SEABIRD AND MARINE MAMMAL MONITORING AND RESPONSE TO A FIREWORKS DISPLAY AT GUALALA POINT ISLAND, SONOMA COUNTY, CALIFORNIA, MAY TO AUGUST 2007

James F. Weigand and Gerard J. McChesney

United States Department of the Interior
Bureau of Land Management
California State Office, Sacramento, CA

and

United States Department of the Interior
Fish and Wildlife Service
San Francisco Bay National Wildlife Refuge Complex, Newark, CA

12 February 2008

SEABIRD AND MARINE MAMMAL MONITORING AND RESPONSE TO A FIREWORKS DISPLAY AT GUALALA POINT ISLAND, SONOMA COUNTY, CALIFORNIA, MAY TO AUGUST 2007

James F. Weigand[1] and Gerard J. McChesney[2]

[1]United States Department of the Interior
Bureau of Land Management
California State Office, Sacramento, CA

and

[2]United States Department of the Interior
Fish and Wildlife Service
San Francisco Bay National Wildlife Refuge Complex, Newark, CA

12 February 2008

Suggested Citation: Weigand, JF; and McChesney, GJ. 2008. Seabird and marine mammal monitoring and response to a fireworks display at Gualala Point Island, California, Sonoma County, May to August 2007. Unpublished report, USDI Bureau of Land Management, California State Office, Sacramento, CA; and USDI Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, CA. 38 pp

Title Page Photo: Marge Anthony

EXECUTIVE SUMMARY

During part of the 2007 breeding season, seabirds and pinnipeds were monitored on Gualala Point Island, Sonoma County, California. Monitoring was conducted in response to reports of disturbance from a fireworks display in July 2006 to nesting seabirds on the island, a part of the California Coastal National Monument (CCNM) administered by the United States Department of Interior (USDI) Bureau of Land Management (BLM). In 2007, monitoring examined potential impacts to seabirds and marine mammals during a fireworks display on 6 July and gained additional basic knowledge of this little studied colony. The fireworks display took place on the north side of the Gualala River mouth in the unincorporated community of Gualala, located at the southern end of Mendocino County, California, and 1.8 km northeast of Gualala Point Island.

The study period extended from 30 May to 30 August, with a core monitoring period from 1 to 12 July. The BLM developed monitoring protocols in collaboration with four of its formal partners: the California Department of Fish and Game, a CCNM Core-Managing Partner; US Fish and Wildlife Service (USFWS) and PRBO Conservation Science, both CCNM Collaborative Partners; and its local CCNM Steward, The Sea Ranch Association. BLM and USFWS staff biologists and trained volunteers from The Sea Ranch CCNM Stewardship Task Force staff carried out protocol monitoring. Monitoring focused on populations of breeding seabirds on Gualala Point Island, particularly the Brandt's Cormorant (*Phalacrocorax penicillatus*), to examine potential responses and effects on reproductive success from the fireworks display. Monitoring also included Harbor Seals (*Phoca vitulina*), which haul out on Gualala Point Island. Seabird monitoring consisted of modified versions of existing protocols from the USFWS for monitoring seabird colonies from mainland vantage points in central California and for aerial photography. Protocols for disturbance monitoring were developed from protocols by PRBO Conservation Science, USFWS, and other sources. Surveys included four daily bird counts of all species and monitoring of visible nests of Brandt's Cormorants, Pelagic Cormorants (*P. pelagicus*), Western Gulls (*Larus occidentalis*), and Black Oystercatchers (*Haematopus bachmanni*) between 1 and 12 July, with follow-up surveys conducted through 18 July. Aerial photographic surveys of the Gualala Point Island Brandt's Cormorant colony were conducted on six dates between 30 May and 30 August to document numbers of nests and relative nest success for the entire colony. Harbor Seals were monitored following the protocol established by the Point Reyes National Seashore. At the same time and location each day, photographs of the visible surface of Gualala Point Island were taken to document seabird distribution, densities and behavior. Nighttime photography (with digiscoped and infra-red photographs) was conducted on two nights, 4 July and 6 July, to examine differences in Brandt's Cormorant behavior prior to and during the fireworks display. Video cameras recorded fireworks explosions and the response vocalizations of seabirds.

Observations documented a visible response by nesting seabirds on Gualala Point Island. Digiscoped and infra-red photography during the 6 July fireworks display showed that Brandt's Cormorants quickly changed from resting to erect postures at the first fireworks, followed by birds moving about or departing from the island. Western Gulls also flushed, circled and called during the fireworks display. During the study period, 90 Brandt's Cormorant nests were documented on Gualala Point Island. Of these, seven nests (35% of

nest failures) were abandoned in the two days between 5 and 7 July, and another seven nests were abandoned between 7 and 12 July. These losses contrast with the abandonment of only six nests (30% of nest failures) for the 30-day period from 5 June to 5 July. Two of nine nests monitored from the adjacent mainland were abandoned between 6 and 8 July. The high rate of Brandt's Cormorant nest abandonment between 5 and 7 July, and possibly nest abandonment from 7 to 12 July, likely resulted from fireworks disturbance.

Pelagic Cormorants abandoned both of the two monitored nests on Gualala Point Island between 10 and 16 July for unknown reasons. For one day after the fireworks display, counts of adult Western Gulls on the island declined significantly, but no Western Gull nesting failures were known to have occurred during the count period. California Brown Pelicans (*Pelecanus occidentalis californicus*) did not use Gualala Point Island as an overnight roost until after the date of the fireworks display. Other seabird species were too few in number or too difficult to monitor to detect potential responses from the fireworks display. No significant response was detected for Harbor Seals, which were not present on the island during the fireworks display.

Other human and "natural" disturbances to the island's wildlife were rare and minor, with no detectable impacts to nesting birds or pinnipeds.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of The Sea Ranch CCNM Stewardship Task Force, in particular:

CONNIE SCHIMBOR and DIANE HICHWA for organizing and shepherding equipment, data sheets, and volunteers to needed locations;
BRYANT HICHWA, ROZANNE RAPOZO, and CRAIG TOOLEY for planning and undertaking nighttime, daytime, and aerial photography;
JERRY RENCH for his piloting skills to expand the aerial inventories;
SANDRA BUSH and BONNIE PLAKOS for Harbor Seal monitoring;
RITA PECK and PHYLLIS SCHMITT for video and sound recording;
GEORGE BUSH for acoustic instrumentation and monitoring;
ROZANNE RAPOZO and JULIE GIBSON for data entry and proofing, and database management;
MICHAEL LANE for valuable insights into the unique geology of Gualala Point Island and its bearing on seabird habitat and donated his GIS and mapping services;
RICHARD KUEHN for document research and historical background on seabird behavior in the area based on years of daily observations; and
RICHARD SCHIMBOR and DEAN SCHULER assisted in all manner of logistics.

The following people donated their time and skills to assist with seabird monitoring:

GINGER ALEXANDER
THOMAS ALEXANDER
GEORGE ANDERSON
MARGE ANTHONY
SUSAN BECHTEL
ELIZABETH BURRIDGE
PAULINE DAKIN
JAMIE EDWARDS
JEANNE GADOL
STEVEN GADOL
MEL GERST
BARBARA GOMES
DOROTHY GREGOR
KENNETH HOLMES
MARY HUNTER
LINDA KEIR
LEE KOSSO
ELAINE MAHAFFEY
GEORGE MARSHALL
MICHELE MARSHALL
GRACE STEURER
JAMES TACKETT
JULIE VERRAN

In addition, field work and photographic analysis accomplished for this study could not have happened without the assistance of BLM wildlife biologists, PAUL ROUSH and GARY DIRIDONI. HERRICK HANKS, manager of the BLM California Coastal National Monument, and JOHN FOX, Community Manager of The Sea Ranch Association, provided funding, logistical support, and public relations efficiently and capably to support this effort. The authors also thank PHILLIP CAPITOLO and DEASY LONTOH of Humboldt State University and WAYNE BURNETT of the California Department of Fish and Game for assistance on aerial photographic surveys.

This report benefited greatly from thoughtful reviews by PAUL ROUSH and PETER WARZYBOK.

