RESTORATION OF COMMON MURRE COLONIES IN CENTRAL CALIFORNIA: ANNUAL REPORT 2005

REPORT TO THE *APEX HOUSTON* TRUSTEE COUNCIL
AND
COMMAND TRUSTEE COUNCIL

Gerard J. McChesney, Lisa E. Eigner, Travis B. Poitras, Peter J. Kappes, Danielle Le Fer, Levin T. Nason, Phillip J. Capitolo, Heather Beeler, Chadd E. Fitzpatrick, Richard T. Golightly, Kirsten S. Bixler, Harry R. Carter, Stephen W. Kress, and Michael W. Parker

U.S. Fish and Wildlife Service
San Francisco Bay National Wildlife Refuge Complex
9500 Thornton Avenue
Newark, CA 94560 USA

FINAL REPORT
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The Common Murre Restoration Project is conducted cooperatively by the U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex (USFWS-SFBNWRC), Humboldt State University (HSU), the National Audubon Society (NAS), and other public and private organizations, with oversight by the *Apex Houston* Trustee Council (made up of USFWS, National Oceanic and Atmospheric Administration [NOAA], and California Department of Fish and Game [CDFG]) and *Command* Trustee Council (made up of USFWS, NOAA, CDFG, California State Parks, and California State Lands Commission).

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EXECUTIVE SUMMARY

This report summarizes the tenth year of seabird restoration and associated monitoring in central California conducted by the Common Murre Restoration Project (CMRP) in 2005. These efforts began in 1996 to restore breeding colonies of seabirds, especially Common Murres, harmed by the 1986 *Apex Houston* oil spill, gill net fishing, and other factors. Our primary goal has been to restore the extirpated Devil's Slide Rock murre colony, as well as to monitor and restore other colonies impacted by the spill. In 2005, the CMRP was augmented to restore seabird colonies impacted by the 1998 *Command* oil spill, with the goal to restore affected breeding colonies mainly through reduction of human disturbance. This augmentation included the reestablishment of monitoring and disturbance surveillance at Point Reyes where monitoring by CMRP was discontinued following the 2002 breeding season.

Since 1996, social attraction equipment (murre decoys, sound system playing murre calls, and mirrors) has been used to restore the murre colony at Devil's Slide Rock, with an ititial goal of obtaining at least 100 nesting pairs within 10 years. Because of rapid recolonization in 1996 and strong colony growth from 1999 to 2004, the numbers of decoys have been reduced dramatically in recent years. In February 2005, only 74 adult murre decoys (66 standing, 8 incubating) were redeployed and the sound system turned back on. This was 33.9% fewer decoys than in 2004, and 81% fewer than the original plot design utilized in 1996-1998. For the first time since 1996, decoys were only placed on the east portion of the rock and none on the west portion. Two remote video cameras were installed for the first time on Devil's Slide Rock to assist monitoring efforts.

Besides the social attraction work, data were collected on various aspects of murre and other seabird breeding and population ecology, as well as both anthropogenic and non-anthropogenic disturbance, to assist and guide monitoring efforts. Data collected on Common Murres included: seasonal attendance patterns; breeding population sizes; breeding phenology and reproductive success; and adult time budgets (Devil's Slide Rock only). Also, data on Brandt's Cormorant (*Phalacrocorax penicillatus*) breeding population sizes, breeding phenology, and productivity (Devil's Slide only) were collected.

In 2005, 164 breeding pairs of murres fledged 52 chicks on Devil's Slide Rock, a decrease of 26 nesting pairs and 81 fledged chicks from the 2004 breeding season. Breeding success of 0.32 chicks per pair was the lowest since restoration efforts began in 1996. Delayed breeding, reduced breeding effort, and reduced breeding success was demonstrated at other monitored colonies as well. Reduced productivity at most colonies was attributed to poor foraging conditions that resulted from a lack of spring upwelling and unusually warm water conditions (non-El Niño related) in central California. At Castle Rocks and Mainland, disturbance by a Brown Pelican as well as disturbance and predation by Common Ravens further exacerbated low breeding success. However, despite delayed breeding, Brandt's Cormorants exhibited surprisingly good reproductive success.

Highlights in 2005 included the sixth consecutive year of exceeding the project goal of 100 breeding pairs of murres on Devil's Slide Rock and the first breeding by murres on the adjacent Devil's Slide mainland. The video cameras placed on Devil's Slide Rock greatly enhanced our capabilities by increasing effectiveness at monitoring breeding sites, permitting monitoring

during inclement weather, identifying fish fed to chicks, reading bird band numbers, and allowing digital recording of video for later use. The live-streaming video was also made accessible to the public for education and outreach through a live web cam and display at the Point Montara Lighthouse Hostel.

INTRODUCTION

Common Murre (*Uria aalge*) colonies in central California occur on certain near-shore rocks and adjacent mainland points between Marin and Monterey counties as well as at the North and South Farallon islands, 20 to 40 kilometers offshore (Carter et al. 1992, 1996, 2001). A steep decline in the central California population between 1980 and 1986 is attributed primarily to mortality in gill nets and oil spills, including the 1986 *Apex Houston* oil spill (Page et al. 1990; Takekawa et al. 1990; Carter et al. 2001, 2003b). Between 1982 and 1986, a colony of close to 3,000 breeding murres on Devil's Slide Rock in northern San Mateo County was extirpated by these mortality events. Since 1996, the Common Murre Restoration Project (CMRP) has sought to restore this and other central California colonies using social attraction and other techniques. Social attraction has been utilized at Devil's Slide Rock and nearby San Pedro Rock, which was extirpated in the early 20th century primarily by commercial egg harvesters (Ray 1909; Carter et al. 2001). Efforts at other colonies, especially the Castle/Hurricane Colony Complex, have focused mainly on working with other agencies and the public to reduce anthropogenic disturbance and mortality factors.

Despite small to moderate increases in the central California murre population in the early 1990s, Devil's Slide Rock was not recolonized by 1995 and most colonies remained in a reduced state. Until more extensive gill-net closures (<60 fathoms from Point Reyes to Point Arguello) were enacted by California Department of Fish and Game in September 2002, gill-net mortality of murres continued through at least 2000 (Forney et al. 2001; National Marine Fisheries Service, unpubl. data). In addition, oil pollution (e.g., *Command* Oil Spill, and the series of oil releases from the sunken vessel *S.S. Jacob Luckenbach*) have continued to kill thousands of murres in central California (Carter 2003; Carter and Golightly 2003; Hampton et al. 2003; Roletto et al. 2003) and anthropogenic disturbance has affected colonies as well (Rojek et al., in prep.; USFWS, unpubl. data).

The *Apex Houston* Oil Spill

Between 28 January and 4 February 1986, the barge *Apex Houston* discharged approximately 20,000 gallons of San Joaquin Valley crude oil while in transit from San Francisco Bay to Long Beach Harbor, California. Between Sonoma and Monterey counties, an estimated 9,900 seabirds were killed, of which approximately 6,300 were Common Murres (Page et al. 1990, Carter et al. 2003b). The murre colony at Devil's Slide Rock was subsequently abandoned (Takekawa et al. 1990; Carter et al. 2001, 2003b).

In 1988, state and federal natural resource trustees began litigation against potentially responsible parties. In August 1994, the case was settled in a Consent Decree for $6,400,000. The *Apex Houston* Trustee Council, with representatives from California Department of Fish and Game (CDFG), National Oceanic and Atmospheric Administration (NOAA), and U.S. Fish and Wildlife Service (USFWS), was given the task of overseeing restoration actions for natural resources injured by the spill. A restoration plan was published (USFWS 1995) and the amount of $4,916,430 was assigned to USFWS for the implementation of the Common Murre Restoration Project.

The *Command* Oil Spill
Shortly after departing San Francisco bound for Panama on the evening of 26 September 1998, the T/V *Command* spilled approximately 3,000 gallons of Intermediate Bunker Fuel (IBF) 380 just off the San Francisco and San Mateo county coasts (USFWS et al. 2004). This relatively small spill mainly oiled the San Mateo County coastline and adjacent waters. An estimated 1,490 Common Murres and other seabirds were killed or injured from the spill.

The successful prosecution of the *Command* vessel operator and owners resulted in a total settlement of $5,518,000, of which $4,007,242 was allocated to restoration of damaged natural resources. The Seabird Colony Protection Program (SCPP) is one of a series of projects funded by the *Command* Oil Spill Restoration Fund (USFWS et al. 2004). The goal of SCPP is to restore seabird colonies damaged by the spill mainly by reducing human disturbance. The Common Murre Restoration Project is conducting a monitoring and colony surveillance aspect of the SCPP. Another aspect of the program, conducted by the Gulf of the Farallones National Marine Sanctuary, focuses on education, outreach, and other methods that will lead to better protection of colonies from human disturbance.

The Common Murre Restoration Project
In 1995, the *Apex Houston* Trustee Council developed a restoration plan consisting of a Scientific Program and an Environmental Education Program for the Common Murre Restoration Project (USFWS 1995). Field work for the Scientific Program has been conducted since 1996 by USFWS-San Francisco Bay National Wildlife Refuge Complex (hereafter "Refuge"), in collaboration with the USFWS-Ecological Services (Sacramento Field Office), Humboldt State University (HSU), and the National Audubon Society. Additional assistance has been provided by: Carter Biological Consulting; CDFG; U.S. Geological Survey (Western Ecological Research Center; USGS); Point Reyes Bird Observatory (PRBO); National Park Service (Point Reyes National Seashore); National Oceanic and Atmospheric Administration (NOAA; Gulf of the Farallones and Monterey Bay National Marine Sanctuaries); and California Department of Parks and Recreation.

The primary goals of the Project have been the restoration of extirpated Common Murre colonies at Devil's Slide and San Pedro rocks (Figures 1, 2). Social attraction was selected as the best-available technique to be used to recolonize these rocks (Parker et al. 1997; Carter et al. 2003b) because of its effective use elsewhere in encouraging seabirds to recolonize extirpated colonies (Kress 1983; Podolsky 1985; Kress and Nettleship 1988; Podolsky and Kress 1989, 1991; Schubel 1993). Secondary goals have been to restore other depleted colonies, such as the Castle/Hurricane Colony Complex in Monterey County. Reducing continued anthropogenic impacts, such as disturbance, and avian predation, have been the primary methods used to aid this and other colonies. Monitoring at other more established colonies, such as Point Reyes, also has been conducted to compare with restoration sites, to examine broad-scale patterns in ecological parameters, and identify other potential restoration needs.

In January 1996, social attraction equipment (murre decoys, mirror boxes, and two sound systems) was deployed on Devil's Slide Rock for the first time (Parker et al. 1997, in prep.). Decoys have been deployed in a similar manner each year since. Successful breeding was recorded in 1996 and the number of breeding pairs has increased steadily since then. Because of the continuous annual growth of the Devil's Slide colony since 1996, the amount of social attraction equipment has been reduced in recent years to promote higher density nesting and provide additional breeding space within decoy areas. As the colony grows over time, social attractants eventually will be phased out completely.

In 2005, our efforts to restore seabird colonies in central California was augmented by the *Command* Trustee Council. Under the *Command* Oil Spill Restoration Plan, reductions in human disturbance to breeding colonies was identified as the main technique to restore seabird populations damaged from the spill. Funds from *Command* allowed us to resume monitoring and disturbance surveillance at Point Reyes as well as to collect ground-based data from three colonies within the Point Resistance-Double (or, Drakes Bay) Colony Complex: Point Resistance; Millers Point Rocks; and Double Point Rocks.

This report summarizes restoration and monitoring efforts conducted by the Common Murre Restoration Project in 2005. Monitoring included data collection similar to previous years on murre colony population sizes, seasonal attendance patterns, nesting phenology and productivity, as well as both anthropogenic and non-anthropogenic disturbances. We also report on Brandt's Cormorant (*Phalacrocorax penicillatus*) nest surveys at all colonies as well as nesting phenology and productivity at Devil's Slide Rock and Mainland. Information on the education component of the project is not included in this report. That aspect of the project underwent several changes in 2005-2006 that mainly resulted from a lack of decoys for school children to paint.

METHODS

Social Attraction

Devil's Slide Rock

On 4 October 2004, following the 2004 breeding season, decoys were removed from Devil's Slide Rock (DSR). On 4 February 2005, 74 adult murre decoys (66 standing, 8 incubating) were redeployed on DSR and the sound system turned on (Figure 3). This was 33.9% fewer decoys than in 2004 (n=112) and 81% fewer than the original plot design utilized in 1996-1998 (n=384 decoys). The reduction of decoys between 2004 and 2005 was primarily due to the fact that decoys were not deployed on the west side of the rock (decoy plots 1-4). Decoys were not deployed here because the high pre-decoy deployment attendance in recent years demonstrated that social attraction techniques may no longer be necessary. The west side breeding sites are disjunct from the east side sites and this allowed us to assess the impact of removing decoys. The placement and number of standing-posture and incubating-posture decoys on East DSR (Plots 6, 7, 8, 9, 10, & 12) was determined based in part on locations of usable decoy rods previously placed on the rock, and murre breeding and territorial sites from previous years. Thus, the configuration of decoys remained roughly the same as in 2004 and decoys were placed mainly within the original plot boundaries. The numbers of decoys placed in each plot was: Plot 6, 13 decoys; Plot 7, 12 decoys; Plot 8, 17 decoys; Plot 9, 12 decoys; Plot 10, 10 decoys; and Plot 12, 10 decoys.

As in other recent years, uniquely painted wooden dowels 0.46 meters in height were placed on existing decoy rods in plots 1, 2, 3, 4, 7, 9, 10 and 12 at or near former mirror locations, to serve as landmarks. One mirror box remained in Plot 8. In addition, on 4 February 2005, two remote-controlled video cameras and photovoltaic power system were installed to assist monitoring efforts. Two other trips were made on 8 February and 15 March to troubleshoot problems with the cameras and the sound system.

Monitoring and analysis of murre site locations on DSR was enhanced through the use of Geographic Information System (GIS) data collected in 2000, 2001, and 2004 (Parker et al. 2001, 2002; McChesney et. al 2005). During the 2005 breeding season, new nest sites and decoys were added to the GIS database by approximating their locations in the field based on previously mapped (by GPS) sites and equipment. Additional verification was done using high quality aerial photographs taken during colony surveys on 15 June 2005 and additional GPS work following the breeding season (see GPS data collection, below).

Decoys were removed from DSR following the breeding season on 13 October 2005. Approximately 20 decoys and one wooden dowel had been lost since deployment. The sound system had not been functioning since 12 April due to a disconnected speaker cable.

GPS data collection

During decoy removal on 13 October 2005, additional GPS work was conducted to update the existing GIS database. GPS data collection was conducted by M. Hink (Bestor Engineers) and W. M. Perry (U.S. Geological Survey). Obtained were GPS locations of 134 breeding and territorial sites used during the 2005 breeding season, existing decoys, missing decoys, wooden dowels, video cameras, the new solar panel, and several additional geographic features. In addition, four additional markers were installed to permit georeferencing of the rock from specialized aerial photographs. Murre site locations were corroborated by field biologists (Kappes and Eigner) stationed both on the rock and from mainland viewing locations (using both scope and video), using field maps and photographs taken during the breeding season.

Following GPS data collection, locations of equipment and murre sites that had been approximated during the field season were updated on the 2005 GIS map (Figure 3). Locations of decoys and dowels lost prior to GPSing were reevaluated and changed if necessary.

Video System Installation

The remote video monitoring system, developed and installed on San Pedro Rock by SeeMore Wildlife Systems (Homer, Alaska) in 2003, was installed on DSR between 4 and 8 February 2005 to enhance monitoring work. Two high resolution video cameras were anchored to the top ridge of the rock: one on the east side of the rock and one on the west side. Both cameras were connected to a transmitter that sent live-streaming images to a receiver at the Pt. Montara Lighthouse Hostel (4.5 km south of DSR) as well as to a portable, manually operated receiving system on the adjacent mainland. The receiving system included a desktop computer equipped with software for remote control of the cameras, with zoom, tilt, and panning capabilities, squirter and wiper for lens cleaning, and the ability to take still pictures and video. At the hostel, the receiving system was connected to the internet. This permitted viewing and control from off-site computers as well as a live web cam accessible via the world wide web, hosted by the National Audubon Society.

Between the two cameras, nearly all active nesting areas on DSR could be viewed, with the exception of former decoy plot 7 on the west-central portion of the rock. The cameras greatly enhanced our monitoring capabilities by providing closer, clearer views of nests and birds, views of nests not visible from mainland vantage points, and permitted data collection when poor viewing conditions precluded viewing from the mainland.

The video cameras experienced few technical difficulties during the season. On 15 March, the West camera was replaced because of a faulty lens cleaning device. The East camera signal, which stopped transmitting video, was restored by switching between UHF cable ports.

Both video cameras were taken down on 13 October 2005 for maintenance and preparation for redeployment in winter 2006.

Monitoring Effort

Using our former standardized scope and binocular techniques, DSR and Mainland sites were monitored for 33.7 hours (67.1 person hours) on 18 observation days between 27 October 2004 and 12 April 2005 ("preseason"), and 594.1 hours (1233.4 person hours) on 120 observation days between 15 April and 22 August ("breeding season"). Using the remotely controlled video cameras, DSR was monitored an additional 204.9 hours (426.1 person hours) on 43 observation days between 4 June and 12 August. With the two monitoring techniques combined, the DSR and Mainland colony was monitored for a total of 799.02 hours on 121 days during the 2005 breeding season. San Pedro Rock was monitored using traditional techniques for 10.80 hours (14.68 person hours) on 17 observation days between 12 April and 3 August.

The Castle/Hurricane Colony Complex (CRM/HPR) was monitored for 33.5 hours (46.3 total person hours) on 10 days during the preseason (25 January to 12 April) and 503.6 hours (604.2 person hours) on 85 days during the breeding season (15 April to 16 August).

Point Reyes (called "Point Reyes Headlands" in past reports; PRH) was monitored for 416.5 hours (606.8 person hours) on 79 days during the breeding season (26 April to 30 August). In addition, three colonies were monitored in the Drakes Bay Colony Complex. Between 27 April and 18 August, monitoring was conducted at: Point Resistance (PRS), 18 days (28.02 observation hours, 36.40 person hours); Millers Point Rocks (MPR), 19 days for (45.0 hours, 55.4 person hours); and Double Point Rocks (DPR), 15 days (57.8 hours, 71.03 person hours).

Seasonal Attendance Patterns - Common Murre

At each colony or colony complex, seasonal attendance patterns of Common Murres were monitored at all active subcolonies from standardized mainland vantage points using 65-130X or 15-60X spotting scopes. Attending murres were counted at each colony, subcolony, or study plot. Three consecutive counts were performed at each location and time and the means were reported. After attendance counts were completed, counts of all birds and marine mammals within 300 m of the colonies were collected. During the preseason (<15 April), counts were conducted mainly between 0700-1100 h when attendance tends to be highest and before most birds depart the colony for the remainder of the day. During the "breeding season" (≥ 15 April), counts were conducted mainly between 1000-1400 h when diurnal attendance patterns tend to be less variable (Takekawa et al. 1990). Counts were conducted until all adults and chicks departed the colonies at the end of the breeding season.

Devil's Slide Rock and Mainland

At DSR, preseason attendance was monitored sporadically from 27 October 2004 to 12 April 2005. Observations were typically conducted once or twice a week, usually between 0800 and 1100 h (range 0745-1446 h). If more than one count was conducted during the day, the high count is presented. Breeding season (15 April to 22 August) counts were conducted every other day (weather permitting) between 1000 and 1400 h. For better comparability, if more than one count was performed between 1000 and 1400 h, the count closest to 1000 h was used to describe murre attendance patterns.

For the first time, we also utilized the two remote video cameras on DSR to conduct murre counts, which permitted comparison to the traditional spotting scope method. Due to the longer period of time required to conduct counts, only one count was conducted (instead of three).

To assess the impact of removing all social attraction decoys from the west side of DSR, counts were divided into east and west side counts, with the sum of the two accounting for total attendance. Three aerial surveys were conducted prior to decoy deployment (25 January, 3 March, and 6 April) to examine spatial distributions of murres on the rock and to compare attendance values.

San Pedro Rock

Colony counts were conducted once a week through the breeding season in conjunction with weekly Brandt's Cormorant nest surveys at DSR and Mainland. Observations were performed from the standardized "Pipe Pullout" along Highway 1.

Castle/Hurricane Colony Complex

Seasonal attendance patterns of murres were determined for 14 subcolonies at Bench Mark-227X (BM227X), Castle Rocks and Mainland (CRM), and Hurricane Point Rocks (HPR; Figure 4). Counts were conducted sporadically during the preseason and twice per week during the breeding season. At three subcolonies, separate subarea counts also were obtained. At CRM-04, separate counts were obtained for the productivity plot; at CRM-06 South, counts were distinguished between the south and north sides of this mainland point which are viewed from different vantage points; and at HPR-02, murre counts were distinguished between the traditional "Ledge" and "Hump" subareas.

Point Reyes

Seasonal attendance patterns of murres were determined for all murre subcolonies visible from mainland observation sites during the breeding season (26 April to 23 August). In 2005, eight mainland and 12 nearshore subcolonies were monitored from 10 standardized observation locations about once per week (Figure 5). Counts were conducted between 1000 and 1400 h when possible, but due to restricted visibility caused by poor weather conditions and the large number of subcolonies monitored, count times ranged from 0735 to 1855 h. Attendance was recorded at established "Type II" index plots (Birkhead and Nettleship 1980) on Lighthouse, Boulder, and Lower Cone rocks because the number of murres attending these sites was too large to be counted regularly and accurately in their entirety. Photographs and maps from previous years were used to ensure that birds were within plot boundaries. At Lighthouse Rock (~14,000 breeding birds), three index plots were used (Ledge Plot, ~150 birds; Dugout Plot, ~150 birds; and Edge Plot, ~75 birds). At Lower Cone Rock (~1,900 birds) and Boulder Rock (~1,900 birds), one index plot at each rock was utilized (~250 and ~275 birds, respectively). In addition, an index plot was established on Flattop Rock (subcolony 10C) because of substantial growth there and associated difficulty making consistent, accurate counts.

Drakes Bay Colony Complex

Seasonal attendance of murres was monitored at PRS, MPR, and DPR (one mainland site and 7 nearshore rocks) during the breeding season (27 April to 18 August). See Sowls et al. (1980) or Carter et al. (1992) for colony locations. Counts were conducted from four standardized observation points between 1000 and 1400 h when possible, but counts began as early as 0845 h. "Type II" index plots (Birkhead and Nettleship 1980) were established at PRS and Stormy Stack (DPR) because of large colony size. Four index plots (Club, Grotto Ledge, Lower Ledge, and Cup plots) were created at PRS and five (Lower Left, Lower Right, Crack Pot, Pond, and Cliff Plots) on Stormy Stack.

Productivity - Common Murre

As in prior years, we monitored productivity of murre breeding pairs at DSR, CRM and PRH at least every two to three days (weather permitting) from mainland vantage points using spotting scopes with lenses ranging from 20x to 130x. At DSR in 2005, two remote video cameras also were used in conjunction with scopes to monitor murre productivity. All plots were monitored in a manner consistent with "Type I" plots as described in Birkhead and Nettleship (1980). The locations of new, returning breeding, territorial, and sporadic sites were identified using maps updated from the prior breeding season. At DSR, locations of murre sites were refined through the interpretation of aerial photographs taken on 15 June 2005. We defined a "breeding site" as any site where an egg was laid and a "territorial site" as a non-egg laying site that had attendance greater than or equal to 15% of monitored days. Sporadic sites were attended on at least two days but on less than 15% of days; however, many possible "sporadic" sites were not identified as such because of frequent movement by visiting birds. Chicks were considered to have "fledged" if they survived to at least 15 days of age (Parker et al. 1997). At breeding sites where hatch dates were less certain, body size and plumage characteristics also were used to determine chick fate.

Devil's Slide Rock

Murre productivity was monitored at all active (breeding, territorial, and sporadic) sites identified on DSR and the Devil's Slide Mainland (DSM). Sites were monitored from several vantage points along the side of Highway 1 and with the remote video system. Because of the video system, observation days were not limited by rain, fog, or heat waves, unlike past years.

Castle/Hurricane Colony Complex

All active and inactive murre nesting sites were monitored in the productivity plots on CRM-04 (established in 1996) and on CRM-03 East (established in 1999). Observations of the plots were conducted from or near the “Castle Pullout” located along the side of Highway 1 and from adjacent private property, approximately 300 m from the CRM-04 plot and 150 m from the CRM-03 East plot.

Point Reyes

We monitored murre productivity at PRH within two “Type I” plots on Lighthouse Rock: the “Ledge Plot” is within the center of the colony and the “Edge Plot” is on the edge of the colony. These plots were monitored from 1996-2002 (e.g., Parker et al. 1997) and monitoring was reestablished in 2005 with funds from the *Command* Trustee Council. Because the Lighthouse Rock subcolony is relatively large (*ca.* 12,500 pairs), center and edge plots were selected to examine differences in reproductive success that may occur due to location (Birkhead 1977, Parker et al. 1997). Observations of both plots were conducted from within or just outside of the Point Reyes Lighthouse foghorn building, about 100 meters from the rock. Returning or new breeding and territorial sites were identified using maps and photographs from previous seasons.

Adult Time Budgets - Common Murre

Time budget (or co-attendance) observations were conducted at DSR after approximately 50% of the breeding sites had chicks. Co-attendance was defined as the time two adults (assumed mates based on behavioral interactions; Johnsgard 1987; Gaston and Jones 1998) were present together at a breeding site. Since parents must feed both themselves and their chick during this stage, it is believed that co-attendance during the chick-rearing period is a better indicator of parental and feeding conditions than co-attendance during incubation (Parker 2005). Criteria for selecting sites included:

1. Prior knowledge that the site was a breeding site with a chick;
2. Ease of viewing both adults (when both adults were attending the site simultaneously);
3. Proximity to other breeding sites; and
4. Ability to include additional nearby breeding sites, if necessary**.**

We monitored arrivals, departures, and food deliveries to chicks (including prey type, size, and fate). In addition, the number of birds at each site was recorded every 15 minutes throughout the entire watch to re-confirm site attendance. Observations were conducted by a rotation of primary observers who were relieved every 2-3 hours. All observations were recorded on a hand-held tape recorder and transcribed later . With this information, we calculated the average time per day murres spent in co-attendance at their breeding sites and average rate of food deliveries.

In 2005, the remote video cameras were used to monitor adult time budgets. This differed from past years when monitoring was conducted from mainland vantage points using spotting scopes. The video system permitted observations even during periods of fog and intense heat waves that impacted and often delayed scope-based monitoring. While this increased our ability to monitor on any given day, a comparison of scope and video-based methods showed no appreciable difference in our ability to detect arrivals, departures, or prey deliveries at particular sites under good visibility conditions. However, the narrower field of view of the video system did sometimes hinder our ability to detect birds arriving on the edge of the colony and to follow birds that wandered away from breeding sites (as opposed to flying off, which is more typical at departure). On the other hand, the recorded video allowed us to review certain events at a later time to correct or confirm what was recorded in real time. While this certainly led to some differences in data collection, we believe these differences are insignificant.

