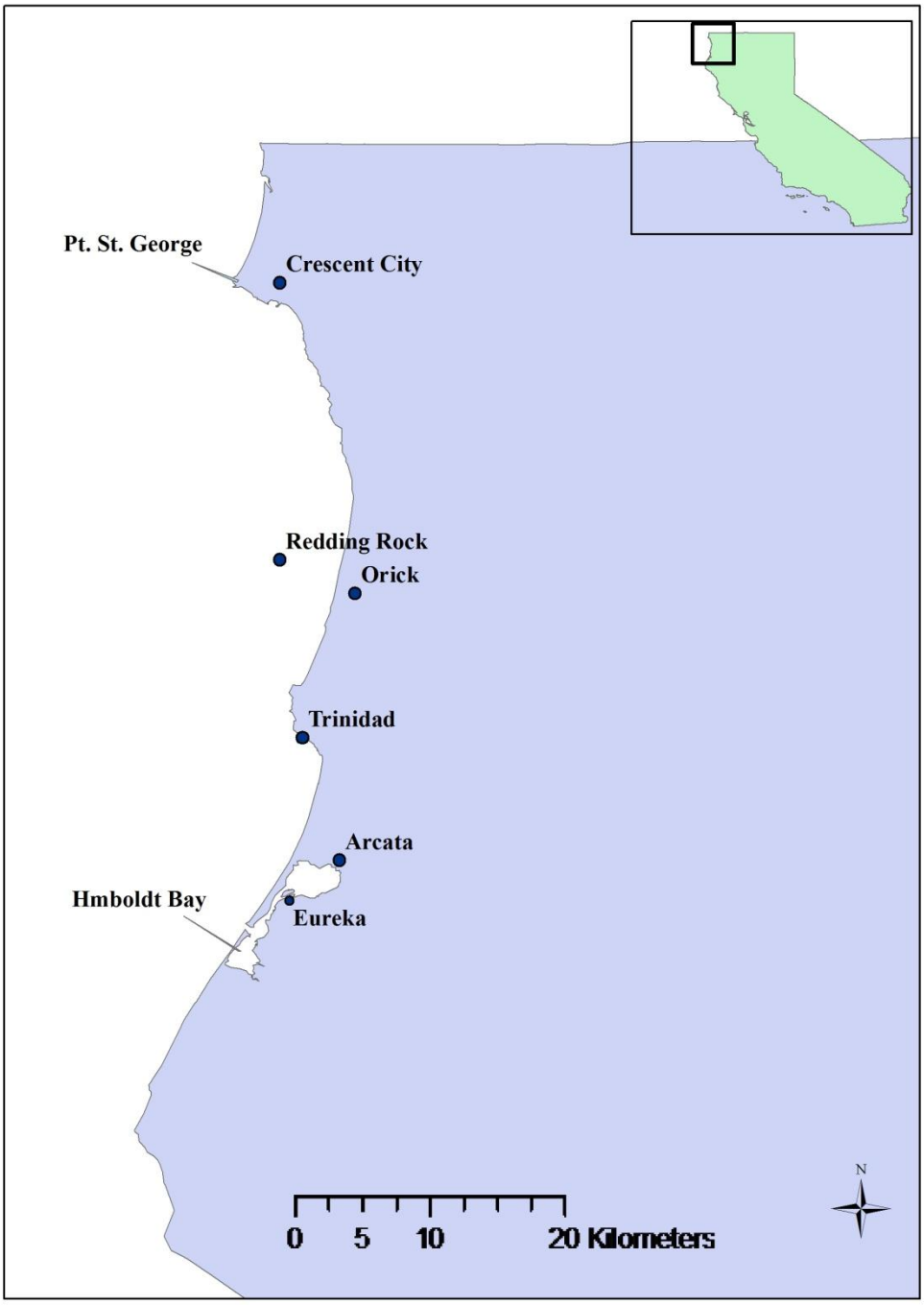


Figure 1. Location of Redding Rock on the northwest coast of California.

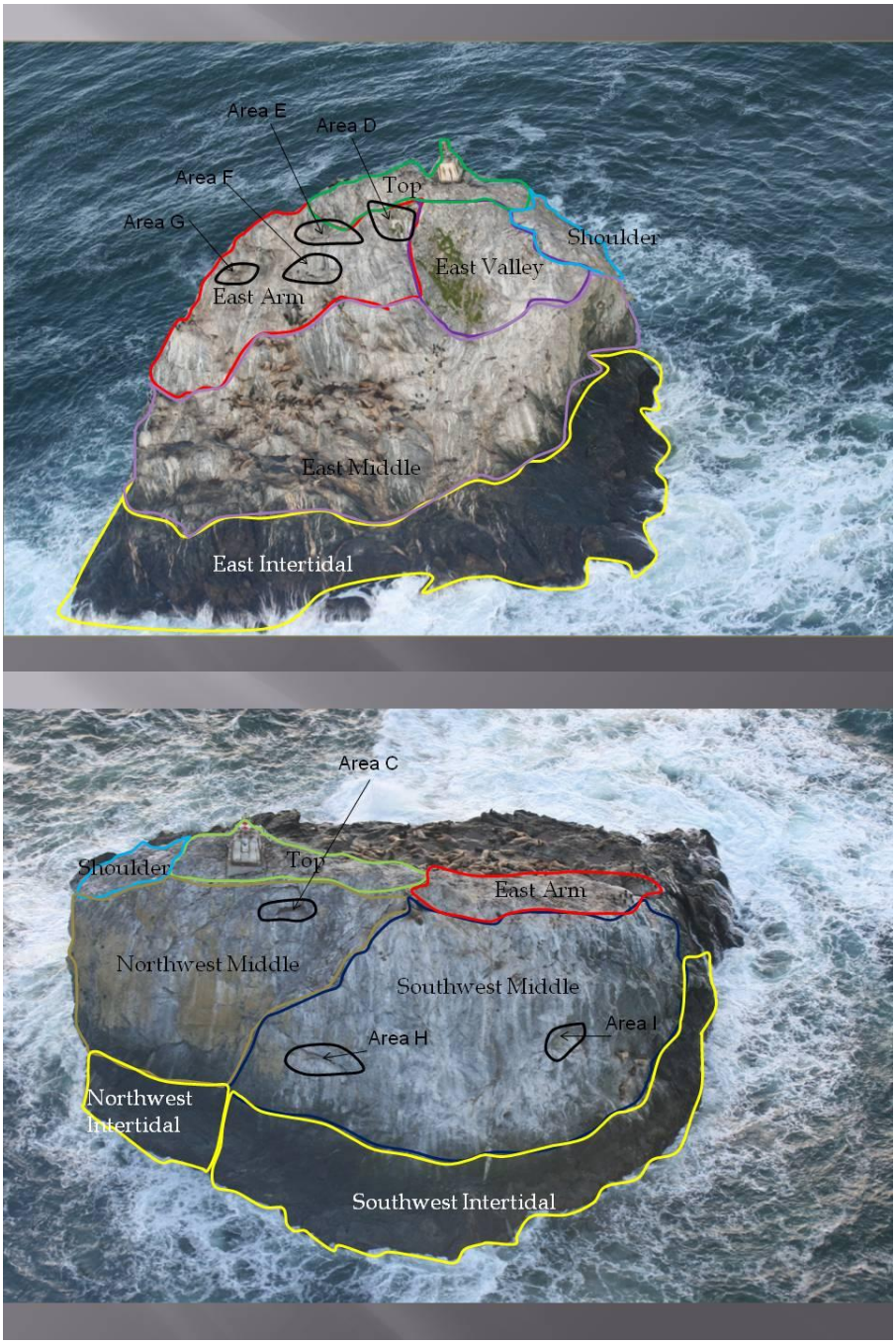


Figure 2**.** Delineation of count zones and areas on Redding Rock: a) east side (top photograph); and b) west side (bottom photograph).

Figure 3. Locations of sea lion survey sites and Common Murre reference colonies in relation to Redding Rock.

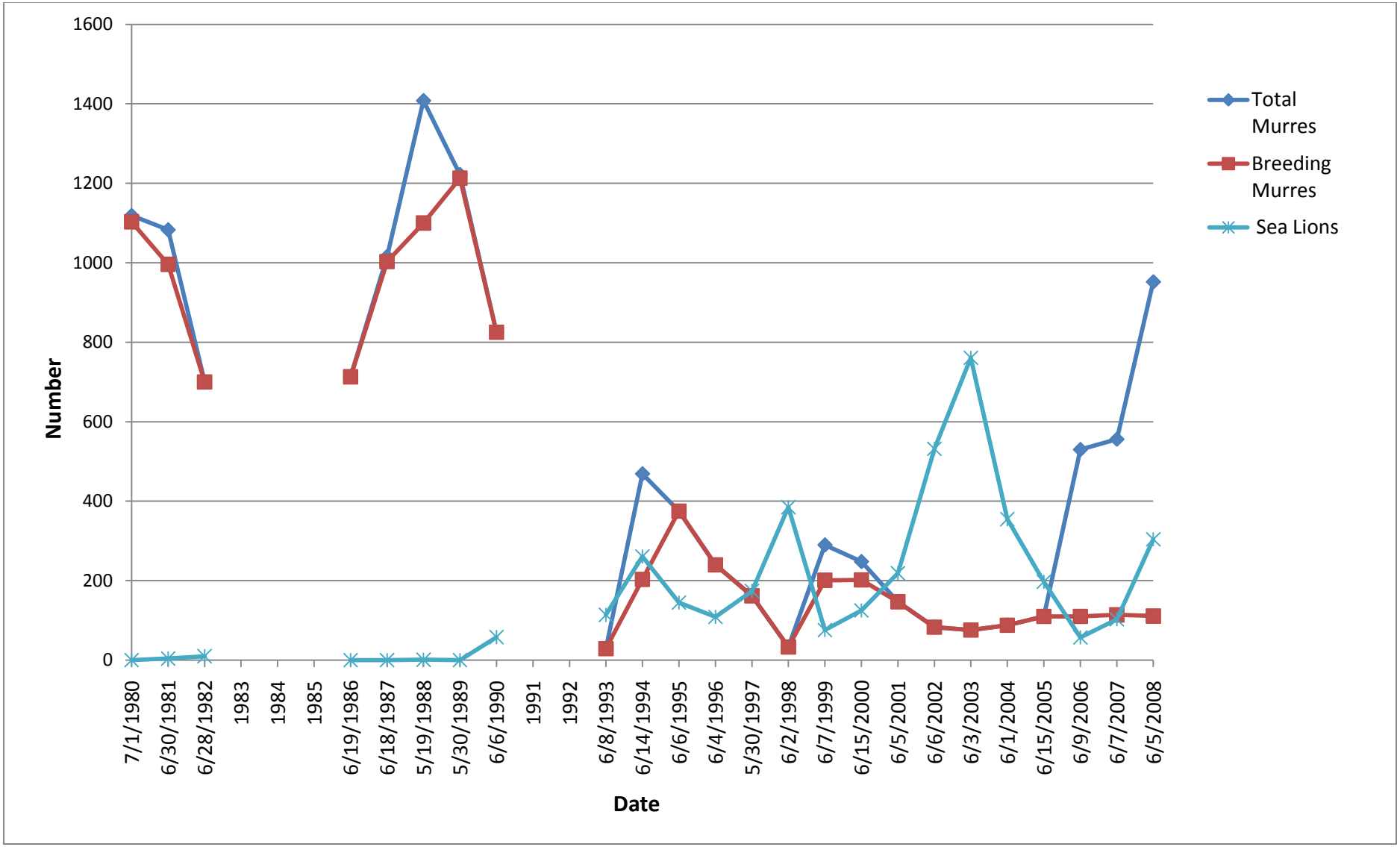


Figure 4. Numbers of Common Murres and total sea lions on Redding Rock from aerial photographs, 1980-2008 (see Tables 2 and 3). "Breeding Murres" includes birds from breeding areas only and "Total Murres" includes all murres counted.

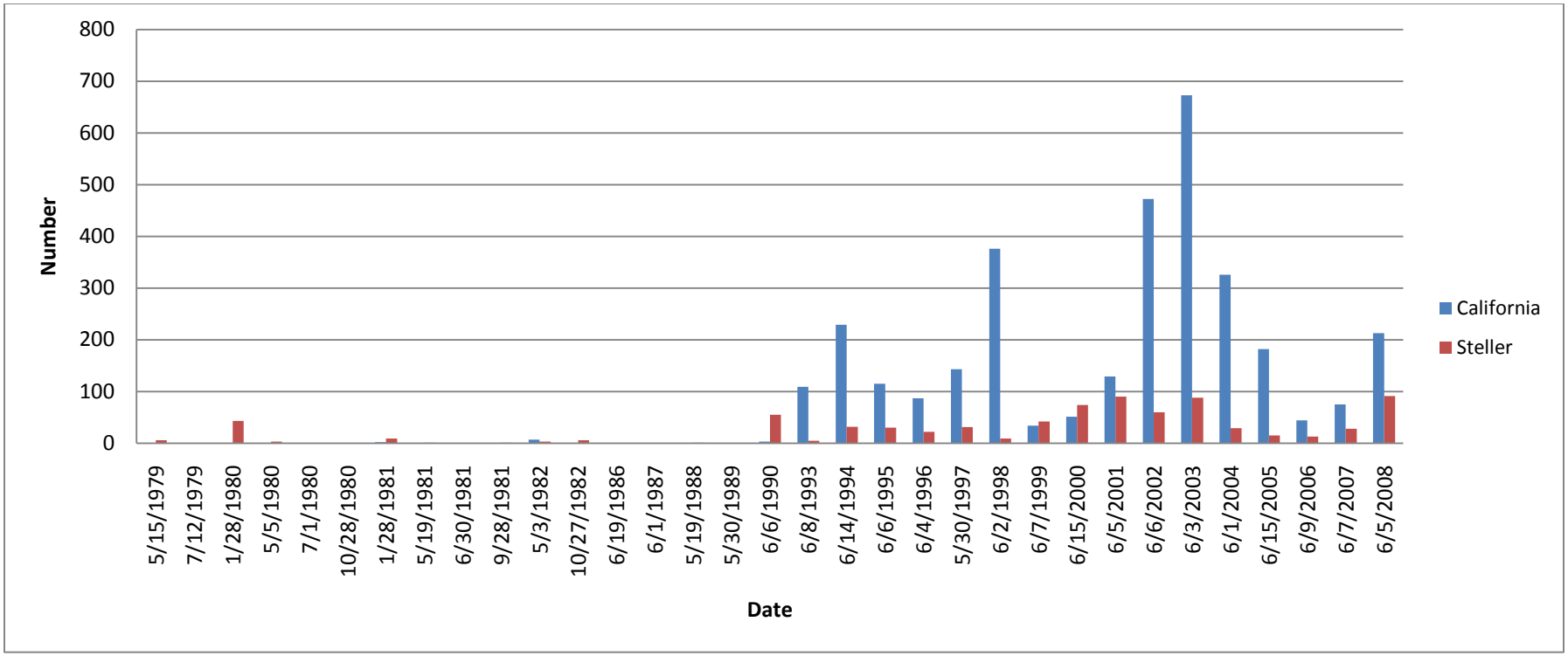


Figure 5. Numbers of Steller and California sea lions on Redding Rock from aerial photographs, 1979-2008. Counts do not include unidentified sea lions.

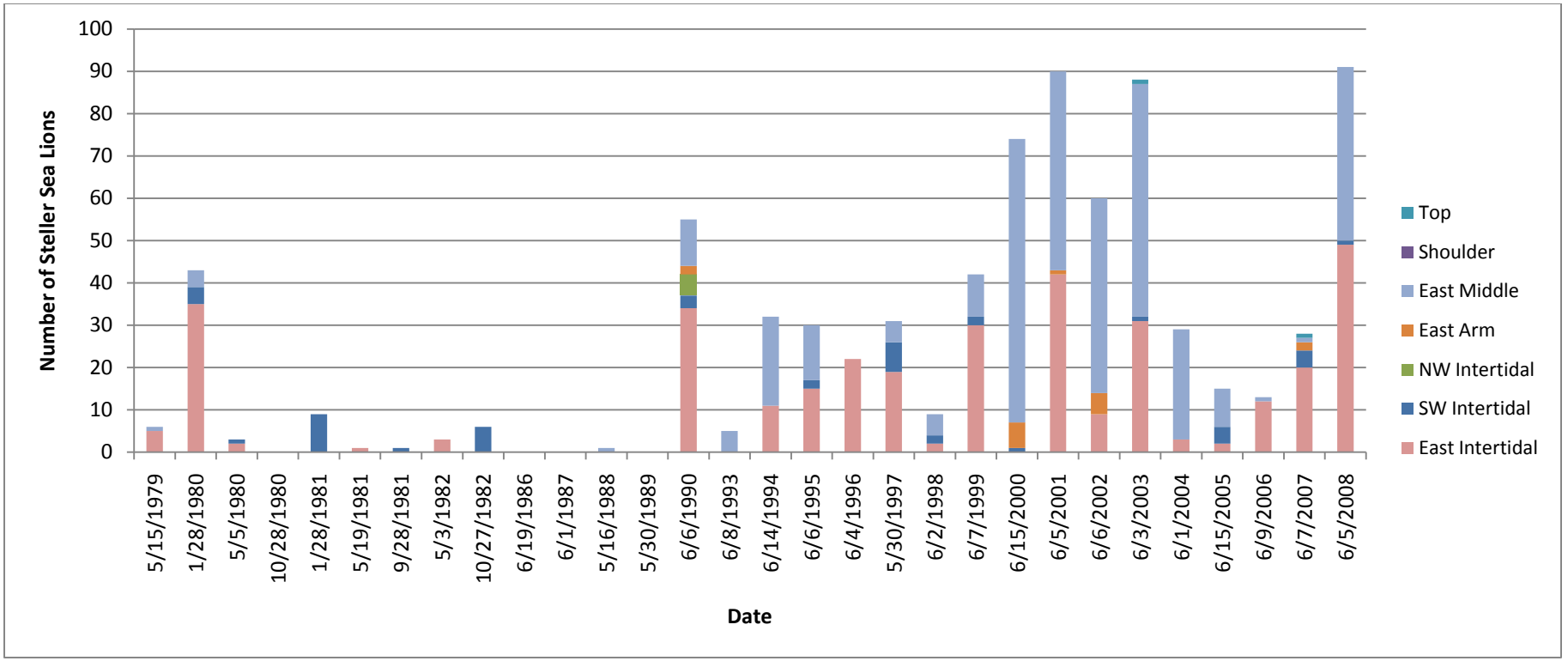


Figure 6. Steller sea lion distribution on Redding Rock from aerial photographs, 1979-2008.

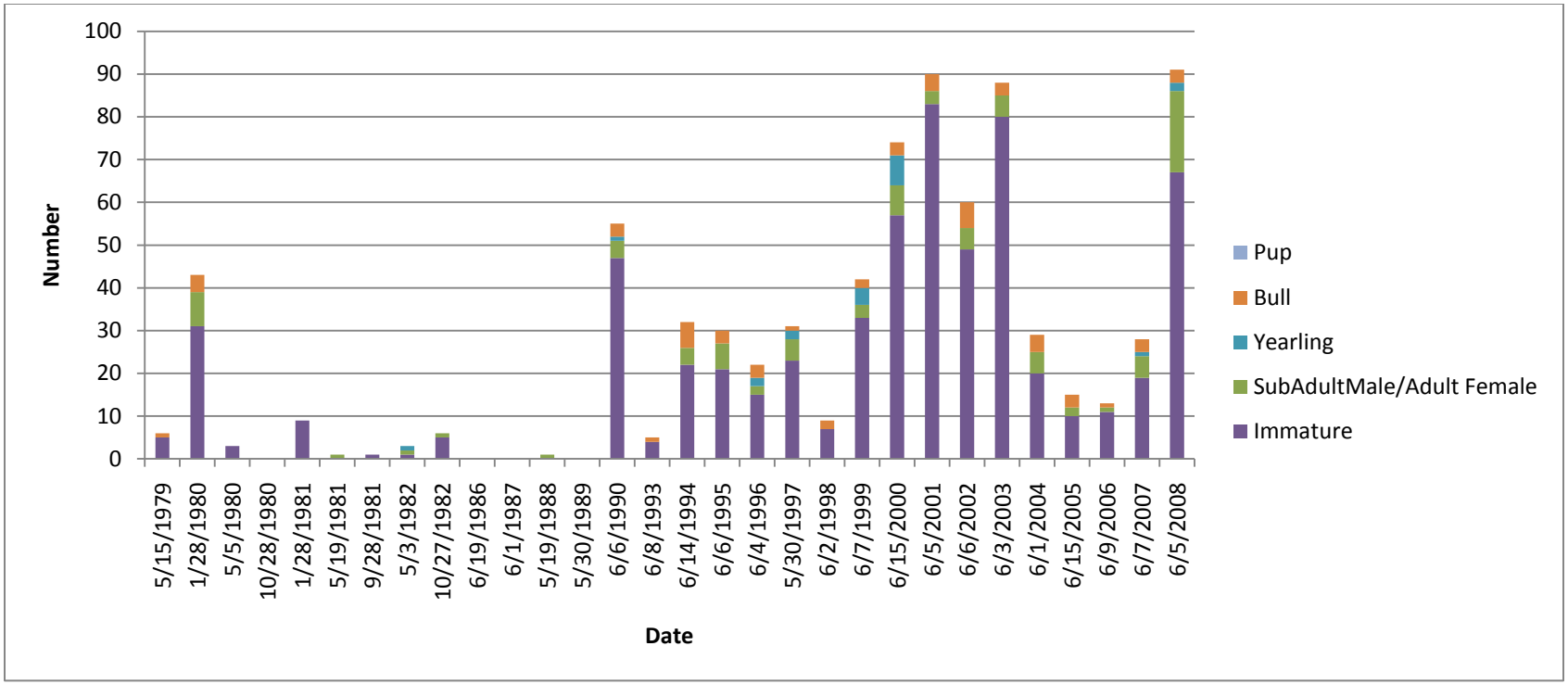


Figure 7. Age and sex categories of Steller sea lions on Redding Rock from aerial photographs, 1979-2008.