TABLE OF CONTENTS

Introduction.....1

Methods.....1

Results.....5

Discussion.....23

Literature Cited.....26

Appendices

Appendix 1 Histories of Brandt's Cormorant Nest and Territorial Sites Recorded in Aerial Photographs, Gualala Point Island, 30 May to 12 July 2007.....29

Appendix 2 Bird Census Totals by Species, Vantage Point and Time of Day, 1 to 12 July 2007.....32

LIST OF TABLES

Table 1 Summary of the status of Brandt's Cormorant nest and territorial sites as determined from aerial photographs, Gualala Point Island, 30 May to 12 July 2007 7

Table 2 Comparison of nest counts for breeding seabirds on Gualala Point Island in 1989 and 2007 17

Table 3 Summary of daily status for the nine Brandt's Cormorants nests monitored from the mainland on Gualala Point Island, 1-18 July 2007 18

Table 4 Summary of daytime disturbances to seabirds on Gualala Point Island recorded during seabird counts and nest surveys, 1-12 July 2007 21

LIST OF FIGURES

Figure 1 Map of Gualala Point Island and vicinity, Mendocino and Sonoma counties, California 2

Figure 2 Aerial photograph of Gualala Point Island from the southeast, 30 May 2007. The arrow points to the Brandt's Cormorant colony, indicated by the dark mass of nests and birds surrounded by white guano. 7

Figure 3 Time series of aerial photographs of the Brandt's Cormorant colony on Gualala Point Island, 30 May to 30 August 2007. Site numbers used for monitoring are indicated in each photograph 8

Figure 4 The Brandt's Cormorant colony on Gualala Point Island, photographed from the south vantage point at mid-morning on 6, 7, 10 and 12 July 2007 13

Figure 5 Location of the Black Oystercatcher nest site, marked in red, from the north vantage point, Gualala Point Island, July 2007 14

Figure 6 View of the Western Gull colony on Gualala Point Island from the south vantage point at 10:30 h on 6 (upper photo) and 7 (lower photo) July 2007. Note the higher density roost near the top of the island on 6 July that was absent throughout the day on 7 July. 15

Figure 7 Pigeon Guillemot nest crevices on Gualala Point Island, marked in red, detected as of 5 July 2007 from the south (upper photo) and north (lower photo) vantage points 16

Figure 8 Images of the two Pelagic Cormorant nest sites on Gualala Point Island from three different dates, 1 to 12 July 2007 19

Figure 9 Census of Harbor Seals at daytime low tide, Gualala Point Island, 1 to 12 July 2007.....21

INTRODUCTION

Understanding impacts from human disturbances to seabird colonies may be key to restoring certain nesting seabird populations along the California coast. Disturbances to seabirds during their reproductive cycles are a critical element for analysis in the process of adapting management to preserve and augment California seabird populations. Sources of human disturbance that are well recognized include habitat destruction, close-approaching boats, humans on foot and low-flying aircraft (*e.g.*, McChesney 1997, Carney and Sydeman 2003, Rojek *et al.* 2007). Another source of human disturbance to seabirds that is not well documented is the display of celebratory fireworks. In California, only one study (Wengert and Gabriel 2002) of the heron colonies of Humboldt Bay has previously looked at the impact of fireworks on colonial waterbirds in California.

This monitoring study was conducted to determine how a recently initiated Independence Day fireworks display affected nesting and resting seabirds and marine mammals on Gualala Point Island within the California Coastal National Monument (CCNM), administered by the US Department of the Interior (USDI), Bureau of Land Management (BLM). Concern about potential impacts to nesting seabirds originated from observer reports of large numbers of birds on Gualala Point Island that flushed and flew into the darkness above the island on 2 July 2006 during the First Annual Gualala Festivals Committee Independence Day fireworks display.

The BLM and its partner regulatory wildlife agencies, the California Department of Fish and Game, the US Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, wanted to assess whether the Gualala fireworks display impacted breeding success or attendance patterns of seabirds and marine mammals at Gualala Point Island and to learn the current status of the island's natural resources. To obtain information, BLM and USFWS biologists worked with The Sea Ranch CCNM Stewardship Task Force (hereafter "the Task Force") to monitor seabirds and marine mammals on Gualala Point Island before, during, and after the fireworks display using a combination of aerial and land-based techniques. This report summarizes the study results from 2007.

METHODS

Study Area

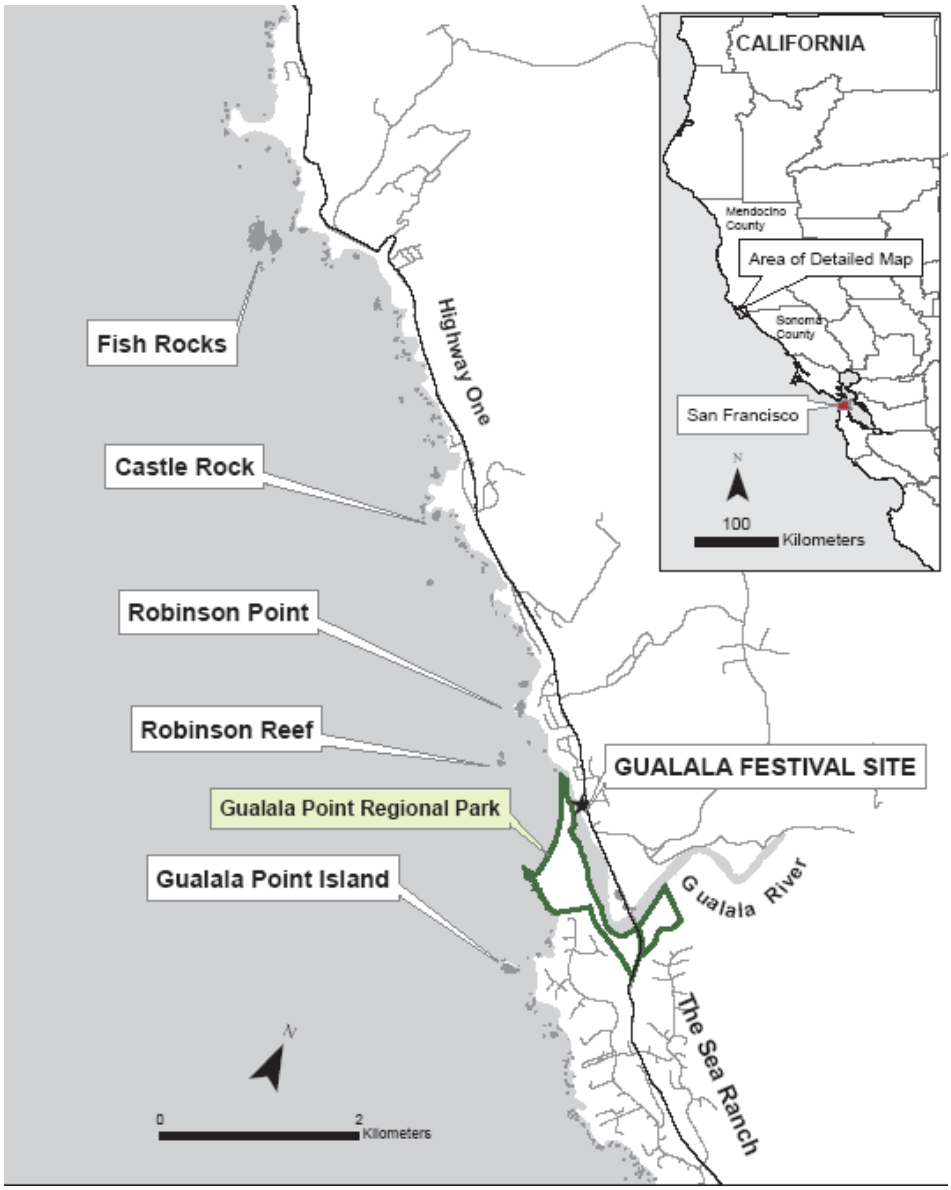
Gualala Point Island (California Seabird Colony Number SO-384-01; 38º45'04" N, 123º31'42" W) is located just offshore at the northern border of Sonoma County, California. The island is situated 1.8 km southwest from the Gualala Festivals Committee fireworks launch site located on a bluff top above the mouth of the Gualala River in the unincorporated community of Gualala, Mendocino County (Figure 1).

Geological factors combine to make Gualala Point Island a unique and favorable habitat for colonial seabirds. Gualala Point Island is part of the Gualala Block, a narrow crustal sliver that extends roughly from Point Arena in Mendocino County south to Fort Ross in Sonoma

County. The Gualala Block consists predominantly of sedimentary formations deposited originally hundreds of miles south of their current location and subsequently transported northward along the San Andreas Fault System. The Gualala Block is the most northerly large assemblage of rocks on the west side of the San Andreas Fault (M. Lane, pers. comm.).