Disturbance

Non-anthropogenic and anthropogenic disturbance events affecting murres and other seabird species at study colonies were recorded incidentally during other monitoring activities. Disturbances recorded included any event that caused one or more of the following: adult murres and other seabird species to be flushed or otherwise displaced; or any eggs or chicks to be exposed, displaced, or depredated. For anthropogenic disturbances, events that caused murres to headbob were also recorded.

All aircraft flying at or below about 1,000 feet (305 m) above sea level (ASL) and boats within about 1,500 feet (460 m) of the nearest murre subcolony were recorded, even if they did not cause disturbance. Information recorded regarding aircraft and boats included: type of craft, any identifying number(s), direction of travel, and distance from the nearest subcolony of murres.

To analyze disturbance events, we separated the data by source and type of disturbance. We present the number of non-anthropogenic and anthropogenic disturbances seen per hour of observation at each colony. Disturbances per hour were calculated based on total observation hours at each colony (see Monitoring Effort, above).

Brandt's Cormorant Productivity

Devil's Slide Rock and Mainland

Brandt's Cormorant productivity was monitored at DSR and three subareas on DSM: April's Finger (AF); Mainland South (MS), and Turtlehead (TRTH; Figure 2). Nests were monitored every 2-7 days from mainland vantage points using a combination of spotting scopes and binoculars. After about 25-30 days of age, chicks begin to wander from their nests, reducing the ability to determine which nests they originated from (Carter and Hobson 1988; McChesney 1997). Therefore, we considered chicks to have fledged if they survived to at least 30 days of age. For each nest, we followed a standardized protocol to determine the laying, hatching, and "fledging" dates, as well as clutch and brood sizes and the number of chicks fledged. We rated the data quality for each parameter and used only high quality data for all calculations.

Brandt's Cormorant Nest Surveys

Nest surveys were conducted at PRH, DSR and Mainland, and CRM/HPR subcolonies once per week during the breeding season. Drakes Bay colonies were surveyed weekly to bi-weekly. Counts were conducted using spotting scopes or binoculars. At DSR, counts were taken from the Traditional Pullout and the mainland bluffs above the Brandt's Cormorant subcolonies between 0800 and 1100 h. At CRM/HPR, counts were conducted from the Rocky Creek Bridge, Castle, and Hurricane pullouts, and were conducted between 1000 and 1400 h. Nest surveys were completed at PRH, PRS, MPR, and DPR between 1000 and 1900 h from six standardized observation locations. For each count, Brandt's Cormorant territorial and nest sites were classified into five groups that roughly describe the nesting stage:

1. Territorial site, with little nesting material or birds conducting displays;
2. Poorly built nest (PBN);
3. Fairly built nest (FBN);
4. Well-built nest (WBN); and
5. Nests with brooded chicks.

In addition, the number of large chicks as well as cormorant birds (including fledged juveniles, immatures, and adults) were counted, although large chicks were sometimes difficult to distinguish from adults/immatures due to varying viewing distances and conditions.

Aerial Photographic Surveys

In 2005, aerial photographic surveys were conducted at all murre colonies and most (greater than about 10 nests) Brandt's and Double-crested (*P. auritus*) Cormorant colonies in northern and central California from the Oregon border south to Point Conception. These surveys are a continuation of a long-term data set focused on monitoring seabird breeding populations in California (e.g., Takekawa et al. 1990, Carter et al. 2001, Capitolo et al. 2004). Surveys were conducted between 31 May and 15 June and were flown in a CDFG twin-engine, high-wing Partenavia fixed-wing aircraft. Due to the volume of commercial airline traffic in and out of San Francisco Airport and the low altitude of our surveys, the Double-crested Cormorant colony at the San Mateo Bridge & P.G.&E. Towers was not surveyed with aerial photographs; instead, we surveyed this colony by boat on 2 June. Caspian Tern (*Hydroprogne caspia*) colonies at Arcata Bay Sand Island, Brooks Island and Salinas River Mouth also were photographed.

Two personnel photographed colonies through a hatch opening in the belly of the aircraft using 35 mm cameras. Overview photographs of each colony were taken with a 50 mm or 70-200 mm zoom lens, while close-up photographs used for counting were taken mostly with 300 mm lenses or occasionally with a 70-200 mm zoom lens. Surveys of some areas were delayed by fog but were completed later in the survey period. Most colonies were photographed on one day only. To assist field mapping of murre breeding sites, digital aerial photographs of DSR were taken on 15 June with a Canon 20D digital SLR camera loaned by W. B. Tyler (University of California, Santa Cruz). In addition, winter and prebreeding season surveys of DSR were conducted on 25 January, 3 March, and 6 April 2005 to obtain photographic documentation of murre spatial distribution on DSR prior to and after decoy deployment.

Counts at sample colonies were conducted using the "dotting" method and followed a standardized protocol. Standardized count areas at the South Farallon Islands followed Capitolo et al. (2002). As in other years since 1996, we determined counts for all central California murre colonies and Brandt's Cormorant colonies within the Gulf of the Farallones area (Point Reyes to Año Nuevo).

For murres, only birds were counted since they do not build nests. For cormorants, birds, nests, and territorial sites were counted. Nests and territorial sites were categorized as follows: 1) well-built nest with incubating/brooding adult; 2) nest with standing adult and visible chicks in the nest bowl; 3) empty nest (i.e., no eggs or chicks) with standing adult present; 4) abandoned nest (evidence of fairly to well-built nest with no adult present); 5) poorly built nest; 6) adult on territorial site with little or no nesting material; and 7) undetermined site (either nest or territorial site). We considered categories 1-5 as "nests" and categories 6 and 7 as territorial "sites". Roosting Brown Pelicans also were counted and aged as adults or immature.

Colony Surveys - Other species

During colony counts and nest surveys of murres and Brandt's Cormorants, we also counted nests and birds of other non-focal seabird species, including Pelagic Cormorant (*P. pelagicus*), Western Gull (*Larus occidentalis*), Pigeon Guillemot (*Cepphus columba*), and Black Oystercatcher (*Haematopus bachmani*) in most areas. While these were not whole-colony counts because of incomplete coverage, they do provide information on presence and relative abundances of these species at monitored colonies. On 21 June 2005, we conducted a boat survey between San Pedro Rock and Pillar Point to count nests and birds not visible from mainland vantage points in order to assess total breeding population sizes of all species in the Devil's Slide/San Pedro area. The survey was conducted in the morning (0730-1015 h) when larger numbers of Pigeon Guillemots, a crevice-nesting species, congregate on the water and land surface at colonies. At CRM/HPR, PRH and Drakes Bay colonies, the high counts for nests of all species surveyed from mainland vantage points are provided. For Pigeon Guillemots, we present the high seasonal count obtained from colony counts and sea surface scans.

Common Raven Surveys

Castle/Hurricane Colony Complex

In 2005, Common Raven surveys were conducted between Point Lobos and Point Sur to assess relative distribution and abundance along this portion of the Big Sur coast and to monitor their presence in relation to the CRM/HPR Colony Complex. Surveys were conducted from a vehicle along California State Highway 1 while in transit to and from the CRM/HPR observation locations. Each morning (0500-0630 h), a survey was conducted while driving south from Point Lobos to CRM. Afternoon surveys (1230-1500 h) were also conducted sporadically throughout the breeding season while driving north from Point Sur to Point Lobos**.** At least once a week, a mid-morning (1000 - 1100 h) survey was conducted from Point Sur to Point Lobos. Each individual raven seen was considered a "detection". All raven detections were recorded on a Garmin Etrex GPS unit and then plotted on National Geographic Topo mapping software.

RESULTS

Social Attraction

Devil's Slide Rock

Common Murre - In 2005, 248 active sites (164 breeding and 84 territorial) plus 19 sporadic sites were recorded on DSR (Figure 6). This was an increase of seven (2.9%) total sites and a decrease of 26 (13.7%) breeding sites from 2004. Of the 164 breeding sites in 2005, 108 (65.9%) were breeding in 2004, seven (4.3%) were territorial sites in 2004, eight (4.9%) were not used in 2004 but were used in previous years, and 41 (25.0%) were new sites in 2005.

Figure 3 maps the distribution of murre breeding and territorial sites in relation to social attraction equipment and other features, and Figure 7 shows an aerial photograph of the colony taken 15 June 2005 during the peak of the egg-laying period. Besides a reduction in breeding sites, the main differences from 2004 (McChesney et al. 2005) included: 1) increased density of breeding and territorial sites in most areas; 2) addition of breeding sites on the far west side; 3) preponderance of 2004 breeding sites that were territorial sites in 2005; and 4) near complete lack of breeding in the low-density, far eastern portion of the rock (i.e., former decoy plot areas 10, 12 and beyond). In this latter area, most former breeding sites were occupied during the pre-laying period, which earned them territorial status. However, roosting Brown Pelicans, which are much larger than murres, forced these birds to abandon their sites just after the start of egg-laying. The absence of murres in that area can be seen in Figure 7, as well as the absence of nesting Brandt's Cormorants which typically nest over much of the rock. The absence of nesting by the larger cormorants, which are better at fending off pelicans, allowed the pelicans easy access to the murre nesting area.

Seasonal Attendance Patterns - Common Murre

Devil's Slide Rock

In 2005, murres were counted both with spotting scope method and video cameras for comparison.

Spotting Scope - Common Murres were observed on 89 of 91 (97.8%) colony count days between 27 October 2004 and 22 August 2005 (Figure 8). Murres were not observed on DSR on two count days conducted during the preseason (prior to 15 April). These were afternoon counts ($1400 h), while most counts were conducted either in the early morning (#1000 h) or during the standardized breeding season count period (1000-1400 h).

Preseason attendance was the highest ever recorded on the project, averaging 286 ± 65 (SD) murres per count (n=14). The highest count of the year, 477 murres on 16 May, was also the highest since 1996 (previous high: 336 on 28 April 2004). However, this count occurred outside of the standardized seasonal attendance count period and is not included in Figure 8. The highest standardized count was 438 birds on 20 April. Three aerial surveys conducted during the preseason also documented high numbers of murres attending DSR well before egg laying: 348 on 25 January; 368 on 3 March; and 460 birds on 6 April. Aerial counts were considerably higher than spotting scope counts conducted simultaneously: 310 birds on 3 March and 343 birds on 6 April.

Unusually erratic attendance characterized the pre-egg and early egg-laying periods. From mid-April to early June, murre numbers were often high ($200) in the early morning (#0930 h) but rapidly decreased thereafter. This often left DSR devoid of murres as early as 1000 h, when we typically performed standardized colony counts. During the early egg-laying period, on many days by early afternoon (~1300 h) only birds incubating eggs remained on the rock. To document this unusual attendance behavior, murres were counted several times throughout the day on colony count days (Figure 9).

Video Camera - Using the video cameras, murres were observed on 48 of 55 (87%) counts between 17 February and 19 August. The seven counts when no murres were seen were conducted before 10 May, and occurred after all murres had already left the rock for the day.

Of the 45 counts conducted using both video cameras and spotting scopes, four (9%) occurred when no murres were on the rock. Of the 41 scans when murres were present, the video camera detected more murres 30 times (73%) versus 11 times (27%) using the spotting scope (Figure 10). When it was the higher of the two scans, the video camera count averaged 40 ± 32 (SD) (range: 2-120; n = 30) more murres than the scope count. When the scope count was the higher of the two scans, it averaged 11 ± 10 (range: 1-29; n = 11) more murres than the video camera count. There was a significant difference between the average number of murres detected using the cameras ($\bar{x}$ = 227 ± 119) and the spotting scopes ($\bar{x}$ = 205 ± 108; Wilcoxon signed rank test: W_{46} = -598; *P*#0.001). Differences were mainly attributed to certain areas visible through the cameras but not from the standard scope counting location, especially on the far west side of the rock adjacent to the solar arrays. However, certain areas were covered better with the scope, such as the southern-most portions of the colony (e.g., Decoy Plot 7 area).

Devil’s Slide Mainland

Beginning in early May to mid-June, murres attended four subareas of the DSM cliffs at April’s Finger (AF), Lower Mainland South (LMS), Upper Mainland South (UMS) and Turtlehead (TRTH; Figures 11-13; Table 1). High counts for the four subareas were: AF, 16 birds (7 June); LMS, 18 (8 July); UMS, 17 (7 July); and TRTH, 25 (16 June). The highest combined total for LMS, UMS, and TRTH, which are counted from the same location, was 41 murres on 16 June. All subareas were within active Brandt’s Cormorant colonies.

During June and July all four subareas averaged two or more murres in attendance. Murres were observed prospecting for sites at each subarea, and breeding was documented at LMS and TRTH (see Murre Productivity, below). Murres also could have bred on the northwest cliff on AF, which is out of view from our observation sites (Figure 11). Murres were frequently observed landing and leaving this area and 34 murres were counted during a boat survey 21 June. Murres were also observed landing and departing from an apparent “club” at the base of the cliff below AF but out of view from mainland vantage points. Birds were recorded clubbing there during the aerial survey on 15 June (see Aerial Surveys, below).

This was only the second year that murres have been recorded on the DSM. In 2003, up to six murres were recorded sporadically attending AF (McChesney et al. 2004).

San Pedro Rock

Of 18 observation days between 12 April and 3 August, only one murre was recorded on 7 July. This bird was observed in the “west end” region and landed briefly before joining a nearby flock of foraging seabirds.

Castle/Hurricane Colony Complex

Murre attendance patterns were sporadic through the prebreeding season until mid-May (Figures 14-17). Only one subcolony with confirmed breeding in 2005, CRM-06 South (North side), was attended each count day from the start of daily field-season observations on 15 April until the start of egg-laying on 22 May (Figure 16). No murres were observed on HPR-01 from 19 April until 25 May, or on CRM-06 North from 19 April until 27 June, although birds might have been present on non-count days (Figure 17, 16).

During mid- to late May (early incubation period), attendance was variable at most subcolonies. This is typical at this colony complex and is usually followed by less variability during the late incubation and early chick periods in June. In 2005, this pattern was consistent mainly at established breeding subcolonies (i.e., CRM-02, CRM-03 West, CRM-04, CRM-05, CRM-07, HPR-01, and HPR-02) although some subcolonies decreased in numbers in early June followed by steady increases from mid-June to mid-July.

On CRM-03East, murres attended sporadically from the start of daily observations on 15 April until mid-May, when egg-laying began (Figure 15). Murres continued to attend the subcolony in low numbers throughout the egg-laying period. On 10 June, a series of disturbances caused by two ravens (see Disturbance, below) resulted in a complete loss of eggs. After these events, murre attendance became very low until murres stopped attending on 27 June.

On BM227X-02 (Esselen Rock), an "ephemeral" murre subcolony, murre attendance steeply declined after 7 July. After 22 July, murres were no longer observed attending the subcolony (Figure 14). The premature abandonment was due to some form of disturbance and predation (see Disturbance, below).

Attendance at CRM dropped significantly after a major Brown Pelican (*Pelecanus occidentalis*) disturbance on 21 July (see Disturbance, below). This disturbance impacted subcolonies CRM-02, CRM-03West, CRM-04, CRM-05, and CRM-07. The last murre attendance was recorded on 8 August at CRM-04 and CRM-06 South, about two weeks later than average.

In 2005, murres were observed attending the mainland in three subareas. At both CRM-06 North and CRM-06 South (North side), murres attended throughout the breeding season among nesting Brandt's Cormorants. Two murre breeding sites were confirmed at CRM-06 South (North side). At CRM-06 South (South side) up to 10 murres were observed on four days in early to mid-April.

This year, on 28 July, two murres were observed on HPR-04 (Jen's Rock) among a group of nesting Brandt's Cormorants. This was the first observation of murres at this subcolony.

Point Reyes

Lighthouse, Boulder, Flattop, Middle, East, Face, and Cone (lower) rocks are traditional, regularly attended breeding subcolonies. Northwest and Beach rocks have been attended annually only in recent years. Aalge Ledge is a traditional "club" where murres roost but have not been recorded breeding. All other subcolonies have been "ephemeral" (attended sporadically from year to year) since 1996 and earlier (McChesney et al. 1998). Murres attended ten ephemeral subcolonies or subareas in 2005: Rock 02, Big Roost Rock, Murrephy's Cliff, Pebble

Point, Chip Rock, Arch Rock, Wishbone/Spine Points, Upper Cone Rock, and Area B.

In 2005, only Lighthouse (Dugout, Edge, and Ledge Plots), Middle and East rocks had regular attendance from the first day of observation (26 April; Figures 18, 19). The remaining traditional subcolonies were attended regularly by 12 May. Ephemeral subcolonies and others attended annually in recent years were regularly attended no earlier than the third week of May (see Pebble Point, Arch Rock, and Wishbone/Spine Points, Figures 20, 21). Murres at the Aalge Ledge club did not start regularly attending until late-May (Figure 18).

At established subcolonies, highest counts occurred during the pre-egg period in late April to late May for four of nine sites (Lighthouse, Boulder, Northwest, and Flattop Rocks; Figures 18, 20). The remaining five subcolonies (Middle, East, Beach, Face, and Lower Cone Rocks) experienced highest numbers of murres between 20 June and 20 July, during mid-incubation to early chick-rearing (Figure 19, 21). As is typical, attendance was less variable during incubation and early chick-rearing and declined in late-July or early-August as chicks fledged and adults departed the colony. Murres abandoned Beach Rock between 15 July and 21 July following an apparent predation event (Figure 19; see Disturbance, below). Murres attended most subcolonies until mid-August, about two weeks later than average and a result of delayed breeding. Attendance was more variable or sporadic at most ephemeral subcolonies, indicating no breeding or failed breeding. Other ephemeral subcolonies where murres have attended in some past years but were not seen in 2005 include: Trinity Point, Greentop, Cliff Colony West, Cliff Colony East, and Miwok Rock.

From aerial photographic surveys, murres also were documented at traditional subcolonies not easily visible from mainland vantage points: N.W. Lighthouse Cliffs, The Bulb, S.W. Lighthouse Cliffs, and South Lighthouse Cliffs (see Aerial Photographic Surveys, below).

Of interest in 2005 was the growing numbers of nonbreeding murres attending clubs, particularly in the Lighthouse area. For the first time since 1979 and 1981, respectively (McChesney et al. 1998), murres were recorded attending clubs on two non-breeding rocks, Rock #2 (subcolony 02) and Big Roost Rock (subcolony 03A). On the latter rock, about 1,200 birds were counted from aerial photographs each year in 1979-1981 (McChesney et al. 1998). Numbers of clubbing birds also increased on Aalge Ledge in 2005. This appears to reflect an overall increase in the Point Reyes murre population.

Drakes Bay Colony Complex

Each colony in Drakes Bay was regularly attended by murres from the first day of observation on 27 April 2005 (Figure 22). High counts at most colonies occurred during the pre- or early egg- laying period count. Highly variable counts during the breeding season at both Millers Rock North and Millers Rock South was consistent with high levels of raven disturbance and indications of failed breeding. Low variability in attendance during incubation and early-chick rearing at PRS and DPR was more indicative of normal breeding conditions. In mid-July, there was an increase in the number of murres (perhaps a result of prospecting subadults), followed by a decline in attendance in late-July or early-August as chicks fledged and adults departed the colony.

Productivity - Common Murre

Devils Slide Rock and Mainland

Of 267 sites documented on DSR in 2005, 164 (61.4%) were egg-laying, 84 (31.5%) were territorial, and 19 (7.1%) were sporadically attended. Numbers of territorial and sporadic sites may have been underestimated due to arrival of more birds late in the season. The number of egg-laying sites declined 14% from 2004, in part due to roosting pelicans that forced nearly all murres on the far west portion of the colony to abandon their sites prior to egg-laying.

Based on “first” eggs, the mean egg-laying date on DSR was 11 June (range: 26 May-9 July, n = 164; Table 2). Earliest and mean lay dates were the latest since 1996; the mean was 17 days later than the 1996-2005 average. This was also reflected in the delayed period of chick fledging, with both mean and last chick fledged in mid-August. A total of 199 eggs were laid, including 35 replacement eggs. Only 77 eggs hatched and 52 chicks fledged. The number of chicks fledged per breeding pair was 0.32, 49% below the long-term average and the lowest since DSR was recolonized in 1996. Low breeding success was affected by both low hatching and fledging success (Table 2). Of 164 first eggs laid, 61 hatched (37.2% hatching success) and 43 chicks fledged (70.5% fledging success). Of 35 replacement eggs, 16 hatched (45.7% hatching success) and nine chicks fledged (56.3% fledging success). Chicks that fledged remained on the rock for an average of 22.6 days.

In 2005, the first murre breeding attempts on the DSM were documented (Figures 11-13). Of the 15 sites recorded, four were egg laying, 10 were territorial, and one was sporadically attended. On DSM, breeding sites were confirmed in two subareas: one on LMS and three on TRTH. The first egg was observed on TRTH 25 June and was already abandoned. Of the four eggs laid, only the LMS one hatched and the chick fledged.

Castle/Hurricane Colony Complex

Of 95 monitored sites in the CRM-04 plot in 2005, 72 (75.8%) were egg-laying, 19 (20%) were territorial, three (3.2%) were attended sporadically, and one site (1.1%) was an active site in previous years but was unoccupied this season. The number of breeding sites declined 15% from 2004. The earliest egg-laying date of 28 May tied for the latest on record. The mean egg-laying date of 28 May (range: 22 May-11 June) was nine days later than the 1997-2005 average; only 1998 (11 June) was later. There were no replacement eggs laid. High hatching success (91.7%) was followed by relatively low fledging success (69.7%) that was largely due to a major disturbance by a juvenile Brown Pelican on 21 July (see Disturbance, below). When this event was discovered, nearly all chicks were missing from the plot and at least some certainly succumbed as a result. However, of 25 chicks remaining just prior to 21 July, 22 were beyond the 15-day fledge cutoff and were considered to have fledged. The last chick observed in the plot was during the pelican disturbance 21 July. Overall measured productivity of 0.64 chicks fledged per pair was 17% higher than the 1996-2005 average.

Of 31 monitored sites in the CRM-03 East plot, all laid eggs (Table 2). The first eight eggs laid between 25 May and 30 May all disappeared within one or two days. After 30 May the murres began incubating on a more consistent basis. On 10 June a series of disturbances caused by two ravens resulted in a complete loss of eggs and the subcolony was subsequently abandoned (see Disturbance, below).

Although productivity was not monitored on all of the CRM/HPR subcolonies, breeding in 2005 was confirmed at: BM227X-02 (Esselen Rock); CRM subcolonies 02, 03 West, 06 South and 07; and HPR-02 (both Ledge and Hump). Breeding was suspected but not confirmed on CRM-05 and HPR-01. Except for Esselen Rock and CRM-06 South, all are established subcolonies with annual breeding in recent years. At Esselen Rock, where murres typically breed in association with Brandt's Cormorants, breeding has occurred sporadically since 1996. However, in 2005 no Brandt's Cormorants bred on Esselen Rock.

Point Reyes
Of 151 sites monitored on the Ledge Plot in 2005, 102 were egg-laying sites, 43 were territorial and 6 were sporadic. A total of 116 eggs were laid, including 14 replacement eggs. The mean egg-laying date for first eggs was 3 June (range 23 May to 12 July). The number of chicks fledged per breeding pair was 0.45 (Table 2). The number of breeding sites was 14% lower than the last year of monitoring in 2002.

Of 49 sites monitored on the Edge Plot in 2005, 36 were egg-laying sites, 10 were territorial, and three were sporadic. A total of 46 eggs were laid, including 10 replacement eggs. The mean egg-laying date for first eggs was 12 June (range 24 May to 7 July). The number of chicks fledged per breeding pair was 0.56 (Table 2). The number of breeding sites was the same as in 2002.

At both Ledge and Edge Plots combined, the mean egg-laying date of 6 June was 10 days later than the long-term average (1996-2002, 2005); only 1998 (mean 17 June) was later. Overall breeding success of 0.48 chicks per pair was the third worst year on record and 13% lower than the long-term average. Poor productivity was largely a result of poor hatching success. Of 67 eggs lost from Edge and Ledge, a large number were related to two events. On 13 June, a California Sea Lion (*Zalophus californianus*) climbed LHR to just above the Edge plot and caused disturbance and egg loss. Following a large, unseasonal rainstorm on 12 June, several eggs were lost to flooding, especially in Ledge where eggs were seen floating in pools of water. In addition, ravens and Western Gulls were seen depredating eggs on other parts of LHR and likely took eggs from the plots as well.

Elsewhere at PRH, breeding was confirmed at nine subcolonies, two located on the mainland and seven on nearshore rocks, including: Boulder, Northwest, Flattop, Middle, East, Beach, Face, and Lower Cone Rocks. Beach Rock was suddenly abandoned during the second week of July, apparently due to a severe disturbance and predation event that also resulted in total failure of the Western Gull colony there (Figure 19). Although unconfirmed, breeding likely occurred at two ephemeral locations, Tim Tam (near-shore rock) and Sloppy Joe (mainland site). Sporadic attendance elsewhere suggests that these were the only two ephemeral sites with potential breeding in 2005.

Adult Time Budgets - Common Murre

Devil's Slide Rock
Three continuous time budget watches were conducted from sunrise to sunset on 19, 22, and 26 July. During each time budget watch, we followed the same breeding pairs from 12 sites that

had chicks. Mean percent of sampling period spent in co-attendance was approximately 8.5% (range: 2.7% - 18.9%; n=12). During time budget observations, 163 mate arrivals were recorded at 12 different nest sites. On average, mates arrived 0.33 times per site per hour (range: 0.07 - 0.66; n=12). Mates arrived with prey at least 54.6% of the time. They arrived with no prey in at least 25.2% of all arrivals, and for 20.2% of all arrivals it was unknown if the mate delivered prey or not. Most unknowns were probably arrivals with no prey, since prey and chick behavior is easily observed. Therefore, mean chick provisioning per site per hour was 0.18 (range: 0.00 - 0.44; n=12; for 3 deliveries it was unknown if a chick was fed). "Babysitting" of some chicks by neighboring birds occurred for long periods, even when adults attended the natal site. There was one record of a chick being left alone on the rock, and subsequently being fed by the mate of a neighboring bird that was "babysitting" the chick.

Disturbance

Non-anthropogenic Disturbance

Devil's Slide Rock - There were 19 non-anthropogenic disturbance events observed at DSR for an average of 0.032 disturbances per observation hour (Table 3). Eighteen disturbances were caused by Brown Pelicans. These typically consisted of a pelican landing on the rock, walking up to murres, lunging and pecking at murres, fighting with other pelicans, or flapping its wings in close proximity to murres, causing murres to flush or get displaced from an incubating position. The other disturbance resulted from a raven flying over the rock, causing murres to flush. Most pelican disturbances were extended events and murres were repeatedly flushed and displaced. Each such extended event was treated as one disturbance event, and an approximate number of birds affected was recorded. Five (26.3%) disturbance events caused murres to flush, 11 (57.9%) caused murres to be displaced, and 3 (15.8%) caused both flushing and displacement (Table 4). However, displacements proved difficult to quantify since they often occurred simultaneously with flushing events. Thirteen murre eggs were exposed and seven were lost (five displaced, two depredated) as a result of pelican disturbances. In addition, one or two chick losses may have resulted from Brown Pelican disturbances. In these cases a dead chick was observed in the hours or day following a disturbance event, but not directly observed at the time of the event. Two pelican disturbances also caused 3-4 Brandt's Cormorants to flush and 10-15 to be displaced.