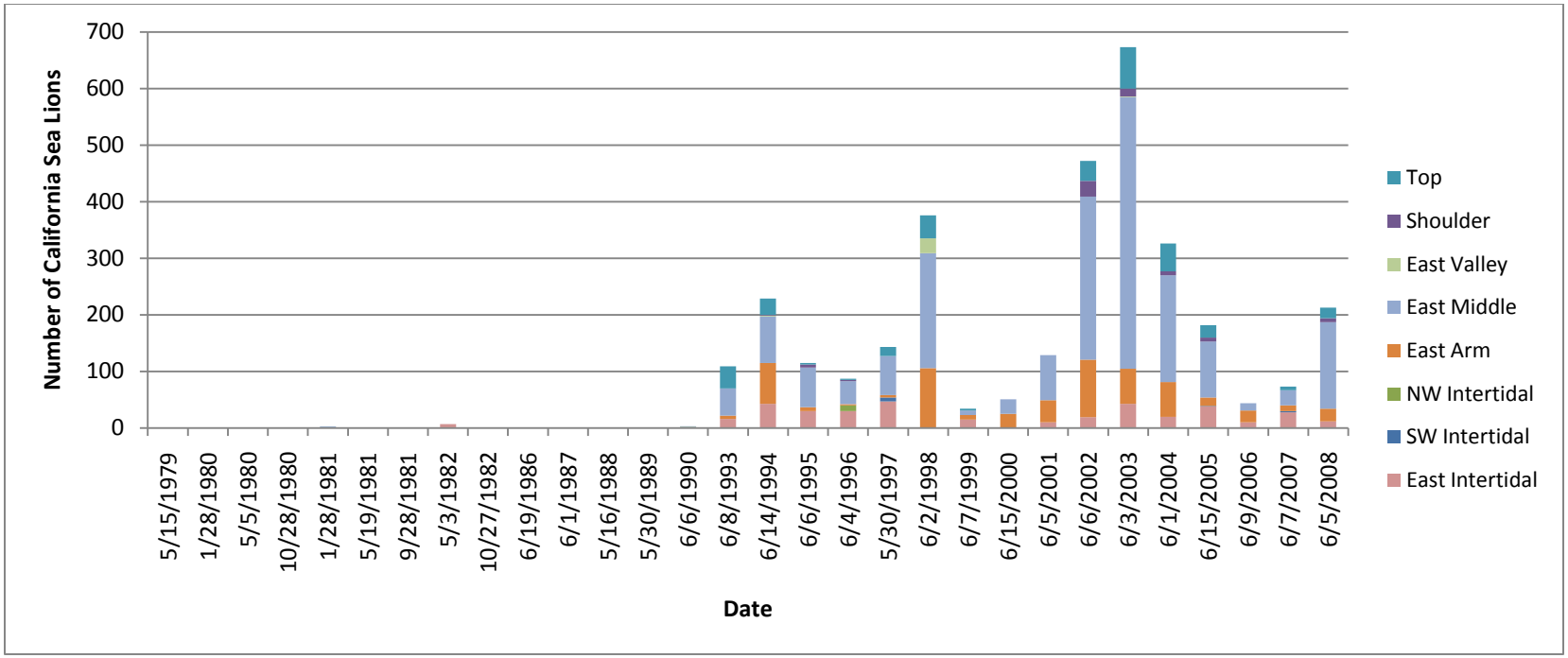


Figure 8. Distribution of California sea lions on Redding Rock from aerial photographs, 1979-2008.

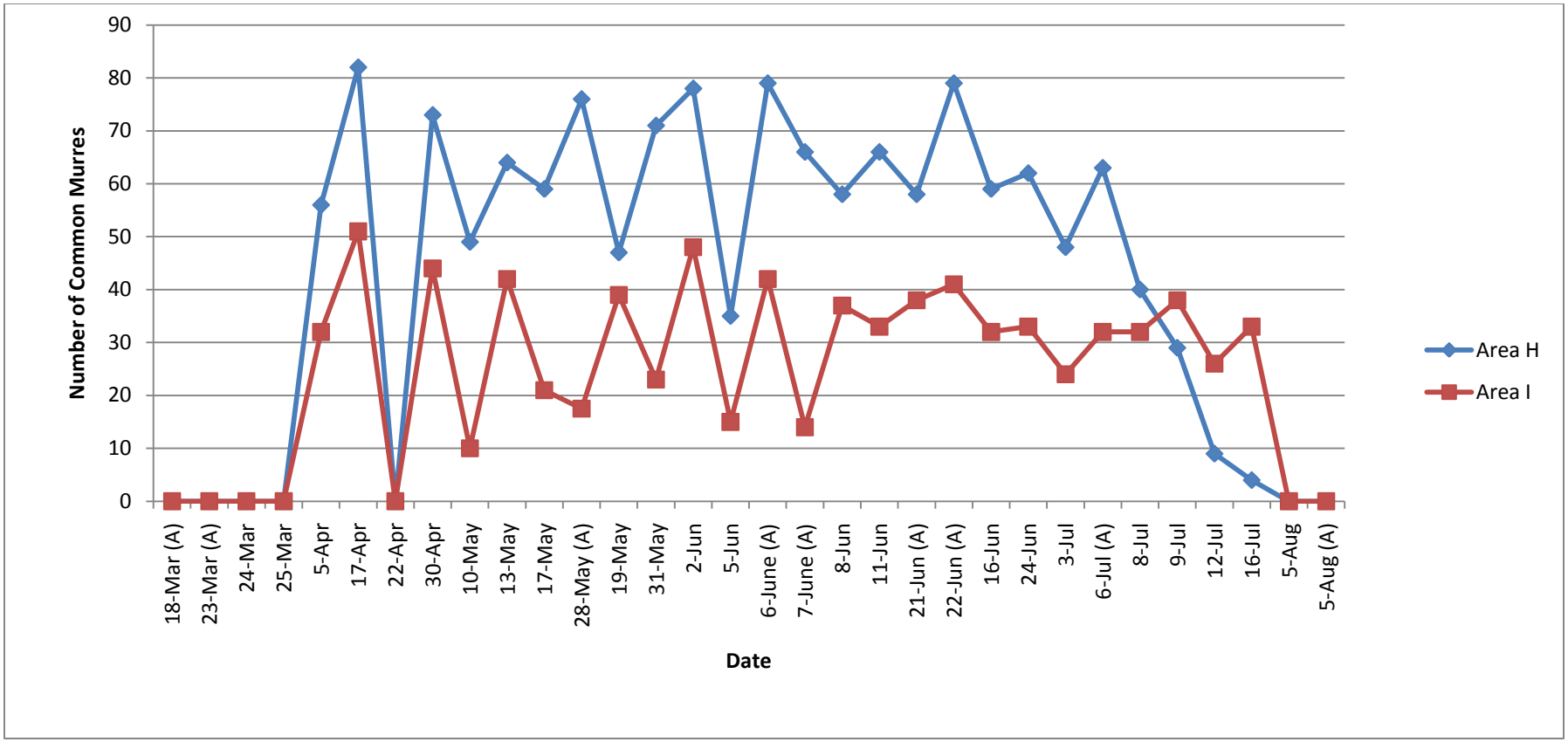


Figure 9. Numbers of Common Murres at Areas H and I on Redding Rock from boat and aerial photographic surveys, 18 March – 5 August 2009. Aerial surveys denoted by an (A).

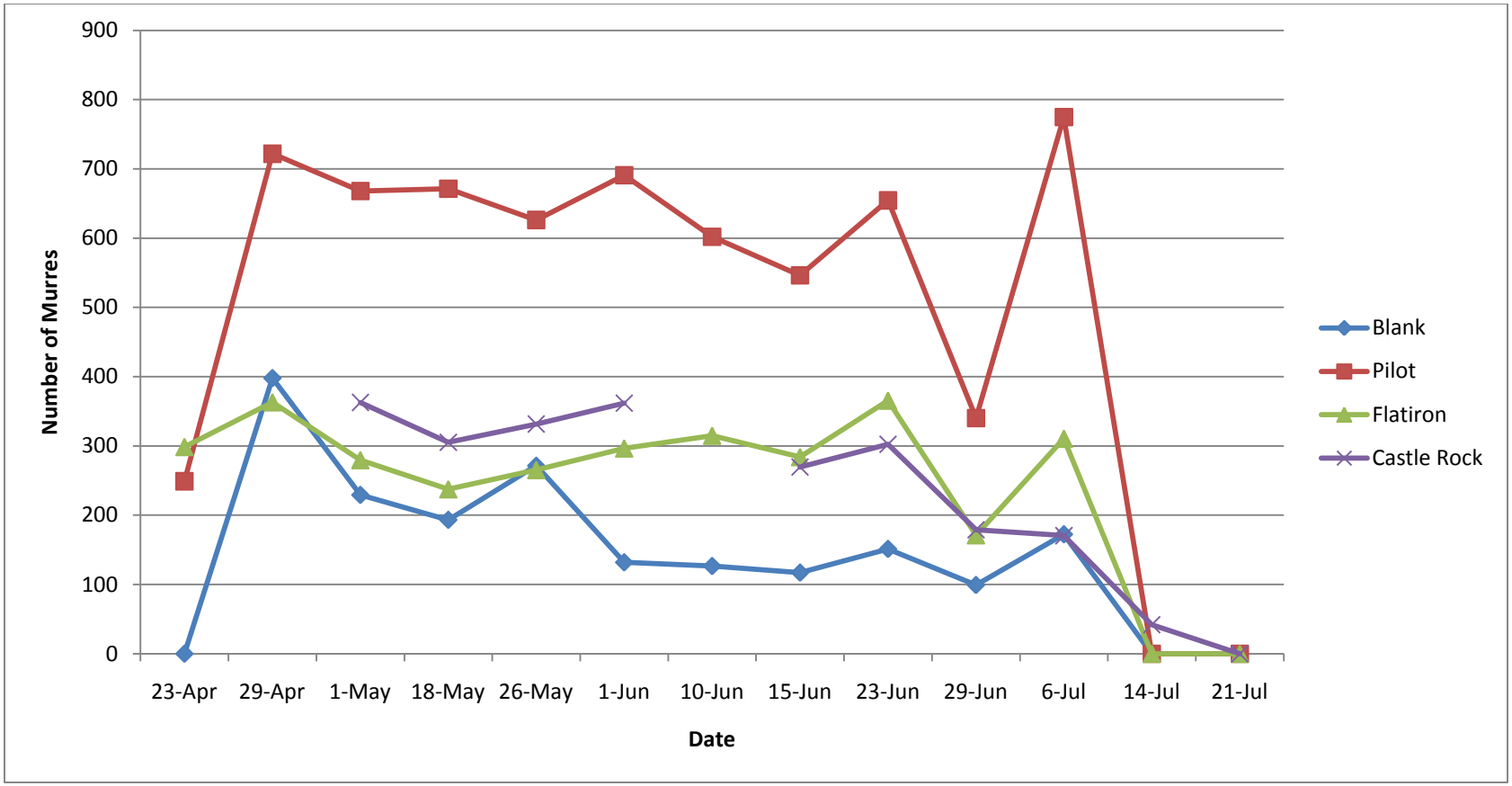


Figure 10. Weekly counts of Common Murres at Blank Rock, Pilot Rock, and subplots of Flatiron Rock and Castle Rock, April to July 2009.

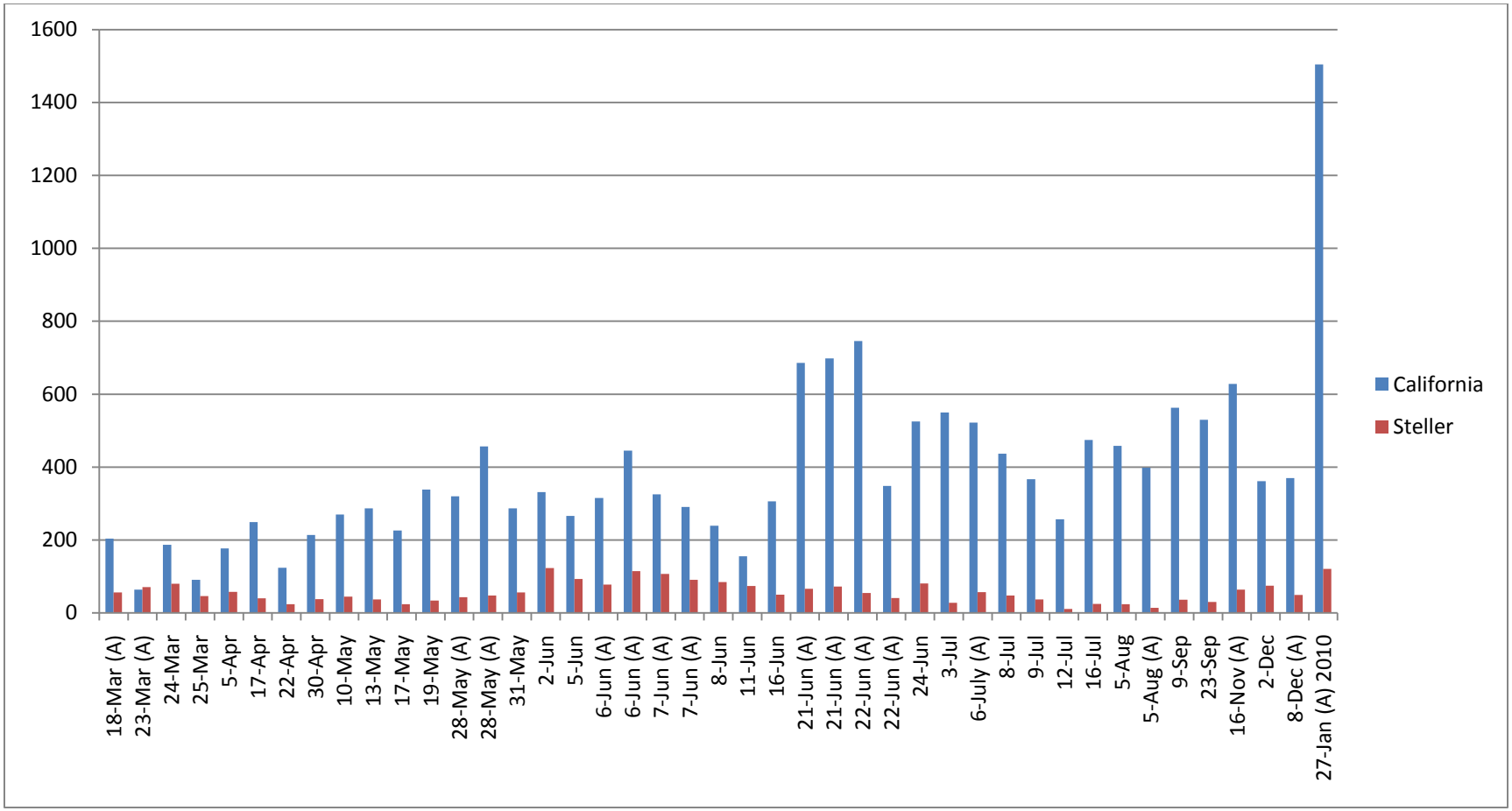


Figure 11**.** Numbers of Steller and California sea lions on Redding Rock from aerial and boat photographic surveys, March 2009 - January 2010. Aerial surveys are denoted by an (A). Counts do not include unidentified sea lions.

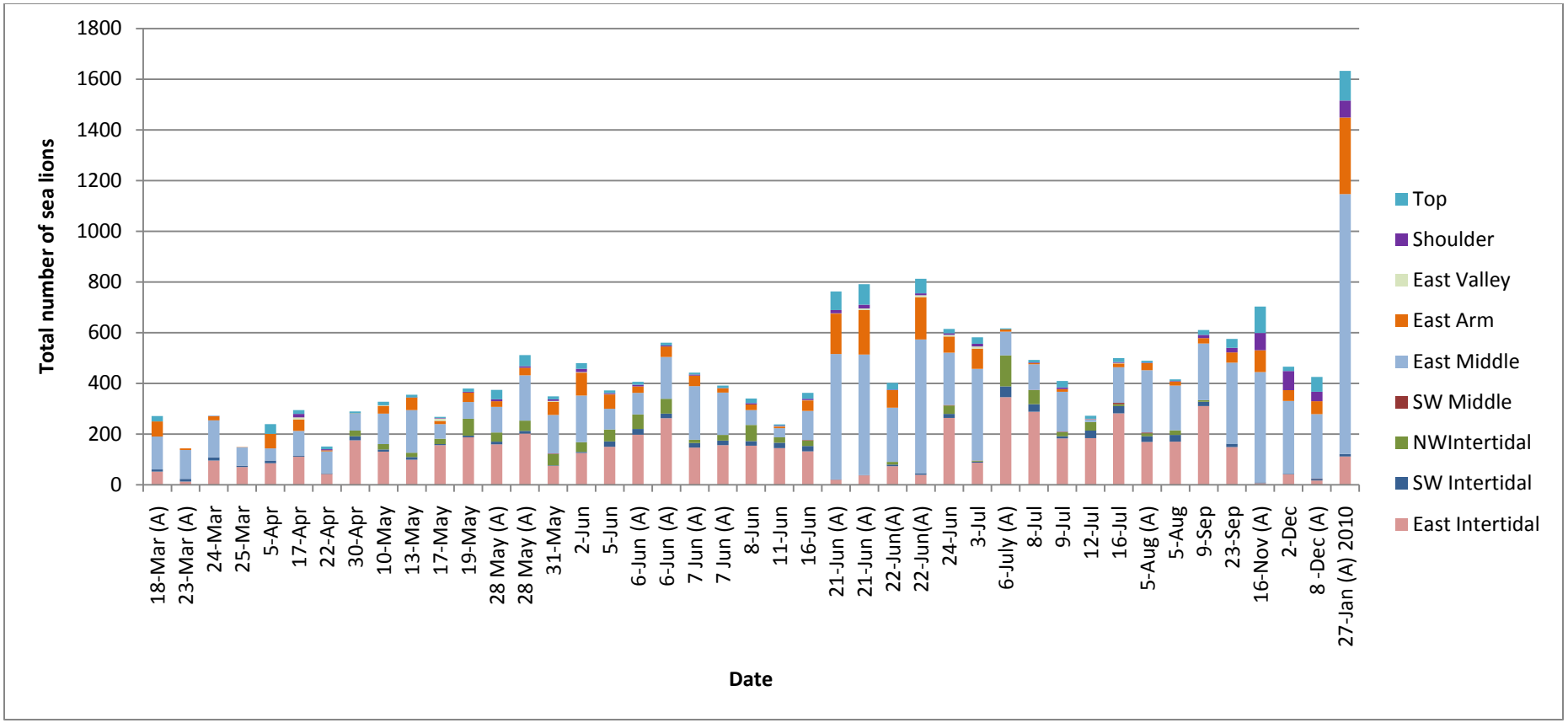


Figure 12. Distribution of total sea lions on Redding Rock from boat and aerial photographic surveys, March 2009 - January 2010. Aerial surveys are denoted by an (A).

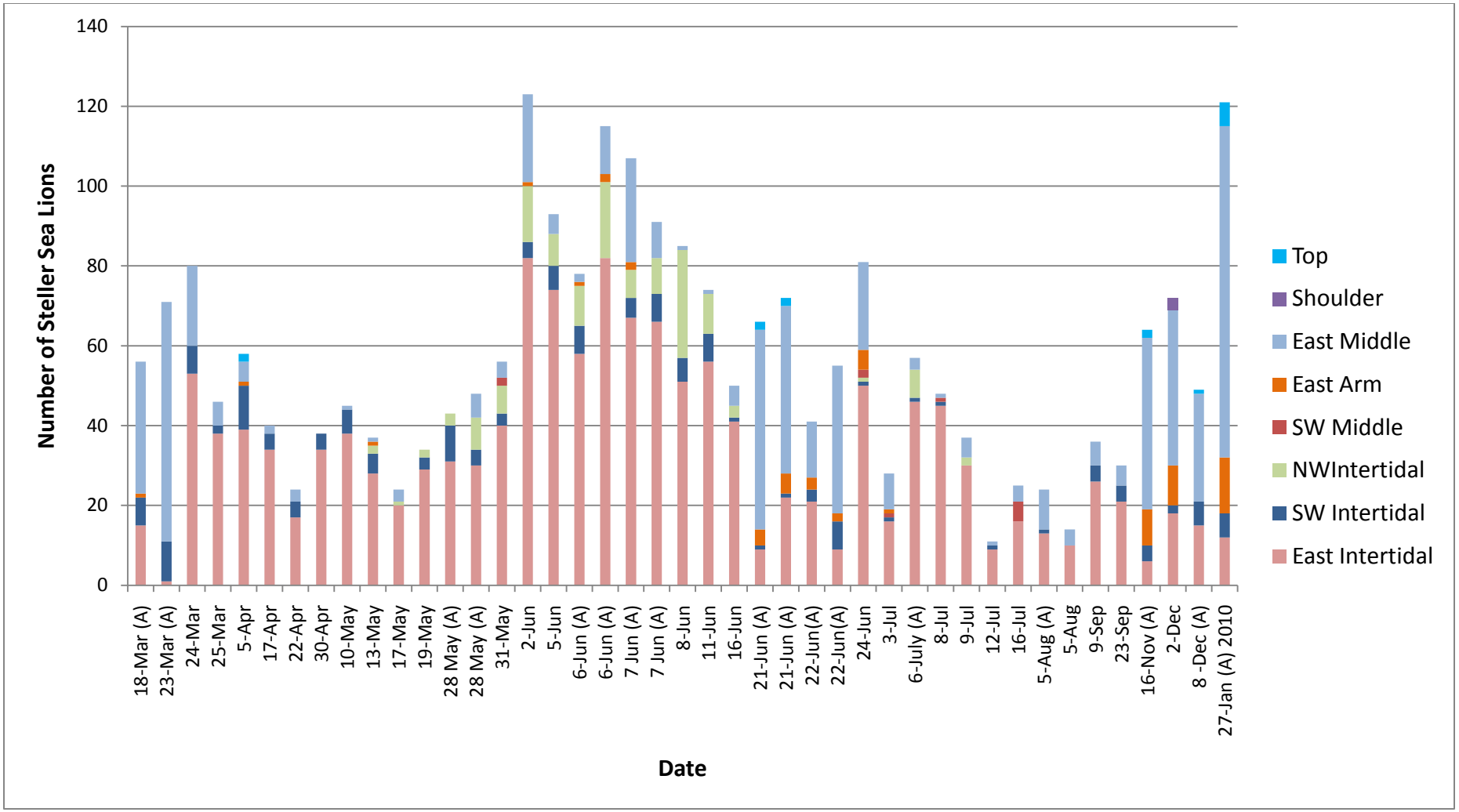


Figure 13. Steller sea lion distribution on Redding Rock from boat and aerial photographic surveys, March 2009 - January 2010. Aerial surveys are denoted by an (A).