Additionally, the large-scale movement has brought to the Gualala area some rocks, such as limestones, that are uncommon along the northern California Coast. This small area of well-bedded sedimentary rocks contrasts sharply with the heterogeneous lithologies of the Franciscan Group prevalent north of San Francisco.

Figure 1 – Map of Gualala Point Island and vicinity, Mendocino and Sonoma counties, California.



Gualala Point Island bedrock consists of interbedded shales and massive sandstones of the Paleocene-Eocene Germán Rancho Formation. However, at this locality, crustal deformation associated with northward transport of the Gualala Block has caused the bedding planes to

twist and become vertical. The result is a corrugated effect to the rocks, with the softer shales eroding more rapidly than the massive resistant sandstones. Crevices that form between the interbedded rock layers form nesting sites for Pigeon Guillemots (*Cepphus columba*) and rock ledges create nesting habitat for Pelagic Cormorants (*Phalacrocorax penicillatus*). Brandt's Cormorants (*P. penicillatus*) nest primarily on the limestone flats of the island.

Monitoring

The study period ranged from 30 May and 30 August 2007, with a more intensive monitoring period (hereafter referred to as the "count period") between 1 and 12 July 2007 (six days before and six days after the fireworks display). Multiple methods were used to record bird and mammal numbers, reproductive success, and potential impacts of fireworks displays and other disturbances. These methods included aerial photography, land-based surveys, land-based photography both during the day and at night (including during the fireworks display), and audio recordings made during the fireworks display. Data collection (except as indicated below) was conducted by BLM staff and Task Force volunteers. Data analysis and interpretation was conducted by the authors with assistance from Paul Roush (BLM). Documentation of the monitoring protocol used for this study (USDI Bureau of Land Management and The Sea Ranch CCNM Stewardship Task Force 2008) is available from the BLM California State Office.

Aerial Photography: The USFWS, in cooperation with Humboldt State University and the California Department of Fish and Game, photographed Gualala Point Island on 30 May 2007 during an annual aerial photographic survey of Common Murre, Brandt's Cormorant, and Double-crested Cormorant colonies in northern and central California. Subsequently, a volunteer pilot and a volunteer professional photographer flew additional surveys of Gualala Point Island on 5 June, 5, 7, and 12 July, and 30 August, using a protocol comparable to that used by the USFWS. A planned flight for 6 July was cancelled because of heavy fog and low visibility. Surveys on 30 May were conducted at 210-230 m (700-750 ft) altitude in a fixed-wing, high-wing Partenavia aircraft. Photographs were taken through a belly port by two photographers with Canon 30D digital cameras and 70-200 mm or 300 mm telephoto lenses. All other flights were conducted above 300 m (1000 ft) altitude in a fixed-wing Cessna 172-M aircraft and digital photographs were taken through a side window. Survey altitudes were flown high enough to alleviate disturbance to seabirds from these types of fixed-wing aircraft. Photographs were taken of the entire island, with a focus on the Brandt's Cormorant colony.

From each aerial survey, the photograph with the highest quality and most complete coverage of the cormorant colony primarily was used, augmented by additional photos as needed for complete views of all nests. From the photographs, all active nest sites were identified and assigned unique site numbers. For each survey, the status of each nest was identified using the following codes:

E = empty nest
P = poorly built nest
F = fairly well-built nest
W= well-built nest
C = chick(s) visible
S = adult sitting on nest
D = adult standing at nest site
T = territorial site, *i.e.*, adult bird(s) on territory but no nest
V = vacant site, *i.e.*, no birds present

"Active nests" were well-built or fairly well-built nests with either an adult sitting on the nest or standing at a nest containing visible eggs or visible chicks, except for nests known to have failed recently (i.e., too soon to have laid a new clutch of eggs). "Territorial sites" had one of three characteristics: adults standing or sitting at a potential nest site with little or no nesting material; adults on a poorly-built nest; or adults sitting or standing at a well-built or fairly well-built nest that was visibly empty or known to have failed recently. From these data, a history of each nest site was established, including seasonal site status (breeding or territorial), approximate breeding phenology, and whether or not the nest failed during the survey period. Breeding sites were those with confirmed eggs or chicks or where breeding was inferred by nest status. Territorial sites were those where breeding could not be confirmed or inferred by nest status.

Seabird Counts from Mainland Vantage Points: These counts were conducted by BLM wildlife biologists and volunteers from the Task Force. Adults and ambulatory chicks of all seabirds on Gualala Point Island were counted through 20x to 60x spotting scopes from two mainland vantage points four times daily (05:30, 08:30, 10:00 and 13:30 h), visibility permitting, during the 1-12 July count period. One vantage point viewed the north side, and the other viewed the south side of the island. Observers also recorded any bird and marine mammal observations at 21:00 h just before sunset on the evening of 6 July.

UTM locations in Zone 10N (NAD 1983) of the vantage points are as follows:

North Vantage Point:	454244 E	4289459 N	about 245 m from the island
South Vantage Point:	454411 E	4289224 N	about 305 m from the island

Seabird Nest Monitoring from Mainland Vantage Points: A modified version of the USFWS Common Murre Restoration Project protocol for Brandt's Cormorant nest monitoring (McChesney *et al.* 2007) was used. Along with Brandt's Cormorants, the protocol included nest monitoring of two other species on Gualala Point Island: Pelagic Cormorant and Western Gull (*Larus occidentalis*). Observations were recorded during the same times that seabird counts took place. For each species, visible nests were assigned unique numbers and identified on photographs. During the count period, the status of each nest was identified by recording the number of adults present, adult posture (sitting or standing), and the number of eggs and chicks visible.

Daytime Marine Mammal Monitoring: The count form for monitoring Harbor Seals (*Phoca vitulina*) at Point Reyes National Seashore and along the Sonoma County coast including The Sea Ranch (Manna *et al.* 2006) was adopted for this project. Censuses of Harbor Seals took place at the daytime low tide closest to seabird count times. In addition, as time permitted, seals were counted during seabird counts.

Daytime Disturbance Monitoring: Disturbances to seabirds were recorded systematically. The protocol to monitor and characterize disturbances combined pre-established protocols from PRBO Conservation Science (unpubl. data), USFWS (McChesney et al. 2007), and Jaques and Strong (2002). All aircraft flying below 300 m (1000 ft) and boats approaching to within 300 m (1000 ft) of Gualala Point Island were recorded, as well as any visible disturbance behaviors to seabirds or seals (*e.g.*, flushing or displacement).

Daytime Land Photography from Mainland Vantage Points: An initial photographic survey of Gualala Point Island was conducted at the onset of the count period. Photographs taken with a Canon 20D digital single lens reflex (DSLR) camera with a 300 mm lens and a 2x teleconverter (magnification = 12x) documented the initial nest site locations for both Western Gulls and Brandt's Cormorants as well as other species of interest. These photographs served as the basis for subsequent monitoring. On most days during the count period, one or more observers took photographs of Gualala Point Island from each of the mainland vantage points between 10:30 and 11:30 h.

Nighttime Photo Monitoring: On both 4 and 6 July, two volunteer professional photographers took nighttime photographic images of the Brandt's Cormorant colony on Gualala Point Island from the south vantage point. Two digital photographic methods were used: visible light digiscoping and infrared photography. On each night, photography documented bird activity for 90 minutes after sunset. Images provided for comparison of cormorant activity during the same time on the two evenings, one before and one during the fireworks display.

Nighttime Video and Sound Recording: Continuous video and audio recordings of Gualala Point Island were conducted from both mainland vantage points during the fireworks display. One observer used a Sony Handycam DCR-DVD308 mounted on a tripod to capture video and sound from 21:00 until 22:00 h, and another observer used a Sony 20x optical Handycam (DCR-HC26). The time marks on the video corresponded within one minute of the time recorded on the nighttime DSLR images.

Acoustic Monitoring: Sound monitoring took place during the Gualala Festivals Committee's fireworks display. Monitoring consisted of a sound recording of the entire fireworks display from the north vantage point for Gualala Point Island and of sound meter readings filmed in real time alongside a GPS unit with satellite clock time. One sound level meter, a Tenma™ model 72-860, measured sound during the fireworks display.