In addition, we recorded three murre flushing events for which we could not determine the source. These were not included in the rate of disturbances per hour.

Castle/Hurricane Colony Complex - Seventy-one non-anthropogenic disturbance events were recorded for a rate of 0.141 events per observation hour (Table 5). Of these, 68 (95.8%) caused murres to flush, one (1.4%) caused murres to be displaced (Table 6), and two (2.8%) caused Brandt's Cormorants to flush. However, displacements were underestimated, since murres displaced during flushing events were too difficult to follow. A total of 11 murre eggs, six cormorant eggs, and one murre chick were depredated as a result of non-anthropogenic disturbances.

Brown Pelicans were responsible for most non-anthropogenic disturbance events, causing 47 murre flushing events (66.2%); these indirectly contributed to predation of one murre chick

(Table 6). Ravens were responsible for 22 disturbance events (31.0%) that resulted in 11 murre and six cormorant egg predations. These raven disturbances included 19 murre flushing events, two Brandt's Cormorant flushing events, and one murre displacement.

Three noteworthy disturbance events occurred in 2005. On 25 April, a pair of ravens were observed harassing, and in two cases flushing, nesting Brandt's Cormorants on CRM-03 East. The ravens also depredated six cormorant eggs during these disturbance events. This event occurrred during a period of cormorant nest abandonment throughout the CRM/HPR Colony Complex in late April (see Productivity - Brandt's Cormorants, below).

A second event occurred on 10 June when two ravens caused a series of murre disturbances on CRM-03 East. The ravens visited the subcolony throughout the day and aggressively harassed murres, causing them to flush from their sites. The ravens were observed pulling murres off of their eggs; they accomplished this by grabbing the murre's wing-tip, or tail-tip, and then pulling it back until its egg was exposed. In total, 11 murre eggs were depredated. Ultimately this resulted in complete loss of eggs and total breeding failure at this subcolony.

A third disturbance event occurred on 21 July when an immature Brown Pelican was discovered causing a series of disturbances nearly throughout the CRM colony. This pelican was already present and raising havoc when daily observations began. As in the 2004 pelican disturbance (McChesney et al. 2005), this pelican flew frequently between subcolonies (CRM-02, CRM-04, CRM-05, & CRM-07), landing on each rock repeatedly, and appeared to deliberately approach and flush groups of murres. Flushed murres circled the rock and eventually returned in small groups, only to be flushed again by the pelican's movements. A total of 12 flushing events were observed over this period. On CRM-04, during one of the flushing events, a Western Gull depredated a murre chick that had been left unattended. Although murres stopped attending the CRM-04 Plot after the disturbances on 21 July, most of the chicks were of fledging age or older at the time and are considered to have fledged.

We also documented unusual events on BM227X-02 (Esselen Rock) towards the end of the season. On 7 July, we discovered about half of the murre subcolony was abandoned; two chick and three adult murre carcasses were visible in the abandoned area. On 22 July, although murres were still attending the other half of the colony, we recorded an additional three murre carcasses (one adult and two chicks) within the active area. We suspect possible owl predation, but some other predator may have been involved.

Point Reyes - We observed 52 incidental observations of non-anthropogenic disturbances at PRH resulting in 0.125 disturbances per hour (Table 7). During disturbance events, 10 murre eggs were observed to have been depredated.

Ravens caused the majority (33 events, 63.5%) of disturbance events (Table 7). Six of these events each resulted in the depredation of single murre eggs (Table 8). Western Gulls and Brown Pelicans each caused three (5.8%) disturbance events.

A disturbance caused by a California Sea Lion occurred at LHR on 13 June 2005, when the sea lion climbed the north side of the rock just above Edge Plot. Unlike other disturbances, this took place over an extended period of time, with multiple instances of flushing and displacing of murres. Because the same group of murres was disturbed repeatedly, we recorded the entire period as one event, and estimated the total number of individual murres affected. During this event, three exposed murre eggs were depredated: two by Western Gulls; and one by a raven. Other eggs likely were lost as a result of this event.

Sometime between 15 and 21 July, a severe disturbance and predation event occurred on Beach Rock (subcolony 10F) that caused complete nest abandonment for both murres and a large colony of Western Gulls. Several dead gull chicks discovered on 21 July indicated a major predator, such as an owl or mammal, was likely the cause.

Drakes Bay Colony Complex - Twenty-five non-anthropogenic disturbances were observed at the three Drakes Bay colonies (0.184 disturbances per hour; Table 9). Of these, 50% caused murres to flush, 20.8% resulted in displacement, and 29.2% caused both flushing and displacement.

Ravens caused the majority of all disturbances (64%, 16 events) and affected the largest numbers of birds. One of these events resulted in the predation of a murre egg at MPR (Table 9, 10). Brown Pelicans were responsible for 16% of disturbances followed by Western Gulls (12%).

Disturbance rates were higher at PRS (0.393/hr) than the other two colonies, largely due to raven disturbance. The lower rate at DPR (0.012/hr) may be related to it's greater distance from shore. However, total breeding failure by murres on MPR North, and near complete if not complete failure on MPR South, were likely partly due to raven disturbance and predation.

Anthropogenic Disturbance

During 2005, we observed 14 aircraft disturbances and six boat disturbances at the four monitored colony complexes. The disturbance rate at DSR was higher than at CRM/HPR, Drakes Bay, and PRH. There were no recorded disturbances at San Pedro Rock although monitoring effort at San Pedro Rock was very low (10.80 hours).

We considered murre "headbobbing" in association with nearby aircraft or boats to be a minor form of disturbance, although not as severe as flushing or displacing of birds (considered "major" disturbances). Murres often headbob at the first sign of a threat, and sometimes headbob whether or not other evidence of disturbance is observed (Rojek et al., in press). In past CMRP reports, numbers of disturbances reported did not include headbob only events. In this report, we present the number of seabird disturbance events both including and not including murre headbobs only.

Devil's Slide Rock - A total of 176 aircraft and 49 boats were observed in the DSR area in 2005 (Table 11); 13 were known to cause major disturbances and another 49 caused murre headbobS only. For 21 aircraft/boat events, bird reaction was unknown due to observer location. Other sources resulted in an additional eight disturbance events (two major): three explosions, four trucks, and one group of motorcycles. At least one explosion event (7 June) resulted from illegal fireworks set off from the old military bunker ("South Bunker") on the point 0.6 km south of the Devil's Slide promontory and 1.2 km from DSR. Other explosions also were believed to be from illegal fireworks. Together, these events resulted in 0.025 disturbances/hr or 0.118 disturbances/hr if headbobbing only events are included.

Of 15 major disturbances to murres or Brandt's Cormorants, those caused by helicopters (40%) occurred in low flyovers of 200-600 ft (60-180 m) ASL. Motor vessel (three recreational fishing, one whale watching charter; 27%) disturbances occurred within 50 m of DSR. Kayakers that came within 300 m of DSR were responsible for another three (20%) disturbances. Most kayak disturbance occurred when kayakers traveled between DSR and the mainland. Truck air brakes on Highway 1 caused 20 murres to be displaced. A series of three explosions, most likely fireworks, coming from both the direction of the South Bunker and San Pedro Point on 31 May caused about 200 murres to scatter (displaced) and a smaller undetermined number to flush (Table 11). Fireworks set off from South Bunker on 7 June caused the entire DSR murre colony to headbob. Because of observer location, impacts could not be determined from another event on 30 May with four explosions (likely fireworks) coming from the South Bunker.

For the third consecutive year, we monitored for potential aircraft disturbance during the Half Moon Bay "Dream Machines" auto and air show on 24 April. In past years, dozens of low overflights by fixed-wing aircraft have been recorded near DSR. By 1000 h on 24 April, all murres had departed DSR for the day. During the course of that day, 22 low (< 305 m) overflights were recorded and for 14 of these no murres were present on the rock. For the eight flights that occurred while murres were present, five resulted in murres headbobbing. The cause of the early departure by the murre colony was not believed to be due to the overflight activity.

Castle/Hurricane Colony Complex - Nine aircraft, six planes and three helicopters, were incidentally observed near CRM/HPR in 2005, resulting in an average of 0.018 aircraft sightings per hour (Table 12). No boats were observed to have entered the area.

A total of six anthropogenic disturbances resulted in birds flushing at CRM/HPR (0.12 disturbances/hr). Of these, five were caused by low flying aircraft and one was caused by a gunshot that occurred on 19 May. Three of the aircraft disturbances were caused by planes and two by helicopters (Table 12). On 19 May, a helicopter pass directly over CRM-04 at about 200 ft (60 m) in elevation caused 300 murres to flush. On 22 July an Air National Guard Hercules C-130 cargo plane passed over CRM/HPR at 400 ft (120 m) ASL, causing 350 murres to flush from CRM-04, 200 to flush from CRM-07, and 100 to flush from HPR-02.

Point Reyes - We observed 20 planes and 27 boats at PRH in 2005 (Table 13). No low overflights by helicopters were recorded. Two events, one plane and one boat, resulted in flushing or displacement of murres (0.005 disturbances/hr). An additional 21 events caused murre headbobs only. When headbob only events were included, the disturbance rate increased to 0.055 events per hour.

One of two events that caused murres to flush resulted from a plane flying 750 ft (230 m) directly over Lighthouse Rock. A fishing boat traveling within 25 m of Aalge Ledge caused 25 murres to flush.

Drakes Bay Colony Complex - Anthropogenic disturbance at the three Drakes Bay colonies are summarized in Table 14. Six planes, three helicopters and 30 boats were observed at the combined colonies. In addition, a group of surfers entered the water at Double Point and approached within 150 m of DPR, but no disturbance was observed.

Of the five major disturbance events, two (40.0%) were caused by helicopters and three (60.0%)

by boats, resulting in 0.046 disturbances per hour. There were an additional five events that caused murres to headbob. If headbobs are included, the disturbance rate increases to 0.076 events per hour. All major events but one involved $\leq$10 birds. A fishing boat that approached to within 20 m of Stormy Stack flushed 40 murres and displaced another 60 murres. All boat disturbance events occurred within 100 m of colonies.

Brandt's Cormorant Productivity

Devil's Slide Rock and Mainland

In 2005, Brandt's Cormorants bred on AF, MS, and TRTH (Figures 11-13). All clearly visible egg laying sites on AF and TRTH were monitored, as well as a large, contiguous sample of nests on MS. Unlike most years, Brandt's Cormorants did not breed on DSR in 2005. After a few (#20) initial nest-building attempts through 23 May, all prospecting and establishment of territories by Brandt's Cormorants ceased on DSR.

For all subcolonies combined, mean clutch initiation date for first clutches was 17 May (range: 6 May - 7 June; n=130 ; Table 15). On average, 3.1 (range: 1-5; n=130) eggs were laid per clutch and 2.1 chicks fledged per pair (range 0-4; n=137). The AF subcolony bred significantly later than both MS and TRTH (Kruskal-Wallis test: $H_{2,130}$ = 76.57; *P*#0.001). Clutch sizes were also significantly lower at AF than MS. Nest abandonment was low at all subcolonies as indicated by the percentage of nests that fledged young: 90% at AF; 88% at MS; and 89% at TRTH.

Only two replacement clutches were observed: one each on Mainland South and Turtlehead. The MS pair laid three eggs then hatched and fledged two chicks. The TRTH pair laid two eggs that did not hatch.

Brandt's Cormorant Nest Surveys

Devil's Slide Rock and Mainland

Detailed monitoring began on 24 March but male courtship displays and nest-building activities were observed as early as mid-February (Figure 23). Numbers of PBN were highest in early to mid-May and began to decline at the onset of egg-laying in mid- to late May. Two to three earlier nest-building efforts in March and April were disrupted following strong storm activity. When courtship activity resumed in early May, nest-building and egg-laying proceeded rapidly. Peak counts of WBN were recorded for nearly all subcolonies on 6 June, during the same week as the last recorded clutch initiations and first hatching. As the season progressed, counts of WBN declined as chicks began to wander from nests and nests were destroyed.

Castle/Hurricane Colony Complex

Detailed monitoring began on 23 February (Figure 24). Well-built cormorant nests were observed at the following subcolonies: CRM-03 East, CRM-07, CRM-06 North, CRM-06 South (north and south sides), CRM-09, HPR-02, and HPR-04 (Jen's Rock). Nesting activity began earlier than normal, with courtship displays and nest-building underway by mid-February. Egg laying likely began in late March, as indicated by the first WBN and eggs observed, and continued until mid- to late June. The peak count of 120 WBN on 15 April did not represent overall breeding effort or phenology because many pairs had not yet initiated egg-laying before abandoning sites. A second peak of 125 well-built nests occurred on 2 June.

In early April to early May, many nests were abandoned following a series of strong spring storms. Later waves of nest initiation resulted in substantial variation in breeding phenology between subcolonies. The first egg was observed on 31 March at CRM-03 East, although first chicks at this location were not observed until 14 May. Later breeding efforts were especially evident at CRM-06 North, CRM-06 South (North side), and HPR-04, where most nest-building was initiated in mid- to late May and nest counts peaked in late May to late June. Based on nest surveys, peak egg laying likely occurred in late May to early June.

Point Reyes

Nest surveys were conducted between 26 April and 13 August 2005 (Figure 25). Data presented are weekly summaries because not all subcolonies were surveyed on the same day. Cormorant nests were documented at Area 06C (subcolony 06C), Arch Rock (11D), Wishbone/Spine Points (11E), Sloppy Joe (12), and Cone Rock (13; see Figure 5 for subcolony locations). The first WBN occurred during the week ending 7 May, or the week following, and likely coincided with the start of egg laying. Nest, and likely clutch, initiation increased rapidly between 14-28 May, then peaked during the week ending 11 June. The number of nests after this point gradually declined as chicks began to wander from nests. Incidental observations indicated that nest success was fairly high at all subcolonies except Subcolony 06C in Sea Lion Cove. Of 15 WBN counted on a cliff there on 27 May, only 2-3 apparently fledged chicks. On 21 July, a sample of 61 nests at Wishbone Point and Sloppy Joe had an average of 2.3 large (≥ 15 days old) chicks, indicating fairly high breeding success.

Drakes Bay Colony Complex

Nest surveys were conducted at PRS, MPR, and DPR between the weeks ending 30 April and 13 August 2005 (Figure 25). At MPR, we counted the maximum number of WBN during the week ending 4 June. The first egg was likely laid during the first week of May. At DPR (Stormy Stack), the first egg was seen during the week of 7 May. Nest initiations continued through May. Counts of WBN peaked during the weeks of 28 May and 4 June. Only one Brandt's Cormorant nest (PBN) was observed at PRS (11 July).

Aerial Photographic Surveys

Aerial photographic survey data on Common Murres, Brandt's Cormorants, and Double-crested Cormorants at sample central California colonies are reported by colony in Table 16 and by subcolony in Appendix 1.

Compared to 2004 (McChesney et al. 2005), the total number of murres counted at all central California colonies combined was 12% higher in 2005. This increase mostly reflected 10% and 20% higher counts at the North and South Farallon Islands, respectively. Higher counts at these large offshore colonies in 2005 followed very similar counts from 2002 to 2004.

For all nearshore colonies combined, the total number of murres counted in 2005 was 1% lower than in 2004, with only PRH and BM-227X having higher counts in 2005. Changes in counts at individual nearshore colonies ranged from -43% at MPR to +8% at PRH. Total counts of murres at the Drake's Bay Colony Complex (including PRS, MPR, and DPR) and CRM/HPR (including BM-227X, CRM, and HPR) were 12% and 22% lower than in 2004, respectively. However, at BM-227X, murre counts and distribution on Esselen Rock were very similar in 2004 and 2005 (323 and 329 murres, respectively), though Brandt's Cormorants did not nest at this "ephemeral" colony in 2005 as they do in most years when murres breed there.

At DSR and Mainland, only 59 murres were counted on DSR at midday on 3 June prior to the stabilization of murre attendance that occurred later in the month (see Seasonal Attendance Patterns, above). DSR was again photographed on 15 June when 301 murres were counted on the rock. This count was similar to the count of 291 in 2004, despite a lower number of breeding pairs in 2005. On DSM, seven murres were counted on April's Finger on 3 June but none were detected in the other mainland breeding areas of Mainland South and Turtlehead (see Seasonal Attendance Patterns and Common Murre Productivity, above). On 15 June, 21 murres were counted on the west facing cliff of April's Finger; however, the main attendance areas on April's Finger, Mainland South and Turtlehead were not photographed on this date.

Compared to 2004 (McChesney et al. 2005), numbers of Brandt's Cormorant nests in 2005 were lower at most sample colonies, with higher nest totals occurring only at Alcatraz Island (+8%), Seal Rocks (no nests in 2004) and Hurricane Point Rocks (+65%). Colony growth at Alcatraz Island colony was less than in recent years, after increases of 20% and 34% in 2003 and 2004, respectively (McChesney et al. 2004, 2005; Capitolo et al. 2006). Higher nest totals at Seal Rocks and Hurricane Point Rocks are likely due to colony shifting of cormorants from Lobos Rock and BM-227X, respectively. Nest totals by colony complex were lower at PRH (-46%), Drake's Bay (-23%) and CRM/HPR (-47%), and higher at Lobos/Seal Rocks (+98%). For Año Nuevo Island, nest totals were 5% lower in 2005; the total for nests and sites combined, however, was less than 1% lower in 2005. For all sample colonies combined, the nest total was 12% lower in 2005; percent changes were similar for nearshore colonies (-12% combined) and offshore colonies (-13% for the North and South Farallones combined). However, sample colonies do not include all Brandt's Cormorant colonies in the region, as several large colonies occur between Año Nuevo and CRM/HPR. Inclusion of all colonies will be needed to further assess overall population changes for this species in 2005.

Count data indicated that surveys may have occurred slightly prior to peak breeding at some Brandt's Cormorant colonies. For example, poorly-built nests (i.e, nests in early stages of construction) accounted for 24% of nests at Seal Rocks and 19% at PRH. Additionally, large numbers of territorial sites (relative to nest totals) were counted at several colonies (see Table 16). Nests with visible chicks were seen only at CRM (5%), indicative of earlier breeding there. Nest surveys and breeding phenology at our monitored colonies indicated that surveys were conducted during the period of peak nest counts, although nest initiations continued well into June at some colonies.

We counted only one Double-crested Cormorant colony in the region, the South Farallon Islands. This is the only outer coast colony in our focal area between Point Reyes and Point Sur, although several other colonies occur in the San Francisco Bay area. Our nest count at the South Farallones was 40% lower than in 2004.

Roosting Brown Pelicans were present at six of our surveyed murre and cormorant colonies, with a high count of 726 pelicans at Año Nuevo Island on 3 June.

Colony Surveys - Other Species

High counts from nest or bird surveys of Pelagic Cormorants, Western Gulls, Pigeon Guillemots, and Black Oystercatchers are presented for all colonies in Table 17. For guillemots, counts of birds both on land and on the water were conducted since these birds nest in crevices. Land-based counts of guillemots may under-represent total population size since they were conducted during the 1000-1400 h time period. Guillemot counts tend to be highest prior to 1000 h (Carter et al. 1992). Bird counts are also provided for Black Oystercatchers because of the difficulty finding nests of this species. Land-based nest counts were conducted during the course of other surveys and thus were not standardized or complete. However, a combination of boat and land-based survey data in the San Pedro/Devil's Slide area provided more complete coverage there. Other counts at least provide data on species presence and relative abundances.

Of note in 2005 was the nearly complete lack of breeding by Pelagic Cormorants at most monitored colonies. While small numbers were observed nest building early in spring, especially at CRM/HPR, all or nearly all abandoned nesting efforts.

Common Raven Surveys

Castle/Hurricane Colony Complex

A total of 68.5 hours of Common Raven surveys were conducted along the Big Sur Coast in 2005 between Pt. Lobos and Pt. Sur. Of 88 raven detections, 21 (23.9%) were located near the Soberanes Pt. trailhead, 19 (21.6%) near the Rocky Creek Bridge, 11 (12.5%) at the Garrapata State Beach parking pull-out, seven (7.9%) near Granite Canyon Bridge, and five (5.7%) near the CDFG Marine Pollution Studies Laboratory in Carmel Highlands. The remaining 25 (28.4%) detections were at various other locations (Figure 26). The highest concentration of detections took place between Yankee Pt. in Carmel Highlands and the Soberanes Pt. trailhead. Pairs of ravens were consistently seen at three locations throughout the breeding season: the Rocky Creek Bridge area, the HPR observation pull-out area, and the vicinity of the Soberanes Pt. trailhead. Many more raven detections, incidentally recorded during our daily murre data collection at both the CRM and HPR observation areas, were not included in the above numbers.

Active management of ravens was conducted at CRM in 2005, in accordance with the Common Raven Response Plan of 2005. In 2004, a nesting pair of ravens was responsible for the early abandonment of the CRM-03 East murre subcolony prior to the egg-laying period, as well as contributing to a series of disturbances that led to the near-complete reproductive failure of murres at CRM (McChesney et al. 2005). In an attempt to prevent further raven disturbance and nest predation of murres at CRM and to determine the effectiveness of such raven management in an area with a newly-expanding raven population, we worked with U.S. Department of Agriculture-Wildlife Services staff to experimentally remove the resident raven nesting pair.

In January 2005, we began periodic monitoring of raven activity in the CRM area. Although a pair of ravens was present at CRM from the start of our monitoring efforts, no activity was observed near the 2004 nest site on the cliffs below the Castle Pullout. Thus, preliminary plans to remove the remaining nesting material along the cliff face were abandoned. After five unsuccessful attempts at raven removal between 27 April and 25 May, both members of the resident pair were removed on 14 and 15 June, respectively. After the 15 June removal, raven activity at CRM ceased for the remainder of the breeding season, although a pair of ravens was often observed along Highway 1 at the HPR observation location. Thus, raven removal was effective for preventing continued raven impacts in 2005.

Banded Brandt's Cormorants - Devil's Slide Rock and Mainland

The addition of zoom, remote-control video cameras on DSR allowed us to discover and read several leg bands on Brandt's Cormorants in 2005 (Figure 27). Most of these were banded as chicks on Southeast Farallon Island (P. Warzybok, PRBO Conservation Science, pers. comm.). Colored bands with large numbers in use since 2002 made reading of most bands relatively easy. Some bands were also read using spotting scopes.

At least 24 (11 first-year and 13 adults) and as many as 32 banded cormorants were identified in 2005 (Table 18). Most were observed only once, but four birds were resighted. Complete band numbers (colored or metal band) were recorded for 16 birds. Banded birds were observed every month from April to August, with a high of at least nine different birds observed in July and a low of at least two different birds seen in April. Especially exciting was confirmed breeding on DSM (AF) by one banded bird although the band number could not be read. No trend was evident when first-year birds or adults were seen. However, the brief appearances by most birds indicated brief attendance by non-breeding (mostly immature) birds throughout the season.

DISCUSSION

The 2005 breeding season marked the tenth consecutive year of seabird restoration and monitoring efforts in central California by the Common Murre Restoration Project. Efforts have focused on reestablishing breeding and increasing colony size at the recently extirpated murre colony at DSR, reestablishing breeding at the long-extirpated San Pedro Rock colony, assessing the status of other nearshore murre colonies, and identifying other methods to restore the nearshore portion of the central California murre population.

A major initial project goal was to obtain 100 breeding pairs of murres on DSR within 10 years, using social attraction techniques. With 164 breeding pairs, the 2005 breeding season marked the sixth consecutive year this goal was reached or surpassed. This length of time differs from past reports. A change in protocol for calculating murre breeding success led to two additional sites being considered breeders in 2000, raising the number of breeding pairs that year from 98 to 100. In any case, this initial project goal has been replaced over time with a new goal: to increase colony size as much as possible. A larger, denser colony will assist future colony growth and buffer the colony against various potential impacts over time. With a historical breeding population of almost 1,500 pairs, the colony still needs substantial growth to be fully restored.

Another milestone for the project was the major reduction in numbers of decoys placed on DSR in 2005. In preparation for final cessation of social attraction efforts, we placed decoys on only one (east side) of two recognized subareas of the rock to roughly examine differences in murre attendance and behavior patterns associated with decoy removal. No discernable differences were noted that could be attributed to differences between subareas with decoys present and decoys absent. In fact, at several sites murres moved closer together, filling in spaces that formerly held decoys and increasing bird density. On the west side of the rock, where all decoys were removed, 24 new breeding sites were established. We see this as a final step before removing all artificial social attraction.

An exciting, natural extension of the DSR colony restoration was the first recorded breeding of murres on DSM. Prior to 2005, only small numbers of murres were observed on a few days in 2003 among a nesting group of Brandt's Cormorants. In 2005, consistent attendance of murres in four subareas among nesting cormorants resulted in four breeding attempts and one chick fledged. Visits by murres in DSM were first recorded in early May as the first cormorant eggs were being laid. Attendance increased further in early to mid-June following an apparent decline in prospecting activity on DSR, abandonment of several breeding sites on DSR due to pelican disturbance, and increased egg-laying on DSR. Thus, it is possible that conditions on DSR, along with the social facilitation of a large cormorant colony, drew several prospectors away from DSR to the mainland. The substantial amount of breeding habitat available on DSM could result in even further growth of the Devil's Slide murre population in the near future.

Although relatively high numbers of murres bred on DSR in 2005, the number of breeding pairs was still 14% lower than in 2004. This reduction was consistent with erratic attendance, delayed breeding, low breeding success, low adult co-attendance, and disturbance. In 2005, DSR murres had the latest egg lay dates (17 days later than the long-term mean) and the lowest productivity (0.32 chicks per pair) since 1996. On the other hand, the year had many positive highlights. Numbers of birds attending the colony increased substantially, and our peak count of the year (477 birds) was 42% above the previous high count in 2004. The total number of active sites (248) also increased by 3%. Despite high levels of egg loss, 35 pairs laid replacement eggs, a sign of good individual body condition and high site fidelity despite poor breeding conditions. The reduced breeding effort and success in 2005 can be largely attributed to low levels of upwelling, warm ocean temperatures, and poor foraging conditions that affected much of the California Current System in spring 2005 (e.g., NOAA Coastwatch El Niño Watch, http://coastwatch.pfel.noaa.gov/cgi-bin/elnino.cgi), and not to changes in social attraction.