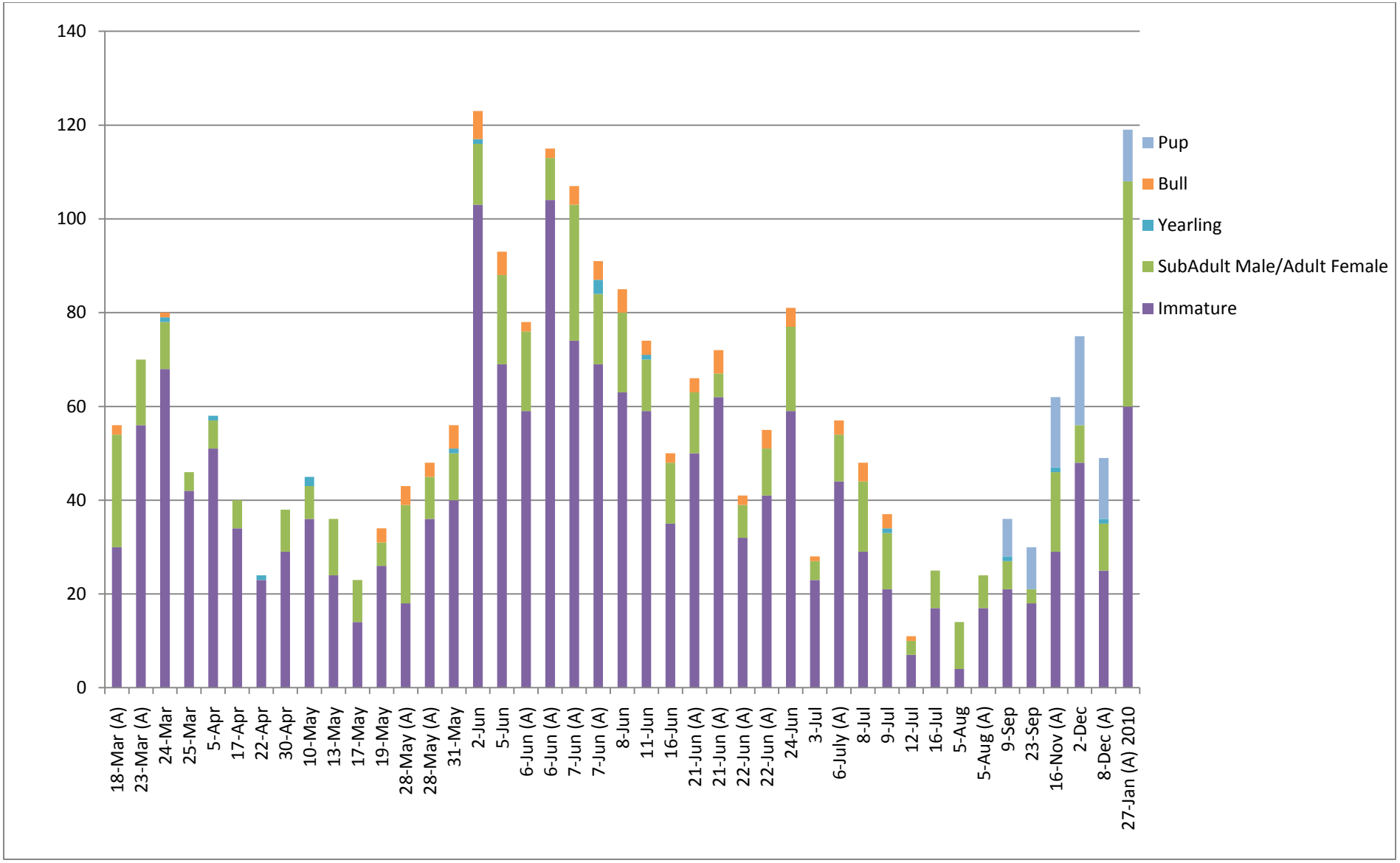


Figure 14. Age and sex categories of Steller sea lions at Redding Rock from boat and aerial photographic surveys, March 2009 - January 2010. Aerial surveys are denoted by an (A).

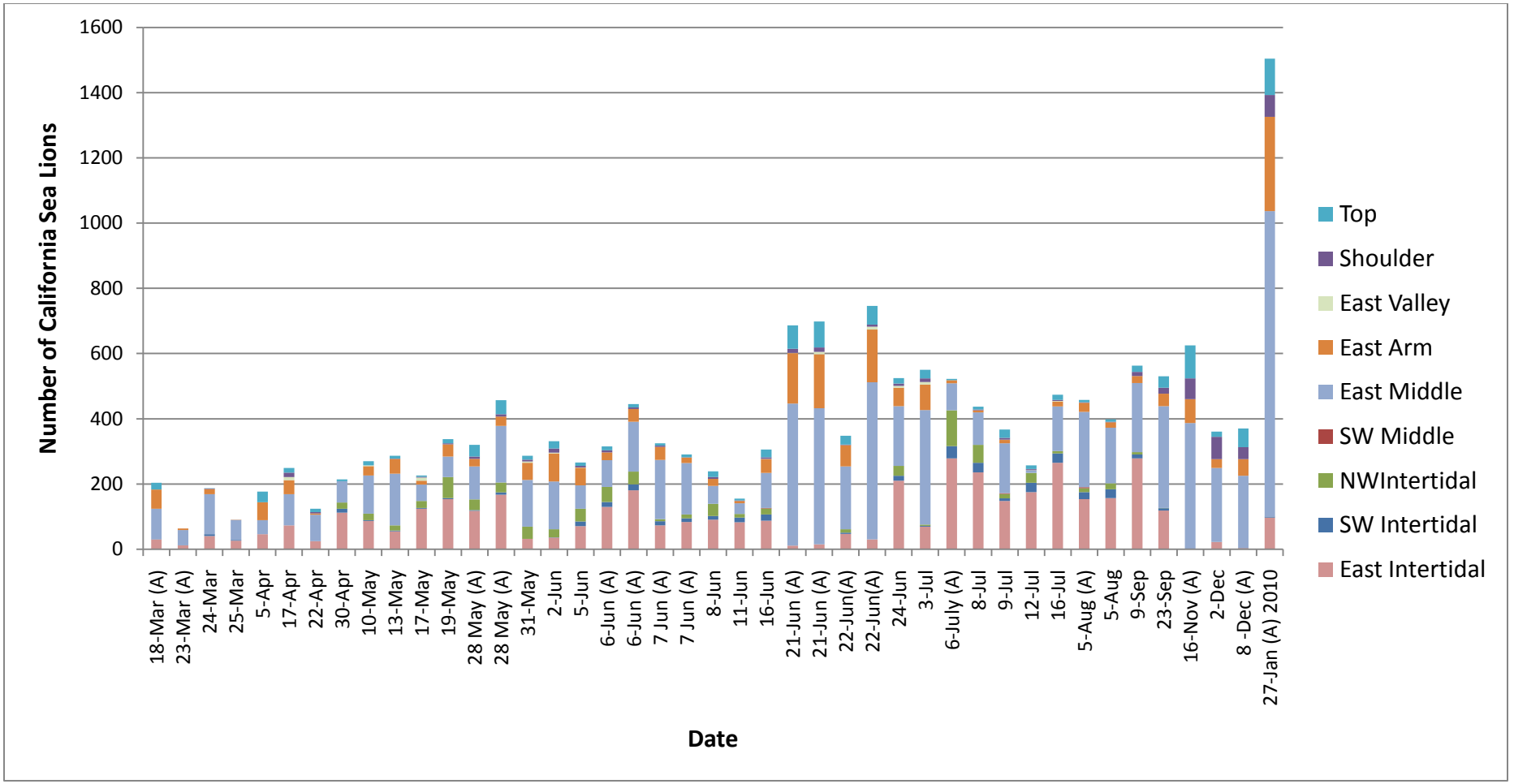


Figure 15. California sea lion distribution on Redding Rock from boat and aerial photographic surveys, March 2009 - January 2010. Aerial surveys are denoted by an (A).

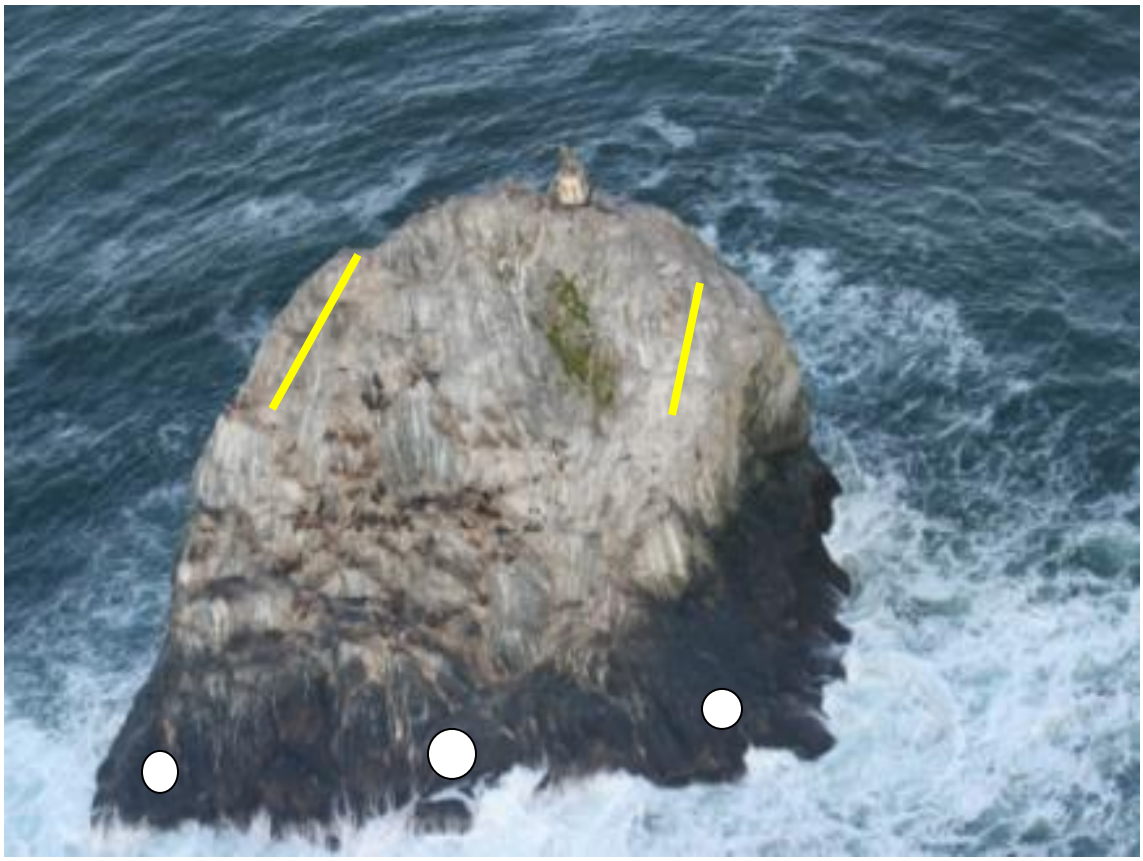


Figure 16. Primary access points (circles) and climbing routes (lines) for sea lions hauling out on Redding Rock, 2009.

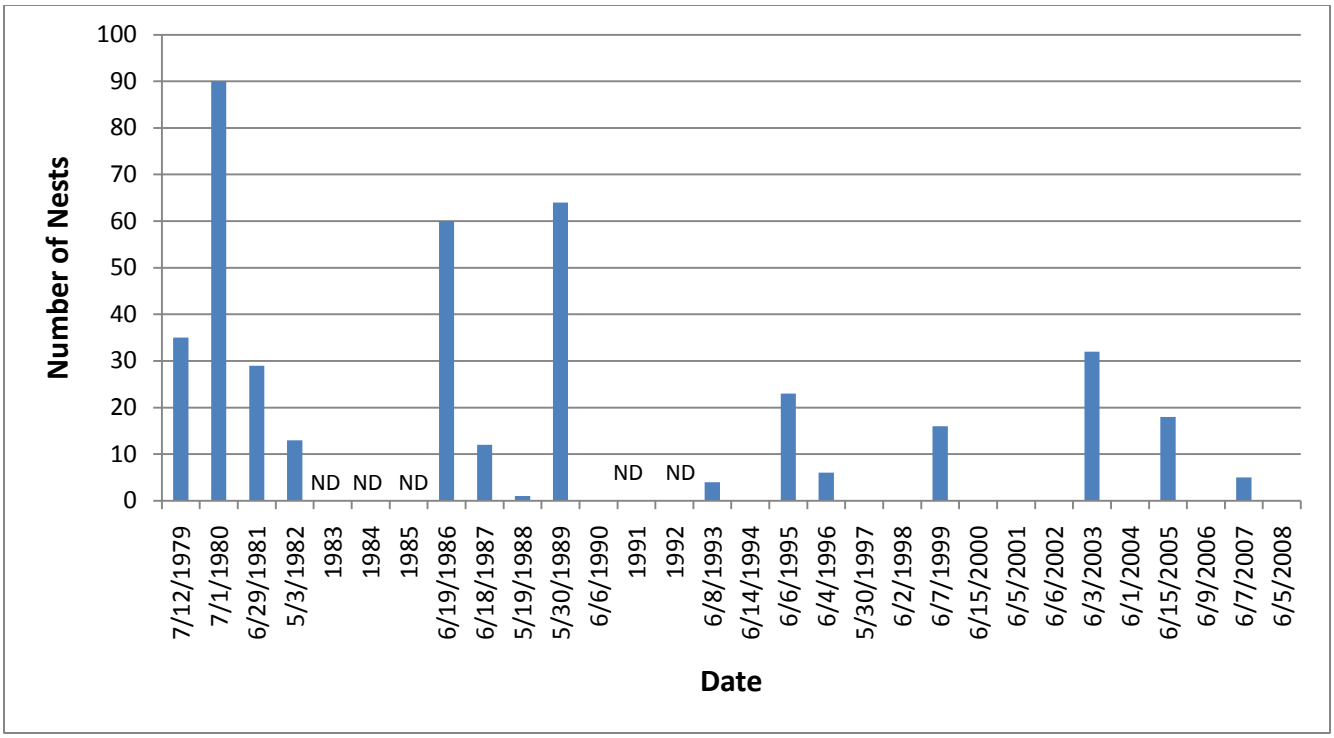


Figure 17. Number of Brandt's Cormorant nests at Redding Rock from aerial photographs, 1979-2008.

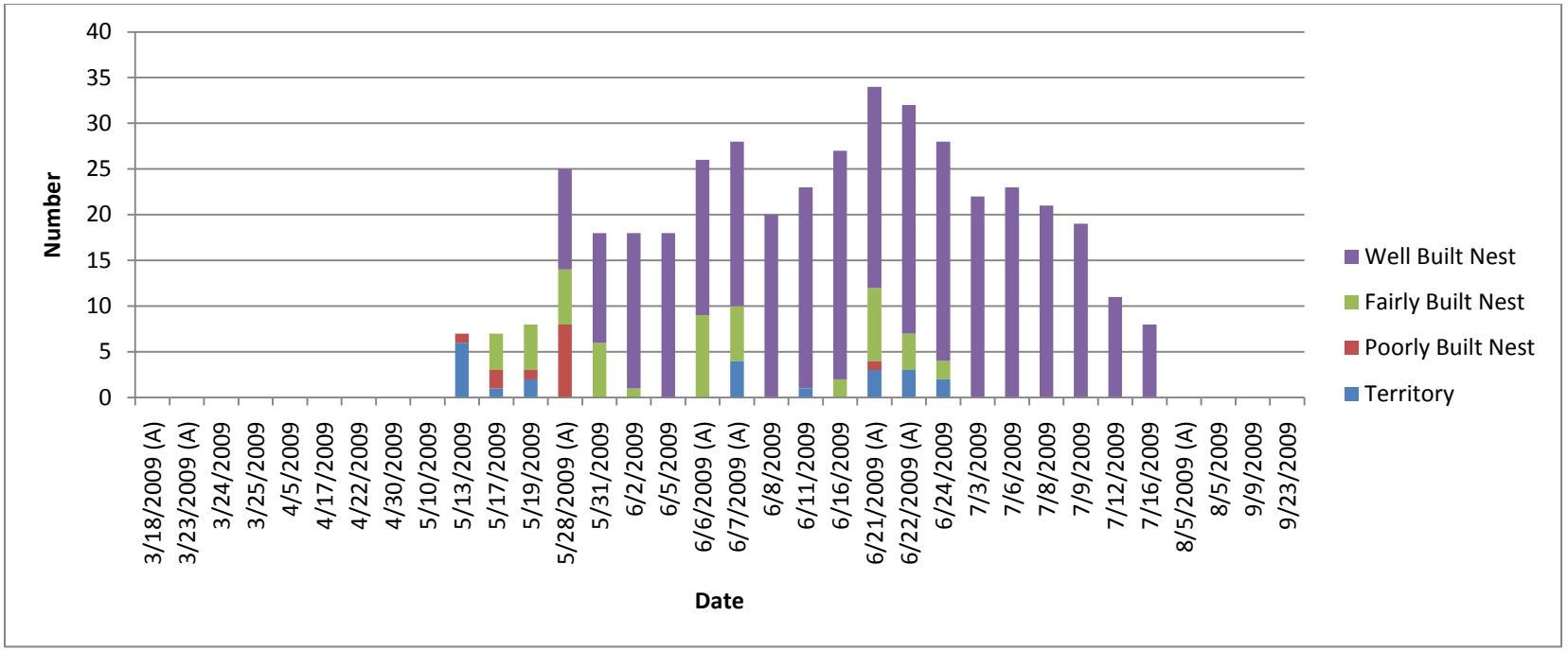
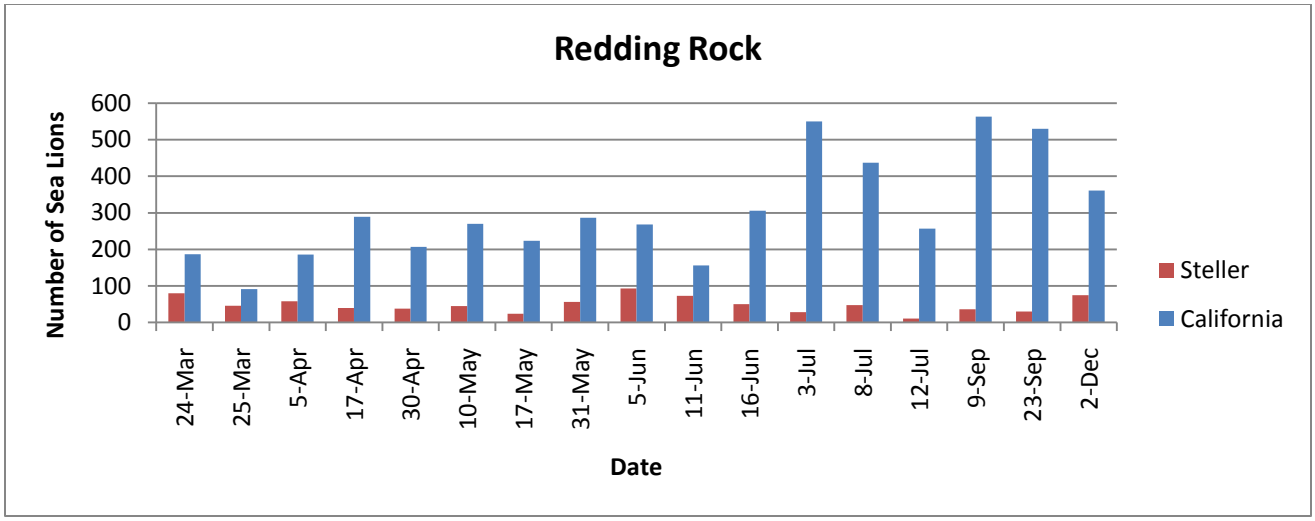
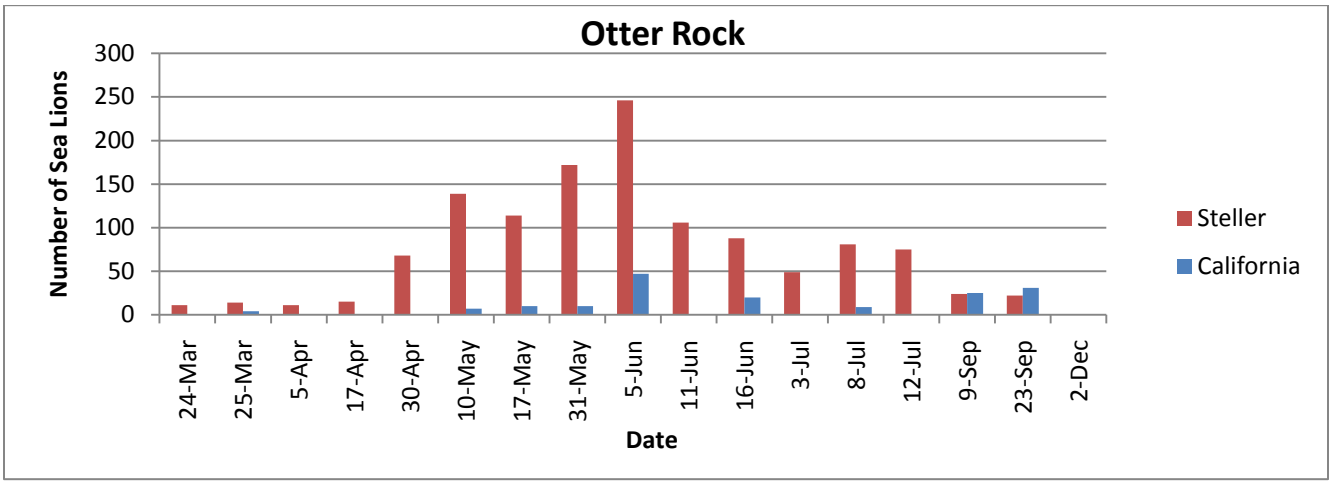


Figure 18**.** Numbers of Brandt's Cormorant nests and territorial sites at Redding Rock from boat and aerial photographic surveys, March-September, 2009. Aerial surveys are denoted by an (A).