RESULTS

Aerial Photography of the Brandt's Cormorant Colony

In 2007, the Brandt's Cormorant colony was limited to a relatively small area on the southwest side of Gualala Point Island (Figure 2). Figure 3 (a-e) shows aerial photographs of the entire Gualala Point Island Brandt's Cormorant colony from six surveys between 30 May and 30 August 2007. During the survey period, a total of 93 sites were identified and assigned unique site numbers that are indicated in the photos. Histories of each site are shown in Appendix 1. A small number of apparent territorial sites that were present on single surveys only were not assigned site numbers.

Of all sites followed, 90 were identified as breeding sites and three as territorial sites (*i.e.*, where egg-laying was not likely to have occurred). Most nests (72%) recorded during the study period were active when the colony was first photographed on 30 May (Table 1); most of these likely had eggs at that time based on well-formed nest structures and adults sitting in incubation postures. Nest establishment continued for some time afterward, and by 5 July an additional 25 nests were added. By 5 July, part of the colony had entered the chick period, as

twelve nests had relatively large chicks (*ca.* two to four weeks old) visible in nests. Six nests, or 8.2% of the 5 June total and 6.7% of the seasonal total, failed between 5 June and 5 July.

On 7 July, no new nests were recorded and six additional nests had visible chicks. Seven nests, or 8.3% of the 5 July nest total and 7.8% of the seasonal total, were newly failed. Of these, none had visible chicks (*i.e.*, adults were either incubating eggs or brooding small chicks) on 5 July, two were newly established between 5 June and 5 July and one was established between 30 May and 5 June. Of fourteen total nests with visible chicks, all were attended by adults, and no chicks appeared to be wandering from natal nests.

On 12 July, another seven nests were newly failed and an additional 28 nests had visible chicks. Of failed nests, none had visible chicks in 5 July photographs. Three were established by 30 May, two were established between 30 May and 5 June, one was established between 5 June and 5 July, and one was established between 30 May and 5 July (nest-building on 30 May but no data on 5 June). Some chicks were clearly larger than on previous surveys, and some chicks were large enough (*ca.* minimum three to four weeks old) to wander from natal nests. Five sites that failed between 5 and 7 July were attended on 12 July: three had large chicks present that had wandered from other nearby nests; and two were attended by territorial adults only. These sites were considered to be territorial sites and not active nests because of their recent failures. Two nests had visible eggs, indicating that some pairs were still incubating.

By 30 August, the entire nesting area was abandoned following the end of breeding. This last survey showed that no pairs that failed nesting in July re-nested successfully. Based on averages of eight days to lay a new egg, a 30-day incubation period, and about 30 days until chicks can become independent from natal nests (Ainley and Boekelheide 1990, Carter and Hobson 1988), active nests still would have been present on 30 August if re-nesting after 6 July had been successful.

In summary, 20 nests, or 22.2%, of documented nests failed between 5 June and 12 July. Of failed nests, 30% failed between 5 June and 5 July and 35% failed during each of the periods 5-7 July and 7-12 July. Cumulatively, 70% of nest failures occurred during the brief period between 5 and 12 July. By 12 July, 46 nests (51%) had visible chicks, with the oldest chicks close to 30 days old and wandering from natal nests. Based on those chicks, the earliest eggs were laid in mid-May. However, at least some nests clearly still had eggs on 12 July, indicating that egg-laying had continued at least through mid-June. No failed nests had chicks visible to observers prior to failure, indicating that failed nests had either eggs or very small (or young) chicks prior to failing.

Figure 2 – Aerial photograph of Gualala Point Island from the southeast, 30 May 2007. The arrow points to the Brandt's Cormorant colony, indicated by the dark mass of nests and birds surrounded by white guano.

Photo courtesy of US Fish and Wildlife Service

Table 1 - Summary of the status of Brandt's Cormorant nest and territorial sites as determined from aerial photographs, Gualala Point Island, 30 May to 12 July 2007.

Reproductive Stage	**30 May**	**5 June**	**5 July**	**7 July**	**12 July**
Active nests[a]	65	83[h]	84	77	69
Active territorial sites[b]	15	7	4	5	11
Total active sites	**80**	**90**	**88**	**82**	**80**
Unknown[c]	0	1	0	0	0
Newly categorized nest sites (former territorial sites)[d]	0	10	5	0	0
New nest sites[e]	65	8	2	0	0
Total new nests[f]	65	18	7	0	0
New territorial sites[e]	15	3	0	0	0
Total new sites[g]	**80**	**11**	**2**	**0**	**0**
Nests w/newly visible chicks	0	0	12	6	28
Newly failed nests	0	0	6	7	7

[a] Includes: 1) nests with birds sitting in fairly well-built to well-built nests (probably incubating eggs or brooding chicks); and 2) nests with visible chicks that were not recorded as failed on a previous survey.
[b] Includes nests that failed previously but were attended by adult birds on the survey date.
[c] No photo coverage available for site that was active on later surveys only.
[d] Sites categorized as nests that were present and categorized as territorial on previous survey(s).
[e] Sites not recorded as either nest or territorial sites on previous surveys.
[f] Sum of "newly categorized nest sites" and "new nest sites."
[g] Sum of "new nest sites" and "new territorial sites."
[h] Includes one site (Site 91) with no photo coverage that was known to be active before and after 5 June.

Figure 3 (a through e) – Time series of aerial photographs of the Brandt's Cormorant colony on Gualala Point Island, 30 May to 30 August 2007. Site numbers used for monitoring are indicated in each photograph.[1]