Reduced numbers of breeders, delayed breeding, and low reproductive success at DSR was consistent with other monitored colonies at PRH and CRM/HPR. At all colonies, 2005 was among the latest years for breeding, ranging nine to 17 days later than long-term averages. At PRH and CRM/HPR, only during the 1998 El Niño was breeding later. Like DSR, PRH murres also exhibited relatively low breeding success (14% lower than the long-term mean). On the other hand, more synchronous breeding and higher productivity of murres at Castle Rocks CRM-04 plot suggested improved local prey availability along the Big Sur Coast later in the season. In 2005, murres and several other seabird species also had poor breeding success on the nearby South Farallon Islands (Warzybok et al. 2005).

Whole-colony counts of murres from aerial surveys showed mixed results, with higher counts at some colonies and lower counts at others. Since murre colony counts are affected by co-attendance patterns of breeders as well as attendance of non-breeders, applications of applicable *k*-correction factors to raw counts (e.g., Takekawa et al. 1990; Nur and Sydeman 2002)are needed to provide breeding population estimates from raw counts. However, increases at the Farallon Islands and PRH were consistent with both on-site monitoring and recent trends at those colonies (Warzybok et al. 2005; This report). Colonies showing lower numbers, MPR and CRM/HPR, have been growing more slowly than other central California colonies in recent years and are more susceptible to disturbance due to their smaller size.

In 2005, Brandt's Cormorants displayed both similarities and differences with murres. At Devil's Slide, both the earliest and mean clutch initiation dates were the latest on record: 21 and 11 days later than their long-term averages, respectively. Nest surveys at other colonies also showed delayed breeding, except for a small number of birds that laid eggs at Castle Rocks in March. Late breeding by cormorants was at least partly related to an unusually stormy spring, when early season nest building efforts were abandoned until a later time. Whole-colony counts from aerial surveys also showed reduced numbers of nests (-12%) in 2005 from the previous year. Surprisingly, however, cormorant breeding success was relatively high, and was 3% above the long-term mean at Devil's Slide. While the situation with other seabird species was less clear, Pelagic Cormorant numbers and breeding success were obviously low.

Recording disturbance is an important facet of our monitoring efforts. Controlling and reducing disturbance to colonies, especially from humans, is a long-term goal to aid population restoration. In past years, disturbance from aircraft and boats was a major problem particularly at CRM/HPR (e.g., Parker et al. 1999, 2000; Rojek et al., in prep.). In 2005, we observed both elevated rates of human disturbance (0.032 disturbances/hr vs. 0.010 disturbances/hr in 2004) and higher numbers of birds disturbed at DSR, with causes that included helicopters, motor vessels, kayaks, and fireworks. Increases were partly related to higher numbers of boats, mostly recreational motor vessels and kayaks, closely approaching the rock. These were our first recorded disturbances from kayaks and fireworks, which the DSR murres were highly sensitive to. There was also a large increase in the number of planes observed in 2005; although several of these caused murres to headbob, none caused flushing. Human disturbance events were relatively infrequent at CRM/HPR and PRH, although disturbances at CRM/HPR affected fairly large numbers of birds (average 192.4 and up to 350). This was our first year of monitoring the Drakes Bay Colony Complex, where possible impacts from boats, surfers, and aircraft is a concern (S. Allen, pers. comm.). While monitoring was limited in this remote area, levels of boat activity were high at both MPR and DPR, with one disturbance that flushed 100 murres from Stormy Stack. These areas may attract more boating activity because of their closer proximity to San Francisco Bay harbors and safer sea conditions that at nearby Point Reyes.

Avian disturbance and predation was again a problem at some colonies in 2005. Brown Pelicans can be aggressive to murres and have caused a great deal of nest failure in past years (e.g., Parker et al. 1999; McChesney et al. 2005). In 2005, large numbers of roosting pelicans on DSR caused the loss of some eggs and forced the abandonment of the far eastern portion of the murre colony before most birds had begun egg-laying. At Castle Rocks, where pelican disturbance has been most severe in past years, a single juvenile caused the loss of at least three (and probably more) chicks in the CRM-04 Plot and apparently more severe nest loss in other parts of the colony. This individual followed a pattern very similar to past pelicans, which typically fly from murre group to murre group, landing among the nesting birds and actively flushing them off. In 2004, one juvenile pelican remained for nine days and caused almost complete nesting failure of the Castle Rocks colony (McChesney et al. 2005).

Common Ravens once again caused large-scale nest loss at Castle Rocks, forcing the abandonment of CRM-03 East. Removal of this resident pair of ravens in 2005 may reduce impacts in the near future. Raven disturbance rates were also high at PRH, PRS, andMPR. While overall impacts were likely low at the former two colonies, raven disturbance and predation may have contributed to poor breeding success of murres at MPR.

In 2005, remote-controlled video cameras placed on DSR increased our ability to monitor breeding sites effectively, conduct diet watches and identify fish fed to chicks. Benefits offered by the video cameras included: the ability to monitor even on foggy or other inclement days; reduced effort confirming site status; the ability to document and archive disturbance events, oiled birds, banded birds and unusual behavior; and outreach. The live-streaming video, which was viewed by the general public online, added to the outreach and education efforts of the project. In cooperation with the Point Montara Lighthouse Hostel, a video screen was installed so that hostel guests can view the colony during the breeding season. A display with two posters describing the restoration project and seabird biology also increases public awareness.

Efforts to reduce anthropogenic disturbance through outreach were continued in 2005, including: 1) in April 2005, an informational letter on the effects of aircraft disturbance on seabirds, methods to avoid disturbance, and maps of sensitive colonies was mailed to 123 airports, aviation companies, and flying clubs throughout the San Francisco Bay area; 2) on 24 April at the 2005 Dream Machines Car and Air Show at Half Moon Bay Airport, we handed out flyers on effects of human disturbance to seabirds and coordinated with event organizers and air tour operators to reduce overflights near DSR during the show; and 3) on 24 April, we continued coordinating with organizers of the Big Sur Marathon and monitoring for disturbance during that event. These efforts appear to be having substantial benefits, as aircraft overflights and disturbance during the Dream Machines and Big Sur Marathon were highly reduced in 2005.

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Table 1. Seasonal attendance information for Common Murres attending mainland subareas at Devil's Slide Mainland in 2005.

Location	Murres 1st Observed	Murres last Observed	High Count	# of Days Observed (%)
April's Finger	17 May	12 August	16	28 (65%)
"Lower" Mainland South	13 June	12 August	18	46 (98%)
"Upper" Mainland South	14 June	30 July	17	11 (29%)
Turtlehead	7 May	10 August	25	53 (80%)

Table 2. Common Murre productivity at Devil's Slide Rock (DSR), Devil's Slide Mainland (DSM), Castle Rocks and Mainland (CRM), and Point Reyes (PRH) in 2005.

Colony/Plot	# of Sites Monitored	# of Egg Laying Sites	Mean Lay Date[1]	# of Eggs Laid	Mean Hatch Date	# of Eggs Hatched	Hatching Success[2]	Mean Fledge Date	# of Chicks Fledged	Fledging Success[3]	Chicks Fledged per Pair
DSR	267	164	11 June (5/26-7/9)	199	19 July (7/3-8/8)	77	38.7%	9 Aug. (7/26-8/22)	52	67.5%	0.32
DSM	15	4	2 July (6/25-7/10)	4	26 July (7/26)	1	25.0%	11 Aug. (8/11)	1	100%	0.25
CRM-03 East	31	31	30 May (5/25-6/7)	31	n/a	0	0	n/a	0	0	0
CRM-04	95	72	28 May (5/22-6/11)	72	9 July (6/22-7/13)	66	91.7%	19 July (7/13-7/21)	46	69.7%	0.64
PRH Edge	49	36	12 June (5/24-7/7)	46	25 July (7/2-8/5)	26	56.5%	17 Aug. (7/30-8/27)	20	76.9%	0.56
PRH Ledge	151	102	3 June (5/23-7/12)	116	13 July (6/27-8/20)	57	49.1%	6 Aug. (7/20-8/30)	46[4]	85.2%[4]	0.45[4]
PRH Edge & Ledge	200	138	6 June (5/23-7/12)	162	16 July (6/27-8/20)	83	51.2%	9 Aug. (7/20-8/30)	66[4]	82.5%[4]	0.48[4]

[1] Calculated using first eggs only; does not include replacement clutches.
[2] Hatching success is defined as the number of eggs hatched per eggs laid (includes both first and replacement clutches).
[3] Fledging success is defined as the number of chicks fledged per eggs hatched (includes both first and replacement clutches).
[4] Does not include three sites at Ledge with unknown fate chicks (eggs and chicks not included in calculations).

Table 3. Summary of non-anthropogenic disturbance to seabirds observed at Devil's Slide Rock, 2005, including numbers of disturbance events, disturbance events/hr, and average numbers of birds disturbed.

Source	Disturbance Events	# of Disturbance Events/hr	Average # of Birds Disturbed (range)
Brown Pelican	18[1]	0.03	36.3 (1-150)
Common Raven	1	0.002	50
Total	19	0.032	37.1 (1-150)

[1] Two events flushed Common Murres and Brandt's Cormorants.

Table 4. Impacts of non-anthropogenic disturbances to Common Murres observed at Devil's Slide Rock in 2005.

Source	Murres Flushed		Murres Displaced		Eggs Exposed		Eggs Displaced		Eggs Taken		Chicks Exposed		Chicks Taken	
	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events
Brown Pelican	24.3 (10-50)	7*	34.6 (1-100)	14*	1.9 (1-4)	7	1.7 (1-4)	3	1	2	0	0	0	0
Common Raven	50	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	37.1 (1-150)	8*	34.6 (1-100)	14*	1.9 (1-4)	7	1.7 (1-4)	3	1	2	0	0	0	0

* This number includes 3 events that caused both flushing and displacement.

Table 5. Summary of non-anthropogenic disturbance to seabirds observed at the Castle/Hurricane Colony Complex, 2005, including numbers of disturbance events, disturbance events/hr, and average numbers of birds disturbed.

Source	Disturbance Events	# of Disturbance Events/hr	Average # of Birds Disturbed (range)
Brown Pelican	47	0.093	84.1 (12-400)
Common Raven	22[1]	0.042	70.6 (1-400)
Peregrine Falcon	1	0.002	50 (50)
Turkey Vulture	1	0.002	15 (15)
Total	71	0.141	78.5 (1-400)

[1] Two Brandt's Cormorant flushing events,19 Common Murre flushing events, and one murre displacement.

Table 6. Impacts of non-anthropogenic disturbances to Common Murres observed at the Castle/Hurricane Colony Complex, 2005.

Source	**Murres Flushed**		**Murres Displaced**		**Eggs Exposed**		**Eggs Displaced**		**Eggs Taken**		**Chicks Exposed**		**Chicks Taken**	
	Mean (range)	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**
Brown Pelican	84.1 (12-400)	47	0	0	0	0	0	0	0	0	0	0	1[1]	1[1]
Common Raven	77.9 (5-400)	19	5	1	0	0	0	0	0	11	0	0	0	0
Peregrine Falcon	50 (50)	1	0	0	0	0	0	0	0	0	0	0	0	0
Turkey Vulture	15 (15)	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	80.8 (5-400)	68	5	1	0	0	0	0	0	11	0	0	0	1

[1] Chick loss due to Western Gull depredation.

Table 7. Summary of non-anthropogenic disturbance to seabirds incidentally observed at Point Reyes, 2005, including numbers of disturbance events, disturbance events/hr, and average numbers of birds disturbed.

Source	Disturbance Events	# of Disturbance Events/hr	Average # of Birds Disturbed (range)
Brown Pelican	3	0.007	95 (15-150)
Common Raven	33	0.079	51 (1-200)
Western Gull	7	0.017	12 (2-45)
Common Raven and Western Gull	1	0.002	10
Peregrine Falcon	1	0.002	186
Peregrine Falcon and Common Raven	1	0.002	200
Turkey Vulture	2	0.005	175 (175)
Unknown	3	0.007	55 (50-60)
California Sea Lion	1	0.002	58
Total	52	0.125	57 (1-200)

Table 8. Impacts of non-anthropogenic disturbances to Common Murres observed at Point Reyes in 2005.

Source	**Murres Flushed**		**Murres Displaced**		**Eggs Exposed**		**Eggs Displaced**		**Eggs Taken**		**Chicks Exposed**		**Chicks Taken**	
	Mean (range)	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**	**Mean (range)**	**# of events**
Brown Pelican	60 (20-100)	2[1]	55 (15-100)	3[1]	0	0	0	0	0	0	0	0	0	0
Common Raven	60 (3-200)	22[4]	19 (1-45)	18[4]	0	0	0	0	1	6	0	0	0	0
Western Gull	12 (2-45)	7	0	0	0	0	0	0	0	0	0	0	0	0
Common Raven & Western Gull	10	1	0	0	0	0	0	0	1	1	0	0	0	0
Peregrine Falcon	186	1	0	0	0	0	0	0	0	0	0	0	0	0
Peregrine Falcon and Common Raven	200	1	0	0	0	0	0	0	0	0	0	0	0	0
Turkey Vulture	175 (175)	2	0	0	0	0	0	0	0	0	0	0	0	0
California Sea Lion	50	1[2]	8	1[2]	0	0	0	0	3[3]	1	0	0	0	0
Unknown	50 (50)	2	60	1	0	0	0	0	0	0	0	0	0	0
Total	61 (2-200)	39	26 (1-100)	23	0	0	0	0	1.25 (1-3)	8	0	0	0	0

[1] Includes 2 events that caused both flushing and displacement.
[2] Includes 1 event that caused both flushing and displacement.
[3] During disturbance event, 2 eggs were scavenged by a Western Gull and 1 egg by a Common Raven.
[4] Includes 7 events that caused both flushing and displacement.

Table 9. Summary of non-anthropogenic disturbance to seabirds observed at Point Resistance, Millers Point Rocks, Double Point Rocks, 2005, including numbers of disturbance events, disturbance events/hr, and average numbers of birds disturbed.

Source	# of Disturbance Events	# of Disturbance Events/hr	Average # of Birds Disturbed (range)
Point Resistance			
Brown Pelican	2	0.071	28 (15-40)
Common Raven	8	0.286	208 (20-450)
Unknown	1	0.036	20
Total	11	0.393	158 (15-450)
Millers Point Rocks			
Common Raven	8	0.178	153 (1-1000)
Unknown	1	0.022	150
Total	9	0.2	153 (1-1000)
Double Point Rocks			
Brown Pelican	2	0.035	75 (50-100)
Western Gull	3	0.052	3 (1-5)
Total	5	0.012	32 (1-100)

Table 10. Impacts of non-anthropogenic disturbances to Common Murres observed at Point Resistance, Millers Point Rocks, and Double Point Rocks, 2005.

Source	Murres Flushed		Murres Displaced		Eggs Exposed		Eggs Displaced		Eggs Taken		Chicks Exposed		Chicks Taken	
	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events	Mean (range)	# of events
Point Resistance														
Brown Pelican	25	1[2]	15 (15)	2[1]	0	0	0	0	0	0	0	0	0	0
Common Raven	165 (6-300)	7[3]	98 (40-200)	5[2]	0	0	0	0	0	0	0	0	0	0
Unknown	20	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	133 (6-300)	9	74 (40-200)	7	0	0	0	0	0	0	0	0	0	0
Millers Point Rocks														
Common Raven	173 (1-1000)	7[1]	6 (5-7)	2[1]	0	0	0	0	1	1	0	0	0	0
Unknown	150	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	170 (1-1000)	8	6 (5-7)	2	0	0	0	0	1	1	0	0	0	0
Double Point Rocks														
Brown Pelican	100	1	50	1	0	0	0	0	0	0	0	0	0	0
Western Gull	2	1	3 (1-5)	2	0	0	0	0	0	0	0	0	0	0
Total	51 (2-100)	2	19 (1-50)	3	0	0	0	0	0	0	0	0	0	0

[1] Includes 1 event that caused both flushing and displacement.
[2] Includes 1 event that caused both flushing and displacement.
[3] Includes 5 events that caused both flushing and displacement.

Table 11. Observations of anthropogenic sources and resulting disturbances to all seabirds, Common Murres (COMU), and Brandt's Cormorants (BRCO) at Devil's Slide Rock in 2005.

Source	Total # of Incidental Obs.[1]	#Obs./hr	# Seabird Disturbance Events		# Seabird Disturbance Events/hour		Mean # Seabirds Disturbed (range)[2]	COMU Disturbance[2]		BRCO Disturbance	
			Flush, Displace	Flush, Displace, Headbob	Flush, Displace/hr	Flush, Displace, Headbob/hr		# Events	Mean # COMU dist. (range)	# Events	Mean # BRCO dist. (range)
Plane	134	0.225	0	28	0	0.047	0	0	0	0	0
Helicopter	42	0.071	6	15	0.01	0.025	93.2 (6-250)	4	86.3 (15-200)	4	53.5 (6-150)
Motor vessel	45	0.076	4	17	0.007	0.029	63.0 (10-200)	2	101.0 (2-200)	3	16.7 (10-25)
Kayak	4	0.007	3	4	0.005	0.007	93.3 (40-200)	2	40 (40)	1	200
Other[3]	8	0.013	2	6	0.003	0.01	110 (20-200)	2	110 (20-200)	0	0
Total	NA	NA	15	70	0.025	0.118	100.118	84.3 (2-200)	8	90.1 (6-200)	87.4 (6-250)

[1] Includes all aircraft at ≤ 1,000 feet ASL and boats within 460 meters of a subcolony.
[2] Numbers do not include events that caused murres to headbob.
[3] See text.

Table 12. Observations of anthropogenic sources and resulting disturbances to all seabirds, Common Murres (COMU), and Brandt's Cormorants (BRCO) at the Castle/Hurricane Colony Complex in 2005.

Source	Total # of Incidental Obs.	#Obs./hr	# Seabird Disturbance Events		# Seabird Disturbance Events/hour		Mean # Seabirds Disturbed[1] (range)	COMU Disturbance[1]		BRCO Disturbance	
			Flush & Displace	Flush, Displace, Headbob	Flush, Displace/hr	Flush, Displace, Headbob/hr		# Events	Mean # COMU dist. (range)	# Events	Mean # BRCO dist. (range)
Plane	6	0.01	3	3	0.006	0.006	216.11 (100-350)	3	216.11 (100-350)	0	0
Helicopter	3	0	2	2	0.004	0.004	156 (12-300)	2	156 (12-300)	0	0
Boat	0	0	0	0	0	0	0	0	0	0	0
Other	1	NA	1	1	0.002	0.002	80	1	80	0	0
Total	NA	NA	6	6	0.012	0.012	192.4 (12-350)	6	192.4 (12-350)	0	0

[1] Numbers do not include events that caused murres to head bob.

Table 13. Observations of anthropogenic sources and resulting disturbances to all seabirds, Common Murres (COMU), and Brandt's Cormorants (BRCO) at Point Reyes in 2005.

Source	Total # of Incidental Obs.	#Obs./hr	# Seabird Disturbance Events		# Seabird Disturbance Events/hour		Mean # Birds Disturbed[1] (range)	COMU Disturbance[1]		BRCO Disturbance	
			Flush & Displace	Flush, Displace, Headbob	Flush, Displace/hr	Flush, Displace, Headbob/hr		# Events	Mean # COMU dist. (range)	# Events	Mean # BRCO dist. (range)
Plane	20	0.05	1	15	0.002	0.036	50	1	50	0	0
Helicopter	0	0	0	0	0	0	0	0	0	0	0
Boat	27	0.07	1	7	0.002	0.017	25	1	25	0	0
Human (on foot)	1	NA	0	1	0	0.002	0	0	0	0	0
Total	NA	NA	2	23	0.005	0.055	38 (25-50)	2	38 (25-50)	0	0

[1] Numbers do not include events that caused murres to headbob.

Table 14. Observations of anthropogenic sources and resulting disturbances to all seabirds, Common Murres (COMU), and Brandt's Cormorants (BRCO) at Point Resistance, Millers Point Rocks, and Double Point Rocks, at Drakes Bay, in 2005.

Source	Total # of Incidental Obs.	# Obs./hr	# Disturbance Events		# Disturb. Events/hour		Mean # Birds Disturbed[1] (range)	COMU Disturbance[1]		BRCO Disturbance	
			Flush & Displace	Flush, Displace & Headbob	Flush, Displace /hr	Flush, Displace & Headbob/hr		# Events	Mean # COMU dist. (range)	# Events	Mean # BRCO dist. (range)
Point Resistance											
Plane	1	0	0	0	0	0	0	0	0	0	0
Helicopter	0	0	0	0	0	0	0	0	0	0	0
Boat	20	0	0	1	0	0.036	0	0	0	0	0
Total	NA	NA	0	1	0	0.036	0	0	0	0	0
Millers Point Rocks											
Plane	4	0.1	0	0	0	0	0	0	0	0	0
Helicopter	2	0	2	2	0.044	0.044	10	1	5	1	5
Boat	9	0.2	1	1	0	0	1	0	0	1	1
Total	NA	NA	3	3	0.067	0.067	6 (1-10)	1	5	2	3 (1-5)
Double Point Rocks											
Plane	1	0	0	1	0	0.017	0	0	0	0	0
Helicopter	1	0	0	1	0	0.017	0	0	0	0	0
Boat	20	0.35	2	4	0.035	0.069	52 (4-100)	1	100	1	4
Surfers	1	0	0	0	0	0	0	0	0	0	0
Total	NA	NA	2	6	0.035	0.121	52 (4-100)	1	100	1	4

[1] Numbers do not include events that caused murres to head bob.

Table 15. Brandt's Cormorant breeding phenology and reproductive success at Devil's Slide Rock and Mainland, 2005. Results of Kruskal-Wallis test comparing metrics among sites, followed by Dunn's method of pairwise multiple comparisons. Sites within a column with the same letters are not significantly different (P < 0.05).

Subcolony	# of sites monitored	Mean laying date (range; n)	Mean clutch size (range; n)	Hatching Success	Mean brood size (range; n)	Fledging Success	Mean # of chicks fledged/pair (range; n)
Devil's Slide Rock	0	n/a	n/a	n/a	n/a	n/a	n/a
April's Finger	60	25 May **A** (5/16 - 6/07; n=47)	2.9 **A** (1-5; n=47)	75% (n=148)	2.2 (0-4; n=51)	95% (n=111)	2.1 (0-4; n=51)
Mainland South	63	12 May **B** (5/06 - 6/01; n=57)	3.2 **B** (1-4; n=57)	76% (n=192)	2.4 (0-4; n=59)	89% (n=143)	2.2 (0-4; n=59)
Turtlehead	32	14 May **B** (5/06 - 5/23; n=26)	3.1 **AB** (1-4; n=26)	71% (n=86)	2.3 (0-3; n=27)	84% (n=61)	1.9 (0-3; n=27)
Total	155	17 May (5/06 - 6/07; n=130)	3.1 (1-5; n=130)	74% (n=426)	2.3 (0-4; n=137)	90% (n=317)	2.1 (0-4; n=137)

Table 16. Summary of aerial photograph counts of Common Murres (COMU), Brandt's Cormorants (BRCO), and Double-crested Cormorants (DCCO) at sample central California breeding colonies, 2005.

Colony Name	CCN[1]	USFWSCN[2]	Date	COMU	Brandt's Cormorant			Double-crested Cormorant		
				Birds	Nests	Sites	Birds	Nests	Sites	Birds
Point Reyes	MA-374-01	429-001	06/15/05	26331	311	36	391	0	0	0
Point Resistance	MA-374-03	429-024	06/03/05	3837	1	0	19	0	0	0
Miller's Point Rocks	MA-374-04	429-002	06/03/05	515	103	30	211	0	0	0
Double Point Rocks	MA-374-05	429-003	06/03/05	8446	147	60	428	0	0	0
North Farallon Islands	SF-FAI-01	429-051	06/10/05	47488	20	3	98	0	0	0
South Farallon Islands	SF-FAI-02	429-052	06/10/05	91508	7437	775	9260	337	13	362
Alcatraz Island	SFB-SF-11	429-036	05/31/05	0	856	95	1179	0	0	0
Lobos Rock & Land's End	SF-374-02	429-029	06/03/05	0	0	0	45	0	0	0
Seal Rocks	SF-374-03	429-009	06/03/05	0	236	99	1302	0	0	0
Devil's Slide Rock & Mainland	SM-372-03	429-014	06/03/05	66[3]	292	22	480	0	0	0
Devil's Slide Rock & Mainland	SM-372-03	429-014	06/15/05	322[4]	ND	ND	ND	ND	ND	ND
Año Nuevo Island	SM-370-04	429-023	06/03/05	0	1556	82	1753	0	0	0
Bench Mark-227X	MO-362-18	454-029	06/06/05	329	0	0	0	0	0	0
Castle Rocks & Mainland	MO-362-19	454-010	06/06/05	1271	170	1	186	0	0	0
Hurricane Point Rocks	MO-362-20	454-011	06/06/05	640	56	0	61	0	0	0
TOTAL				180687	11185	1203	15413	337	13	362

[1] CCN = California Colony Number.
[2] USFWSCN = U.S. Fish and Wildlife Service Colony Number.
[3] Includes 59 birds on Devil's Slide Rock and seven birds on the Devil's Slide Mainland.
[4] Includes a complete survey for Devil's Slide Rock (301 birds) and incomplete survey of the adjacent Devil's Slide Mainland (21 birds).

Table 17. High nest or bird counts of Pelagic Cormorant (PECO), Western Gull (WEGU), Pigeon Guillemot (PIGU), and Black Oystercatcher (BLOY), at monitored colonies in 2005. Data are from land-based surveys except where indicated. IN = incomplete; ND = no data.

Colony Name	**PECO Nest**	**WEGU Nest**	**PIGU Bird**	**BLOY Nest**	**BLOY Bird**
Point Reyes	0	IN	IN	ND	IN (4)
Point Resistance	0	1	14	0	0
Miller's Point Rocks	1	4	19	1	2
Double Point Rocks	0	5	16	1	4
San Pedro Rock[1]	0	3	38	ND	2
Point San Pedro[1]	0	0	8	0	0
Devil's Slide Rock and Mainland	1[2]	16[2]	56[1]	0[2]	2[2]
Bench Mark-227X	0	4	IN (0)	0	0
Castle Rocks and Mainland	4	6	IN (6)	0	2
Hurricane Point Rocks	4	2 (IN)	IN (4)	0	0

[1] Data from boat survey only.
[2] Combination of land and boat survey.

Table 18. Banded Brandt's Cormorants observed at Devil's Slide Rock and Mainland, 2005.