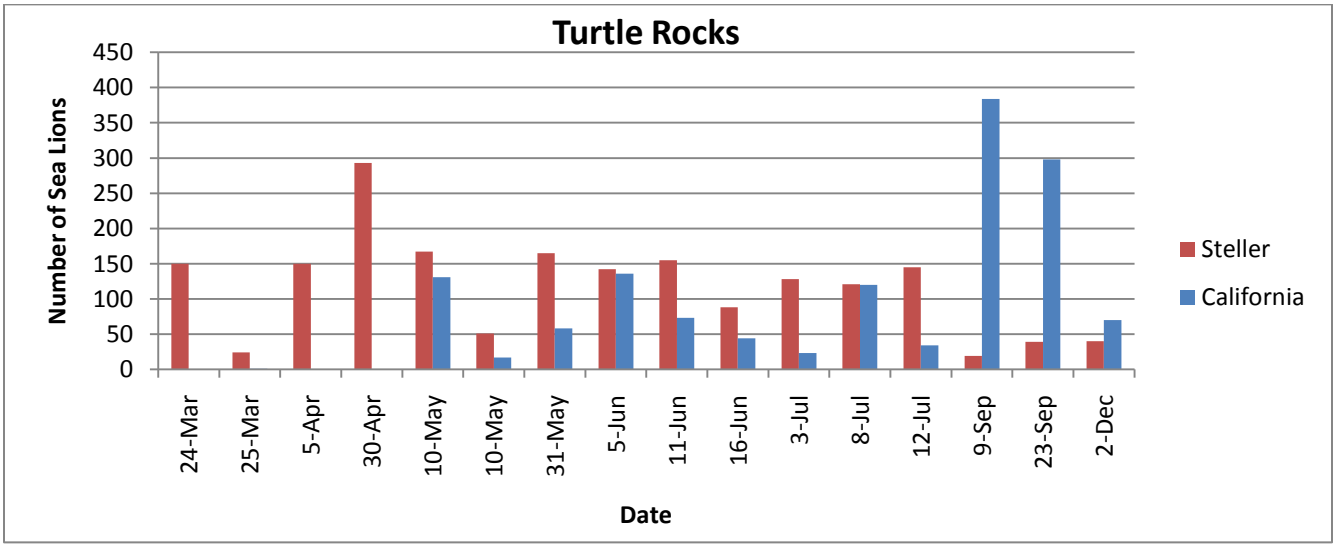
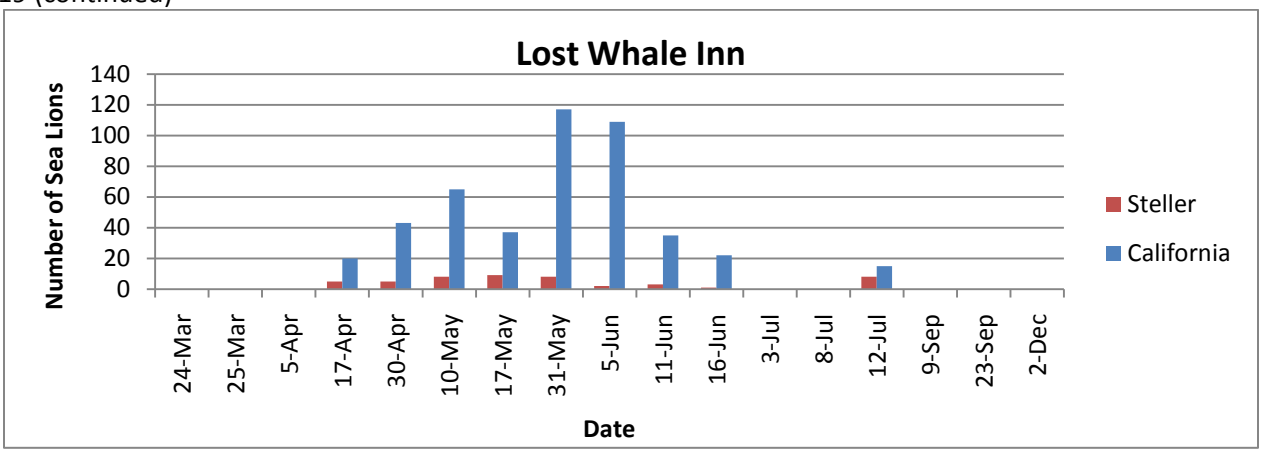
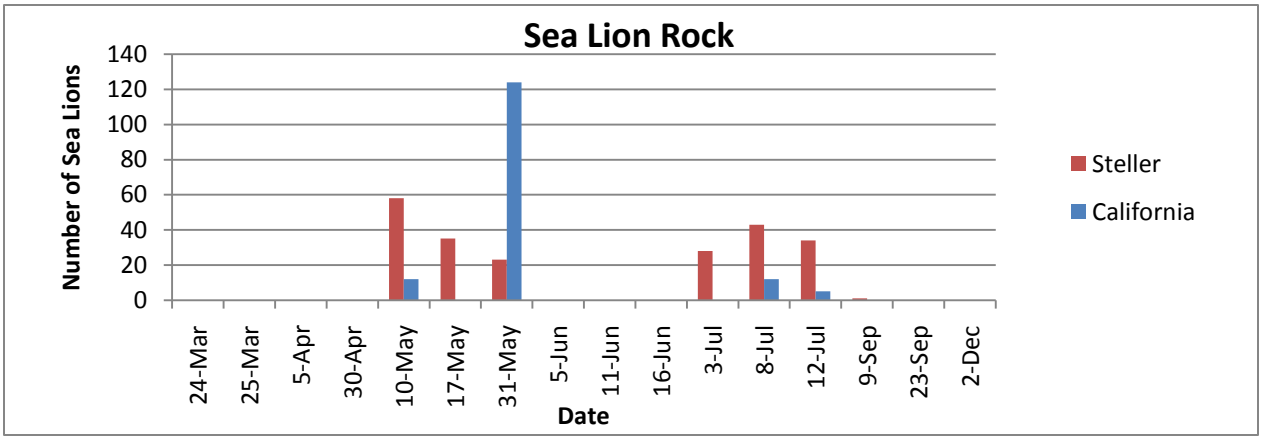
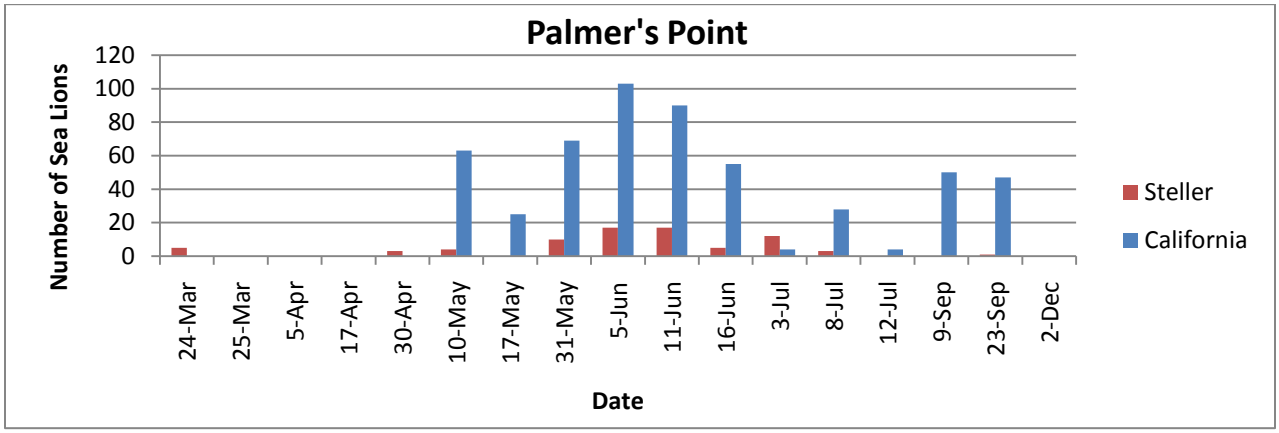


Figure 19. Numbers of Steller and California sea lions from coast-wide surveys, March-December 2009.

Figure 19 (continued)







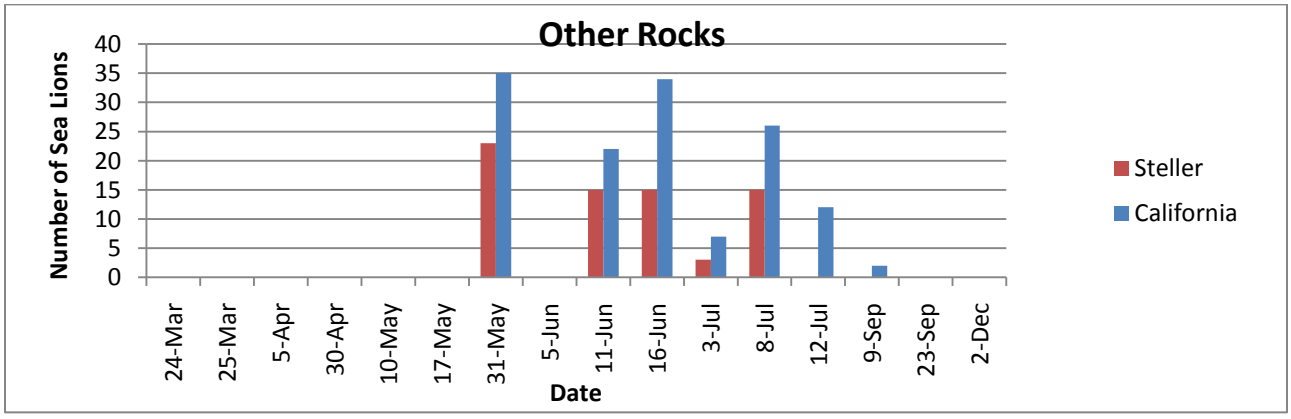
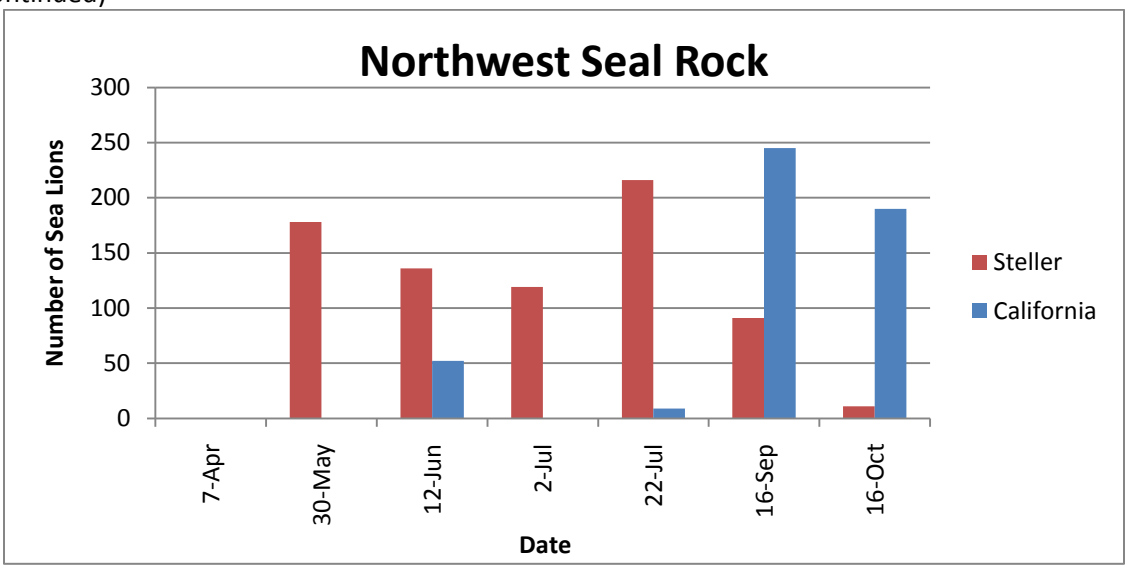
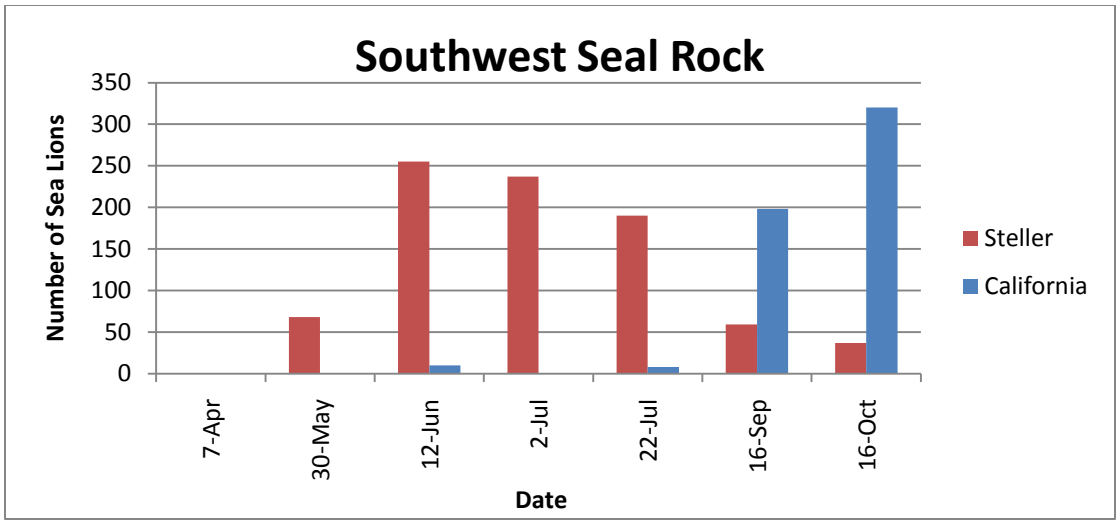
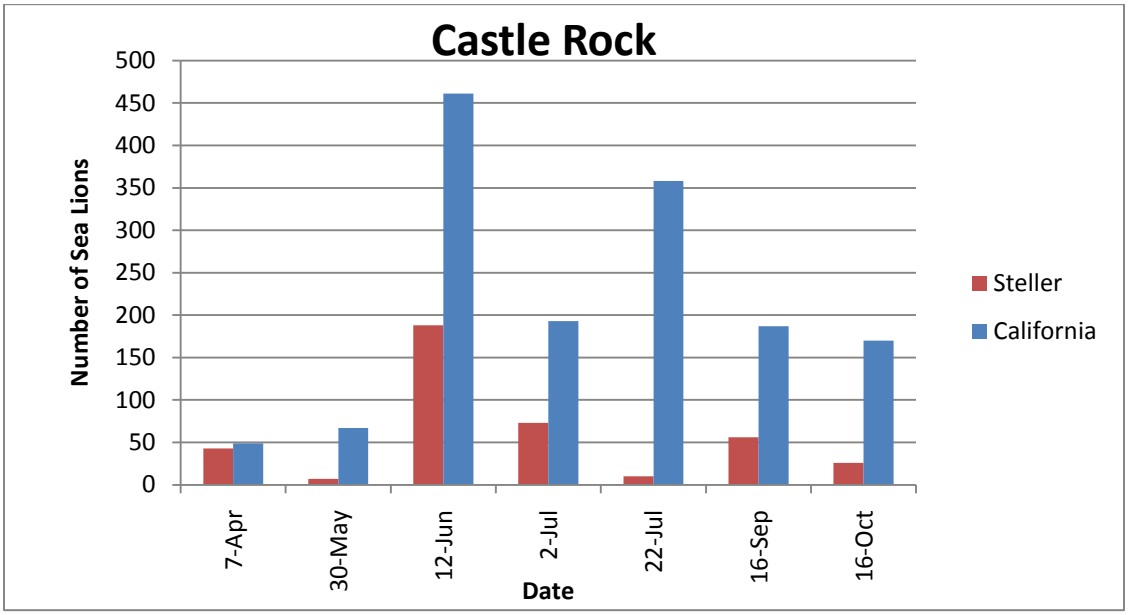


Figure 19 (continued)







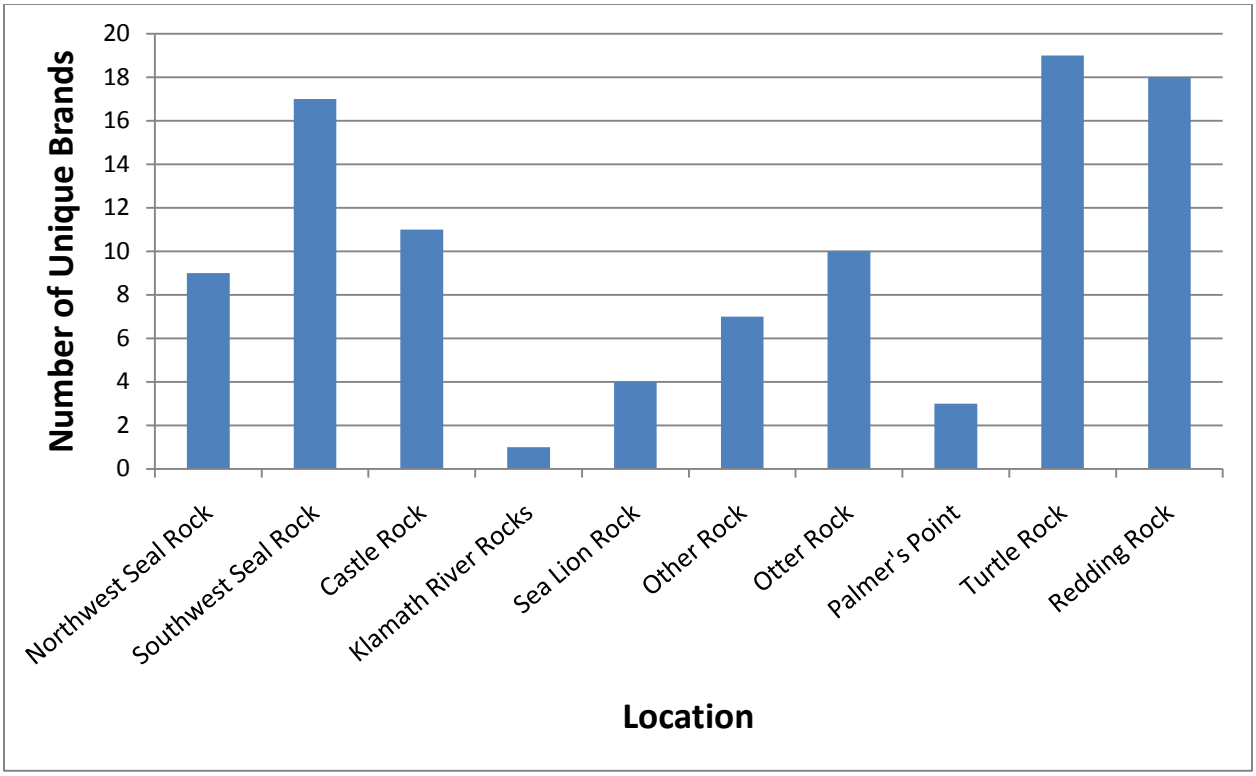


Figure 20. Distribution and abundance of branded Steller sea lions re-sighted during coast-wide sea lion surveys and aerial photographic surveys of Redding Rock, March 2009 - January 2010.

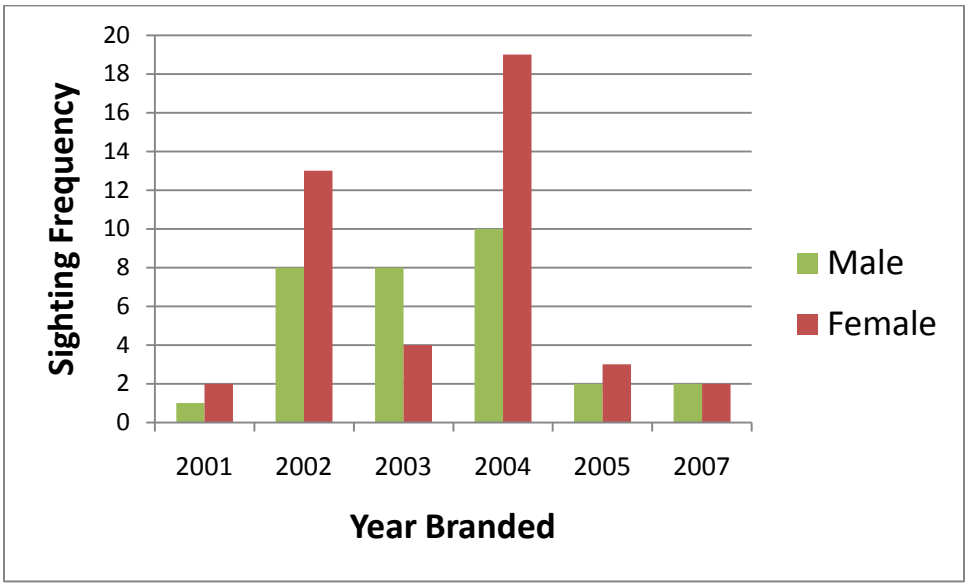


Figure 21. Sex and age distribution of branded Steller sea lions re-sighted during coast-wide sea lion surveys and aerial photographic surveys of Redding Rock, March 2009 - January 2010. Sea lions were branded as pups.