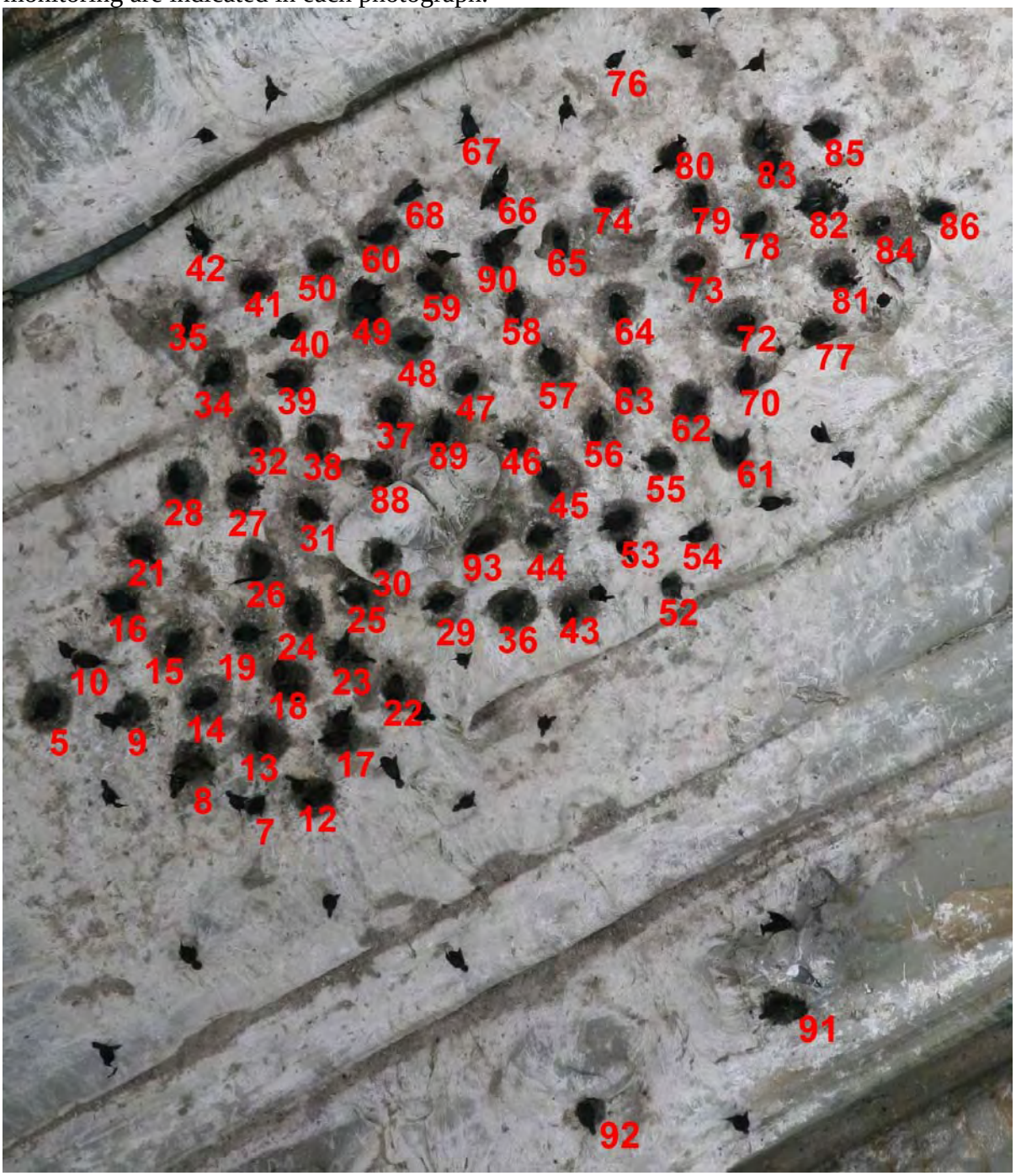


Photo by Gerard McChesney, US Fish and Wildlife Service

a) 30 May 2007

Photo © Craig Tooley, The Sea Ranch School of Photography

b) 5 June 2007

Photo © Craig Tooley, The Sea Ranch School of Photography

c) 5 July 2007

Photo © Craig Tooley, The Sea Ranch School of Photography

d) 7 July 2007

Photo © Craig Tooley, The Sea Ranch School of Photography

e) 12 July 2007

Photo © Craig Tooley, The Sea Ranch School of Photography

f) 30 August 2007

[1]For the photographs on 5, 7 and 12 July 2007, nest numbers are color coded as follows:

blue: active nests or territorial sites;
red: 6 nests categorized as newly failed on 5 July 2007;
green: 7 nests categorized as newly failed on 7 July 2007; and
pink: 7 nests categorized as newly failed on 12 July 2007.

Seabird Counts from Mainland Vantage Points

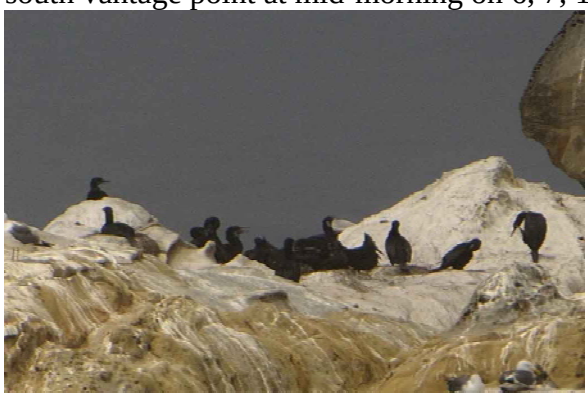
Appendix 2 displays graphs of seabird count data by count time and vantage point for the key species monitored on Gualala Point Island. All but the Brown Pelican nested on the island. Where data bars are absent in graphs, either no birds were present or no data were collected because of adverse weather conditions. Foggy conditions on 6-7 July precluded some counts and comparisons between the day of the fireworks and the day immediately after the fireworks.

Brown Pelican: Gualala Point Island is frequently a nocturnal roost for Brown Pelicans during their post-breeding dispersal. During the count period, many more pelicans were observed flying by Gualala Point Island than actually landing on the island, and pelicans were absent on the island on most days before the fireworks display. Large numbers of pelicans have roosted on Gualala Point Island in past summers, often reaching 100 birds before 1 July (R. Kuehn and G. Marshall, pers. comm.). The island did not appear to be a significant nocturnal roost site during the count period in 2007. When present during the day, most birds roosted on the lower rocks at the west end of Gualala Point Island or occasionally on the lower rocks on the east end of the island.

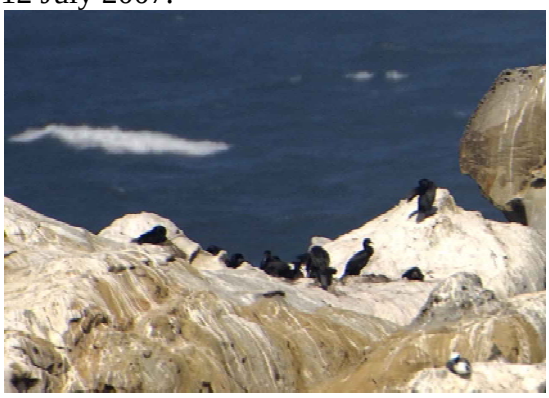
Brandt's Cormorant: Only a small portion (10%) of the Brandt's Cormorant colony was visible from the mainland and only from the south vantage point. Brandt's Cormorants were typically most numerous during the two earlier daily count times (see Appendix 2). Between 1 and 10 July, no consistent trend in counts was discernible, although a decline may have occurred between 5 and 9 July. Fog prevented counts at 05:30 and 08:00 h on 6 July, making this assessment less clear. On 11 and 12 July, an influx of non-breeding or post-breeding Brandt's Cormorants arrived and began roosting on Gualala Point Island. Their different origin was apparent by the presence of immature birds, not previously recorded on the island during the count period, and a clear spatial segregation between the roosting birds and the nesting colony.

Figure 4 shows the Brandt's Cormorant colony on Gualala Point Island from the south vantage point on four different days between 6 and 12 July. Nest #1 at the far left edge of the colony was found to be abandoned on 8 July and then reoccupied on 12 July. A Common Murre appears in flight in the 12 July photograph.

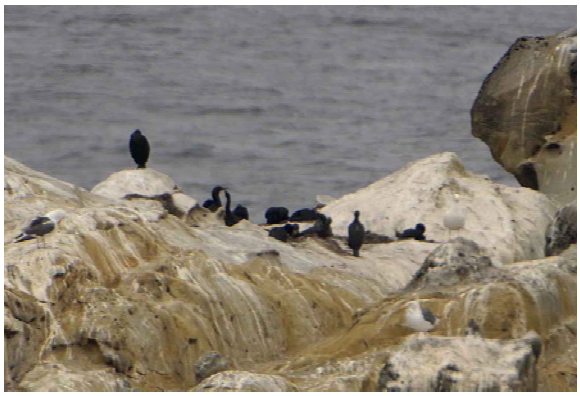
Figure 4 – The Brandt's Cormorant colony on Gualala Point Island, photographed from the south vantage point at mid-morning on 6, 7, 10 and 12 July 2007.



Brandt's Cormorants GPI-S 20070706



Brandt's Cormorants GPI-S 20070707



Brandt's Cormorants GPI-S 200707010

Brandt's Cormorants GPI-S 20070712

Photos © Rozanne Rapozo, Nature As I See It

<u>Pelagic Cormorant:</u> Counts of Pelagic Cormorants on Gualala Point Island consisted mostly of non-breeding birds. Most birds congregated on ledges along the north side of the island. Bird counts varied considerably between count times and days. No trend in counts was evident during the count period.

Black Oystercatcher: One breeding pair of oystercatchers was located from the north vantage point (Figure 5). Parents fed the young throughout the count period after first being discovered on 2 July 2007. All three young birds were first seen together on 6 July 2007. The chicks were still present at the end of the count period and beyond.

On most days, the total numbers of adult oystercatchers using Gualala Point Island for feeding and resting included more than the breeding pair. Most activity occurred in the intertidal foraging zone. They were also regularly seen in transit between the island and the mainland. Daily maximum counts ranged from two to seven birds.

Figure 5 – Location of the Black Oystercatcher nest site, marked in red, from the north vantage point, Gualala Point Island, July 2007.