Date	Age	Left Band	Right Band	Location
21 April	1st Year	Red-EX?	Metal	DSR
24 April	1st Year	Red-EUU	Metal	DSR
27 April	1st Year	Red-?U?	Metal	ER
3 May	Adult	Yellow	Metal	DSR
7 May	Adult	Green-J9?	Metal	ER
12 May	Adult	Yellow	Metal	ER
13 May	1st Year	Red	Metal	DSR
13 May	Adult	None[1]	Metal	AF
16 May	1st Year	Red	Metal	DSR
27 May	Adult	Green-K3?	Metal	ER
2 June	Adult	Blue-E23	Metal-???63	DSR
16 June	1st Year	Red-JPN	Metal	DSR
17 June	Adult	Green-J71	Metal	DSR
24 June	Adult	Green-H14	Metal	DSR
25 June	Adult	Green or Blue	Metal	ER
30 June	1st Year	Red-AHK	Metal	DSR
1 July	Adult	Green-E34	Metal	DSR
1 July	Adult	Metal-02486[2]	Grey	DSR
1 July	1st Year	Red-KAH	Metal	DSR
2 July	Adult	Blue-F28	Metal	DSR
2 July	1st Year	Red-AN?	Metal	DSR
5 July	1st Year	Red-A??	Metal	DSM
5 July	1st Year	Red-?HP	Metal	DSM
7 July	1st Year	Red-ACK[3]	Metal	DSM
7 July	Adult	Green	Metal	DSM
8 July	1st Year	Red-ACK	Metal	DSM
21 July	Adult	Black	Metal-??689	DSR
30 July	Adult	Grey/Metal	Metal-091?4	DSR
6 August	Adult	Blue-H41	Metal	DSR
8 August	1st Year	Red-ELK[4]	Metal	DSR
8 August	1st Year	Red-KCT[4]	Metal-22419	DSR
9 August	1st Year	Red-ELK	Metal-21???	DSR

[1] This bird nested on AF and was seen throughout the summer.
[2] This bird was resighted on 4, 7, 13, 21, 30 July and 3, 8, 11 August.
[3] This bird was resighted on 8 July.
[4] These birds were resighted on 9 August.

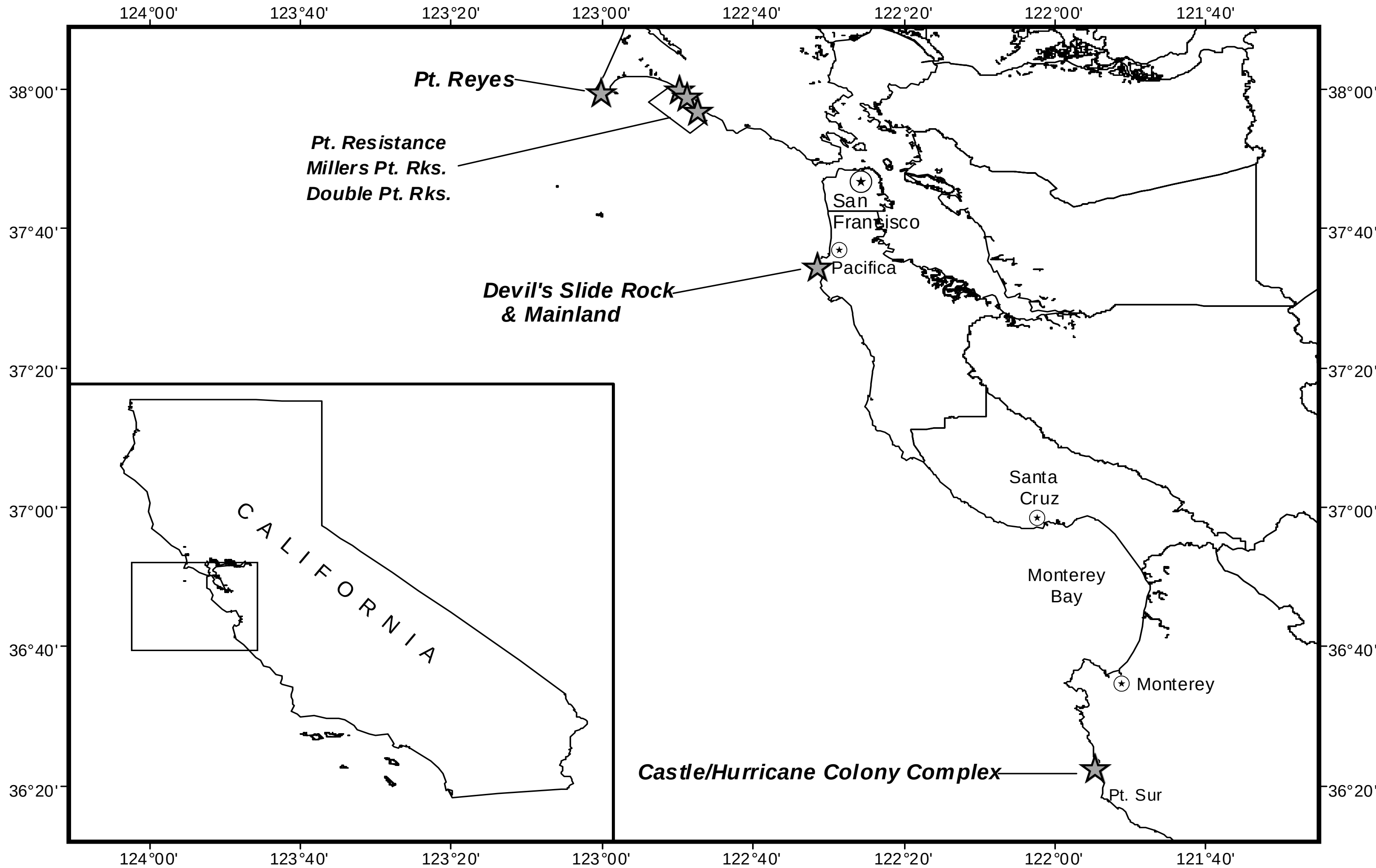


Figure 1. Map of the study area showing locations of study colonies.

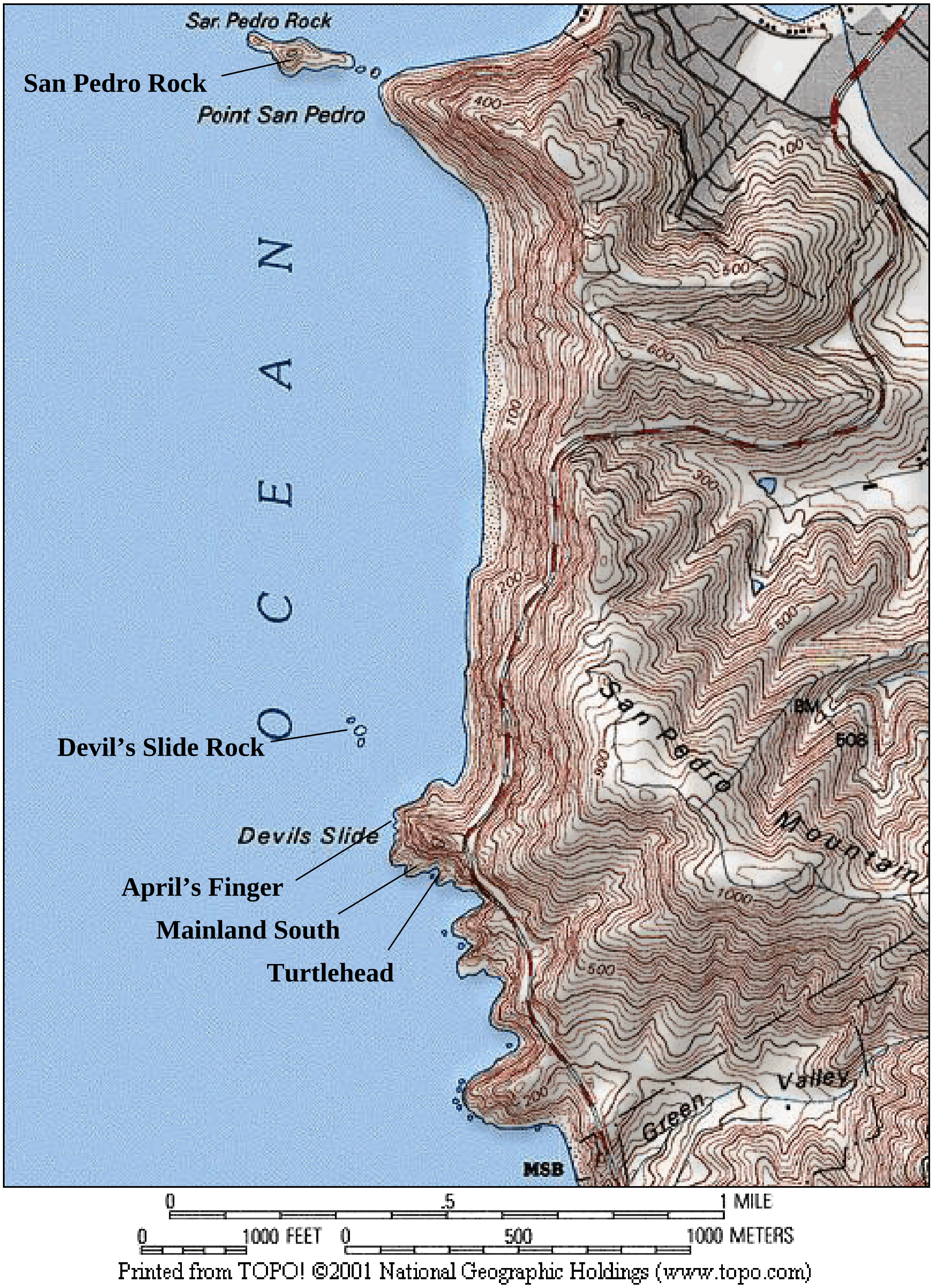


Figure 2. Devil's Slide Colony Complex including colonies and subcolonies monitored.

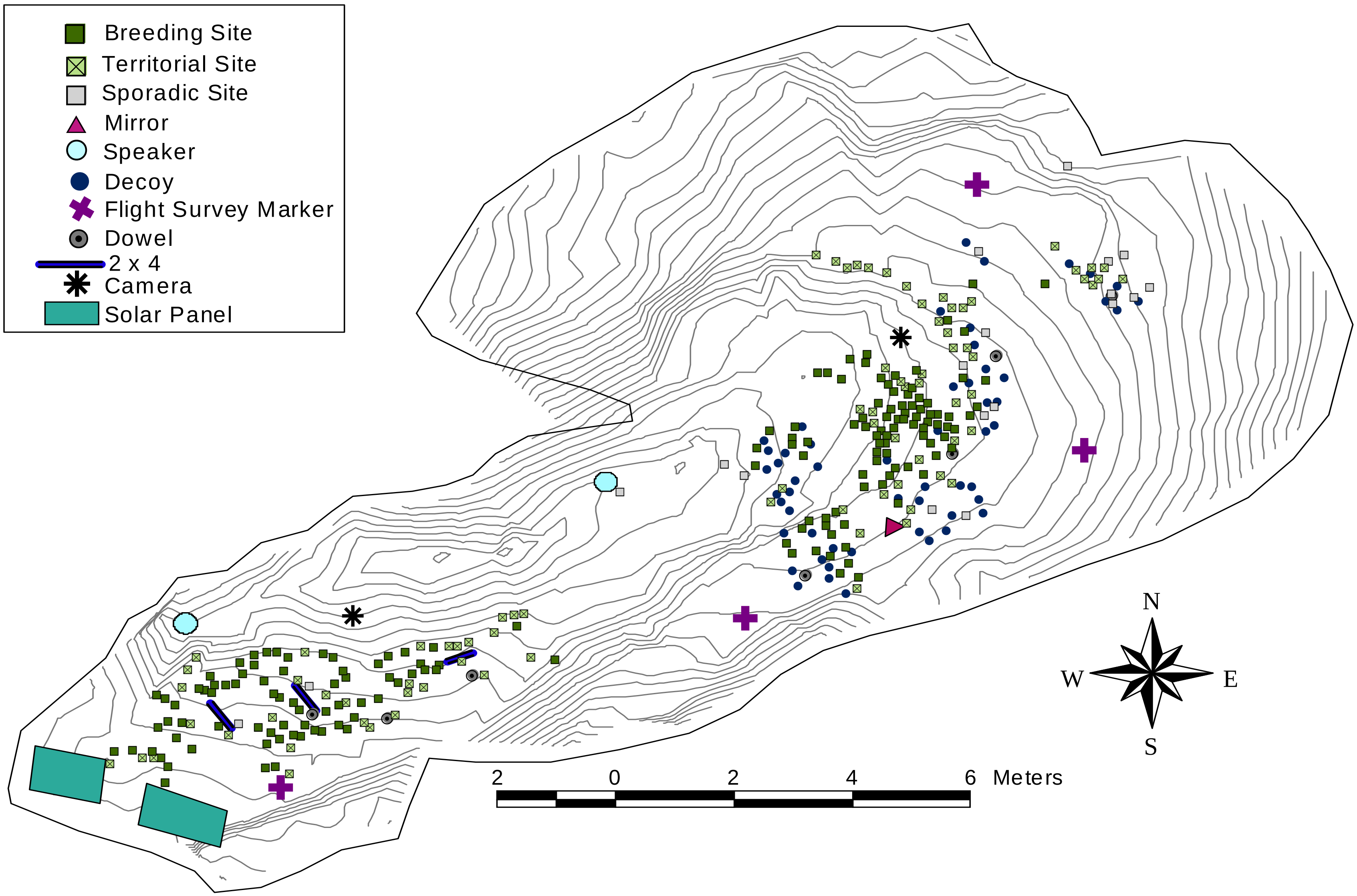


Figure 3. GIS map of Devil's Slide Rock, 2005. Common Murre breeding, territorial, and sporadic sites are shown in relation to social attraction equipment and other features.

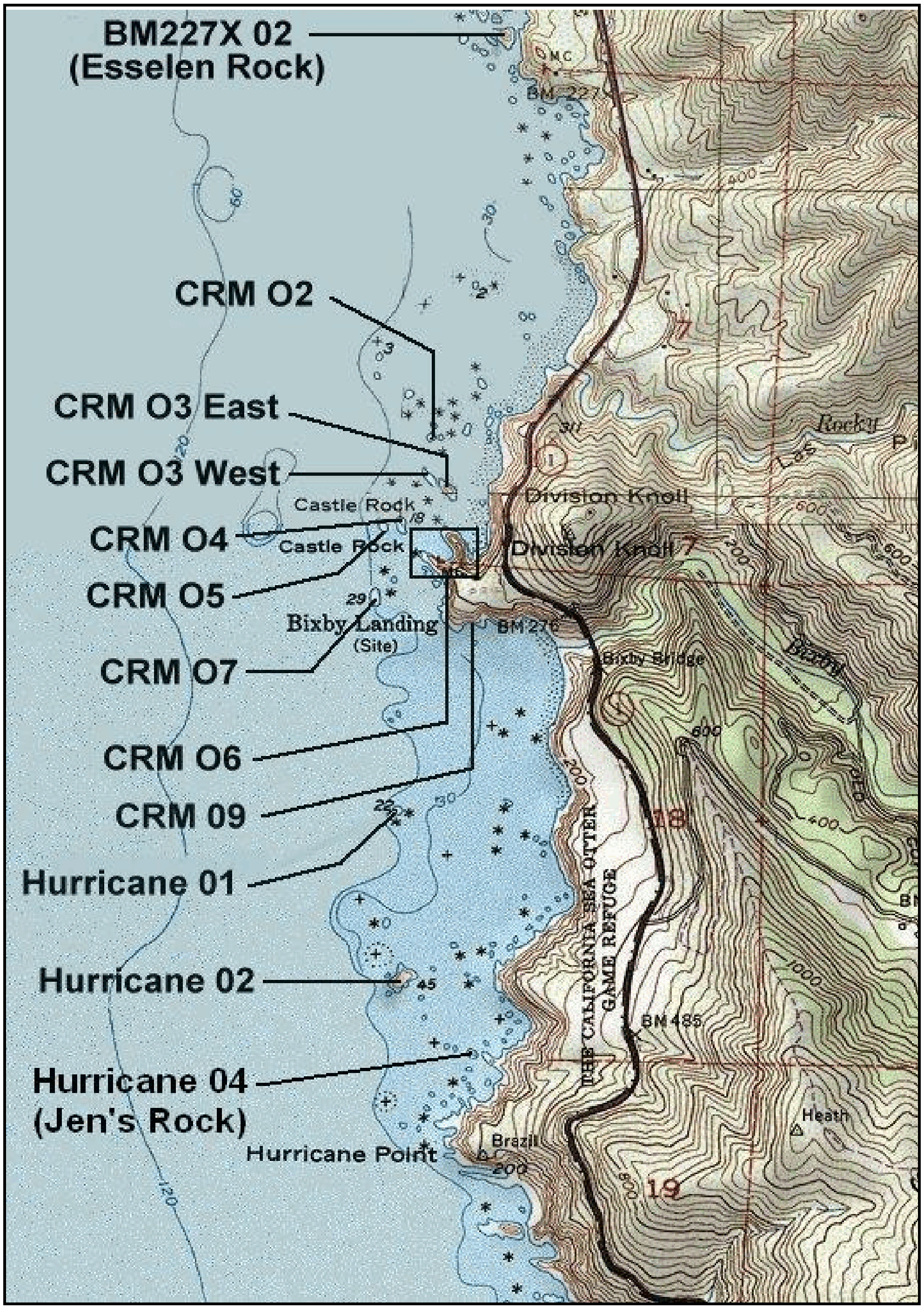


Figure 4. Castle/Hurricane Colony Complex, including Bench Mark-227X (BM227X), Castle Rocks and Mainland (CRM), and Hurricane Point Rocks (Hurricane). Labels indicate subcolonies mentioned in the text.

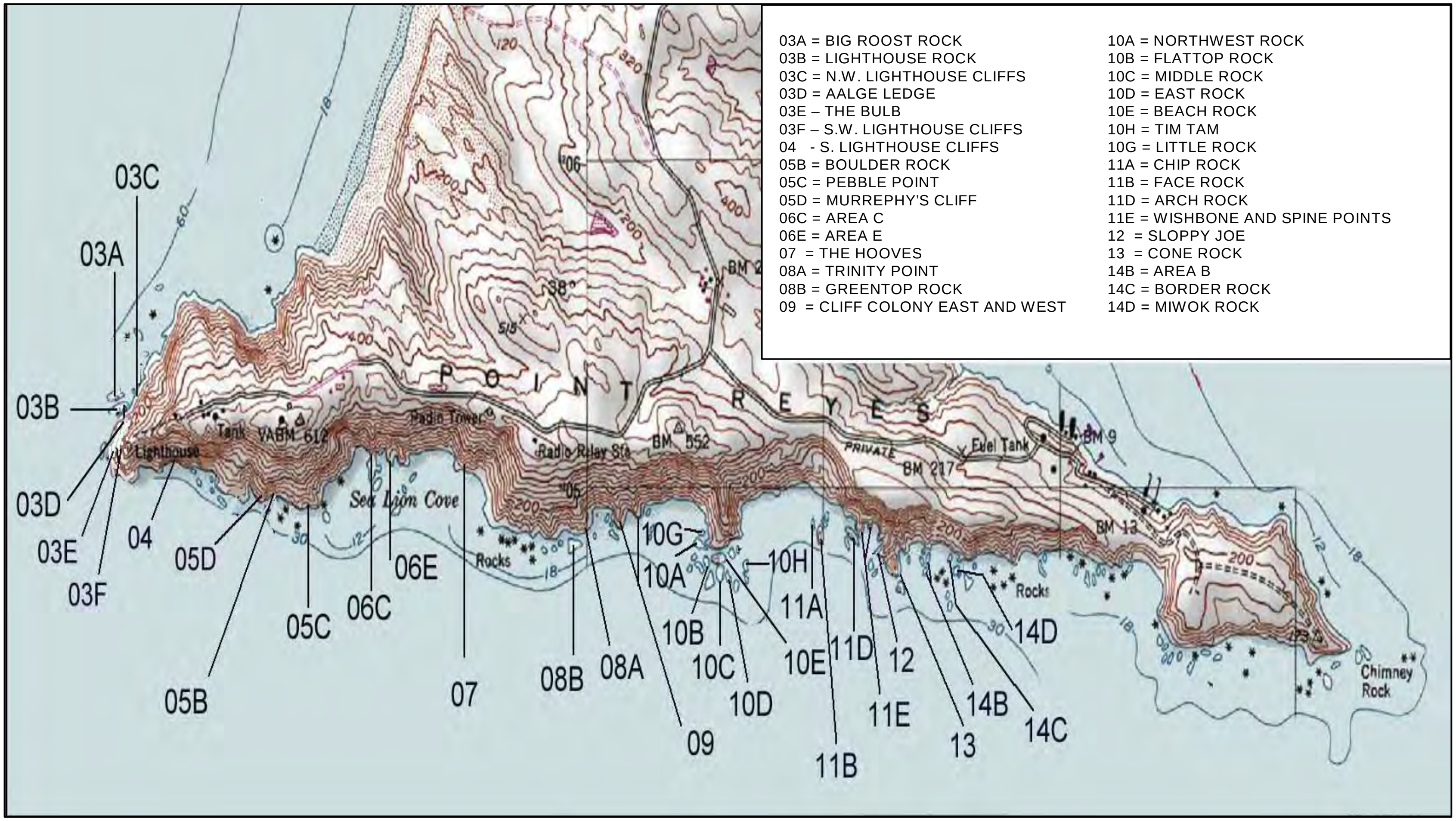


Figure 5. Point Reyes, including subcolonies mentioned in this report.

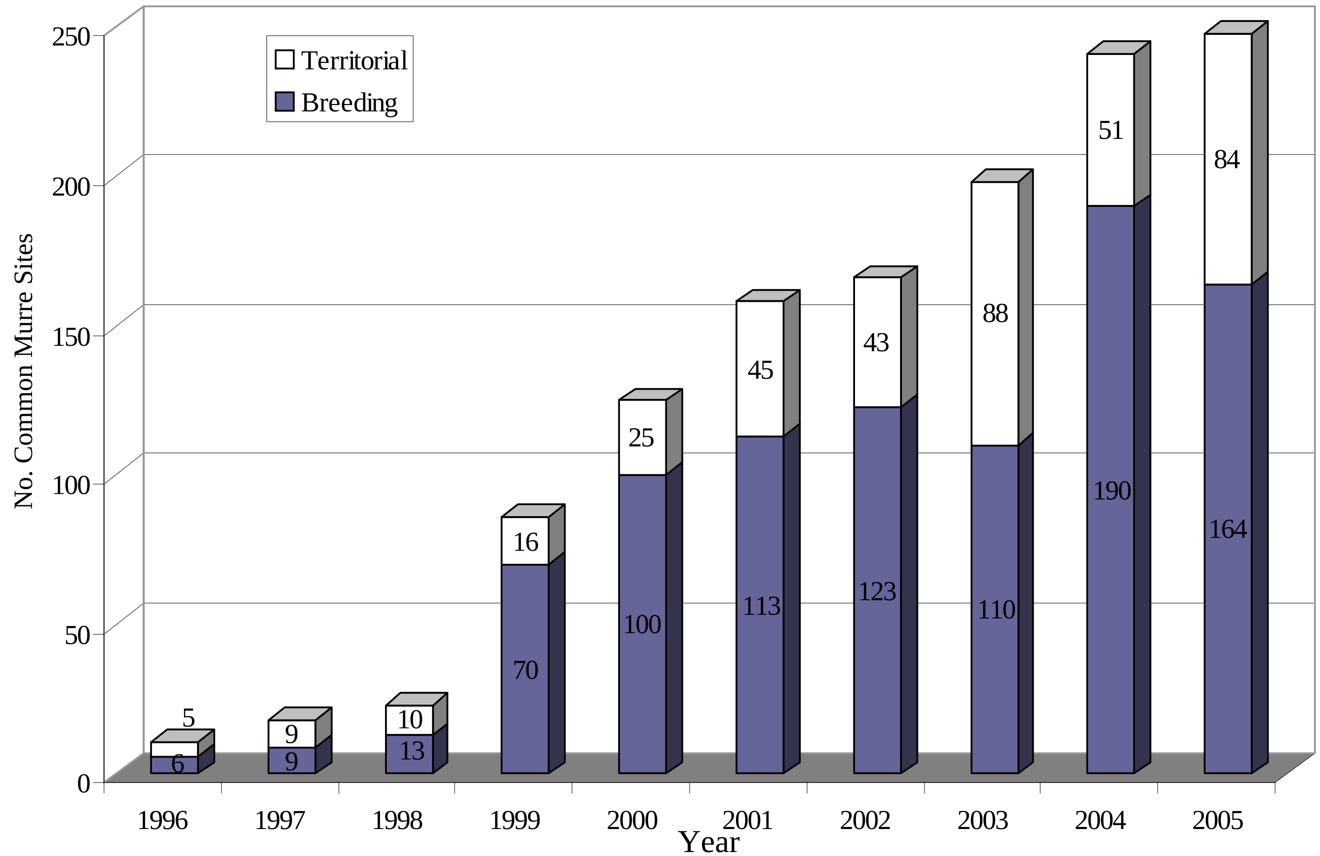


Figure 6. Numbers of Common Murre breeding and territorial sites on Devil's Slide Rock, 1996-2005.

Figure 7. Aerial overview photograph of Devil's Slide Rock, 15 June 2005, showing distribution of Common Murres. Note absence of breeding Brandt's Cormorants and absence of murres on far east (top right) side of rock.

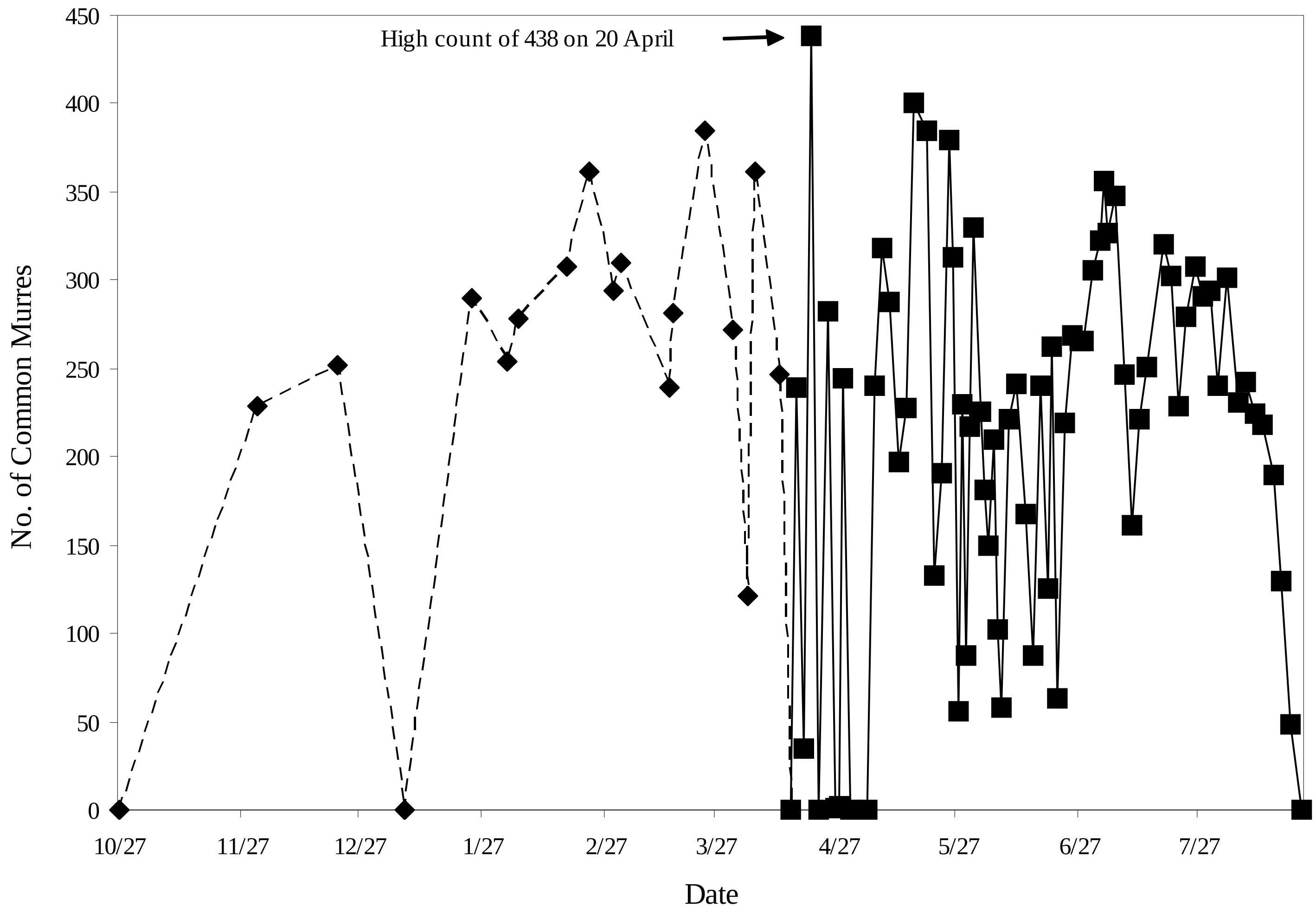


Figure 8. Seasonal attendance of Common Murres at Devil's Slide Rock, 27 October 2004 to 22 August 2005. Dashed line indicates "preseason" (prior to 15 April) when most counts were conducted between 0700 and 1000 h. Solid line indicates main field season, when counts were conducted between 1000 and 1400 h.