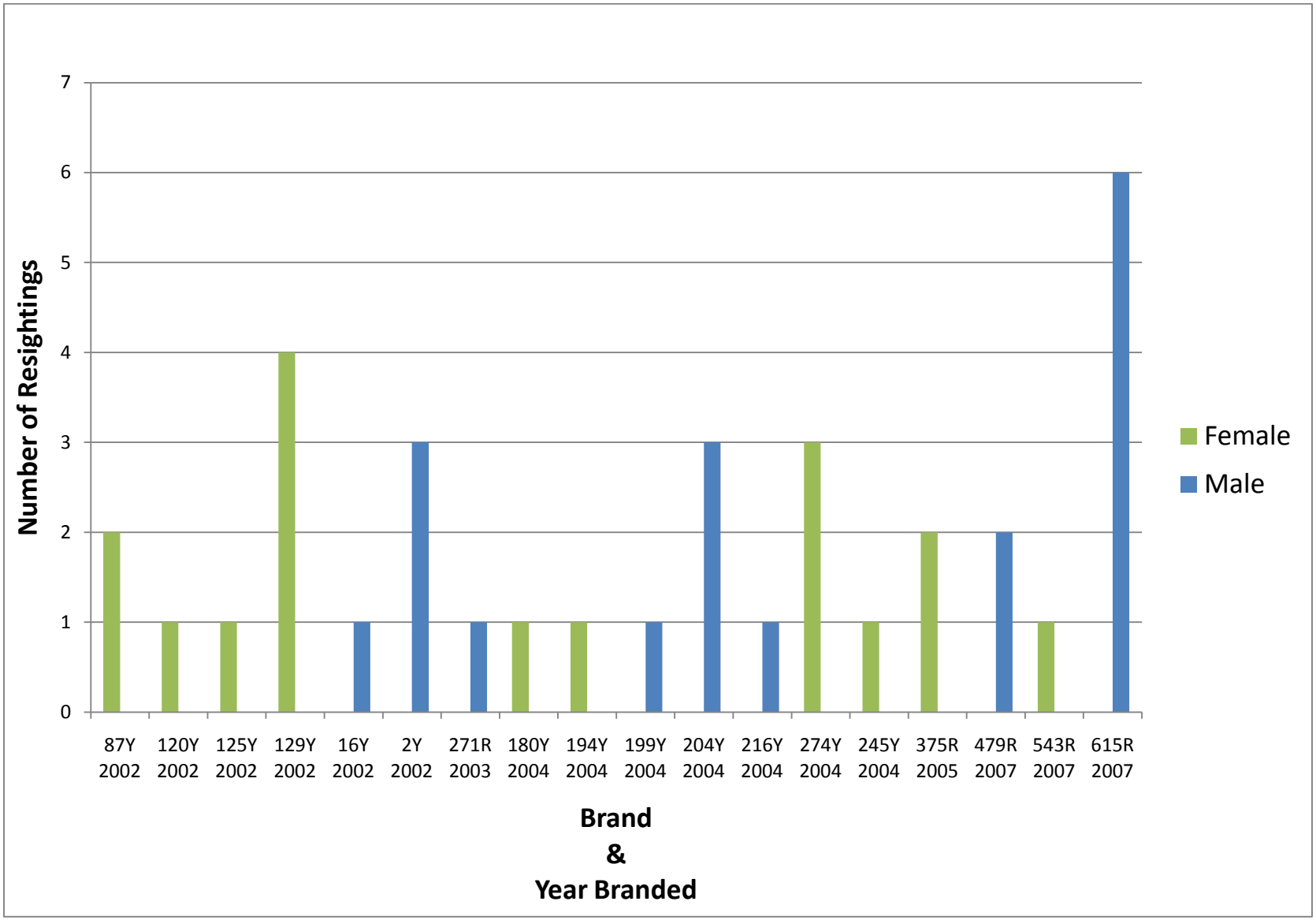


Figure 22. Re-sightings of branded male and female Steller sea lions observed at Redding Rock, March 2009 - January 2010.

Table 1. Aerial photographic and boat survey effort at Redding Rock, March 2009 - January 2010.

Date	Start Time	End Time	Survey Type
18 March	09:40	10:10	Aerial
23 March	08:19	08:34	Aerial
24 March	12:43	13:40	Boat
25 March	10:06	11:25	Boat
05 April	09:45	10:05	Boat
17 April	10:39	12:07	Boat
22 April	10:50	11:31	Boat
30 April	10:48	12:05	Boat
10 May	10:30	11:50	Boat
13 May	10:10	11:30	Boat
17 May	10:55	11:42	Boat
19 May	10:40	12:05	Boat
28 May	10:18	10:45	Aerial
	11:57[1]	12:00	
31 May	10:48	11:28	Boat
2 June	10:45	12:00	Boat
5 June	10:18	11:20	Boat
6 June	12:30	12:53	Aerial
	15:14	15:45	
7 June	10:04	10:20	Aerial
	12:35	12:55	
8 June	10:05	12:32	Boat
11 June	12:06	13:51	Boat
16 June	12:15	13:45	Boat
21 June	13:19	13:35	Aerial
	16:05	16:27	
22 June	09:43	10:00	Aerial
	12:35	12:54	
24 June	10:31	13:13	Boat
3 July	09:10	10:53	Boat
6 July	11:48	12:15	Aerial
8 July	11:40	14:05	Boat
9 July	09:47	12:15	Boat
12 July	11:50	13:40	Boat
16 July	11:29	13:09	Boat
5 August	13:12	13:38	Boat
5 August	14:29	14:40	Aerial
9 September	14:12	14:55	Boat
23 September	13:35	14:21	Boat
16 November	10:46	11:00	Aerial
2 December	12:35	13:40	Boat
8 December	08:31	08:41	Aerial
27 January	08:20	08:30	Aerial

[1]Annual breeding seabird survey conducted by UCSC, USFWS, and CDFG

Table 2. Numbers of Common Murres in each area on Redding Rock from aerial photographs, 1979-2008. Counts are from this study except where indicated. Zones and areas comprised mostly or completely of non-actively breeding birds are denoted by an asterisk (*). "Subtotal Breeding" refers to the numbers of murres in breeding areas only. Bolded values in Subtotal Breeding and Total Murres were used in Figure 4. A dash (-) indicated no data.

Date	Zone or Area Name													Subtotal Breeding	Total Murres	Source[1]
	Top	Shoulder	Area C	Area D	Area E	Area F	Area G	Area H	Area I	SW Middle	East Middle	NW Middle	East Arm			
5 June 2008	30*	21*	0	0	0	0	0	67	44	741*	0	49*	0	**111**	**952**	A
7 June 2007	0	0	0	0	0	0	0	69	45	442*	0	0	0	**114**	**556**	A
9 June 2006	52*	112*	0	0	0	0	0	70	40	215*	0	41*	0	**110**	**530**	A
15 June 2005	0	0	0	0	0	0	0	87	23	0	0	0	0	**110**	**110**	A
1 June 2004	0	0	0	0	0	0	0	66	22	0	0	0	0	**88**	**88**	B,A
3 June 2003	0	0	6	0	0	0	0	48	22	0	0	0	0	**76**	**76**	B,A
6 June 2002	0	0	31	0	0	0	0	31	21	0	0	0	0	**83**	**83**	B,A
5 June 2001	0	20	43	0	0	0	0	76	8	0	0	0	0	**147**	**147**	B,A
15 June 2000	46*	72	47	0	0	0	0	69	14	0	0	0	0	**202**	**248**	B,A
7 June 1999	0	85	34	0	0	0	0	66	16	89*	0	0	0	**201**	**290**	B,A
2 June 1998	0	0	0	0	0	0	0	33	-	0	0	0	0	**33**	**33**	B,A
30 May 1997	0	84	31	0	0	0	0	47	-	0	0	0	0	**162**	**162**	B,A
4 June 1996	0	120	48	0	0	0	0	61	11[2]	0	0	0	0	**240**	**240**[2]	B,A
6 June 1995	41	194	83	0	0	0	0	57	0	0	0	0	0	**375**	**375**	C,A
14 June 1994	21	93	89	0	0	0	0	8*	7*	251*	0	0	0	**203**	**469**	C,A
8 June 1993	0	29	0	0	0	0	0	0	0	0	0	0	0	**29**	**29**	C,A
6 June 1990	431	205	35	6	38	38	72	0	0	0	0	0	0	**825**	**825**	C,A
30 May 1989	719	273	36	19	54	48	64	0	0	0	9*	0	0	**1213**	**1222**[3]	D,C,A
19 May 1988	595	289	22	13	49	36	96	0	0	15*	0	0	293*	**1100**	**1408**	C,A
18 June 1987	550	192	48	28	58	62	65	0	0	0	0	0	13*	**1003**	**1016**	C,A
19 June 1986	419	140	31	13	20	16	74	0	0	0	0	0	1*	**713**	**714**[4]	E,C,A
July 1982	-	-	-	-	-	-	-	-	-	-	-	-	-	**700**[5]	**700**[5]	F
3 May 1982	509	162	23	32	56	85	85	0	0	0	0	0	0	952	952[6]	F,A

Table 2 (continued)

Date	Zone or Area Name													Subtotal Breeding	Total Murres	Source[1]
	Top	Shoulder	Area C	Area D	Area E	Area F	Area G	Area H	Area I	SW Middle	East Middle	NW Middle	East Arm			
30 June-2 July 1981	537	221	31	27	69	61	50	0	0	0	0	0	87*	**996**	**1083**[7]	F,A
19 May 1981	553	196	31	13	32	63	74	0	0	103*	0	0	101*	962	1166[8]	F,A
9 July 1980	541	202	39	27	64	63	42	0	0	0	8*	0	36*	1002	1022[9]	G,A
1 July 1980	577	245	62	30	69	61	59	0	0	0	12*	0	4*	**1103**	**1119**[10]	F,A
5 May 1980	275	83	6	6	33	24	8	0	0	0	6*	0	23*	435	464[11]	F,A
12 July 1979	446	92	21	0	0	0	0	0	0	0	65*	0	0	559	624[12]	G,A
15 May 1979	304	144	11	19	35	33	25	0	0	56*	0	0	327*	571	954[13]	G,C,A

[1] A, This study; B, Capitolo et al. (2006); C, Carter et al. (2001); D, Carter et al. (1992); E, Takekawa et al. (1990); F, Briggs et al. (1983) G, Sowls et al. (1980 and unpubl. data).
[2] Capitolo et al. (2006) missed the birds in Area I in their counts and reported a total of 229 murres.
[3] Carter et al. (1992, 2001) reported a total of 1,632 murres. Count was revised after we found an error in tallying.
[4] Takekawa et al. (1990) and Carter et al. (2001) reported a total of 780 murres.
[5] Count from Briggs et al. (1983) Photographs were not found from archives and could not be inspected for this study. Thus, all birds were assumed to have been in breeding areas.
[6] Briggs et al. (1983) reported a total count of 880 murres. Total was revised after birds were re-counted for this study.
[7] Briggs et al. (1983) reported a total count of 650 murres. Total was revised after birds were re-counted for this study.
[8] Briggs et al. (1983) reported a total count of 800 murres. Total was revised after birds were re-counted for this study.
[9] Sowls et al. (1980) reported a total of 1275 murres. Total was revised after birds were re-counted for this study. Carter et al. (2001) determined the Sowls et al. (1980) count was the best to use for an annual population estimate. However, we decided the 1 July 1980 count was better because by 9 July more chicks with parents may have departed the colony, thereby reducing attendance by breeders.
[10] Briggs et al. (1983) reported a total of 1031 murres. Total was revised after birds were re-counted for this study. We determined that this count was the best to use for the annual population estimate instead of the 9 July 1980 count used by Carter et al. (2001; see footnote 9, above).
[11] Briggs et al. (1983) reported a total of 1050 murres. Total was revised after birds were re-counted for this study.
[12] Count from this study only. No counts had been previously obtained from photographs obtained from Sowls et al. (1980) survey archives.
[13] Sowls et al. (unpublished survey archives) and Carter et al. (2001) reported an estimate of 500 murres. Total was revised after birds were re-counted for this study.

.

Table 3. Numbers of Steller, California, and unidentified sea lions on Redding Rock from aerial photographs, 1979-2008. Counts are from this study except where indicated[1].

Date	Steller Sea Lion	California Sea Lion	Unidentified Sea Lion	Total
5 June 2008	91	213	2	306
7 June 2007	28	75	1	104
9 June 2006	13	44	4	61
12 July 2005[2]	63	48	n/d	111
15 June 2005	15	182	189	386
5 July 2004[2]	288	n/d	n/d	288
1 June 2004	29	326	197	552
12 July 2003[2]	8	50	n/d	58
3 June 2003	88	673	4	765
9 July 2002[2]	109	n/d	n/d	109
6 June 2002	60	472	1	533
17 July 2001[2]	10	78	n/d	88
5 June 2001	90	129	5	224
8 July 2000[2]	0	69	n/d	69
15 June 2000	74	51	0	125
7 July 1999[2]	19	56	n/d	75
7 June 1999	42	34	0	76
15 December 1998[2]	n/d	146	n/d	146
13 September 1998[2]	n/d	556	n/d	556
2 June 1998	9	376	50	435
31 May 1998[2]	n/d	312	n/d	312
30 May 1997	31	143	11	185
4 June 1996	22	87	57	166
6 June 1995	30	115	0	145
14 June 1994	32	229	23	284
8 June 1993	5	109	64	178
6 June 1990	55	3	20	78
30 May 1989	0	0	0	0
19 May 1988	1	0	0	1
18 June 1987	0	0	0	0
19 June 1986	0	0	0	0
27 October 1982[3]	6	0	0	6
30 June 1982[4]	1[4]	n/d[4]	-	1[4]
3 May 1982[5]	3	7	1	11
January 1981[6]	9	2	0	11
30 June 1981[7]	0	0	0	0
19 May 1981[8]	1	0	7	8
28 January 1980[9]	41	0	3	44
1 July 1980[10]	0	0	0	0
5 May 1980[11]	3	0	0	3
12 July 1979	0	0	0	0
15 May 1979	6	0	0	6

[1] n/d, no data.

[2] Counts reported by M. Lowry (NMFS, unpubl. data).

[3] Bonnell et al. (1983) reported 6 Steller sea lions and no data for California sea lions.

Table 3 (continued)

[4] Counts from Bonnell et al. (1983). Photographs from this survey were not included in archives obtained so could not be inspected for this study.
[5] Bonnell et al. (1983) reported 3 Steller sea lions and 8 California sea lions.
[6] Bonnell et al. (1983) reported 11 Steller sea lions and 0 California sea lions.
[7] Bonnell et al. (1983) reported 0 Steller sea lions; California sea lions n/d.
[8] Bonnell et al. (1983) reported 4 Steller sea lions and 0 California sea lions.
[9] Bonnell et al. (1983) reported 43 Steller sea lions; California sea lions n/d.
[10] Bonnell et al. (1983) reported 0 Steller sea lions; California sea lions n/d.
[11] Bonnell et al. (1983) reported 2 Steller sea lions and no California sea lion

Table 4**.** Common Murre high counts and sites monitored within breeding areas on Redding Rock, May-August 2009. All data from boat surveys unless otherwise indicated.

Area	High Bird Count (Aerial)	High Bird Count (Boat)	High Count of Incubating/Brooding Birds[1]	No. of sites monitored	No. of Probable (Confirmed) Breeding Sites[2]	No. of Probable Territorial Sites[2]	No. of Undetermined Sites[2]	No. of Chicks Observed
Area H	90	82	27	27	19 (10)	3	5	8
Area I	44	51	14	8	6 (2)[3]	2[3]	0	2-4[4]
Total	134	133	41	35	25 (12)	5	5	10-12[4]

[1]Birds recorded as being in incubation or brooding postures during counts. However, birds may or may not have been incubating or brooding.
[2]Data from monitored sites only. May not include all occupied sites present.
[3] One chick was observed at a site identified as probable breeding but where the bird was believed to be still incubating at the time. This chick likely wandered to the site from another nearby site (either monitored or unmonitored). A chick also was observed at a site determined to be territorial. This chick likely wandered to the site from another nearby site (either monitored or unmonitored). However, if chicks originated from either of these sites, the number of breeding and confirmed breeding sites could be as high as 7 and 4, respectively.
[4]Two chick observations in Area I probably did not originate at the sites where they were observed and may have originated from another monitored or unmonitored site(s). If these chicks were unique, number of chicks observed ranged as high as four in Area I and 12 total.

Table 5. Brandt's Cormorant bird and nest counts on Redding Rock from aerial photographs, 1979-2008.

Year	Number of Birds	Number of Nests
1979	109	35
1980	107	90
1981	62	29
1982	156	13
1986	132	60
1987	37	12
1988	3	1
1989	154	64
1990	28	0
1993	61	4
1994	58	0
1995	181	23
1996	8	6
1997	0	0
1998	9	0
1999	39	16
2000	17	0
2001	3	0
2002	3	0
2003	83	32
2004	17	0
2005	140	18
2006	3	0
2007	13	5
2008	0	0

Table 6. High counts of Brandt's Cormorant nests and chicks on Redding Rock from boat and aerial photographic surveys, 2009.

Subarea	Number of well-built nests[1]	Number of well--built nests[2]	Number of nests with chicks[2]	Number of fledglings[2]	Minimum Productivity[3]
Top	19	16	4	5	0.26
Shoulder	5	5	4	9	1.8
East Arm	2	4	1	0	0.0
Area D	2	2	0	0	0.0
Total	28	27	9	14	0.5

[1] Aerial survey
[2] Boat survey
[3] Number of fledglings/high well-built nest count. See text.

Table 7. Number of Western Gull nests and chicks on Redding Rock from boat and aerial photographic surveys, May-August, 2009.

Subarea	Number of nests	Number of nests that hatched chicks	Hatching success[1]	Number of fledglings	Overall productivity[2]
East Middle	2	1	0.5	2	1.0
East Arm	1	0	0	0	0

[1] Number of nests that hatched chicks/number of nests.
[2] Number of fledglings/breeding pair.

Table 8. Coast-wide sea lion survey dates, 2009.

North Pinniped Survey	**South Pinniped Survey**	
13 March	25 March	11 June
7 April	5 April	16 June
30 May	30 April	3 July
12 June	10 May	8 July
2 July	17 May	16 July
22 July	31 May	9 September
16 September	5 June	22 September
16 October		2 December

Table 9. Locations and dates (month/date) of branded Steller sea lions observed during coast-wide sea lion surveys, March 2009 – January 2010.

Brand	Sex	Location									
		Redding Rock	**Sea Lion Rock**	**Otter Rock**	**Other Rock**	**Palmer's Point**	**Turtle Rocks**	**Castle Rock**	**SW Seal Rock**	**NW Seal Rock**	**Klamath River Rock**
2Y	M	6/16 6/21 6/22									
10Y	M		5/10 7/12		5/31		6/16				
13Y	F				6/11						
14Y	M				6/5						
16Y	M	6/21									
19Y	F									5/30	
20Y	N/A						5/10 5/17 6/5				
26Y	F								7/22	10/16	
37Y	M							10/16			
39Y	F								7/2		
76Y	F		5/10 5/17					6/12			
78Y	F								10/16		
87Y	F	3/24 3/25					4/5 4/30				
88Y	F								7/22		
102Y	M		7/3					6/12			
103Y	F							7/2			
117Y	F						4/30 7/3				
120Y	F	6/6					6/5				

Table 9 (continued)

Brand	Sex	Location									
		Redding Rock	Sea Lion Rock	Otter Rock	Other Rock	Palmer's Point	Turtle Rocks	Castle Rock	SW Seal Rock	NW Seal Rock	Klamath River Rock
125Y	F	6/6									
129Y	F	3/23 5/28 6/21 1/27					7/12				
136Y	M							6/12			5/31
140Y	M					6/5					
160Y	F									7/22	
164Y	M					5/17					
175Y	M			6/11							
176Y	F			7/8							
178Y	F						7/12				
180Y	F	6/7		6/5			5/17				
193Y	M								5/30		
194Y	F	4/30									
197Y	F			7/12		7/3					
199Y	M	6/5									
201Y	M						6/11				
204Y	M	6/6 6/7 1/27									
212Y	F								5/31 7/22		
214Y	F								7/22		
216Y	M	6/11									
218Y	F							6/12			
219Y	F						7/12				
226Y	F			5/17							
228Y	F							9/16			

Table 9 (continued)

Brand	Sex	Location									
		Redding Rock	Sea Lion Rock	Otter Rock	Other Rock	Palmer's Point	Turtle Rocks	Castle Rock	SW Seal Rock	NW Seal Rock	Klamath River Rock
235Y	M							6/12			
242Y	F									5/30	
245Y	F	1/27									
268Y	F									5/30	
274Y	F	3/23 3/25 1/27					4/30		7/22		
281Y	M				6/11						
287Y	M			7/3							
6R	M							7/2			
108R	F									7/2	
165R	F									7/2	
183R	M				6/5		5/10				
195R	M			5/17							
220R	M			6/5 6/11							
271R	M	6/6									
273R	M						4/30				
275R	M				7/3						
301R	M							7/22			
317R	F						5/31				
334R	F								5/31		
335R	M							6/12			
363R	F								7/22		
374R	F						7/3 7/12				
375R	F	5/13 6/24					5/17				
405R	F						4/5				

Table 9 (continued)

Brand	Sex	Location									
		Redding Rock	Sea Lion Rock	Otter Rock	Other Rock	Palmer's Point	Turtle Rocks	Castle Rock	SW Seal Rock	NW Seal Rock	Klamath River Rock
407R	M								10/16		
432R	M									5/30	
477R	F			6/5							
479R	M	6/2 6/11									
543R	F	5/19					7/12		7/29		
615R	M	4/5 4/17 6/5 6/6 6/7 6/8					5/10				

Table 10**.** U.S. Coast Guard trips to Redding Rock to maintain the aid to navigation, 1983-2008. Trips made during the Common Murre breeding season (25 April to 15 August) are marked with an asterisk (*).

Year	Service Date	Reason for Trip	Notes
2008	4/30/2008*	Scheduled Maintenance	
2005	3/10/2005	Scheduled Maintenance	Replaced lamps with LED's & removed fog horn
2003	12/11/2003	Scheduled Maintenance	
	6/30/2003*	Scheduled Maintenance	
2002	11/12/2002	Scheduled Maintenance	"Inside of structure heavily fouled with seal excrement"
	4/29/2002*	Discrepancy	"Leads were broken; need a better solution for a door"
2001	11/8/2001	Scheduled Maintenance	
	5/17/2001*	Scheduled Maintenance	
2000	11/27/2000	Scheduled Maintenance	"Seals have forced their way into hut and chewed through solar panel wires"
	5/31/2000*	Scheduled Maintenance	
1999	11/3/1999	Scheduled Maintenance	
	4/12/1999	Scheduled Maintenance	
	3/5/1999	Unknown	
1998	10/14/1998	Scheduled Maintenance	
	4/18/1998	Scheduled Maintenance	
1997	8/18/1997	Scheduled Maintenance	
	2/10/1997	Scheduled Maintenance	
1996	8/26/1996	Scheduled Maintenance	
	4/25/1996*	Site survey	
	1/12/1996	Discrepancy	Replaced flasher
1995	4/17/1995	Scheduled Maintenance	
1994	8/17/1994	Discrepancy	
	1/14/1994	Scheduled Maintenance	
1993	12/14/1993	Scheduled Maintenance	
	5/25/1993*	Scheduled Maintenance	
1992	11/18/1992	Scheduled Maintenance	
	5/26/1992*	Scheduled Maintenance	
1991	10/29/1991	Scheduled Maintenance	
	4/2/1991	Scheduled Maintenance	
1990	11/5/1990	Scheduled Maintenance	
	4/2/1990	Scheduled Maintenance	
1989	9/25/1989	Scheduled Maintenance	

Table 10 (continued)

Year	Service Date	Reason for Trip	Notes
	5/9/1989*	Scheduled Maintenance	
1988	11/14/1988	Inspection	
	6/30/1988*	Preventative maintenance	
	3/24/1988	Interim Inspection	
	1/6/1988	Scheduled Maintenance	
1987	10/26/1987	Discrepancy	Replaced batteries
	6/29/1987*	Unknown	Remounted solar panels from 90° to 60°
	6/3/1987*	Discrepancy	Sound signal restored to normal
	5/22/1987*	Discrepancy	Batteries not recovering after discharge
	1/16/1987	Scheduled Maintenance	
1986	8/15/1986*	Discrepancy	Recharged batteries
1985	9/28/1985	Discrepancy	Recharged batteries
1984	9/18/1984	Discrepancy	Fog horn restored to normal
	6/29/1984*	Unknown	
	5/7/1984*	Scheduled Maintenance	
1983	7/25/1983*	Scheduled Maintenance	
	4/26/1983*	Scheduled Maintenance	“6 feet of guano on rock”

Table 11. Watercraft observed near Redding Rock, April-August 2009.