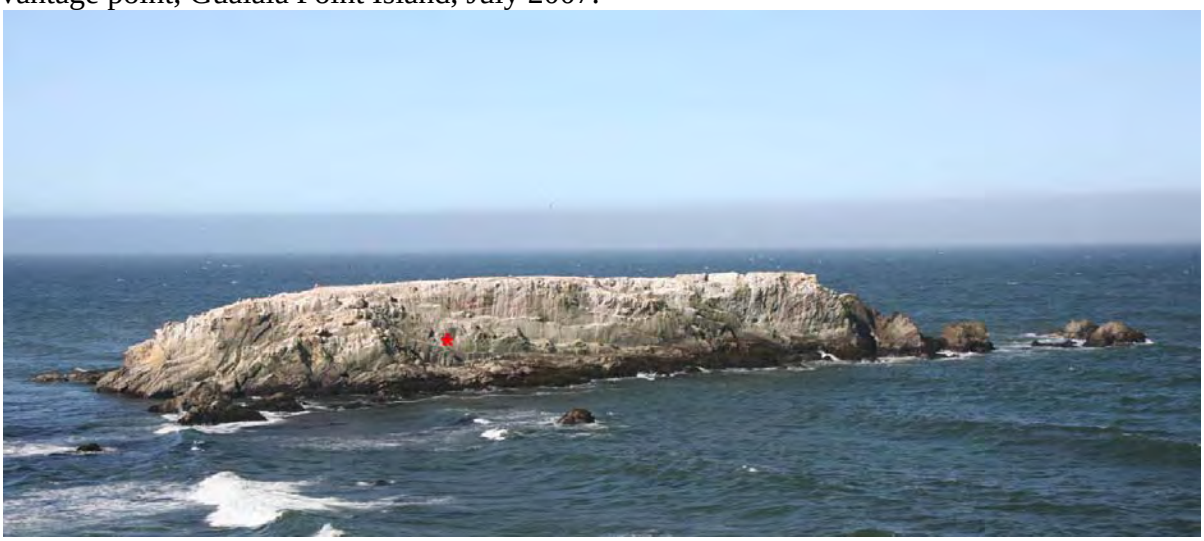


Photo by Paul Roush, USDI Bureau of Land Management

Western Gull: Although more Western Gull nests were visible from the north vantage point of the island, counts of adult Western Gulls were consistently higher from the south vantage point (Appendix 2). Immature Western Gulls were virtually absent from the island during the count period, as noted in previous years (R. Kuehn, pers. comm.). Most adult gulls not attending nests roosted on the sparsely vegetated flat top of the east end of the island. Maximum daily counts usually occurred during the second or third shift (08:00 or 10:30 h). Counts of adult Western Gulls generally increased through the count period, except for a clear decline that lasted through the day on 7 July (Appendix 2, Figure 6). These counts were among the lowest of the count period and indicated that many gulls departed the island and remained away during the course of that day. Otherwise, the general increase observed suggested an influx of non-breeders or failed breeders from other colonies.

Figure 6 shows the Western Gull colony as viewed from the south vantage point on 6 and 7 July at about 10:30 h each day. The higher density gull roost on top of the island on 6 July was absent on 7 July.

Figure 6 – View of the Western Gull colony on Gualala Point Island from the south vantage point at 10:30 h on 6 (upper photo) and 7 (lower photo) July 2007. Note the higher density roost near the top of the island on 6 July that was absent throughout the day on 7 July.

Western Gulls GPI-S
20070706

Western Gull GPI-S
20070707

Pigeon Guillemot: Observers at both the north and south vantage points regularly noted Pigeon Guillemots resting on ledges and cliffs as well as entering crevices where birds were believed to be nesting (Figure 7).

Figure 7 - Pigeon Guillemot nest crevices on Gualala Point Island, marked in red, detected as of 5 July 2007 from the south (upper photo) and north (lower photo) vantage points.

Photos by Paul Roush, USDI Bureau of Land Management

Counts of Pigeon Guillemots may have contained birds simultaneously visible to observers at both the north and south vantage points. Highest guillemot counts occurred during the first two shifts each day. This pattern was expected because guillemots tend to congregate near

nest sites in the early morning hours (Carter *et al.* 1992, Ewins 1993). Numbers of guillemots counted generally increased through the count period.

Other Bird Species Observed: In addition to bird species discussed above, observers recorded the following species on Gualala Point Island during the count period:

Double-crested Cormorant	*Phalacrocorax auritus*
Unknown Sandpiper	*Calidris* spp.
Whimbrel	*Numenius phaeopus*
Ring-billed Gull	*Larus delawarensis*
Heermann's Gull	*Larus heermanni*
Common Murre	*Uria aalge*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
European Starling	*Sturnus vulgaris*
Brewer's Blackbird	*Euphagus cyanocephalus*

Common Murres were observed on nine days during the main count period and on 16 to 18 July, usually among the nesting Brandt's Cormorants. Counts ranged from one to seven birds. Although this abundant California breeder has the closest colonies located just north of Point Arena, nesting has not been documented on Gualala Point Island or anywhere else in Sonoma County (Carter *et al.* 2001).

Seabird Nest Counts

All species noted as nesting on Gualala Point Island during the last complete colony survey in 1989 (Carter *et al.* 1992) were nesting in 2007 (Table 2). Historically and in 2007, Brandt's Cormorants have been the most numerous nesting seabird species. Although census methodologies were different each year except for Brandt's Cormorants, numbers of breeding birds for most species appeared similar between the 1989 and 2007 counts.

Table 2 – Comparison of nest counts for breeding seabirds on Gualala Point Island in 1989 and 2007.

Species	**1989**			**2007**		
	Nest Count	**Census Method**	**Census Date**	**Nest Count**	**Census Method**	**Census Date**
Brandt's Cormorant	237	aerial survey	23 May	84[1]	aerial survey	5 July
Pelagic Cormorant	2	boat survey	6 June	2	mainland survey	1 July
Black Oystercatcher	0	boat survey	6 June	1	mainland survey	2 July
Western Gull	13	boat survey	6 June	17	mainland survey	5 July

[1]High single survey count. The seasonal total for all nests constructed in 2007 was 90 nests (see text).

Brandt's Cormorant nest counts were conducted using aerial photographic surveys. A total of 90 Brandt's Cormorant nests were identified over the five surveys conducted between 30

May and 12 July 2007, with a high count of 84 nests on 5 July 2007. Only 65 nests were active during the standardized annual USFWS survey on 30 May (Table 1). Other past nest counts have been: 620 in 1980 (Sowls *et al.* 1980); 78, 139, and 125 nests in 1993, 1994, and 1995, respectively (Carter *et al.* 2000); and 132 in 2003 (Capitolo *et al.* 2004).

Thus, nest counts of Brandt's Cormorants on Gualala Point Island in 2007 were 85% lower than the high count in 1980 and 32% lower than the most recent count in 2003. Comparing the standardized USFWS survey periods, the 2007 nest count was 51% lower than the 2003 count.

Seabird Nest Monitoring

Brandt's Cormorant: In 2007, only about 10% of the Brandt's Cormorant colony was visible from the mainland and only from the south vantage point. Although views were not ideal, the data obtained were sufficient to establish nesting status during the count period for nine sites (Table 3). Of these, six nest sites had breeding confirmed by the presence of chicks. Two other sites were not confirmed to have eggs or chicks, but breeding was inferred by the conditions of the nests and adult behavior (*i.e.*, sitting in nests). One site (#15) was identified as "territorial" only. At this site, an adult was sitting on the nest during nearly every nest check between 11 and 18 July, suggesting that egg-laying might have occurred during that period although the nest was clearly empty (*i.e.*, no eggs or chicks) by 21 July (data not shown in Table 3).

Table 3 - Summary of daily status for the nine Brandt's Cormorants nests monitored from the mainland on Gualala Point Island, 1-18 July 2007.[1,2]

Nest #	**Status**	**Day in July 2007**														
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**16**	**17**	**18**
1	B	N	N	N	N	N	N	N	F	T	T	T	T	T	T	T
2	B	N	C	N	C	N	N	C	N	C	C	C	N	N	C	?
3	B	N	N	N	N	N	N	F	T	T	T	T	T	T	T	T
4	B	N	N	N	N	N	N	N	N	N	N	C	N	N	C	N
13	B	?	C	N	C	C	C	N	N	C	C	C	C	?	C	?
14	B	N	N	N	N	N	C	N	N	C	C	C	N	C	N	?
15	T	T	T	T	T	T	T	N?	N?	T?	T?	N	N	N	N	N
16	B	?	C	N	C	C	N	N	N	C	C	C	C	N	C	?
18	B	?	?	?	?	?	?	?	?	C	C	C	?	N	C	?

[1]The numbered nests below are different from the schema used in Figure 2 and in Appendix 1.
[2]Key to abbreviations:
B = breeding site
C = cormorant chick(s) seen
F = failed nest
N = adult sitting on nest
N? = uncertain whether the site is a functioning nest
T = territorial site ("status") or adult at nest territory only (daily nest condition)
T? = uncertain whether the site is functioning as a territory
? = or no data (nest view obstructed or not checked)

Chicks were not visible until they were large enough to be seen above the nest bowl, usually after seven to ten days of age. Of nests with chicks, the maximum numbers of chicks

recorded were: one chick at one nest; two chicks at four nests; and > 3 chicks at one nest. Four nests had chicks confirmed before the fireworks, and three more nests had chicks confirmed after the fireworks. Beginning on 9 July, some chicks were large enough to begin wandering from nests, when failed Nest #3 was sporadically visited by a wandering chick from another nearby nest.