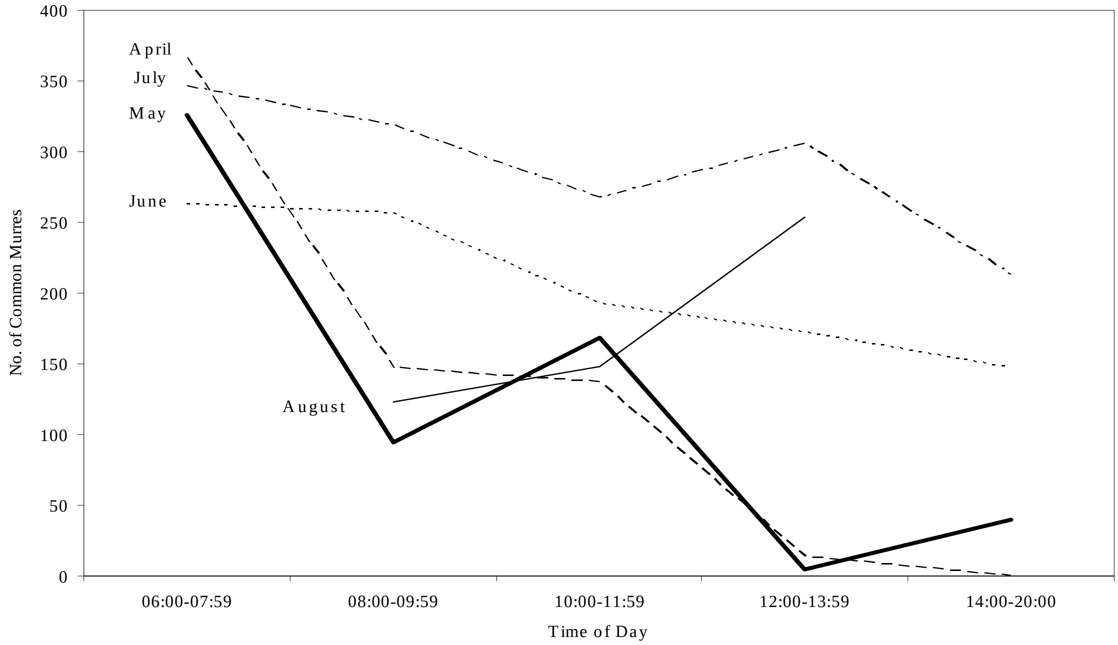


Figure 9. Average daily attendance patterns of Common Murres by month at Devil's Slide Rock, April to August 2005.

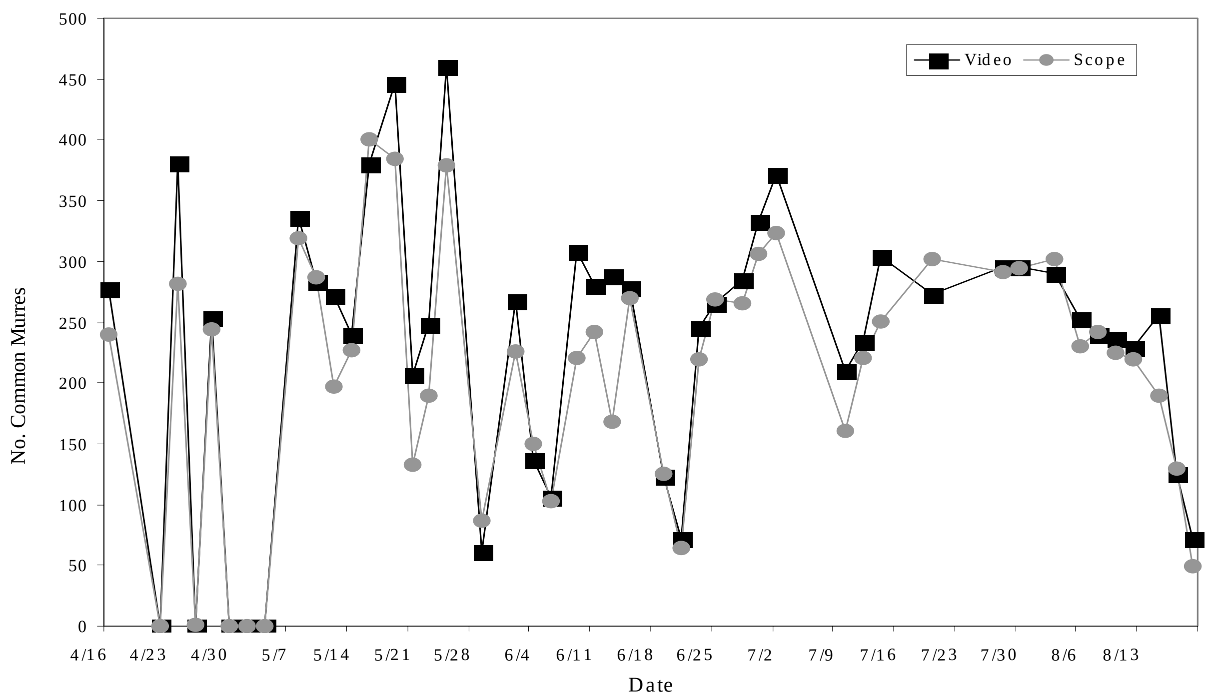


Figure 10. Comparison of daily counts of Common Murres made with spotting scopes and video cameras at Devil's Slide Rock, 16 April to 19 August 2005.

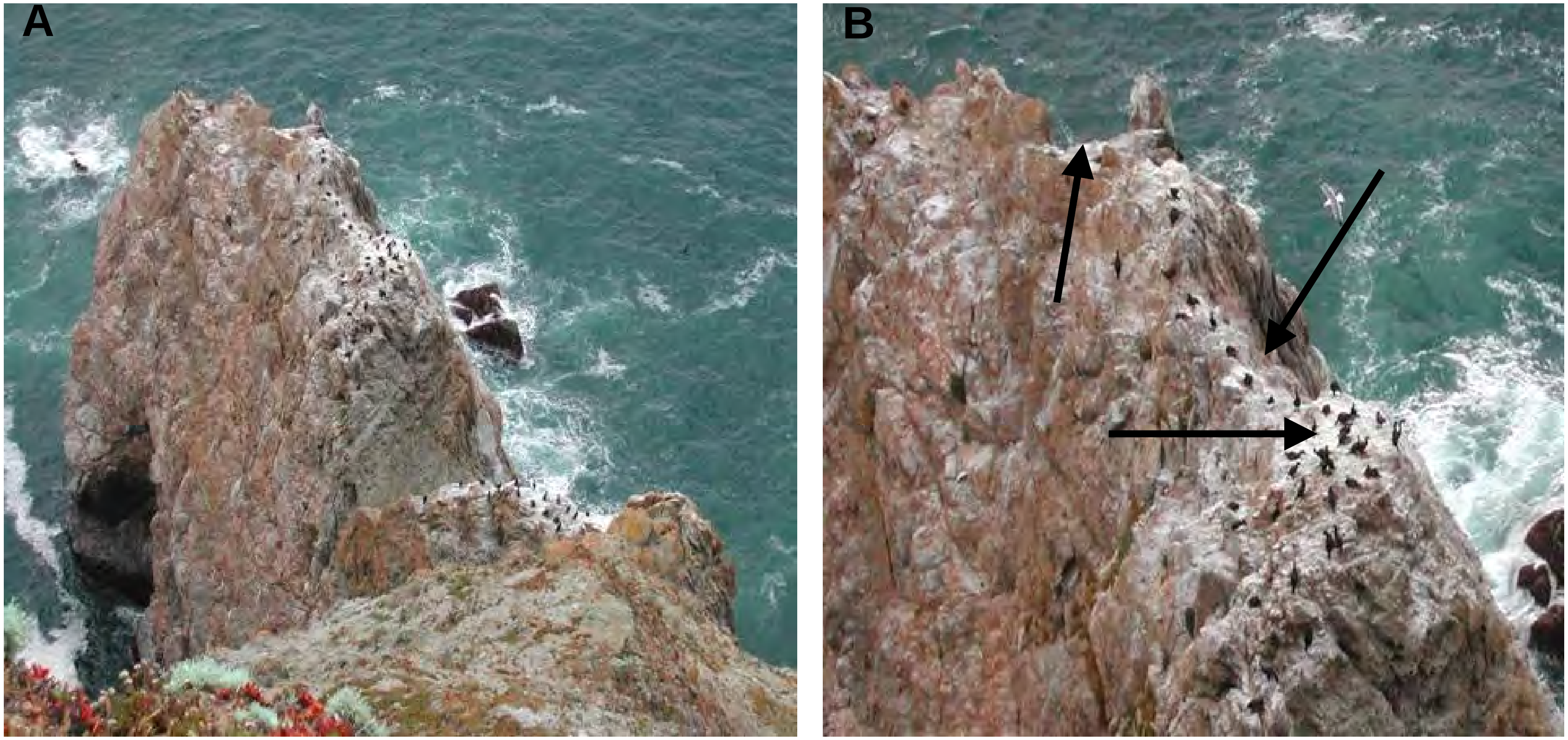


Figure 11. Views of April's Finger Brandt's Cormorant subcolony at Devil's Slide Mainland from the mainland observation site: A) Overview; and B) closer view with arrows indicating areas frequented by murres. Murres were also observed arriving and departing from areas on the far side of the ridge, where about 40 murres were observed during a boat survey on 21 June.

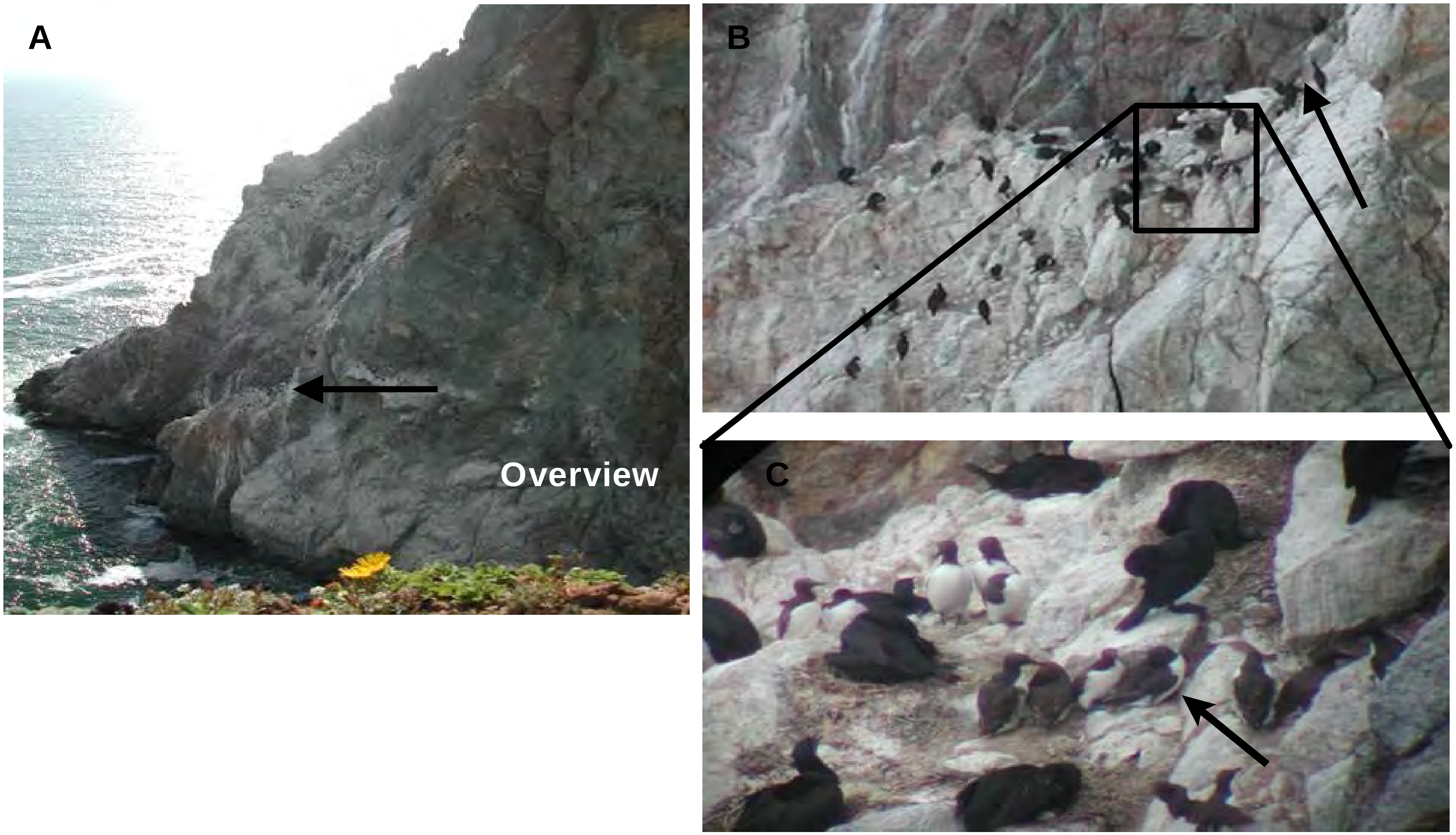


Figure 12. Views of Lower Mainland South, Devil's Slide Mainland, showing location of Common Murre breeding site among nesting Brandt's Cormorants: A) overview; B) nesting area; and C) breeding site. Arrows indicate areas murres were most frequently observed and breeding site.

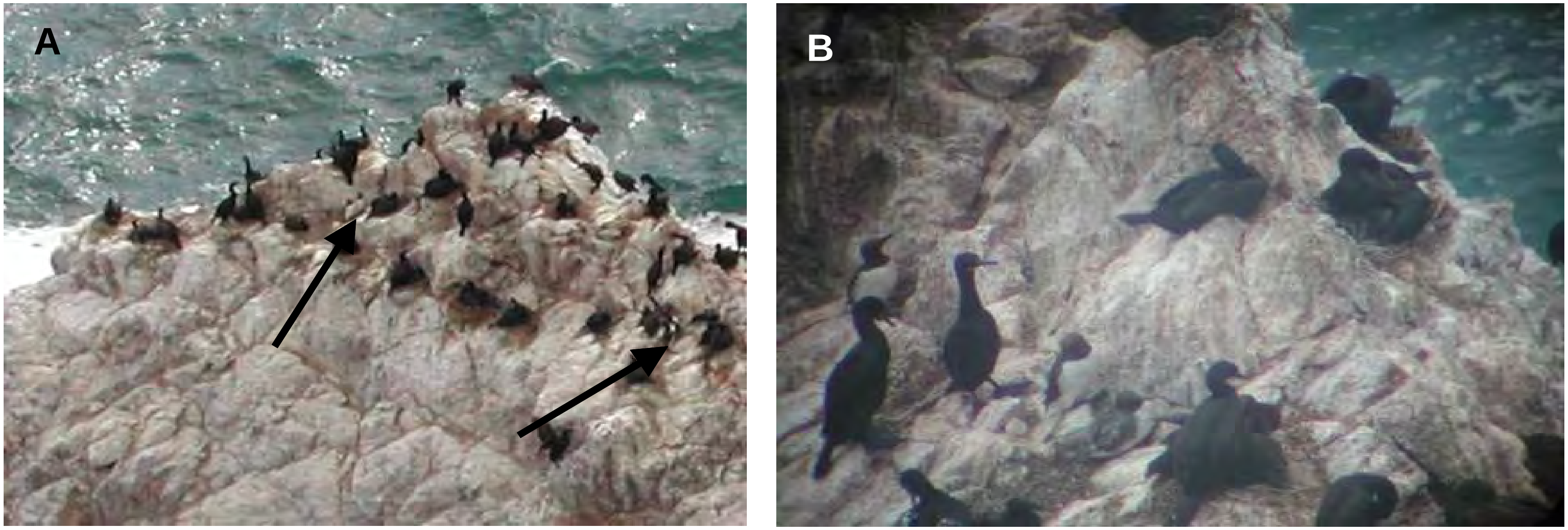


Figure 13. Photograph of Turtlehead, Devil's Slide Mainland, showing locations of Common Murre breeding sites among nesting Brandt's Cormorants: A) Common Murre sites. Arrows indicate areas where murres were most frequently observed; and B) Common Murre breeding site, showing an incubating murre, two standing murres, and Brandt's Cormorants.

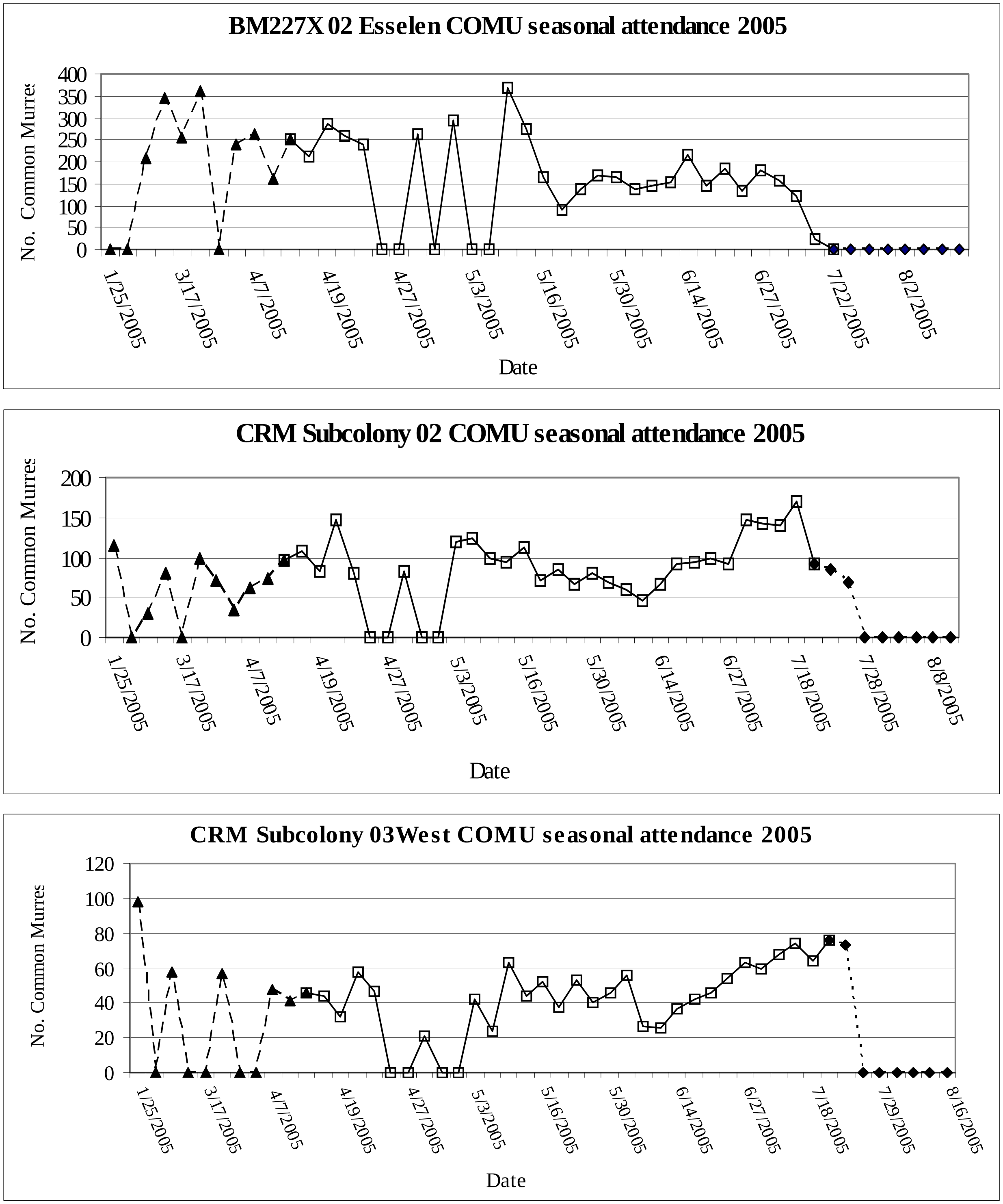


Figure 14. Seasonal attendance patterns of Common Murres at BM227X-02 (Esselen) and Castle Rocks and Mainland 02 and 03 West, 25 January to 16 August 2005. Dashed line indicates pre-season attendance. Dotted line indicates attendance after arrival of a juvenile Brown Pelican on 21 July (see Disturbance).

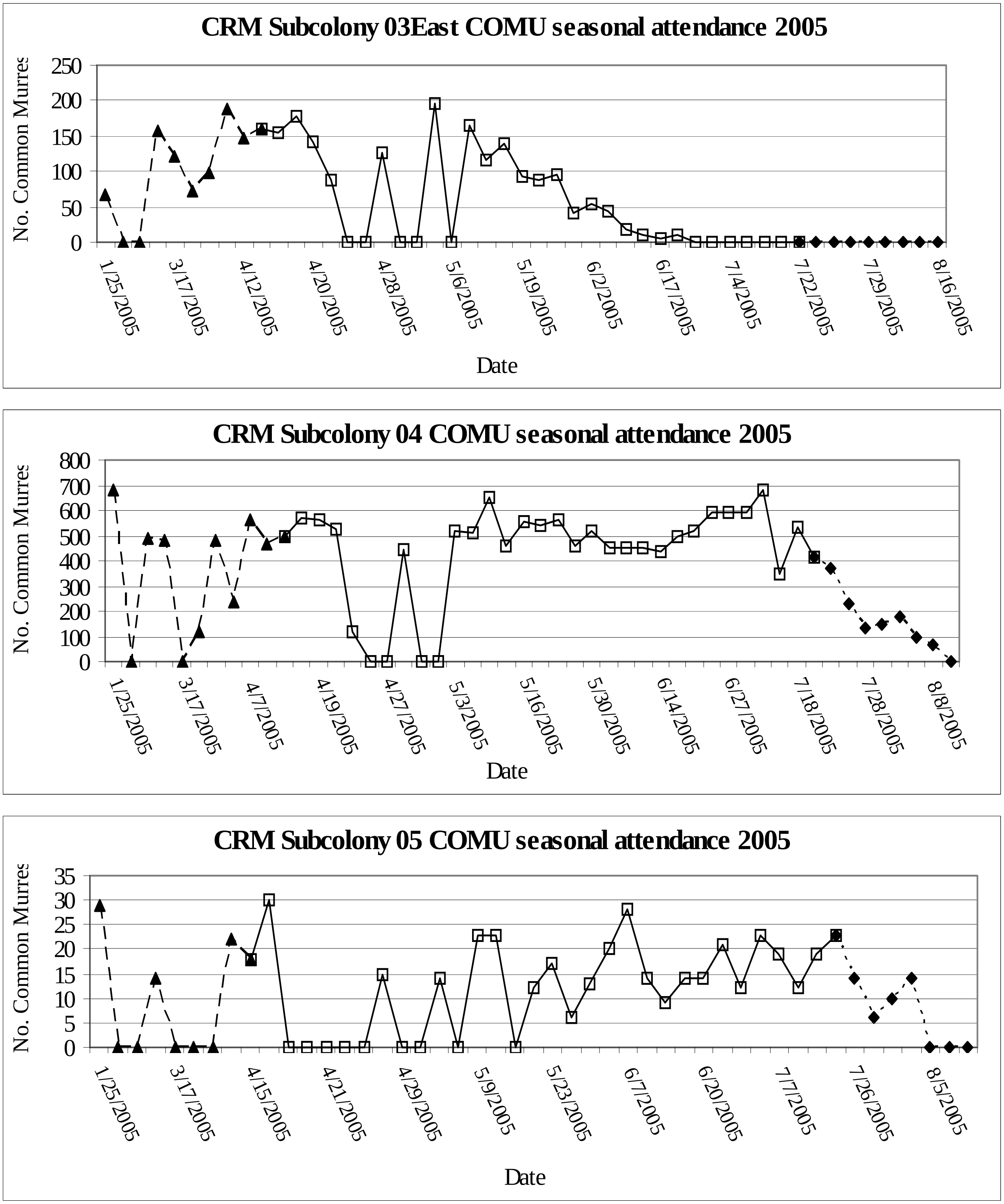
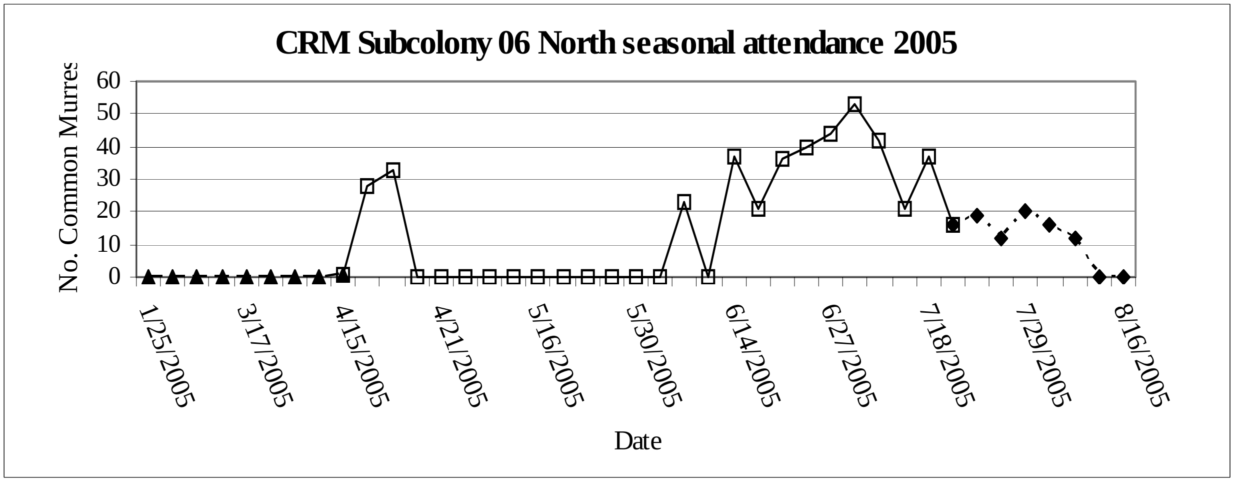
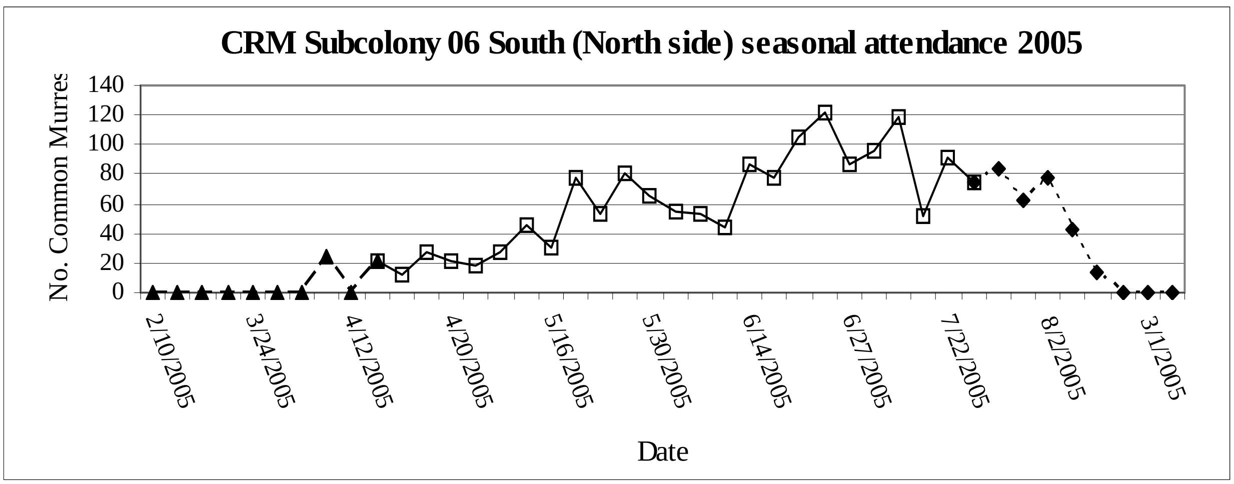


Figure 15. Seasonal attendance patterns of Common Murres at Castle Rocks and Mainland subcolonies 03 East, 04 and 05, 25 January to 16 August 2005. Dashed line indicates pre-season attendance. Dotted line indicates attendance after arrival of a juvenile Brown Pelican on 21 July (see Disturbance).