Date	Time	Vessel	Distance from Rock (m)
17 April 2009	1022	Recreational Fishing	100
17 April 2009	1022	Recreational Fishing	400
17 May 2009	1046	Recreational Fishing	160
31 May 2009	1029	Recreational Fishing	No Data
31 May 2009	1029	Recreational Fishing	No Data
31 May 2009	1029	Recreational Fishing	No Data
5 June 2009	1020	Recreational Fishing	400
3 July 2009	0919	Recreational Fishing	No Data
8 July 2009	1138	Recreational Fishing	15-20
8 July 2009	1138	Recreational Fishing	15-20
8 July 2009	1138	Recreational Fishing	30-50
9 July 2009	1250	Law Enforcement	No Data
12 July 2009	1159	Charter Fishing	200
5 Aug 2009	1429	Recreational Fishing	78-80
5 Aug 2009	1312	Recreational Fishing	40-60

Appendix A. Numbers of seabirds and sea lions by zone or area at Redding Rock from aerial photographs, 1979-2008. Codes: COMU, Common Murre; WEGU, Western Gull; BRCO, Brandt's Cormorant; BRPE, Brown Pelican; PECO, Pelagic Cormorant; SubAd. M/Ad. F, Subadult Male/Adult Female; Imm, Immature; Yrl, Yearling; Calif., California; Unid., Unidentified. Counts are from this study.

					COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
Year	Day	Month	Area	Zone	Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2008	5	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2008	5	June		Southwest Middle	741	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June		Northwest Middle	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June		Shoulder	21	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	
2008	5	June		Top	30	1	0	0	0	0	0	0	0	0	0	0	0	0	19	0	
2008	5	June		East Arm	0	12	0	0	0	0	0	0	0	0	0	0	0	0	22	0	
2008	5	June		East Middle	0	29	0	0	0	0	0	0	0	2	7	32	0	0	41	153	1
2008	5	June		East Intertidal	0	0	0	0	0	0	0	0	0	1	12	34	2	0	49	12	1
2008	5	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	H		67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	I		44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	5	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	3	0	0	4	2	0

Appendix A. (continued)

					COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
Year	Day	Month	Area	Zone	Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2007	7	June		Southwest Middle	442	22	3	7	5	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June		Shoulder	0	2	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0
2007	7	June		Top	0	0	0	1	0	0	3	0	0	0	0	1	0	0	1	6	0
2007	7	June		East Arm	0	18	1	0	0	0	4	0	0	1	1	0	0	0	2	10	0
2007	7	June		East Middle	0	52	1	5	0	0	42	0	0	0	1	0	0	0	1	27	0
2007	7	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	2	15	1	0	20	28	1
2007	7	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2007	7	June	H		69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	I		45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	7	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Southwest Middle	215	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Northwest Middle	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Shoulder	112	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		Top	52	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		East Arm	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	21	0
2006	9	June		East Middle	0	13	0	0	0	0	0	0	0	1	0	0	0	0	1	13	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2006	9	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	1	11	0	0	12	10	4
2006	9	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	H		70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	I		40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	9	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June		Southwest Intertidal	0	0	0	4	0	0	0	0	0	0	1	3	0	0	4	1	0
2005	15	June		Southwest Middle	0	3	0	65	0	0	53	0	0	0	0	0	0	0	0	0	0
2005	15	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June		Shoulder	0	0	0	22	0	0	14	0	0	0	0	0	0	0	0	7	0
2005	15	June		Top	0	1	0	20	12	0	3	0	0	0	0	0	0	0	0	22	0
2005	15	June		East Arm	0	2	1	16	6	0	12	0	0	0	0	0	0	0	0	15	0
2005	15	June		East Middle	0	3	0	13	0	0	0	0	0	3	1	5	0	0	9	99	77
2005	15	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	38	112
2005	15	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	H		87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	I		23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2005	15	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	15	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		Southwest Middle	0	32	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		Shoulder	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	7	0
2004	1	June		Top	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	49	0
2004	1	June		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	0
2004	1	June		East Middle	0	0	0	0	0	0	0	0	0	3	3	20	0	0	26	189	178
2004	1	June		East Intertidal	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3	20	19
2004	1	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June		East Valley	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	H		75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	I		24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	1	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2003	3	June		Southwest Middle	0	80	0	14	0	0	5	0	0	0	0	0	0	0	0	0	0
2003	3	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2003	3	June		Shoulder	0	1	1	13	4	0	0	0	0	0	0	0	0	0	0	14	0
2003	3	June		Top	0	1	1	39	14	0	0	0	0	0	0	1	0	0	1	73	0
2003	3	June		East Arm	0	2	1	17	14	0	0	0	0	0	0	0	0	0	0	62	0
2003	3	June		East Middle	0	0	0	0	0	0	0	0	0	1	1	53	0	0	55	480	4
2003	3	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	3	26	0	0	31	43	0
2003	3	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June		East Valley	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2003	3	June	H		52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	I		24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	3	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		Southwest Middle	0	33	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0
2002	6	June		Top	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	35	0
2002	6	June		East Arm	0	1	1	0	0	0	0	0	0	0	3	2	0	0	5	102	1
2002	6	June		East Middle	0	0	0	0	0	0	0	0	0	4	2	40	0	0	46	288	0
2002	6	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	0	7	0	0	9	19	0
2002	6	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June		East Valley	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2002	6	June	H		24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	I		31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	C		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	6	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Southwest Middle	0	12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Shoulder	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		Top	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		East Arm	0	5	2	1	0	0	0	0	0	0	0	1	0	0	1	39	0
2001	5	June		East Middle	0	9	3	0	0	0	0	0	0	2	2	43	0	0	47	80	2
2001	5	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	1	39	0	0	42	10	3
2001	5	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June		East Valley	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	H		91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	I		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	C		44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	5	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2000	15	June		Southwest	0	47	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																	
2000	15	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		Shoulder	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		Top	41	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		East Arm	0	1	1	0	0	0	0	0	0	0	1	4	1	0	6	25	0
2000	15	June		East Middle	0	2	0	6	0	0	0	0	0	3	6	52	6	0	67	26	0
2000	15	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June		East Valley	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	H		75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	I		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	C		54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	15	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0
1999	7	June		Southwest Middle	87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		Shoulder	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		Top	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0
1999	7	June		East Arm	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	8	0
1999	7	June		East Middle	0	1	0	33	14	0	5	0	0	1	0	7	2	0	10	8	0

Appendix A. (continued)

					COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
Year	Day	Month	Area	Zone	Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1999	7	June		East Intertidal	0	0	0	0	0	0	0	0	0	1	1	26	2	0	30	15	0
1999	7	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	H		66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	I		12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	C		40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	7	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	1	0
1998	2	June		Southwest Middle	0	6	0	9	0	0	7	0	0	0	0	0	0	0	0	0	0
1998	2	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June		Top	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	41	6
1998	2	June		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105	7
1998	2	June		East Middle	0	1	0	0	0	0	0	0	0	1	0	4	0	0	5	203	37
1998	2	June		East Intertidal	0	1	0	0	0	0	0	0	0	1	0	1	0	0	2	0	0
1998	2	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June		East Valley	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	26	0
1998	2	June	H		34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1998	2	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	2	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	6	0	0	7	7	3
1997	30	May		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		Shoulder	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		Top	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	16	0
1997	30	May		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
1997	30	May		East Middle	0	2	1	0	0	0	3	0	0	0	1	4	0	0	5	69	6
1997	30	May		East Intertidal	0	0	0	0	0	0	0	0	0	1	3	13	2	0	19	47	2
1997	30	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	H		52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	C		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	30	May	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June		Southwest Middle	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June		Northwest Middle	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1996	4	June		Shoulder	115	0	0	7	5	0	0	0	0	0	0	0	0	0	0	2	0
1996	4	June		Top	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0
1996	4	June		East Arm	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
1996	4	June		East Middle	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	41	15
1996	4	June		East Intertidal	0	0	0	0	0	0	0	0	0	3	2	15	2	0	22	30	42
1996	4	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	H		54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	I		11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	C		37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	4	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0
1995	6	June		Southwest Middle	0	4	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June		Shoulder	194	0	0	15	0	0	0	0	0	0	0	0	0	0	0	5	0
1995	6	June		Top	41	2	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0
1995	6	June		East Arm	6	17	0	46	0	0	0	0	0	0	0	0	0	0	0	7	0
1995	6	June		East Middle	0	3	1	83	23	0	0	0	0	1	3	9	0	0	13	70	0
1995	6	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	3	10	0	0	15	30	0
1995	6	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June		East Valley	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1995	6	June	H		57	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	C		83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	6	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June		Southwest Middle	251	26	0	1	0	0	0	68	11	0	0	0	0	0	0	0	0
1994	14	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June		Shoulder	93	0	0	35	0	0	0	0	0	0	0	0	0	0	0	1	0
1994	14	June		Top	21	25	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0
1994	14	June		East Arm	0	1	1	22	0	0	0	0	0	0	0	0	0	0	0	72	0
1994	14	June		East Middle	0	9	1	0	0	0	0	0	0	4	4	13	0	0	21	82	20
1994	14	June		East Intertidal	0	0	0	0	0	0	0	0	0	2	0	9	0	0	11	43	3
1994	14	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
1994	14	June	H		8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	I		7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	C		89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	14	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June		Southwest	0	2	0	3	0	0	0	27	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																	
1993	8	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June		Shoulder	29	1	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0
1993	8	June		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	8
1993	8	June		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7
1993	8	June		East Middle	0	10	0	54	4	0	11	0	0	1	0	4	0	0	5	48	11
1993	8	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	38
1993	8	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June		East Valley	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	8	June	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0
1990	6	June		Southwest Middle	0	1	0	6	0	0	0	11	6	0	0	0	0	0	0	0	0
1990	6	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	1	3
1990	6	June		Shoulder	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June		Top	431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June		East Arm	0	0	0	6	0	0	0	0	0	0	0	2	0	0	2	0	0
1990	6	June		East Middle	0	4	0	16	0	0	1	0	0	0	1	10	0	0	11	1	3

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1990	6	June		East Intertidal	0	0	0	0	0	0	0	0	0	3	3	27	1	0	34	1	14
1990	6	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June	H		0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0
1990	6	June	I		0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0
1990	6	June	C		35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June	E		38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June	F		38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June	G		72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	6	June	D		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Shoulder	252	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		Top	704	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May		East Middle	2	19	0	152	63	0	117	0	0	0	0	0	0	0	0	0	0
1989	30	May		East Intertidal	0	38	0	1	0	0	5	0	0	0	0	0	0	0	0	0	0
1989	30	May		North Cliff	0	0	0	0	0	0	0	6	4	0	0	0	0	0	0	0	0
1989	30	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	C		44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	E		64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1989	30	May	F		61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	G		70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	30	May	D		19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Southwest Middle	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Shoulder	289	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		Top	595	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		East Arm	293	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		East Middle	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
1988	19	May		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May		East Valley	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	C		22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	E		49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	F		36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	G		96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	19	May	D		13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		Southwest Middle	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1987	18	June		Shoulder	192	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		Top	550	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		East Arm	13	27	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		East Middle	0	6	0	27	7	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	C		48	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	E		58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	F		62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	G		65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	18	June	D		28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Southwest Middle	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Shoulder	140	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		Top	419	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		East Arm	1	0	0	17	12	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		East Middle	0	0	0	107	46	0	12	0	0	0	0	0	0	0	0	0	0
1986	19	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1986	19	June	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	C		31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	E		20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	F		16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	G		74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	19	June	D		13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	5	0	0	6	0	0
1982	27	October		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		East Middle	0	1	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		East Intertidal	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	27	October	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		Southwest	0	3	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																	
1982	3	May		Northwest Middle	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		Shoulder	162	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		Top	473	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		East Arm	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		East Middle	0	2	0	101	9	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		East Intertidal	0	0	0	4	0	0	0	0	0	0	1	1	1	0	3	7	1
1982	3	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May		East Valley	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	H		0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	C		23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	E		56	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	F		73	0	0	15	2	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	G		85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	3	May	D		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	3
1981	28	Sept.		Southwest Middle	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		Shoulder	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		Top	0	0	0	13	0	0	2	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		East Arm	0	1	0	19	0	0	10	0	0	0	0	0	0	0	0	0	
1981	28	Sept.		East Middle	0	0	0	108	0	0	34	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1981	28	Sept.		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	H		0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	I		0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	C		0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Sept.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Southwest Middle	0	1	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Shoulder	221	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		Top	537	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		East Arm	87	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
1981	30	June		East Middle	0	0	0	42	21	0	123	0	0	0	0	0	0	0	0	0	0
1981	30	June		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	H		0	0	0	9	4	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	I		0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	C		31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	E		69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1981	30	June	F		61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	G		50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	30	June	D		27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Southwest Middle	103	4	0	7	4	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Shoulder	196	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		Top	553	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		East Arm	101	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		East Middle	0	1	0	40	18	0	4	0	0	0	0	0	0	0	0	0	0
1981	19	May		East Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	7
1981	19	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May		East Valley	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	H		0	0	0	7	3	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	I		0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	C		31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	E		32	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	F		63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	G		74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	19	May	D		13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	0	9	0	0	9	2	0
1981	28	Jan.		Southwest Middle	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1981	28	Jan.		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		East Middle	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	28	Jan.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		East Arm	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		East Middle	0	5	0	34	1	0	65	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1980	28	Oct.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Oct.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Shoulder	34	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		Top	81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		East Arm	4	0	0	2	2	0	10	0	0	0	0	0	0	0	0	0	0
1980	1	July		East Middle	12	0	0	78	68	0	114	0	0	0	0	0	0	0	0	0	0
1980	1	July		East Intertidal	0	0	0	5	0	0	43	0	0	0	0	0	0	0	0	0	0
1980	1	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	I		0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	E		0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	F		0	0	0	16	15	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	1	July	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		Southwest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																	
1980	9	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		Shoulder	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		Top	28	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		East Arm	36	0	0	2	2	0	4	0	0	0	0	0	0	0	0	0	0
1980	9	July		East Middle	8	0	0	88	56	0	97	0	0	0	0	0	0	0	0	0	0
1980	9	July		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	I		0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	E		0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	F		0	0	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	9	July	D		5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
1980	5	May		Southwest Middle	0	0	0	9	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		Shoulder	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		Top	275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		East Arm	23	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		East Middle	6	0	0	28	3	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1980	5	May		East Intertidal	0	0	0	9	0	0	0	0	0	0	0	2	0	0	2	0	0
1980	5	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	H		0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	I		0	0	0	6	6	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	C		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	E		33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	F		24	0	0	9	5	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	G		8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	5	May	D		6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	2	2	0	0	4	0	0
1980	28	Jan.		Southwest Middle	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		Northwest Middle	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		Shoulder	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		Top	174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		East Middle	0	2	0	0	0	0	0	0	0	1	1	2	0	0	4	0	3
1980	28	Jan.		East Intertidal	0	5	0	0	0	0	0	0	0	3	5	27	0	0	35	0	0
1980	28	Jan.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

					COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
Year	Day	Month	Area	Zone	Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1980	28	Jan.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	28	Jan.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		Top	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		East Arm	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		East Middle	7	0	0	87	25	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	H		0	0	0	10	6	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	I		0	0	0	10	4	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	12	July	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		Southwest Middle	56	2	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		Northwest Intertidal	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix A. (continued)

Year	Day	Month	Area	Zone	COMU	WEGU		BRCO			BRPE	PECO		Steller sea lion						Calf. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Nest	Territory	Bird	Bird	Nest	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
1979	15	May		Shoulder	16	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		Top	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		East Arm	327	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		East Middle	0	21	0	81	22	0	0	0	0	0	0	1	0	0	1	0	0
1979	15	May		East Intertidal	0	3	0	0	0	0	0	0	0	1	0	4	0	0	5	0	0
1979	15	May		North Cliff	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	H		0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	I		0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	E		9	0	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	F		0	0	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	15	May	D		0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. Numbers of seabirds and sea lions by zone or area at Redding Rock from aerial photographic surveys, 2009. Codes: COMU, Common Murre; WEGU, Western Gull; BRPE, Brown Pelican; BRCO, Brandt's Cormorant; PECO, Pelagic Cormorant; HEEG, Heermann's Gull; SubAd. M/Ad. F, Subadult Male/Adult Female; Imm, Immature; Yrl, Yearling; Calif., California; Unid., Unidentified.

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
18	March	1000		Southwest Intertidal	0	3	0	0	3	0	0	0	0	1	6	0	0	7	1	0
18	March	1000		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0
18	March	1000		East Arm	0	2	0	0	20	0	0	0	0	0	1	0	0	1	59	0
18	March	1000		East Middle	0	2	0	0	9	0	0	0	2	15	16	0	0	33	93	4
18	March	1000		East Intertidal	0	0	0	0	0	0	0	0	0	8	7	0	0	15	30	7
18	March	1000		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	March	1000	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830		Southwest Intertidal	0	0	0	0	0	0	0	0	0	3	7	0	0	10	0	0
23	March	830		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
23	March	830		Northwest Middle	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0
23	March	830		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830		East Arm	0	1	0	0	8	0	0	0	0	0	0	0	0	0	5	1
23	March	830		East Middle	0	1	0	0	50	0	0	0	0	11	48	0	0	60	47	7
23	March	830		East Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	12	0
23	March	830		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	March	830	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030		Southwest Intertidal	0	0	0	0	0	0	0	0	1	6	2	0	0	9	2	0
28	May	1030		Southwest Middle	0	0	0	15	5	0	0	0	0	0	0	0	0	0	0	0
28	May	1030		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030		Northwest Intertidal	0	0	0	0	0	0	0	0	1	0	2	0	0	3	33	0
28	May	1030		Shoulder	0	0	0	10	7	1	0	0	0	0	0	0	0	0	7	0
28	May	1030		Top	0	0	0	0	31	8	0	0	0	0	0	0	0	0	36	1
28	May	1030		East Arm	0	2	0	0	15	0	0	0	0	0	0	0	0	0	23	0
28	May	1030		East Middle	0	23	1	31	3	0	0	2	0	0	0	0	0	0	101	0
28	May	1030		East Intertidal	0	0	0	0	0	0	0	0	2	15	14	0	0	31	118	10
28	May	1030		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
28	May	1030		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030			80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	H		15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1030	G		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
28	May	1030	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	4	0	0	4	7	0
28	May	1200		Southwest Middle	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200		Northwest Intertidal	0	0	0	0	0	0	0	0	1	2	5	0	0	8	31	1
28	May	1200		Shoulder	0	0	0	6	0	1	0	0	0	0	0	0	0	0	7	0
28	May	1200		Top	0	0	0	1	0	8	0	0	0	0	0	0	0	0	43	0
28	May	1200		East Arm	0	0	0	0	0	2	0	0	0	0	0	0	0	0	29	0
28	May	1200		East Middle	0	8	1	25	0	0	0	0	0	0	6	0	0	6	173	0
28	May	1200		East Intertidal	0	0	0	0	0	0	0	0	2	7	21	0	0	30	167	5
28	May	1200		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200		East Valley	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	H		72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	I		20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	May	1200	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
6	June	1200		Southwest Intertidal	0	0	0	0	1	0	0	0	0	2	5	0	0	7	15	0
6	June	1200		Southwest	0	11	0	20	5	0	0	7	0	0	0	0	0	0	0	0

Appendix B. (continued)