During the count period, two nests, or 22% of the sample, failed as indicated by a sudden change in adult behavior (*e.g.*, standing outside the nest, irregular attendance), lack of eggs or chicks in nests when exposed to view, and deterioration of the nests. Nest #3 was found to be failed on 7 July and Nest #1 on 8 July (Table 3). Although these nests were fairly regularly (but not constantly) attended thereafter until at least 18 July, subsequent checks through 28 July showed no evidence of re-nesting. Because no chicks had been observed prior to nest failure, these nests likely were in the egg or early chick stage when they failed (Nest #3 had a possible egg observed on 1 July).

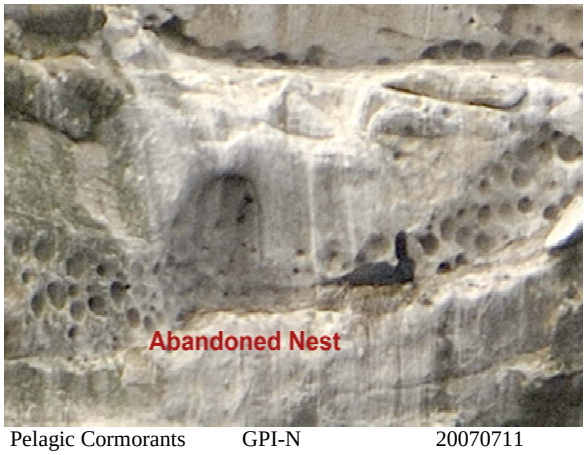
Pelagic Cormorant: Two Pelagic Cormorant nests were located on the same ledge on the north side of Gualala Point Island (Figure 8). The number of nests was low in comparison to 2006, when seven nests were recorded on the south side cliffs of the island (R. Kuehn, pers. comm.).

Figure 8 – Images of the two Pelagic Cormorant nest sites on Gualala Point Island from three different dates, 1 to 12 July 2007.

Pelagic Cormorants GPI-N 20070706

Pelagic Cormorants GPI-N 20070706

Pelagic Cormorants GPI-N 20070707



Pelagic Cormorants GPI-N 20070711

Photos © Rozanne Rapozo, Nature As I See It

In 2007, both nests monitored on Gualala Point Island failed. Pelagic Cormorant Nest #1 first showed signs of failure on 10 July when an apparently incubating adult departed the nest for several hours. Later the same day, the same or a different bird was observed sitting on the nest. Sporadic occupancy continued after 10 July but eggs or chicks were not observed and the nest was completely abandoned by 12 July. At Nest #2, adults incubating two or more eggs were observed through 12 July; by 16 July (outside the count period), this nest also was abandoned.

Western Gull: Observers at both the north and south vantage points observed Western Gull nests and young in nests throughout the count period. Western Gull nests occupied either the relatively flat top surface at the east end of the island or wide ledges and nooks just below the top of the island. Thirteen nests on the north side and eight nests on the south side of the island were visible. Accounting for visual overlap between vantage points, a total of seventeen nests were observed daily for as long as the young gulls remained in or near the nest. Afterward it was not possible to distinguish nest origin of mobile chicks and loss of individual young could not be determined.

All but four nests contained visible chicks by 2 July and all nests had chicks by 12 July. Brood sizes averaged 2.29 chicks (range = 2–3, n = 17); 29% of broods contained three chicks. No nest failures or chick fatalities were recorded during the count period. However, surveys of all chicks were often difficult to obtain because of high wind conditions, when chicks crouched out of the wind. As chicks grew larger, they were easier to detect, which may explain the continued rising trend in counts of mobile chicks toward the end of the count period, even though very few young hatched after 2 July.

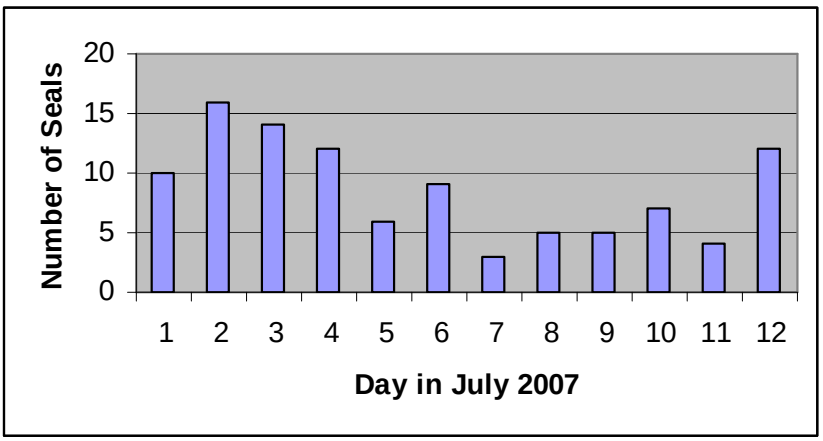
Harbor Seal Counts from Mainland Vantage Points

Harbor Seals regularly hauled out along the intertidal perimeter of the island and less often above the mean high tide line. No Harbor Seal pups were recorded at Gualala Point Island during the count period.

Seals were not double-counted during simultaneous counts from each vantage point. Therefore, counts from north and south vantage points were pooled for the total daily maximum count at the diurnal low tide (Figure 9). Because the counts took place as close to low tides as possible, Harbor Seal count times changed from day to day.

In general, low-tide counts declined through the count period, with the lowest count on 7 July. This observation suggests that there may have been a response that coincided with the fireworks display. However, at 21:00 h on 6 July, just before the Gualala fireworks display began and the island was still visible, Task Force observers did not locate any Harbor Seals from either vantage point on Gualala Point Island. Thus, a link between a decline in numbers on 7 July and the fireworks display is not conclusive.

Figure 9 – Census of Harbor Seals at daytime low tide, Gualala Point Island, 1 to 12 July 2007.



Daytime Disturbance Monitoring

Aircraft and boat disturbances have been shown to impact certain seabird colonies in central California and elsewhere (Carney and Sydeman 1999, Rojek *et al.* 2007). To assess overall agents of disturbance and their effects at Gualala Point Island, all potential human disturbances and all non-human disturbances were recorded during daytime seabird counts (Table 4). Daytime disturbance agents and disturbances to seabirds, whether human- or animal-caused, were rare and minor during the count period. Two disturbances were from cannon blasts and one from a fishing boat. Of all aircraft recorded, only the jets and helicopter flew below 300 m but still did not cause any notable disturbance. The fishing boat that caused two Brandt's Cormorants to flush had approached to within 45 m of the island.

Table 4 – Summary of daytime disturbances to seabirds on Gualala Point Island recorded during seabird counts and nest surveys, 1-12 July 2007.

Disturbance Agent	Total Number of Events	Total Duration in Minutes	Number of Disturbance Events	Effect on Seabirds
Aircraft				
Airplane	7	14	0	none
Military Jets (4)	1	1	0	none
Helicopter	1	1	0	none
People on Beach	1	22	0	none
Cannon Blast	3	3	2	Brandt's Cormorants assumed an alert posture, did not flush
Fishing Boats	6	25	1	2 Brandt's Cormorants flushed
Avian Sources				
Brown Pelican	1	1	1	20 Western Gulls flew up, called
Western Gull	1	1	1	other gulls became agitated
Unknown	1	2	1	20 to 30 Western Gulls flushed
Total	**22**	**70**	**6**	--

Data Collection during the Gualala Festivals Committee Fireworks Display, 6 July 2007

The South Coast Fire Protection District issued a permit, dated 13 June 2007, to the Gualala Festivals Committee to detonate 732 three-inch shells containing fireworks during an interval of ten minutes. The fireworks display ran from 21:35 to 21:53 h on 6 July 2007. A bird count, taken at 21:00 h while light conditions still permitted complete coverage, included nineteen Brandt's Cormorants, eight Pigeon Guillemots, one Black Oystercatcher and about 100 Western Gulls on the island.

Observers did not tally the number of detonations during that time. However, the detonations were continuous for the entire eighteen-minute interval. In contrast with the permit issued for the 2006 display, the 2007 permit covered a narrower spectrum and less powerful selection of fireworks to display.

Weather conditions during the fireworks display were clear with a strong northwest wind onshore, but a fog bank was present offshore.