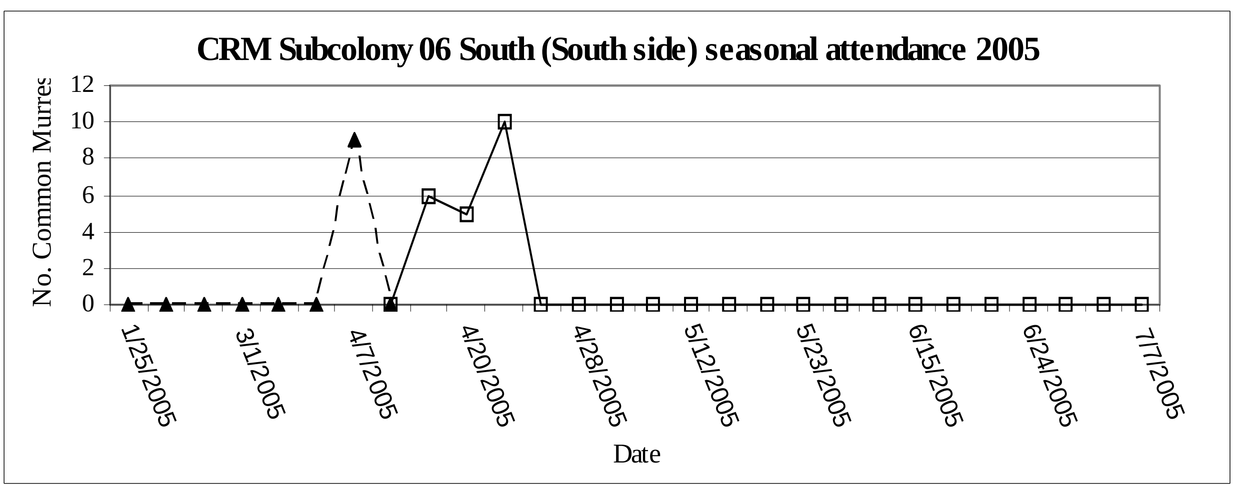
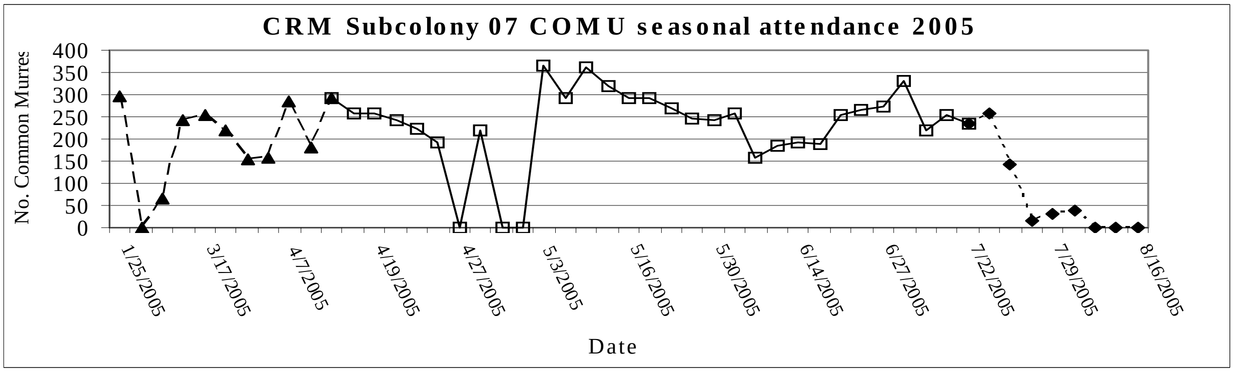
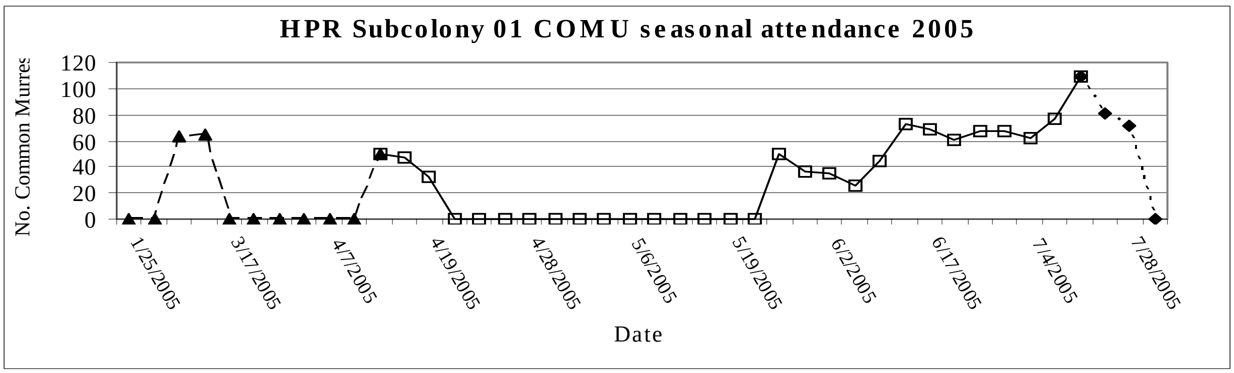
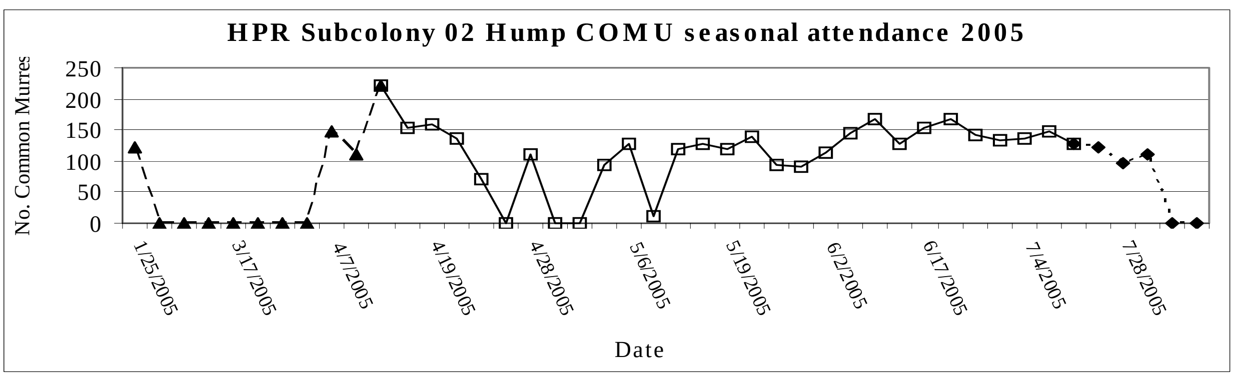


Figure 16. Seasonal attendance patterns of Common Murres at Castle Rocks and Mainland subcolonies 06 North, 06 South (North side) and 06 South (South side), 25 January to 16 August 2005. Dashed line indicates pre-season attendance. Dotted line indicates attendance after arrival of a juvenile Brown Pelican on 21 July (see Disturbance).







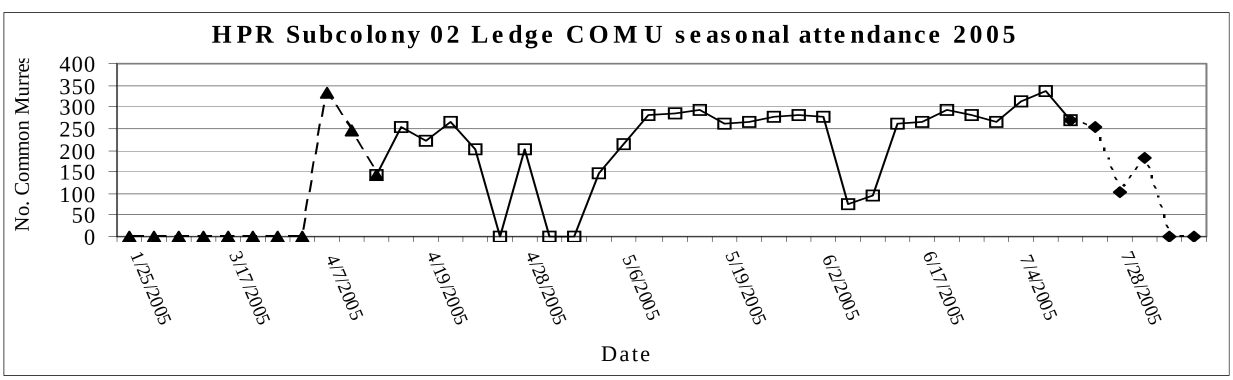


Figure 17. Seasonal attendance patterns of Common Murres at Castle Rocks and Mainland subcolony 07, and Hurricane Point Rocks subcolonies 01, 02 Hump, and 02 Ledge, 25 January to 16 August 2005. Dashed line indicates preseason attendance. Dotted line indicates attendance after arrival of a juvenile Brown Pelican on 21 July (see Disturbance).

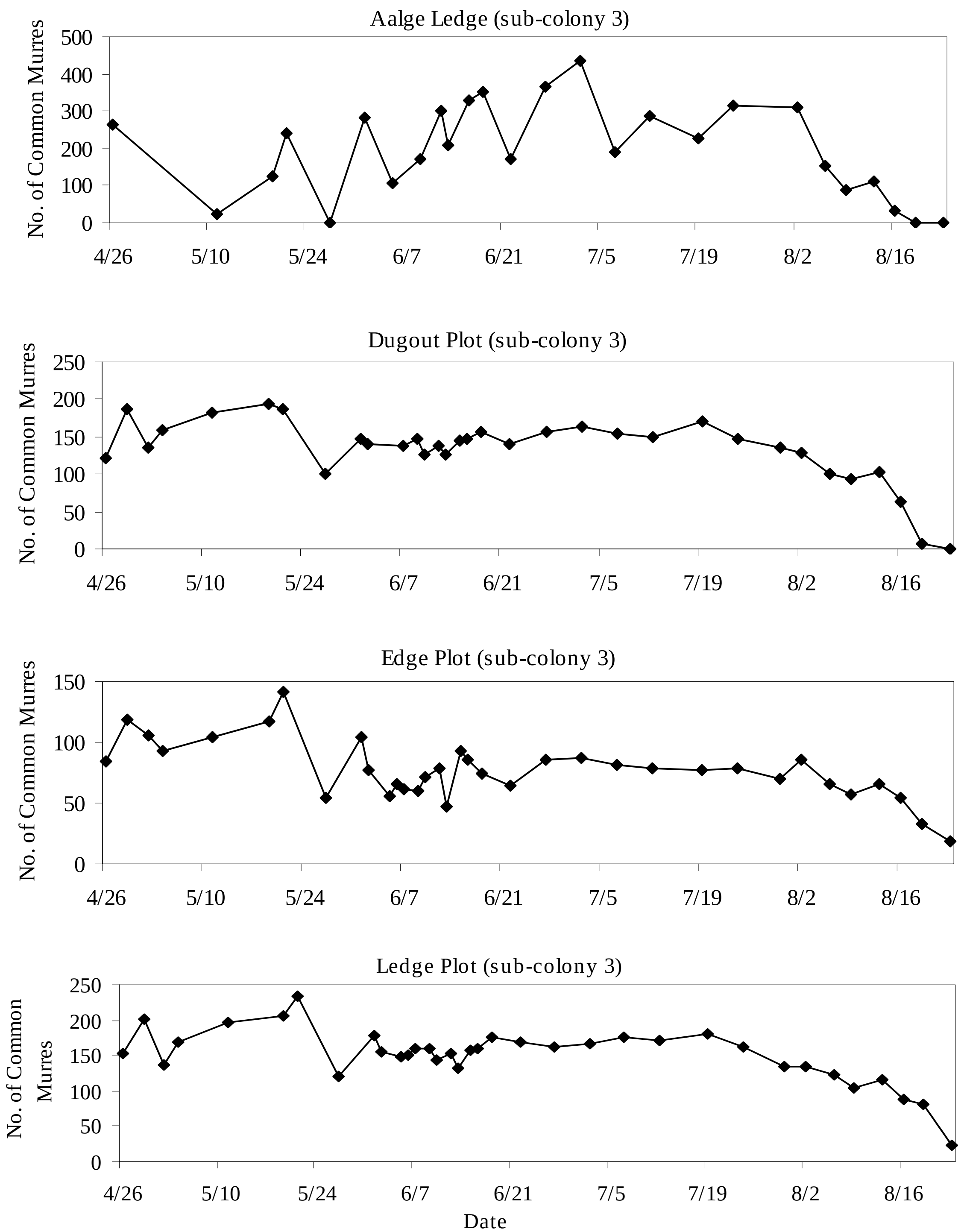


Figure 18. Seasonal attendance patterns of Common Murres at Aalge Ledge and Lighthouse Rock (3 index plots), Point Reyes (subcolony 03), 26 April to 16 August 2005.

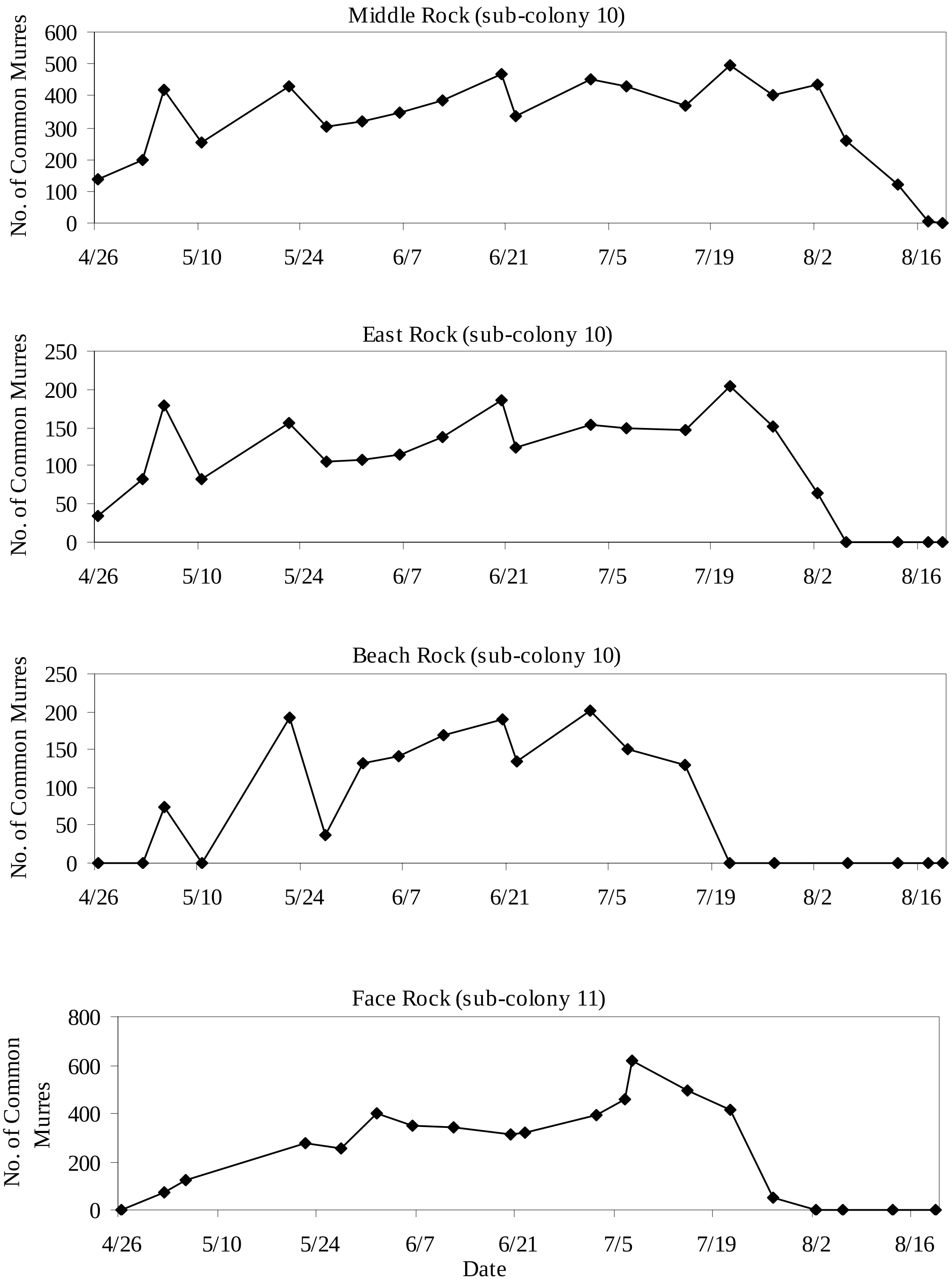


Figure 19. Seasonal attendance patterns of Common Murres at Middle, East, Beach and Face Rocks, Point Reyes (subcolonies 10 and 11), 26 April to 19 August 2005.

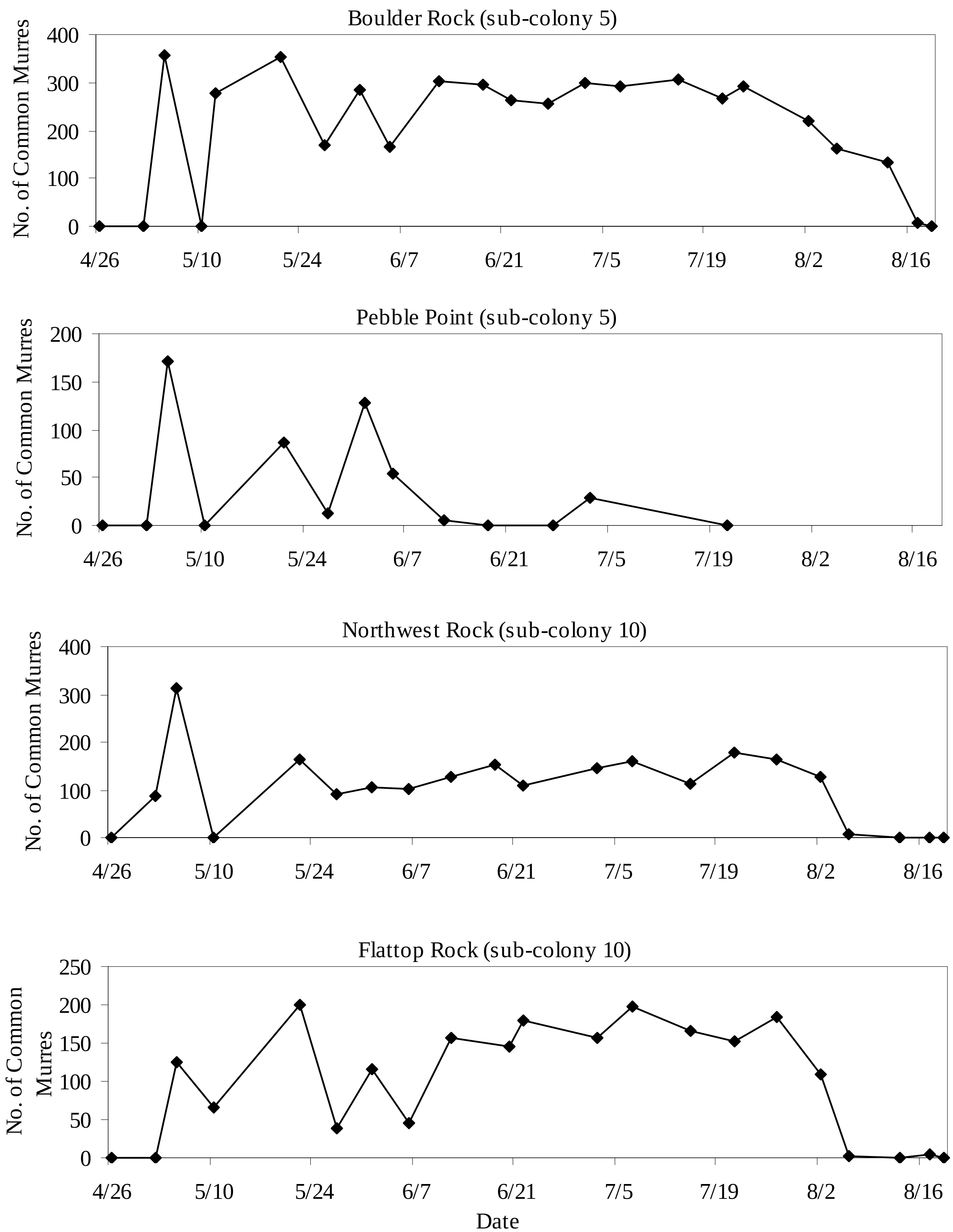


Figure 20. Seasonal attendance patterns of Common Murres at Boulder Rock, Pebble Point, Northwest Rock and Flattop Rock, Point Reyes (subcolonies 05 and 10), 26 April to 19 August 2005.

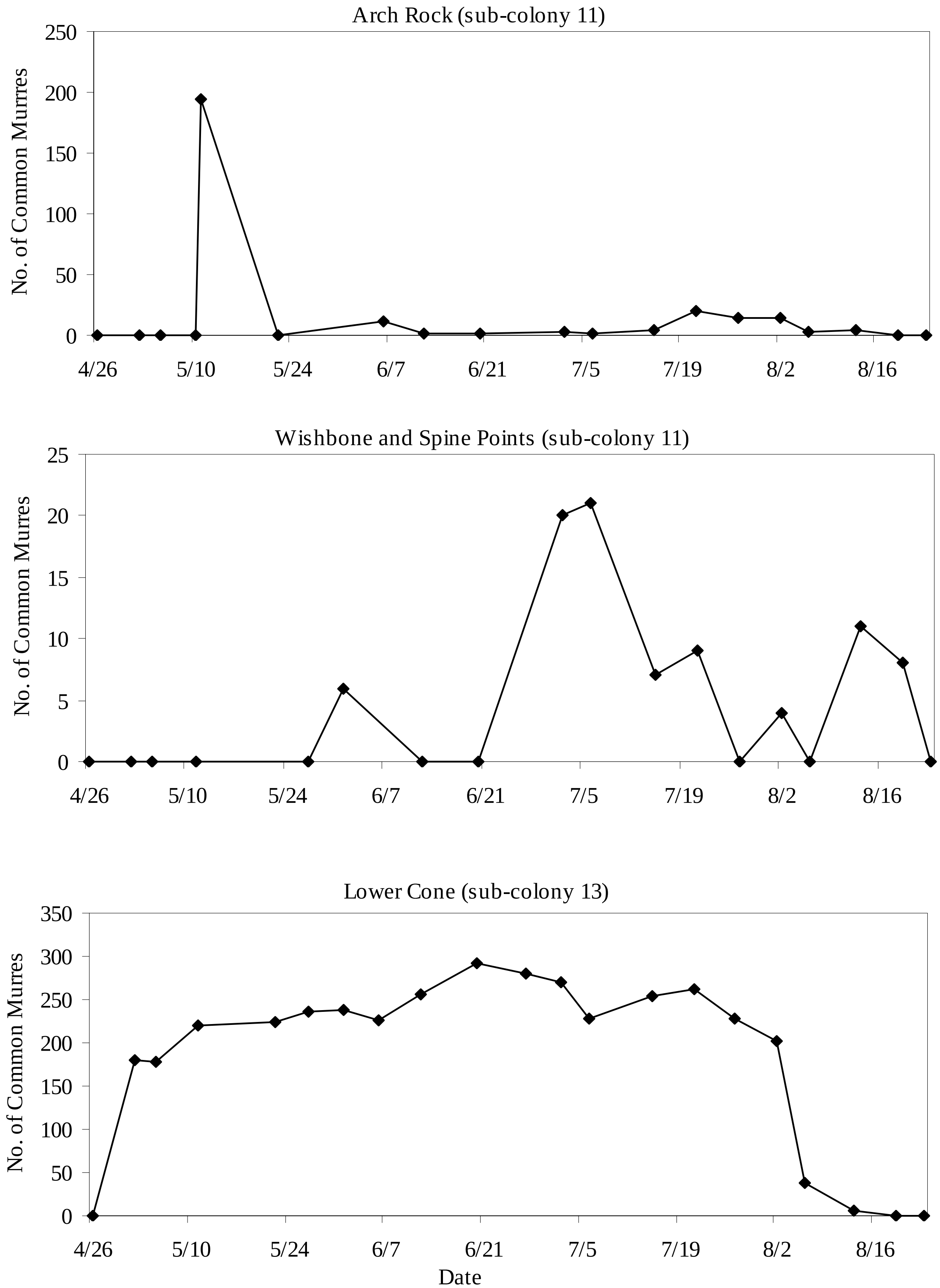


Figure 21. Seasonal attendance patterns of Common Murres at Arch Rock, Wishbone/Spine Points and Lower Cone Rock (index plot), Point Reyes (subcolonies 11 and 13), 26 April to 23 August 2005.