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																
6	June	1200		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200		Northwest Intertidal	0	0	0	0	0	0	0	0	0	3	7	0	0	10	46	2
6	June	1200		Shoulder	0	0	0	0	6	3	0	0	0	0	0	0	0	0	6	0
6	June	1200		Top	0	0	0	0	31	10	0	0	0	0	0	0	0	0	12	0
6	June	1200		East Arm	0	0	0	0	0	0	0	0	0	0	1	0	0	1	24	0
6	June	1200		East Middle	0	11	2	0	0	0	0	0	0	1	1	0	0	2	82	1
6	June	1200		East Intertidal	0	0	0	0	0	0	0	0	2	11	45	0	0	58	130	10
6	June	1200		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	H		79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	I		42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1200	D		0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
6	June	1500		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
6	June	1500		Southwest Middle	0	9	0	20	3	0	0	0	0	0	0	0	0	0	0	0
6	June	1500		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500		Northwest Intertidal	0	0	0	0	0	0	0	0	0	2	17	0	0	19	39	0
6	June	1500		Shoulder	0	0	0	0	8	3	0	0	0	0	0	0	0	0	5	0
6	June	1500		Top	0	0	0	0	27	10	0	0	0	0	0	0	0	0	10	0
6	June	1500		East Arm	0	0	0	0	14	2	0	0	0	0	2	0	0	2	39	0
6	June	1500		East Middle	0	10	2	0	4	0	0	0	0	2	10	0	0	12	153	0
6	June	1500		East Intertidal	0	0	0	0	0	0	0	0	2	5	75	0	0	82	181	0
6	June	1500		North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Cliff																
6	June	1500		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	H		90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	I		23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	June	1500	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
7	June	1000		Southwest Intertidal	0	3	0	0	1	0	0	7	0	3	2	0	0	5	13	0
7	June	1000		Southwest Middle	0	18	0	30	6	0	0	13	0	0	0	0	0	0	0	0
7	June	1000		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000		Northwest Intertidal	0	0	0	0	0	0	0	0	0	3	4	0	0	7	6	0
7	June	1000		Shoulder	0	0	0	7	6	4	0	0	0	0	0	0	0	0	4	0
7	June	1000		Top	0	1	0	0	28	9	0	0	0	0	0	0	0	0	7	0
7	June	1000		East Arm	0	1	0	0	10	2	0	0	0	1	1	0	0	2	40	0
7	June	1000		East Middle	0	13	2	0	2	0	0	7	0	10	16	0	0	26	182	3
7	June	1000		East Intertidal	0	0	0	0	0	0	0	0	4	12	51	0	0	67	73	7
7	June	1000		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	H		70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	I		13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1000	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
7	June	1300		Southwest Intertidal	0	0	0	0	1	0	0	3	0	2	5	0	0	7	11	0
7	June	1300		Southwest	0	25	0	22	7	0	0	19	0	0	0	0	0	0	0	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																
7	June	1300		Northwest Middle	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7	June	1300		Northwest Intertidal	0	0	0	0	0	0	0	0	1	3	5	0	0	9	12	2
7	June	1300		Shoulder	0	0	0	11	5	4	0	0	0	0	0	0	0	0	1	0
7	June	1300		Top	0	1	0	0	28	10	0	0	0	0	0	0	0	0	9	0
7	June	1300		East Arm	0	1	0	0	12	2	0	0	0	0	0	0	0	0	17	0
7	June	1300		East Middle	0	7	2	0	0	0	0	0	0	3	6	0	0	9	157	1
7	June	1300		East Intertidal	0	0	0	0	0	0	0	0	3	7	53	3	0	66	84	6
7	June	1300		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	H		62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	I		15	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	June	1300	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
21	June	1300		Southwest Intertidal	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
21	June	1300		Southwest Middle	1	22	0	0	7	0	0	6	0	0	0	0	0	0	0	0
21	June	1300		Northwest Middle	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300		Shoulder	0	1	0	0	11	4	0	0	0	0	0	0	0	0	13	0
21	June	1300		Top	2	0	0	0	41	12	0	0	0	0	2	0	0	2	71	0
21	June	1300		East Arm	0	0	0	0	5	0	0	0	0	1	3	0	0	4	154	1
21	June	1300		East Middle	0	4	2	0	0	0	0	0	3	8	39	0	0	50	436	9
21	June	1300		East Intertidal	0	0	0	0	0	0	0	0	0	3	6	0	0	9	11	0
21	June	1300		North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Cliff																
21	June	1300		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
21	June	1300	H		58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	I		38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	C		0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1300	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
21	June	1600		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
21	June	1600		Southwest Middle	0	29	0	0	20	0	0	4	0	0	0	0	0	0	0	0
21	June	1600		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1600		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1600		Shoulder	0	0	0	0	11	5	0	0	0	0	0	0	0	0	14	0
21	June	1600		Top	0	2	0	0	31	14	0	0	0	0	2	0	0	2	79	0
21	June	1600		East Arm	0	0	0	0	5	1	0	0	1	1	3	0	0	5	166	4
21	June	1600		East Middle	0	2	2	0	1	0	0	0	3	3	36	0	0	42	417	17
21	June	1600		East Intertidal	0	0	0	0	0	0	0	0	1	1	20	0	0	22	15	0
21	June	1600		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	June	1600		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
21	June	1600	H		68	0	0	0	0	0	0	0								
21	June	1600	I		38	0	0	0	0	0	0	0								
21	June	1600	C		0	0	0	0	7	0	0	0								
21	June	1600	E		0	0	0	0	0	0	0	0								
21	June	1600	F		0	0	0	0	0	0	0	0								
21	June	1600	G		0	0	0	0	0	0	0	0								
21	June	1600	D		0	0	0	0	2	2	0	0								
22	June	900		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	3	0	0	3	4	0
22	June	900		Southwest	0	5	0	14	12	0	0	9	0	0	0	0	0	0	0	0

Appendix B. (continued)

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																
22	June	900		Northwest Middle	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0
22	June	900		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
22	June	900		Shoulder	0	0	0	33	14	4	0	0	0	0	0	0	0	0	2	0
22	June	900		Top	0	0	0	0	25	18	0	0	0	0	0	0	0	0	27	0
22	June	900		East Arm	0	0	0	0	5	1	0	0	0	0	3	0	0	3	65	1
22	June	900		East Middle	0	5	2	0	0	0	0	0	0	3	11	0	0	14	193	7
22	June	900		East Intertidal	0	0	0	0	0	0	0	0	2	4	15	0	0	21	47	5
22	June	900		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	H		81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	I		44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	C		0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
22	June	900	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	900	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
22	June	1200		Southwest Intertidal	0	0	0	0	0	0	0	0	0	1	6	0	0	7	0	0
22	June	1200		Southwest Middle	1	29	0	10	11	0	0	3	0	0	0	0	0	0	0	0
22	June	1200		Northwest Middle	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200		Shoulder	0	0	0	0	17	4	0	0	0	0	0	0	0	0	7	0
22	June	1200		Top	0	0	0	0	36	19	0	0	0	0	0	0	0	0	57	0
22	June	1200		East Arm	0	0	0	0	4	1	0	0	0	0	2	0	0	2	162	3
22	June	1200		East Middle	0	6	2	0	1	0	0	0	3	9	25	0	0	37	482	8
22	June	1200		East Intertidal	0	0	0	0	0	0	0	0	1	0	8	0	0	9	30	0
22	June	1200		North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Cliff																
22	June	1200		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
22	June	1200	H		77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	I		38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	C		0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	June	1200	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
6	July	1200		Southwest Intertidal	0	0	0	0	7	0	0	0	0	0	1	0	0	1	37	4
6	July	1200		Southwest Middle	0	1	0	27	40	0	0	24	0	0	0	0	0	0	0	0
6	July	1200		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	7	0	0	7	110	5
6	July	1200		Shoulder	0	1	0	7	17	4	0	0	0	0	0	0	0	0	0	0
6	July	1200		Top	0	0	0	0	19	15	0	0	0	0	0	0	0	0	4	0
6	July	1200		East Arm	0	3	0	4	2	2	0	0	0	0	0	0	0	0	9	0
6	July	1200		East Middle	0	8	0	33	12	0	0	43	0	0	3	0	0	3	83	8
6	July	1200		East Intertidal	0	0	0	0	0	0	0	0	3	10	33	0	0	46	279	21
6	July	1200		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	H		63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	I		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	C		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	July	1200	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	21	0
5	Aug.	1430		Southwest	0	1	0	30	24	0	0	75	0	0	0	0	0	0	3	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																
5	Aug.	1430		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
5	Aug.	1430		Shoulder	0	1	0	0	8	0	0	0	0	0	0	0	0	0	2	0
5	Aug.	1430		Top	0	0	0	0	12	0	0	0	0	0	0	0	0	0	7	0
5	Aug.	1430		East Arm	0	2	0	0	0	0	0	0	0	0	0	0	0	0	28	0
5	Aug.	1430		East Middle	0	1	0	0	0	0	0	28	0	3	7	0	0	10	231	5
5	Aug.	1430		East Intertidal	0	0	0	0	0	0	0	0	0	4	9	0	0	13	154	2
5	Aug.	1430		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	1430	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045		Southwest Intertidal	0	0	0	0	0	0	0	0		0	4	0	0	4	0	0
16	Nov.	1045		Southwest Middle	0	2		1	50	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	4
16	Nov.	1045		Top	0	0	0	0	0	0	0	0	0	1	0	0	1	2	101	1
16	Nov.	1045		East Arm	0	0	0	0	0	0	0	0	0	4	1	0	4	9	73	4
16	Nov.	1045		East Middle	0	0	0	0	26	0	0	0	0	11	22	1	9	43	387	5
16	Nov.	1045		East Intertidal	0	0	0	0	0	0	0	0	0	1	4	0	1	6	3	0
16	Nov.	1045		North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

Day	Month	Time	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
					Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Cliff																
16	Nov.	1045		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	I		0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Nov.	1045	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	5	0	1	6	0	0
8	Dec.	0830		Southwest Middle	0	17	0	0	9	0	0	0	0	0	0	0		0	1	0
8	Dec.	0830		Northwest Middle	0	0	0	0	0	0	8	0	0	0	0	0		0	0	0
8	Dec.	0830		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
8	Dec.	0830		Shoulder	0	1	0	0	0	0	0	0	0	0	0	0		0	37	0
8	Dec.	0830		Top	0	1	0	0	0	0	0	0	0	0	1	0	0	1	57	0
8	Dec.	0830		East Arm	0	1	0	0	0	0	0	0						0	51	0
8	Dec.	0830		East Middle	0	11	0	0	0	0	0	0	0	8	9	0	10	27	222	6
8	Dec.	0830		East Intertidal	0	0	0	0	0	0	0	0	0	2	10	1	2	15	2	0
8	Dec.	0830		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830		East Valley	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Dec.	0830	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820		Southwest Intertidal	0	4	0	0	0	0	0	0	0	3	0	0	3	6	3	0
27	Jan.	0820		Southwest	0	96	0	0	36	0	0	0	0	0	0	0	0	0	0	0

Appendix B. (continued)

					COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Day	Month	Time	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
				Middle																
27	Jan.	0820		Northwest Middle	0	6	0	0	6	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820		Shoulder	0	1	0	0	9	0	0	0	0	0	0	0	0	0	67	0
27	Jan.	0820		Top	0	1	0	0	13	0	0	0	0	2	4	0	0	6	111	0
27	Jan.	0820		East Arm	0		0	0	0	0	0	0	0	7	7	0	0	14	289	
27	Jan.	0820		East Middle	0	9	0	0	21	0	0	0	0	30	46	0	5	81	937	5
27	Jan.	0820		East Intertidal	0	5	0	0	0	0	0	0	0	6	3	0	3	12	97	3
27	Jan.	0820		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820		East Valley	0	15	0	0	2	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	Jan.	0820	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. Numbers of seabirds and sea lions by zone or area of Redding Rock from boat surveys, 2009. Codes: COMU, Common Murre; WEGU, Western Gull; BRPE, Brown Pelican; BRCO, Brandt's Cormorant; PECO, Pelagic Cormorant; HEEG, Heermann's Gull; SubAd. M/Ad. F, Subadult Male/Adult Female; Imm, Immature; Yrl, Yearling; Calif., California; Unid. Unidentified.

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
24	March		Southwest Intertidal	0	0	0	0	0	0	0	0	0	1	6	0	0	7	5	0
24	March		Southwest Middle	0	7	0	0	8	0	0	0	0	0	0	0	0	0	0	0
24	March		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March		Shoulder	0	2	0	0	44	0	3	0	0	0	0	0	0	0	1	0
24	March		Top	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0
24	March		East Arm	0	7	0	0	32	0	0	0	0	0	0	0	0	0	16	0
24	March		East Middle	0	3	0	0	66	0	0	0	0	0	20	0	0	20	123	3
24	March		East Intertidal	0	1	0	0	0	0	0	0	1	9	42	1	0	53	41	2
24	March		North Cliff	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0
24	March		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	March	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	2	0	0	2	3	0
25	March		Southwest Middle	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
25	March		Northwest Middle	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
25	March		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March		East Arm	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
25	March		East Middle	0	0	0	0	0	0	0	0	0	2	4	0	0	6	61	6
25	March		East Intertidal	0	0	0	0	0	0	0	0	0	2	36	0	0	38	26	6
25	March		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	March	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April		Southwest Intertidal	0	3	0	0	0	0	0	0	0	1	9	1	0	11	0	0
5	April		Southwest Middle	0	5	0	0	6	0	0	0	0	0	0	0	0	0	0	0
5	April		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April		Top	0	0	0	0	0	0	0	0	0	0	2	0	0	2	33	3
5	April		East Arm	0	2	0	0	1	0	0	0	0	0	1	0	0	1	55	1
5	April		East Middle	0	4	0	0	7	0	0	0	0	0	5	0	0	5	43	0
5	April		East Intertidal	0	0	0	0	0	0	0	0	0	5	34	0	0	39	46	0
5	April		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April			56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	H		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	April	D		0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0
17	April		Southwest Intertidal	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
17	April		Southwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
17	April		Northwest Intertidal	0	0	0	0	9	0	0	0	0	0	0	0	0	0	14	0
17	April		Shoulder	0	1	0	0	0	0	0	0	0	0	0	0	0	0	14	0
17	April		Top	0	2	0	0	0	0	0	0	0	0	0	0	0	0	43	1
17	April		East Arm	0	7	0	0	14	0	0	0	0	0	2	0	0	2	96	1
17	April		East Middle	0	0	0	0	0	0	0	0	0	6	28	0	0	34	73	3
17	April		East Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April		North Cliff	0	1	0	0	0	0	0	0	0	0	0	0	0	0	9	0
17	April		East Valley	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	H		51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	April	D		0	3	0	0	0	0	0	0	0	1	9	1	0	11	0	0
22	April		Southwest Intertidal	0	3	0	0	0	0	0	0	0	0	3	1	0	4	0	0
22	April		Southwest Middle	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
22	April		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April		Shoulder	0	1	0	0	3	0	0	0	0	0	0	0	0	0	4	0
22	April		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1
22	April		East Arm	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	0
22	April		East Middle	0	21	0	0	15	0	0	0	0	0	3	0	0	3	81	2
22	April		East Intertidal	0	0	0	0	0	0	0	0	0	0	17	0	0	17	25	0
22	April		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	April	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April		Southwest Intertidal	0	1	0	0	0	0	0	0	0	1	3	0	0	4	12	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
30	April		Southwest Middle	16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April		Northwest Intertidal	0	2	0	0	0	0	0	0	0	0	0	0	0	0	19	4
30	April		Shoulder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2
30	April		East Arm	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	1
30	April		East Middle	0	4	0	0	0	0	0	0	0	0	0	0	0	0	66	1
30	April		East Intertidal	0	0	0	0	0	0	0	0	0	8	26	0	0	34	112	29
30	April		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	H		73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	I		44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	April	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May		Southwest Intertidal	0	4	0	0	0	0	0	0	0	2	4	0	0	6	2	0
10	May		Southwest Middle	0	14	0	17	7	0	0	0	0	0	0	0	0	0	0	0
10	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	1
10	May		Shoulder	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0
10	May		Top	0	1	0	0	13	0	0	0	0	0	0	0	0	0	13	0
10	May		East Arm	0	6	0	3	2	0	0	0	0	0	0	0	0	0	29	2
10	May		East Middle	0	7	0	0	37	0	0	0	0	1	0	0	0	1	117	3
10	May		East Intertidal	0	0	0	0	0	0	0	0	0	4	32	2	0	38	87	6
10	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
10	May	H		49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May	I		10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
10	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	May	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	3	2	0	0	5	2	3
13	May		Southwest Middle	0	9	0	0	4	0	0	0	0	0	0	0	0	0	0	0
13	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	1	1	0	0	2	16	0
13	May		Shoulder	0	0	0	0	14	0	0	0	0	0	0	0	0	0	1	0
13	May		Top	0	2	0	0	21	0	0	0	0	0	0	0	0	0	9	1
13	May		East Arm	0	1	0	0	0	0	0	0	0	0	0	0	0	1	45	4
13	May		East Middle	0	4	0	2	17	0	0	0	0	1	0	0	0	1	159	7
13	May		East Intertidal	0	0	0	0	0	0	0	0	0	7	21	0	0	28	55	16
13	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	H		64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	I		42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	May	D		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
17	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
17	May		Southwest Middle	0	8	0	1	1	0	0	0	0	0	0	0	0	0	0	0
17	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	21	1
17	May		Shoulder	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	0
17	May		Top	0	3	0	0	12	0	0	0	0	0	0	0	0	0	4	0
17	May		East Arm	0	1	0	0	0	0	0	0	0	0	0	0	0	0	12	1
17	May		East Middle	0	24	0	0	2	0	0	0	0	3	0	0	0	3	50	4
17	May		East Intertidal	0	0	0	0	0	0	0	0	0	6	13	0	0	20	124	12
17	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May		East Valley	0	1	0	0	0	0	0	0	0	0	0	0	0	0	10	0
17	May	H		59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
17	May	I		21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	May	D		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
19	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3	0
19	May		Southwest Middle	0	6	0	0	3	0	0	0	0	0	0	0	0	0	0	0
19	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	2	0	0	2	64	1
19	May		Shoulder	0	0	0	3	22	0	0	0	0	0	0	0	0	0	3	0
19	May		Top	0	5	0	0	20	0	0	0	0	0	0	0	0	0	13	0
19	May		East Arm	0	5	0	0	0	0	0	0	0	0	0	0	0	0	38	0
19	May		East Middle	0	6	1	0	3	0	0	0	0	0	0	0	0	0	63	3
19	May		East Intertidal	0	0	0	0	0	0	0	0	3	5	21	0	0	29	154	4
19	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	H		47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	I		39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	May	D		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
31	May		Southwest Intertidal	0	0	0	0	0	0	0	0	0	1	1	1	0	3	0	0
31	May		Southwest Middle	41	17	0	14	3	0	0	0	0	0	2	0	0	2	0	0
31	May		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May		Northwest Intertidal	0	0	0	0	0	0	0	0	1	1	5	0	0	7	37	0
31	May		Shoulder	0	1	0	0	5	5	0	0	0	0	0	0	0	0	6	0
31	May		Top	0	2	0	3	18	5	0	0	0	0	0	0	0	0	12	0
31	May		East Arm	0	1	0	6	2	2	0	0	0	0	0	0	0	0	52	0
31	May		East Middle	0	25	2	5	4	0	0	4	1	0	3	0	0	4	144	4
31	May		East	0	0	0	0	0	0	0	0	3	8	29	0	0	40	32	2

Appendix C. (continued)

Date	Month	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
				Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
			Intertidal																
31	May		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
31	May	H		71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	I		23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	May	D		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2	June		Southwest Intertidal	0	6	0	0	0	0	0	0	0	4	0	0	0	4	1	0
2	June		Southwest Middle	0	11	0	23	4	0	0	3	0	0	0	0	0	0	0	0
2	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June		Northwest Intertidal	0	0	0	0	0	0	0	0	2	2	10	0	0	14	24	0
2	June		Shoulder	0	0	0	11	8	5	0	0	0	0	0	0	0	0	13	0
2	June		Top	0	0	0	0	17	8	0	0	0	0	0	0	0	0	22	1
2	June		East Arm	0	1	1	0	2	2	0	0	0	0	1	0	0	1	86	3
2	June		East Middle	0	7	2	0	1	0	0	0	0	4	17	1	0	22	147	15
2	June		East Intertidal	0	0	0	0	0	0	0	0	4	3	75	0	0	82	36	7
2	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June		East Valley	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2	June	H		78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	I		48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	June	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
5	June		Southwest Intertidal	0	13	0	0	15	0	0	0	0	1	5	0	0	6	14	1
5	June		Southwest Middle	0	15	0	11	8	0	0	6	0	0	0	0	0	0	0	0
5	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	3	5	0	0	8	39	0
5	June		Shoulder	0	0	0	0	5	5	0	0	0	0	0	0	0	0	5	0
5	June		Top	0	2	0	0	25	9	0	0	0	0	0	0	0	0	10	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
5	June		East Arm	0	0	0	0	12	2	0	0	0	0	0	0	0	0	54	2
5	June		East Middle	0	58	2	13	19	0	0	6	0	0	5	0	0	5	72	5
5	June		East Intertidal	0	3	0	0	0	0	0	1	5	15	54	0	0	74	71	5
5	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June		East Valley	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
5	June	H		35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	I		15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	June	D		0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
8	June		Southwest Intertidal	0	2	0	0	5	0	0	1	1	3	2	0	0	6	11	1
8	June		Southwest Middle	2	27	0	1	9	0	0	23	0	0	0	0	0	0	0	0
8	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June		Northwest Intertidal	0	0	0	0	0	0	0	0	2	1	24	0	0	27	37	0
8	June		Shoulder	0	0	0	0	6	5	0	0	0	0	0	0	0	0	5	0
8	June		Top	0	3	0	0	26	11	0	0	0	0	0	0	0	0	18	0
8	June		East Arm	0	1	0	0	6	2	0	0	0	0	0	0	0	0	22	0
8	June		East Middle	0	7	2	19	6	0	0	3	0	0	1	0	0	1	55	3
8	June		East Intertidal	0	0	0	0	0	0	0	0	2	13	36	0	0	51	91	12
8	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	H		58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	I		37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	June	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
11	June		Southwest Intertidal	0	6	0	0	6	0	0	4	2	1	4	0	0	7	14	0
11	June		Southwest Middle	0	43	0	30	25	0	0	18	0	0	0	0	0	0	0	0
11	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
11	June		Northwest Intertidal	0	3	0	0	0	0	0	0	0	1	8	1	0	10	11	0
11	June		Shoulder	0	1	0	0	8	5	0	0	0	0	0	0	0	0	2	0
11	June		Top	0	0	0	0	35	13	0	0	0	0	0	0	0	0	5	0
11	June		East Arm	0	0	0	3	9	2	0	0	0	0	0	0	0	0	7	0
11	June		East Middle	0	44	2	40	37	0	0	3	0	0	1	0	0	1	33	2
11	June		East Intertidal	0	0	0	0	0	0	0	0	1	9	46	0	0	56	83	6
11	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	H		66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	I		33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	June	D		0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
16	June		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	19	1
16	June		Southwest Middle	0	1	0	51	0	0	0	7	0	0	0	0	0	0	2	0
16	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June		Northwest Intertidal	0	0	0	0	1	0	0	0	0	1	2	0	0	3	18	0
16	June		Shoulder	0	0	0	26	7	5	0	3	0	0	0	0	0	0	5	0
16	June		Top	0	1	0	0	28	16	0	0	0	0	0	0	0	0	24	0
16	June		East Arm	0	0	0	27	7	2	0	0	0	0	0	0	0	0	42	0
16	June		East Middle	0	23	2	76	19	0	0	0	0	1	4	0	0	5	107	3
16	June		East Intertidal	0	6	0	0	1	0	0	0	2	11	28	0	0	41	88	3
16	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
16	June	H		59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	I		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	June	D		0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0
24	June		Southwest Intertidal	0	16	0	0	1	0	0	0	1	0	0	0	0	1	15	0

Appendix C. (continued)