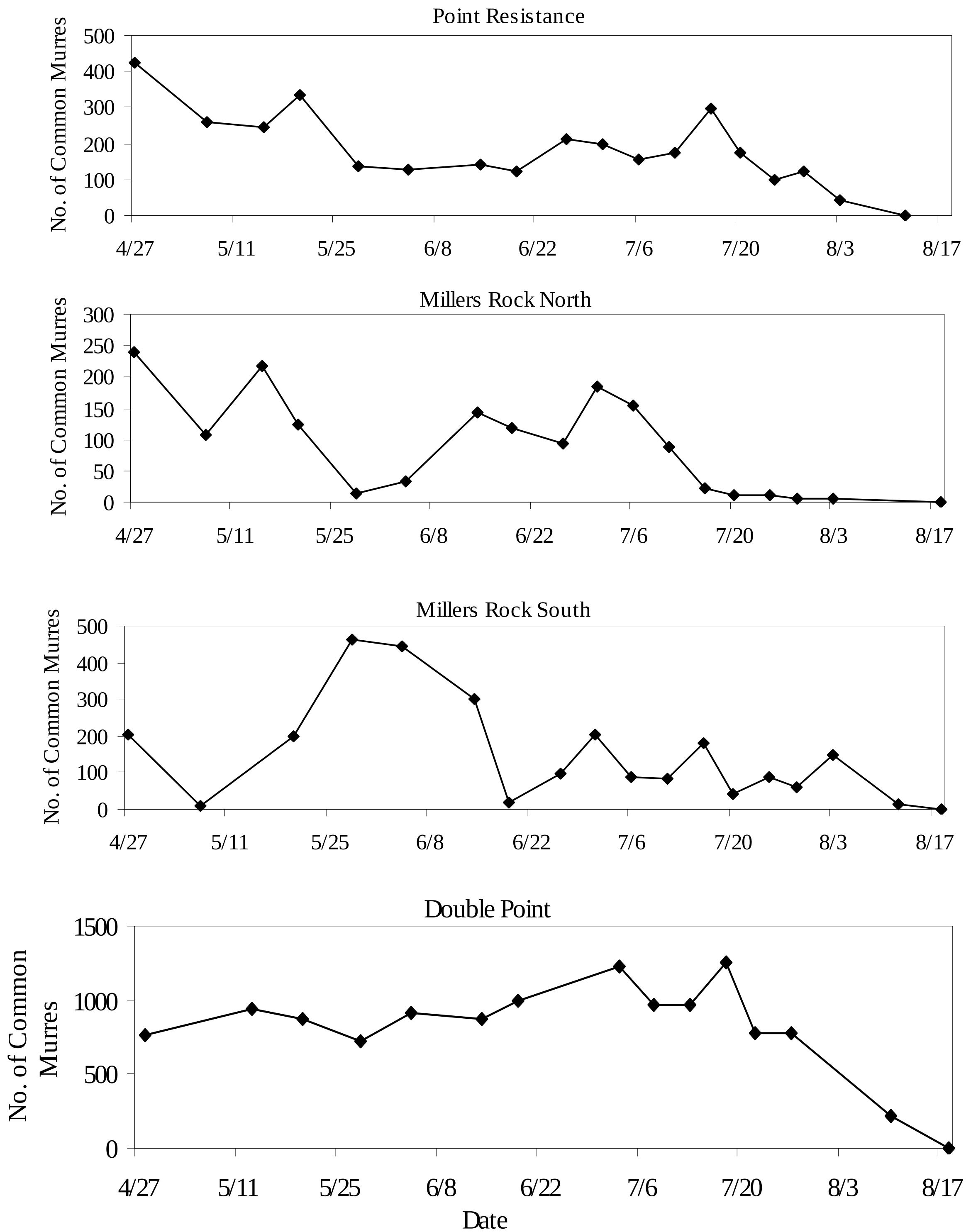


Figure 22. Seasonal attendance patterns of Common Murres at Point Resistance, Millers Point Rocks (Millers Rock North and Millers Rock South) and Double Point Rocks, late April to mid-August 2005.

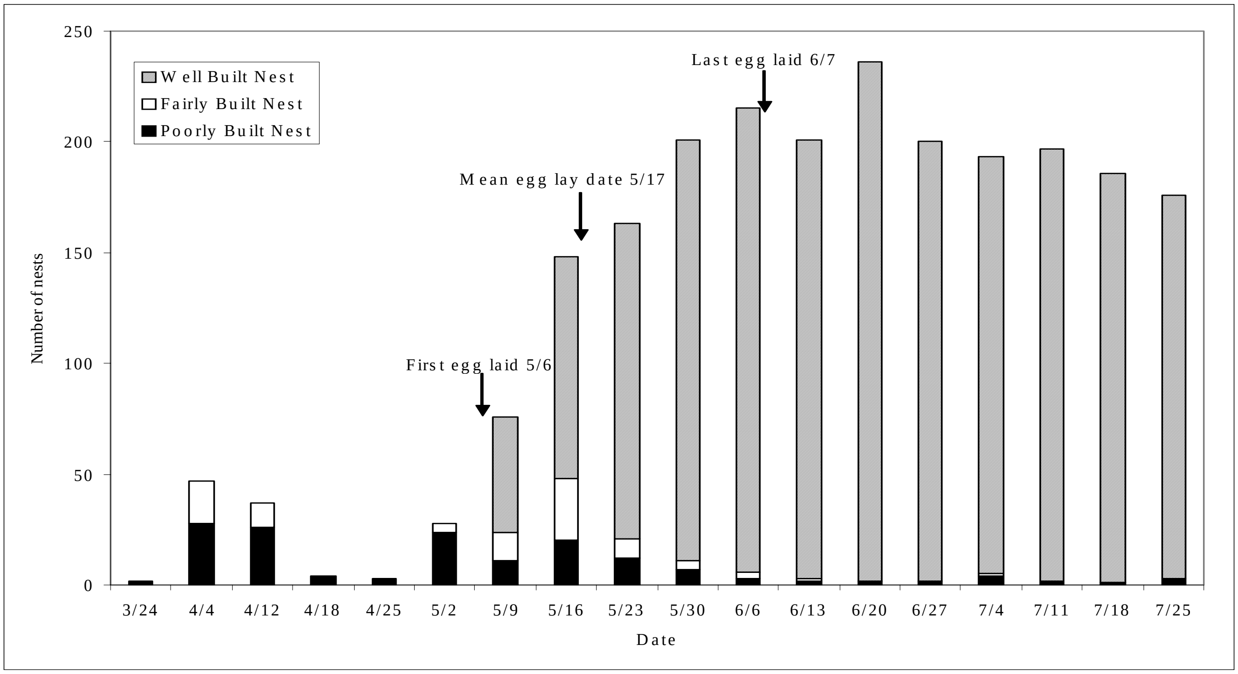


Figure 23. Numbers of Brandt's Cormorant nests counted at Devil's Slide Rock and Mainland, 24 March to 25 July 2005.

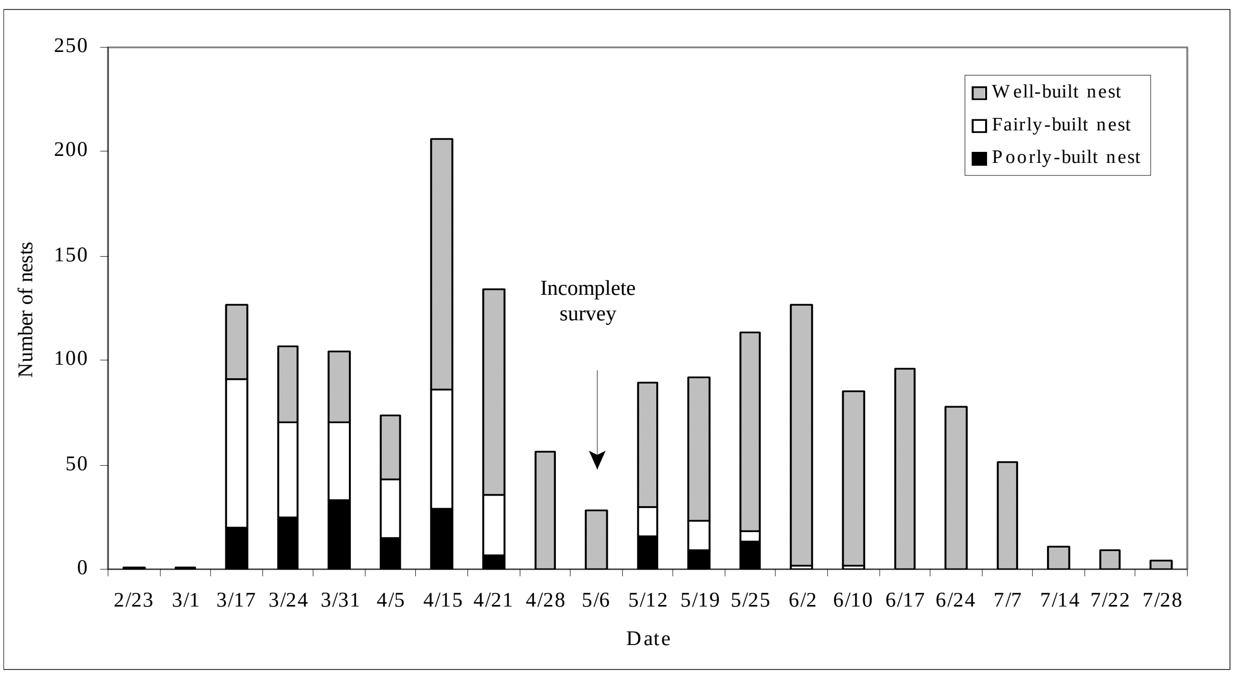


Figure 24. Numbers of Brandt's Cormorant nests counted at the Castle/Hurricane Colony Complex, 23 February to 16 August 2005.

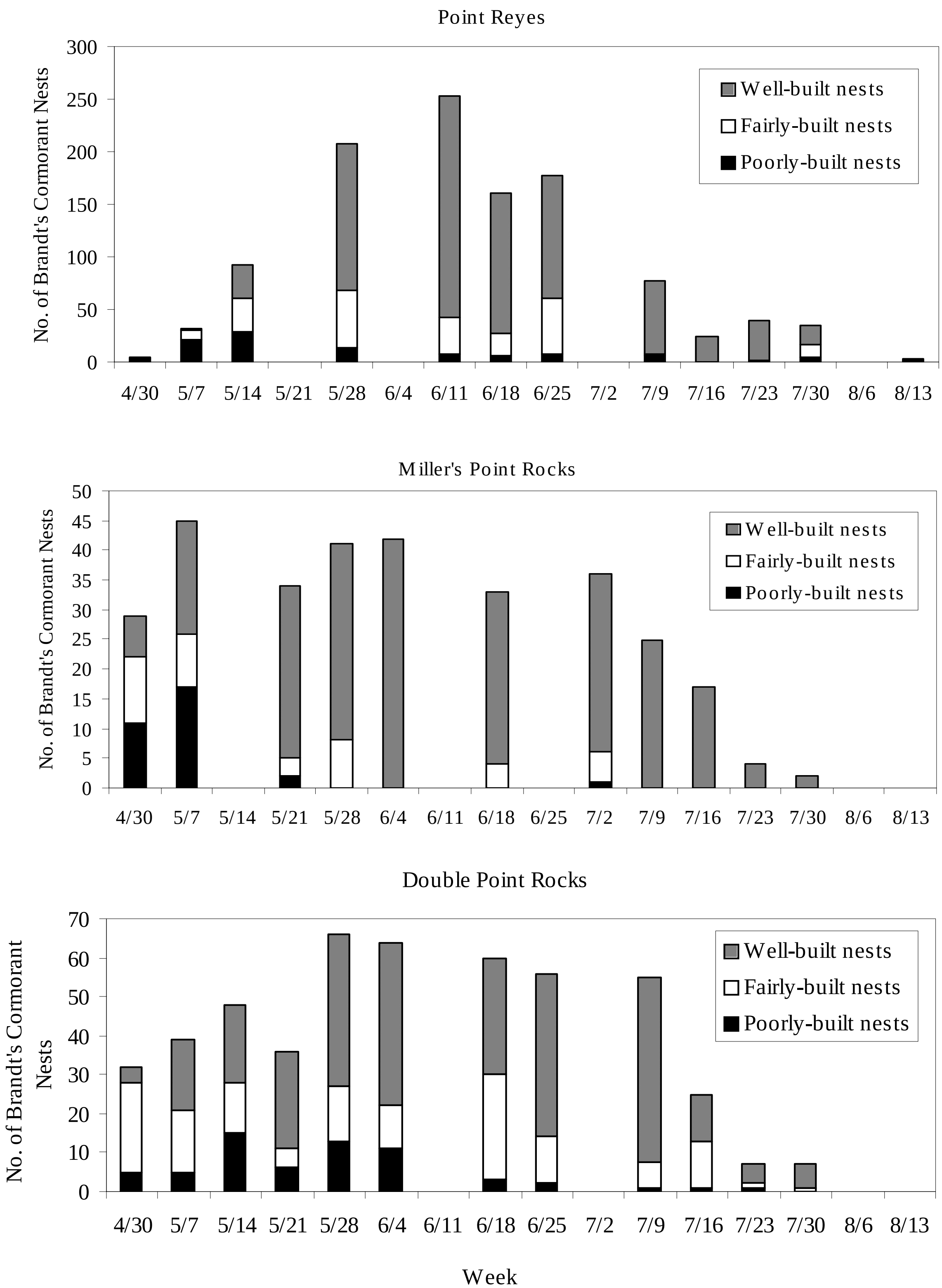


Figure 25. Numbers of Brandt's Cormorant nests counted at Point Reyes, Millers Point Rocks and Double Point Rocks, late April to mid-August 2005. Week-ending dates shown.

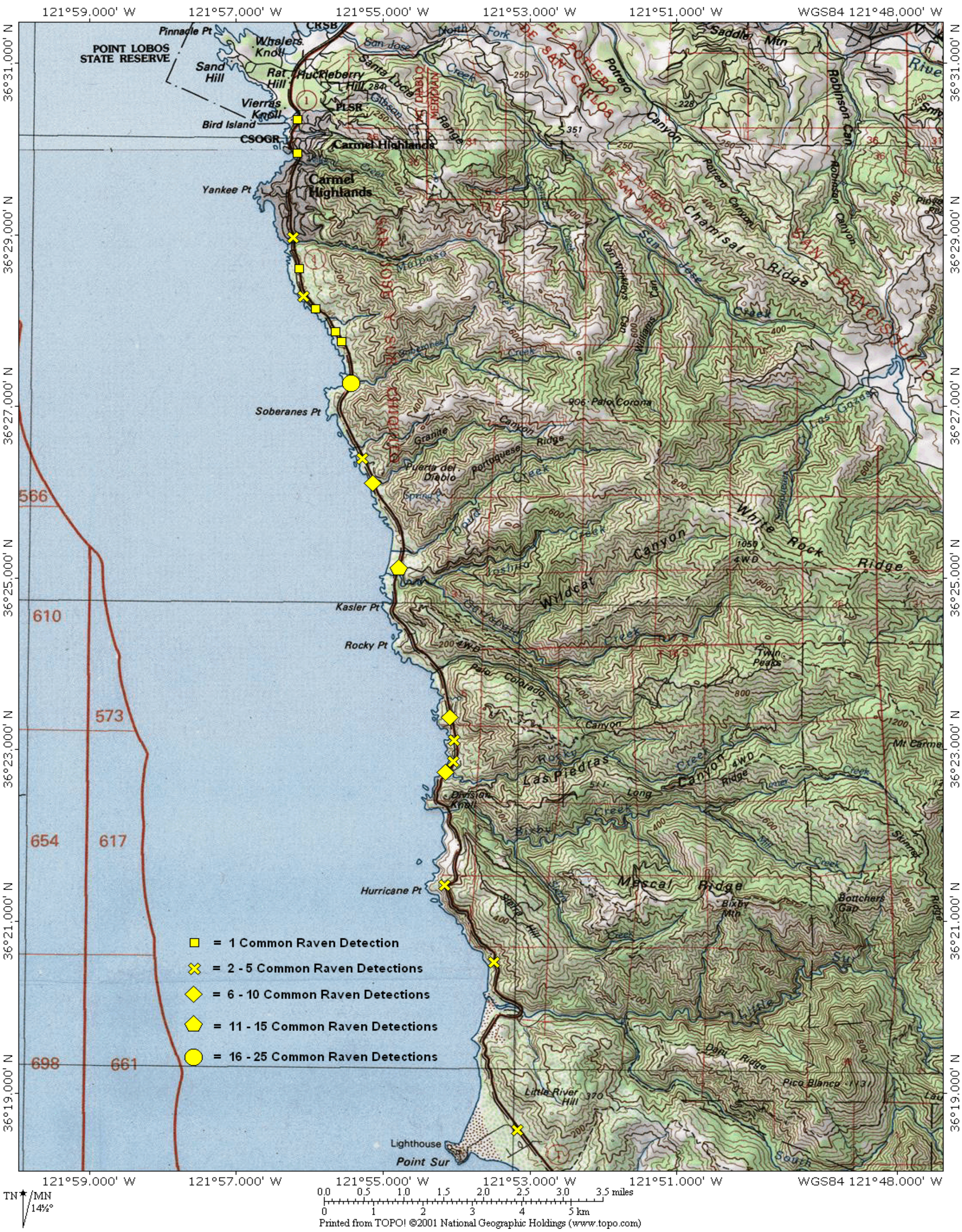


Figure 26. Topographic map showing locations of Common Raven detections along Highway 1 between Point Lobos and Point Sur, California in 2005.

2005 PICTORIAL HIGHLIGHTS

Figure 27. View of banded Brandt's Cormorant on Devil's Slide Rock. The video camera allows us to read band numbers.

Figure 39. Digiscoped photo of "Bridge" area of Devil's Slide Rock, showing density of breeding Common Murres, 20 May 2005.

Figure 28. Photograph of "Bridge" area of Devil's Slide Rock, taken with video cameras, 1 March 2005.

Figure 30. Common Murre turning egg, 5 June 2005. Photograph taken with video camera which allows close-up views of incubating murres to determine egg and chick status.

Appendix 1. Raw counts by subcolony of Common Murre birds and Brandt's and Double-crested Cormorant nests, sites, and birds from aerial photographic surveys of central California colonies, 2005. SC# = Subcolony Number.

				Common	Brandt's Cormorant			Double-crested Cormorant		
Date	Colony Name	SC#	Subcolony Name	Murre	Nest	Site	Bird	Nest	Site	Bird
6/15/2005	Point Reyes	03A	Big Roost Rock	55	0	0	0	0	0	0
6/15/2005	Point Reyes	03B	Lighthouse Rock	14837	0	0	0	0	0	0
6/15/2005	Point Reyes	03C	NW Lighthouse Cliffs	880	0	0	0	0	0	0
6/15/2005	Point Reyes	03D	Aalge Ledge	537	0	0	0	0	0	0
6/15/2005	Point Reyes	03E	The Bulb	337	0	0	0	0	0	0
6/15/2005	Point Reyes	03F	SW Lighthouse Cliffs	69	0	0	0	0	0	0
6/15/2005	Point Reyes	04	S. Lighthouse Cliffs	437	0	0	0	0	0	0
6/15/2005	Point Reyes	05B	Boulder Rock	2198	0	0	0	0	0	0
6/15/2005	Point Reyes	05C	Pebble Point	443	0	0	0	0	0	0
6/15/2005	Point Reyes	06C	SC 06C	0	15	1	20	0	0	0
6/15/2005	Point Reyes	07	The Hooves	0	0	0	0	0	0	0
6/15/2005	Point Reyes	08	Trinity Point and Greentop	0	0	0	0	0	0	0
6/15/2005	Point Reyes	09	Cliff Colony East and West	0	0	0	0	0	0	0
6/15/2005	Point Reyes	10A	Northwest Rock	156	0	0	0	0	0	0
6/15/2005	Point Reyes	10B	Flattop	1494	0	0	0	0	0	0
6/15/2005	Point Reyes	10C	Middle Rock	921	0	0	0	0	0	0
6/15/2005	Point Reyes	10D	East Rock	250	0	0	0	0	0	0
6/15/2005	Point Reyes	10E	Beach Rock	407	0	0	0	0	0	0
6/15/2005	Point Reyes	10H	Tim Tam	95	0	0	0	0	0	0
6/15/2005	Point Reyes	11B	Face Rock	486	0	0	0	0	0	0
6/15/2005	Point Reyes	11D	Arch Rock	7	6	11	20	0	0	0
6/15/2005	Point Reyes	11E	Wishbone and Spine Points	37	111	10	130	0	0	0
6/15/2005	Point Reyes	12	Sloppy Joe	245	121	11	148	0	0	0
6/15/2005	Point Reyes	13	Cone Rock	2405	58	3	65	0	0	0
6/15/2005	Point Reyes	14B	SC 14B	35	0	0	8	0	0	0
6/15/2005	Point Reyes	14C-E	Border, Miwok, Mainland	0	0	0	0	0	0	0
6/03/2005	Point Resistance	02	Point Resistance rock	3837	1	0	19	0	0	0

Appendix 1 (continued).

Date	Colony Name	SC#	Subcolony Name	Common Murre	Brandt's Cormorant Nest	Brandt's Cormorant Site	Brandt's Cormorant Bird	Double-crested Cormorant Nest	Double-crested Cormorant Site	Double-crested Cormorant Bird
6/03/2005	Miller's Point Rocks	01	North Rock	65	26	0	30	0	0	0
6/03/2005	Miller's Point Rocks	02	South Rock	410	69	17	103	0	0	0
6/03/2005	Miller's Point Rocks	03	SC 03	0	0	0	36	0	0	0
6/03/2005	Miller's Point Rocks	05	SC 05	40	8	13	42	0	0	0
6/03/2005	Double Point Rocks	01	Stormy Stack	8444	147	60	364	0	0	0
6/03/2005	Double Point Rocks	99	Rock N. of Stormy Stack	2	0	0	64	0	0	0
6/10/2005	North Farallon Islands	01	North Islet	7222	0	0	22	0	0	0
6/10/2005	North Farallon Islands	02	West Islet	15761	11	3	38	0	0	0
6/10/2005	North Farallon Islands	03	East Islet	16622	9	0	25	0	0	0
6/10/2005	North Farallon Islands	04	South Islet	7883	0	0	13	0	0	0
6/10/2005	South Farallon Islands	01	Southeast Farallon Island	40665	5262	345	6321	0	0	0
6/10/2005	South Farallon Islands	02	West End Island	36376	2093	418	2757	337	13	362
6/10/2005	South Farallon Islands	03	The Islets	12279	82	12	138	0	0	0
6/10/2005	South Farallon Islands	04	Saddle Rock	2188	0	0	44	0	0	0
5/31/2005	Alcatraz Island	01	Alcatraz Island	0	856	95	1179	0	0	0
6/03/2005	Lobos Rock and Land's End	04	Lobos Rock	0	0	0	45	0	0	0
6/03/2005	Lobos Rock and Land's End	06	Nearshore Rock	0	0	0	0	0	0	0
6/03/2005	Seal Rocks	01	SC 01	0	0	0	626	0	0	0
6/03/2005	Seal Rocks	02	SC 02	0	236	99	623	0	0	0
6/03/2005	Seal Rocks	03	SC 03	0	0	0	53	0	0	0
6/03/2005	Devil's Slide Rock & Mainland	01	Devil's Slide Rock	59	0	0	18	0	0	0
6/03/2005	Devil's Slide Rock & Mainland	02	April's Finger	8	85	21	223	0	0	0
6/03/2005	Devil's Slide Rock & Mainland	05	Mainland South/Turtlehead	0	207	1	239	0	0	0
6/15/2005	Devil's Slide Rock & Mainland	01	Devil's Slide Rock	301	0	0	6	0	0	0
6/15/2005	Devil's Slide Rock & Mainland	02	SC 02 - partial	21[1]	ND[1]	ND[1]	ND[1]	0	0	0
6/03/2005	Año Nuevo Island	01	Año Nuevo Island	0	1556	82	1753	0	0	0
6/06/2005	Bench Mark-227X	02	Esselen Rock	329	0	0	0	0	0	0

Appendix 1 (continued).

Date	Colony Name	SC#	Subcolony Name	Common Murre	Brandt's Cormorant Nest	Brandt's Cormorant Site	Brandt's Cormorant Bird	Double-crested Cormorant Nest	Double-crested Cormorant Site	Double-crested Cormorant Bird
6/06/2005	Castle Rocks & Mainland	02	Rock 02	134	0	0	0	0	0	0
6/06/2005	Castle Rocks & Mainland	03A	Rock 03 West	39	0	0	0	0	0	0
6/06/2005	Castle Rocks & Mainland	03B	Rock 03 East	49	13	0	16	0	0	0
6/06/2005	Castle Rocks & Mainland	04	Rock 04	508	0	0	0	0	0	0
6/06/2005	Castle Rocks & Mainland	05	Rock 05	6	0	0	0	0	0	0
6/06/2005	Castle Rocks & Mainland	06A	Mainland 06 North	85	103	1	114	0	0	0
6/06/2005	Castle Rocks & Mainland	06B	Mainland 06 South	53	52	0	54	0	0	0
6/06/2005	Castle Rocks & Mainland	07	Rock 07	397	2	0	2	0	0	0
6/06/2005	Castle Rocks & Mainland	08	SC 08	0	0	0	0	0	0	0
6/06/2005	Castle Rocks & Mainland	09[2]	SC 09	0	ND[2]	ND[2]	ND[2]	0	0	0
6/06/2005	Hurricane Point Rocks	01	Rock 01	128	0	0	0	0	0	0
6/06/2005	Hurricane Point Rocks	02	Rock 02	512	9	0	9	0	0	0
6/06/2005	Hurricane Point Rocks	04	Jen's Rock	0	47	0	52	0	0	0

[1] Only the west facing cliff at April's Finger was surveyed for the Devil's Slide Mainland (subcolony 02).
[2] Ground observations noted 2-3 nests.