Date	Month	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
				Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
24	June		Southwest Middle	0	6	0	64	15	0	0	5	0	2	0	0	0	2	0	0
24	June		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	1	0	0	1	31	1
24	June		Shoulder	0	1	0	9	7	4	0	0	0	0	0	0	0	0	7	0
24	June		Top	0	2	0	0	18	16	0	0	0	0	0	0	0	0	17	0
24	June		East Arm	0	1	0	0	4	2	0	0	0	2	3	0	0	5	56	3
24	June		East Middle	0	13	2	3	0	0	0	1	1	6	15	0	0	22	183	1
24	June		East Intertidal	0	0	0	0	0	0	0	0	2	8	40	0	0	50	210	4
24	June		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1
24	June	H		62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June	I		33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June	C		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
24	June	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	June	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
3	July		Southwest Intertidal	0	1	0	0	0	0	0	0	0	0	1	0	0	1	3	0
3	July		Southwest Middle	0	2	0	14	20	0	0	15	0	0	1	0	0	1	0	0
3	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
3	July		Shoulder	0	0	0	16	6	4	0	1	0	0	0	0	0	0	11	0
3	July		Top	0	2	0	1	22	12	0	0	0	0	0	0	0	0	26	0
3	July		East Arm	0	2	0	0	13	4	0	2	0	0	1	0	0	1	78	1
3	July		East Middle	0	1	0	1	0	0	0	8	0	2	7	0	0	9	351	1
3	July		East Intertidal	0	0	0	0	0	0	0	0	1	2	13	0	0	16	69	2
3	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
3	July	H		48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July	I		24	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
3	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
3	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	July	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
8	July		Southwest Intertidal	0	1	0	0	0	0	0	0	0	1	0	0	0	1	29	0
8	July		Southwest Middle	0	4	0	9	26	0	0	42	0	0	1	0	0	1	0	0
8	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0
8	July		Shoulder	0	0	0	13	11	4	0	0	0	0	0	0	0	0	2	0
8	July		Top	0	0	0	0	22	13	0	0	0	0	0	0	0	0	9	0
8	July		East Arm	0	1	0	4	2	2	0	0	0	0	0	0	0	0	6	0
8	July		East Middle	0	4	1	4	4	0	0	34	0	0	1	0	0	1	100	0
8	July		East Intertidal	0	0	0	0	0	0	0	0	4	14	27	0	0	45	236	7
8	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	H		40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	I		32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	July	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
9	July		Southwest Intertidal	0	1	0	0	6	0	0	0	0	0	0	0	0	0	8	0
9	July		Southwest Middle	1	0	0	16	43	0	0	28	0	0	0	0	0	0	2	0
9	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	2	0	0	2	14	0
9	July		Shoulder	0	0	0	4	10	4	0	1	0	0	0	0	0	0	6	0
9	July		Top	0	4	0	0	20	11	0	0	0	0	0	0	0	0	25	0
9	July		East Arm	0	1	0	0	3	2	0	0	0	0	0	0	0	0	10	0
9	July		East Middle	0	3	0	0	0	0	0	2	0	2	3	0	0	5	153	0
9	July		East Intertidal	0	0	0	0	0	0	0	0	3	10	16	1	0	30	148	5
9	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
9	July	H		29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
9	July	I		38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	July	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
12	July		Southwest Intertidal	0	0	0	0	1	0	0	2	0	0	1	0	0	1	29	0
12	July		Southwest Middle	0	0	0	9	27	0	0	34	0	0	0	0	0	0	0	0
12	July		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	4
12	July		Shoulder	0	1	0	6	1	0	0	1	0	0	0	0	0	0	2	0
12	July		Top	0	2	0	0	12	7	0	1	0	0	0	0	0	0	11	0
12	July		East Arm	0	1	0	0	2	2	0	1	0	0	0	0	0	0	1	0
12	July		East Middle	0	15	0	3	0	0	0	44	0	1	0	0	0	1	9	0
12	July		East Intertidal	0	1	0	0	0	0	0	0	1	2	6	0	0	9	175	0
12	July		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	H		9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	I		26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	July	D		0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0
16	July		Southwest Intertidal	0	1	0	0	1	0	0	0	0	0	0	0	0	0	29	0
16	July		Southwest Middle	0	2	0	0	46	0	0	8	0	0	5	0	0	5	0	0
16	July		Northwest Middle	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
16	July		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
16	July		Shoulder	0	0	0	0	10	0	0	1	0	0	0	0	0	0	3	0
16	July		Top	0	0	0	0	12	6	0	0	0	0	0	0	0	0	16	0
16	July		East Arm	0	0	0	0	2	1	0	0	0	0	0	0	0	0	15	0
16	July		East Middle	0	4	0	0	8	0	0	5	0	4	0	0	0	4	137	0
16	July		East	0	0	0	0	1	0	0	0	0	4	12	0	0	16	265	1

Appendix C. (continued)

Date	Month	Area	Zone	COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
				Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
			Intertidal																
16	July		North Cliff	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
16	July		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
16	July	H		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	I		33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	July	D		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
5	Aug.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0
5	Aug.		Southwest Middle	0	0	0	25	19	0	0	44	0	0	0	0	0	0	0	0
5	Aug.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
5	Aug.		Shoulder	0	1	0	5	10	0	0	0	0	0	0	0	0	0	2	0
5	Aug.		Top	0	1	0	2	8	0	0	0	0	0	0	0	0	0	7	0
5	Aug.		East Arm	0	1	0	0	0	0	0	0	0	0	0	0	0	0	16	0
5	Aug.		East Middle	0	2	0	0	2	0	0	38	0	1	3	0	0	4	171	1
5	Aug.		East Intertidal	0	0	0	0	0	0	0	0	0	9	1	0	0	10	157	3
5	Aug.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Aug.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	4	0	0	4	12	0
9	Sept.		Southwest Middle	0	4	0	1	16	0	0	25	0	0	0	0	0	0	0	0
9	Sept.		Northwest Middle	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
9	Sept.		Northwest Intertidal	0	0	0	0	1	0	0	0	0	0	0	0	0	0	7	0
9	Sept.		Shoulder	0	2	0	0	1	0	0	0	0	0	0	0	0	0	13	0
9	Sept.		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
9	Sept.		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0
9	Sept.		East Middle	0	0	0	0	0	0	0	2	0	0	6	0	0	6	212	5
9	Sept.		East Intertidal	0	0	0	0	0	0	0	0	0	6	11	1	8	26	279	6
9	Sept.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Sept.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	4	0	0	4	7	0
23	Sept.		Southwest Middle	0	12	0	0	10	0	0	0	0	0	0	0	0	0	0	0
23	Sept.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.		Northwest Intertidal	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0
23	Sept.		Shoulder	0	3	0	0	0	0	0	0	0	0	0	0	0	0	18	0
23	Sept.		Top	0	2	0	0	0	0	0	0	0	0	0	0	0	0	35	0
23	Sept.		East Arm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	2
23	Sept.		East Middle	0	3	0	0	1	0	0	2	0	0	4	0	1	5	312	4
23	Sept.		East Intertidal	0	0	0	0	0	0	0	0	0	3	10	0	8	21	119	9
23	Sept.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Sept.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.		Southwest Intertidal	0	0	0	0	0	0	0	0	0	0	2	0	0	2	1	0
2	Dec.		Southwest Middle	0	5	0	0	1	0	1	0	0	0	3	0	0	3	0	0
2	Dec.		Northwest Middle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. (continued)

				COMU	WEGU		BRPE	BRCO		PECO	HEEG	Steller sea lion						Calif. sea lion	Unid. sea lion
Date	Month	Area	Zone	Bird	Bird	Nest	Bird	Bird	Nest	Bird	Bird	Bull	SubAd. M/Ad. F	Imm	Yrl	Pup	Total	Total	Total
2	Dec.		Northwest Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.		Shoulder	0	0	0	0	0	0	0	0	0	0	3	0	0	3	69	4
2	Dec.		Top	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1
2	Dec.		East Arm	0	0	0	0	0	0	0	0	0	2	6	0	2	10	27	5
2	Dec.		East Middle	0	3	0	0	0	0	0	0	0	5	22	0	12	39	226	22
2	Dec.		East Intertidal	0	0	0	0	0	0	0	0	0	1	12	0	5	18	22	1
2	Dec.		North Cliff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.		East Valley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	H		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	I		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	C		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	E		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	F		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	G		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Dec.	D		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix D. Steller sea lion brands observed during coast-wide sea lion surveys and aerial photographic surveys of Redding Rock, March 2009 - January 2010.

Date	Location	Brand	Survey Type	Year Branded	Sex
3/23/2009	Redding Rock	274Y	Aerial	2004	F
3/23/2009	Redding Rock	129Y	Aerial	2002	F
3/24/2009	Redding Rock	87Y	Boat	2002	F
3/25/2009	Redding Rock	274Y	Boat	2004	F
3/25/2009	Redding Rock	87Y	Boat	2002	F
4/5/2009	Redding Rock	615R	Boat	2007	M
4/5/2009	Turtle Rock	87Y	Boat	2002	F
4/5/2009	Turtle Rock	405R	Boat	2005	F
4/17/2009	Redding Rock	615R	Boat	2007	M
4/30/2009	Redding Rock	194Y	Boat	2004	F
4/30/2009	Turtle Rock	273R	Boat	2003	M
4/30/2009	Turtle Rock	117Y	Boat	2002	F
4/30/2009	Turtle Rock	87Y	Boat	2002	F
4/30/2009	Turtle Rock	274Y	Boat	2004	F
5/10/2009	Turtle Rock	183R	Boat	2003	M
5/10/2009	Turtle Rock	615R	Boat	2007	M
5/10/2009	Turtle Rock	20Y	Boat	2002	N/A
5/10/2009	Turtle Rock	228_	Boat		
5/10/2009	Sea Lion Rock	10Y	Boat	2002	M
5/10/2009	Sea Lion Rock	76Y	Boat	2002	F
5/13/2009	Redding Rock	375R	Boat	2005	F
5/17/2009	Turtle Rock	375R	Boat	2005	F
5/17/2009	Turtle Rock	180Y	Boat	2004	F
5/17/2009	Turtle Rock	20Y	Boat	2002	N/A
5/17/2009	Palmer's Point	164Y	Boat	2004	M
5/17/2009	Otter Rock	226Y	Boat	2004	F
5/17/2009	Otter Rock	195R	Boat	2003	M
5/17/2009	Sea Lion Rock	76Y	Boat	2002	F
5/19/2009	Redding Rock	543R	Boat	2007	F
5/28/2009	Redding Rock	129Y	Aerial	2002	F
5/30/2009	Northwest Seal Rock	268Y	Boat	2003	F
5/30/2009	Northwest Seal Rock	2__R	Boat		
5/30/2009	Northwest Seal Rock	226Y	Boat	2004	F
5/30/2009	Northwest Seal Rock	19Y	Boat	2002	F
5/30/2009	Northwest Seal Rock	432R	Boat	2005	M
5/30/2009	Northwest Seal Rock	242Y	Boat	2004	F
5/30/2009	Southwest Seal Rock	193Y	Boat	2004	M
5/30/2009	Southwest Seal Rock	16Y	Boat	2002	M
5/31/2009	Other Rocks	10Y	Boat	2002	M
5/31/2009	Turtle Rocks	317R	Boat	2003	F
5/31/2009	Klamath River Rocks	129Y	Boat	2002	F

Appendix D. (continued)

Date	Location	Brand	Survey Type	Year Branded	Sex
5/31/2009	Southwest Seal Rock	212Y	Boat	2004	F
6/2/2009	Redding Rock	479R	Boat	2007	M
6/5/2009	Redding Rock	199Y	Boat	2004	M
6/5/2009	Redding Rock	615R	Boat	2007	M
6/5/2009	Turtle Rock	20Y	Boat	2002	N/A
6/5/2009	Turtle Rock	120Y	Boat	2002	F
6/5/2009	Palmer's Point	140Y	Boat	2002	M
6/5/2009	Otter Rock	220R	Boat	2003	M
6/5/2009	Otter Rock	180Y	Boat	2004	F
6/5/2009	Otter Rock	477R	Boat	2007	F
6/5/2009	Other Rock	14Y	Boat	2002	M
6/5/2009	Other Rock	183R	Boat	2003	M
6/6/2009	Redding Rock	271R	Aerial	2003	M
6/6/2009	Redding Rock	125Y	Aerial	2002	F
6/6/2009	Redding Rock	615R	Aerial	2007	M
6/6/2009	Redding Rock	120Y	Aerial	2002	F
6/6/2009	Redding Rock	204Y	Aerial	2004	M
6/7/2009	Redding Rock	204Y	Aerial	2004	M
6/7/2009	Redding Rock	180Y	Aerial	2004	F
6/7/2009	Redding Rock	615R	Aerial	2007	M
6/8/2009	Redding Rock	615R	Boat	2007	M
6/11/2009	Other Rock	13Y	Boat	2002	F
6/11/2009	Other Rock	281Y	Boat	2004	M
6/11/2009	Otter Rock	220R	Boat	2003	M
6/11/2009	Otter Rock	175Y	Boat	2004	M
6/11/2009	Turtle Rock	201Y	Boat	2004	M
6/11/2009	Redding Rock	216Y	Boat	2004	M
6/11/2009	Redding Rock	479R	Boat	2007	M
6/12/2009	Castle Rock	218Y	Boat	2004	F
6/12/2009	Castle Rock	335R	Boat	2003	M
6/12/2009	Castle Rock	102Y	Boat	2002	M
6/12/2009	Castle Rock	136Y	Boat	2002	M
6/12/2009	Castle Rock	76Y	Boat	2002	F
6/12/2009	Castle Rock	235Y	Boat	2004	M
6/16/2009	Turtle Rock	10Y	Boat	2002	M
6/16/2009	Redding Rock	2Y	Boat	2002	M
6/21/2009	Redding Rock	2Y	Aerial	2002	M
6/21/2009	Redding Rock	16Y	Aerial	2002	M
6/21/2009	Redding Rock	129Y	Aerial	2002	F
6/22/2009	Redding Rock	2Y	Aerial	2002	M
6/24/2009	Redding Rock	375R	Boat	2005	F
7/2/2009	Northwest Seal Rock	108R	Boat	2001	F
7/2/2009	Northwest Seal Rock	165R	Boat	2001	F
7/2/2009	Southwest Seal Rock	12_Y	Boat		

Appendix D. (continued)

Date	Location	Brand	Survey Type	Year Branded	Sex
7/2/2009	Southwest Seal Rock	39Y	Boat	2002	F
7/2/2009	Castle Rock	103Y	Boat	2002	F
7/2/2009	Castle Rock	6R	Boat	2001	M
7/3/2009	Sea Lion Rock	102Y	Boat	2002	M
7/3/2009	Palmer's Point	197Y	Boat	2004	F
7/3/2009	Turtle Rock	374R	Boat	2005	F
7/3/2009	Turtle Rock	117Y	Boat	2002	F
7/3/2009	Otter Rock	287Y	Boat	2004	M
7/3/2009	Other Rock	76Y	Boat	2002	F
7/3/2009	Other Rock	275R	Boat	2003	M
7/3/2009	Redding Rock	43_R	Boat		
7/8/2009	Sea Lion Rock	120Y	Boat	2002	F
7/8/2009	Otter Rock	176Y	Boat	2004	F
7/12/2009	Sea Lion Rock	10Y	Boat	2002	M
7/12/2009	Otter Rock	197Y	Boat	2004	F
7/12/2009	Turtle Rock	178Y	Boat	2004	F
7/12/2009	Turtle Rock	374R	Boat	2005	F
7/12/2009	Turtle Rock	129Y	Boat	2002	F
7/12/2009	Turtle Rock	219Y	Boat	2004	F
7/12/2009	Turtle Rock	543R	Boat		
7/22/2009	Southwest Seal Rock	212Y	Boat	2004	F
7/22/2009	Southwest Seal Rock	_9Y	Boat		
7/22/2009	Southwest Seal Rock	363R	Boat	2003	F
7/22/2009	Southwest Seal Rock	274Y	Boat	2004	F
7/22/2009	Southwest Seal Rock	88Y	Boat	2002	F
7/22/2009	Southwest Seal Rock	214Y	Boat	2004	F
7/22/2009	Southwest Seal Rock	26Y	Boat	2002	F
7/22/2009	Southwest Seal Rock	334R	Boat	2003	F
7/22/2009	Pt. St. George	160Y	Boat	2004	F
7/22/2009	Castle Rock	301R	Boat	2003	M
7/29/2009	Southwest Sea Rock	26Y	NMML survey	2002	F
7/29/2009	Southwest Sea Rock	78Y	NMML survey	2002	F
7/29/2009	Southwest Sea Rock	200Y	NMML survey	2004	F
7/29/2009	Southwest Sea Rock	222Y	NMML survey	2004	F
7/29/2009	Southwest Sea Rock	227Y	NMML survey	2004	F
7/29/2009	Southwest Sea Rock	272Y	NMML survey	2004	F
7/29/2009	Southwest Sea Rock	543R	NMML survey	2007	F
9/16/2009	Castle Rock	228Y	Boat	2004	F
10/16/2009	Southwest Seal Rock	407R	Boat	2005	M
10/16/2009	Southwest Seal Rock	78Y	Boat	2002	F
10/16/2009	Northwest Seal Rock	26Y	Boat	2002	F
10/16/2009	Castle Rock	37Y	Boat	2002	M
1/27/2010	Redding Rock	204Y	Aerial	2004	M
1/27/2010	Redding Rock	245Y	Aerial	2004	F

Appendix D. (continued)

Date	Location	Brand	Survey Type	Year Branded	Sex
1/27/2010	Redding Rock	129Y	Aerial	2002	F
1/27/2010	Redding Rock	274Y	Aerial	2004	F

Appendix E. Photographic history of Redding Rock from aerial photographic surveys during the seabird breeding season, 1979-2009, showing the distributions of the Common Murre colony, sea lion haul outs, and other features.

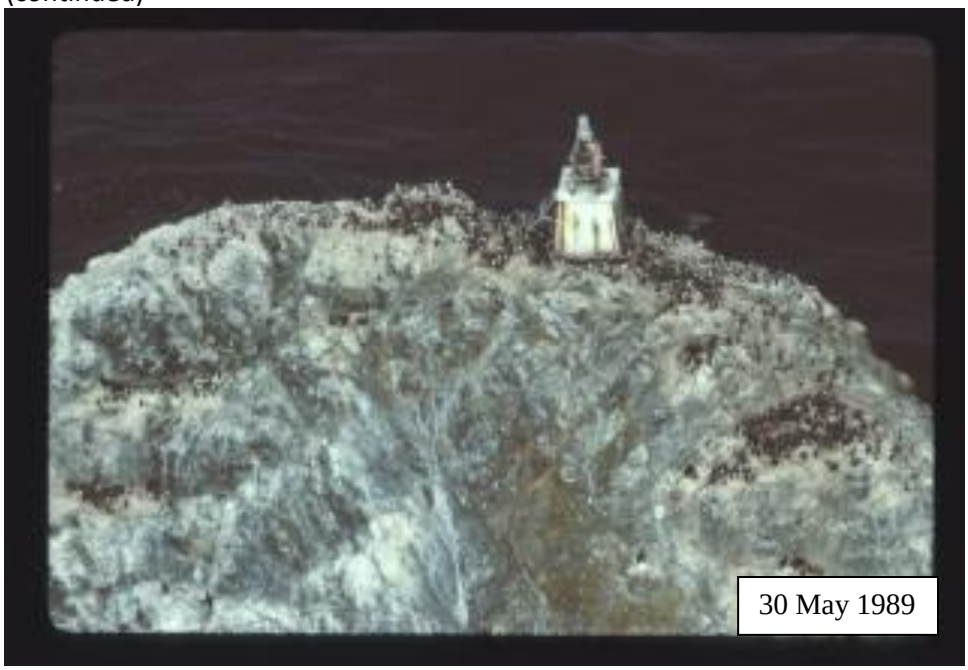
Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)



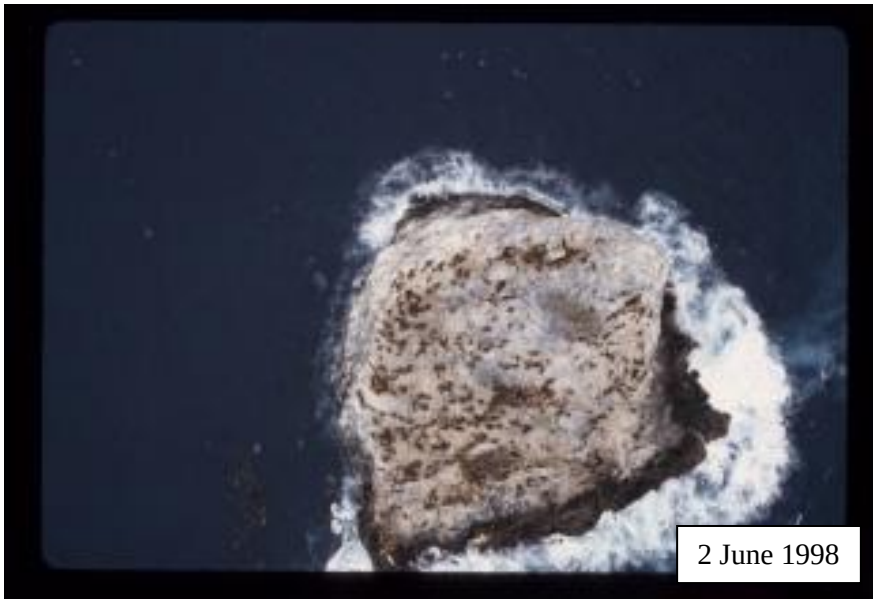
Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

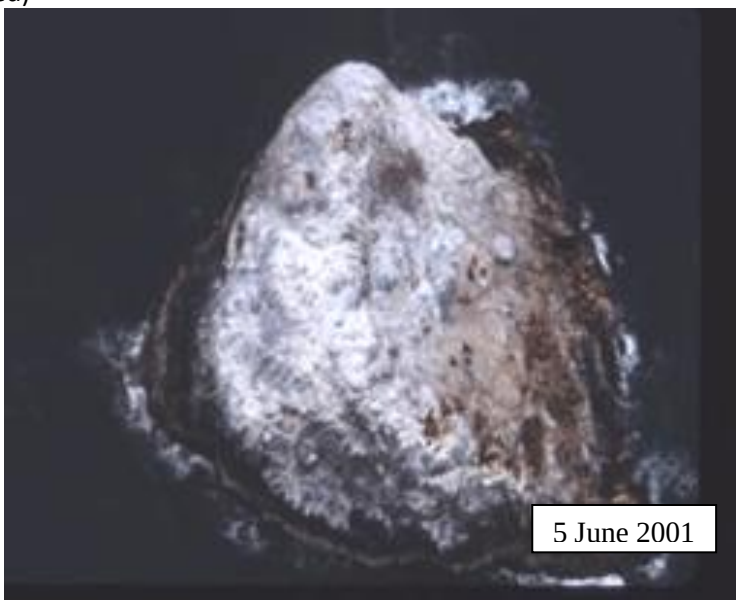
Appendix E. (continued)



Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)



Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)

Appendix E. (continued)