During the fireworks display, two observers viewed and verbalized observations to a third observer who recorded observations. The following are verbatim observations recorded at the south vantage point viewing Gualala Point Island:

> "At 9:35 pm the fireworks began with no loud 'salutes' but with light burst[s] and pops. There was lots of noise from the birds as soon as the fireworks started. We heard the bird cries from 1000 feet away. The gulls are up and flying immediately and constantly calling. Cormorants are moving around at the nest area; a few are up and flying also. Birds are flying higher and higher. Lots of bird noise. Birds are high enough to silhouette above the fog bank. None are seen landing at this time. Birds are up 1½ times higher than the island's height. Fireworks 'pop' every 1 to 1½ seconds. No break between fireworks; steadily shot off. About 9:45 pm it is quieter: we cannot hear the gulls nor see them in flight. Have they landed? About 9:50 pm we lost visibility to the dark and the fog bank background. The right corner of the upper face of Gualala Point Island is lit up 3 times by fireworks. The finale is very loud and frequent explosions. Right face of the rock is lit up. Birds are flying again and calling loudly through the finale. 18 minutes total disturbance time."

During these observations, "bird noise" referred to Western Gulls, a vocal species. Most other seabird calls, such as from cormorants, were not audible from the mainland vantage points. The cormorants observed referred to Brandt's Cormorants. In the darkness, observers were not able to obtain data on Pelagic Cormorants, Black Oystercatchers, or Pigeon Guillemots.

<u>Nighttime Photography and Audio Recording:</u> Photographers took pictures set for nighttime exposures on two evenings during the count period. On 4 July 2007, photographs taken at thirty-second exposures monitored Western Gull and Brandt's Cormorant behavior for 80 minutes after sunset. Minimal bird activity was noted during this time; both cormorants and gulls appeared to be in the same positions from image to image.

On 6 July 2007, photographic images of the Brandt's Cormorant colony were taken from 55 minutes prior to the start of the fireworks display until 22:00 h. Prior to the fireworks, activity of Brandt's Cormorants and Western Gulls was minimal; birds were in the same relative positions from image to image. In the images acquired at 21:35 h just after the start of the fireworks, cormorants had changed postures from resting to standing and alert. By 21:36 h, some birds had moved from their original locations to points on the tops of rocks. By 21:37 h at least six birds were gone from their positions, having either flushed or otherwise moved out of view. In the next four minutes, at least three other birds departed and one other bird moved to a position higher on the rock. In one example, a resting cormorant first became alert, looked to the left, then looked to the right, and then lifted off and departed the colony.

Audio was recorded with a hand-held video camera during the fireworks. An iMovie™ slide file with the synchronized Western Gull calls was made. High winds appeared to dampen the sounds of the gulls and fireworks at the observation site. Additional photographs and sound recordings are on file with The Sea Ranch Association.

Acoustical Readings: No data on acoustical readings are reported here. A windscreen used did not adequately shield the sound recording instrument, and the wind turbulence caused high background readings. Further sound analysis will require more complex filtering of background noise from this procedure. Task Force members and BLM biologists will work further to analyze the recordings with software for generating sound spectrograms.

Data from the fireworks operator were not available for comparing sound levels of the fireworks displays in 2006 and 2007.

Discussion

Short-term Impacts

This study was the first to examine colony attendance patterns and relative breeding parameters for seabirds and marine mammals at Gualala Point Island. The impetus for the study was to examine potential impacts of a fireworks display conducted from a low coastal bluff 1.8 km from the island on 6 July 2007. Data also provide baseline information that will be valuable for guiding future monitoring efforts, management, or other studies. Surveys demonstrated the same five species of seabirds nesting on Gualala Point Island in 2007 as in the previous complete survey of the island in 1989 (Carter et al. 1992). Breeding populations of most species also were similar to 1989 except for Brandt's Cormorant, which has declined substantially.

While data were collected on all species observed, efforts focused on the colony of Brandt's Cormorants because of their known sensitivity to human disturbance (Hunt *et al.* 1981, McChesney 1997, Wallace and Wallace 1998, Thayer *et al.* 1999) and the relatively large sample size that could be monitored. For this species, colony monitoring combined land-based nest monitoring and bird counts with data from a series of aerial photographs. The aerial photography established "snapshots" in time and provided coverage of the entire cormorant colony. Land-based nest monitoring, however, was limited because only about 10% of the colony was visible from the mainland vantage point. Still, land-based nest monitoring provided

relatively detailed information on the nests that could be viewed and helped interpret aerial photographic results.

From the aerial photographs, 90 breeding pairs of Brandt's Cormorants were identified on Gualala Point Island in 2007. Overall, 78% of nests were successful through 12 July (but may have been lower if additional nests failed after 12 July). Most (70%) nests that failed did so within a short, seven-day interval between 5 and 12 July, and 35% of nest failures occurred over just two days between 5 and 7 July. Nest success was lower than Brandt's Cormorant nest success in 2007 at three central California colonies: 86%, 90%, and 97% at Castle Rocks and Mainland (Monterey County), Devil's Slide Rock and Mainland (San Mateo County), and Point Reyes (Marin County), respectively (G. J. McChesney, USFWS, unpubl. data). At these colonies, nest failures occurred infrequently and asynchronously over the course of the season, and most nest failure occurred prior to 6 July.

Nighttime monitoring during the 6 July fireworks display demonstrated visible disturbance to both Brandt's Cormorants and Western Gulls on Gualala Point Island. The cormorants became visibly alert immediately after the start of the display, followed shortly by birds being displaced and flushed. Western Gulls also flushed and flew over the island. These responses coincided with high rates of Brandt's Cormorant nest abandonment in the days immediately after and shortly following 6 July. During severe disturbance events, cormorants may depart their nests, leaving eggs and chicks susceptible to predators such as gulls or they may accidentally kick eggs out of the nest (McChesney 1997, Wallace and Wallace 1998). Following the cessation of the disturbance, birds may either return to their nests or they may abandon nesting efforts entirely. Thus, it is highly likely that nests found to be failed on 7 July were associated with the fireworks disturbance the previous evening.

For Brandt's Cormorant nests found to be failed after 7 July, the causes for failure are less clear but also may have been associated with the fireworks disturbance. Brandt's Cormorants sometimes will attend nests for up to several days after nest failure, even refurbishing and sitting in the nest (G. McChesney, pers. obs.). Thus, it is possible that some nests recorded as "active" on 7 July actually had already failed but that adults were still attending nests, which visibly failed a few days later. Other factors associated with the fireworks display also may have contributed to a prolonged period of nest failure. For example, at certain colonies with high levels of human activity, high nest loss over longer periods has been demonstrated in other seabirds even in the absence of obvious behavioral cues (Giese 1996, Beale and Monaghan 2004). High stress caused by human disturbance was thought to be the cause. Based on behavioral observations in this study, cormorants and other birds almost certainly experienced elevated stress levels during the fireworks display and this may have had an effect lasting up to several days. Also, if a cormorant mate had been disturbed by the display and subsequently abandoned the island, the breeding pair's nest certainly would have failed because two parents are necessary for cormorants to nest and rear young successfully.

The fact that most cormorant nests abandoned were on the edge of the colony was not surprising. Studies of other seabirds have shown that birds nesting on the edge or in low-density portions of a colony can experience higher rates of nest predation and lower breeding success than nests in the interior or denser parts of colonies (Birkhead 1977, Siegel-Causey and Hunt 1981). Also, nests established later and still holding eggs or small chicks were more prone to predation by gulls (e.g., Birkhead 1977). Larger chicks, such as chicks in many nests on 6 July, are generally

too large for avian predators to handle and are capable of maintaining their body temperatures to survive brief periods of exposure when adults are absent (Ainley and Boekelheide 1990). None of the cormorant nests known to have failed on Gualala Point Island between 7 and 12 July had large chicks.

Data were not adequate to fully evaluate potential impacts of the fireworks display on other species. However, for the entire day on 7 July, Western Gulls showed a brief but marked decline in numbers of adults counted on Gualala Point Island. This decline may have been associated with disturbance to gulls recorded the previous night during the fireworks display.

Potential Long-term Impacts

The Brandt's Cormorant is one of the most abundant breeding seabirds in California (Sowls *et al.* 1980, Carter *et al.* 1992). However, along the southern Mendocino County and Sonoma County coasts, few colonies exist mainly because suitable breeding habitat is scarce. Formerly, Gualala Point Island was the largest of only a handful of Brandt's Cormorant colonies between Point Arena and Bodega Bay. Available data indicate that the Brandt's Cormorant colony at Gualala Point Island has declined substantially since 1980. The count of 65 nests on 30 May 2007 was the lowest recorded to date during standardized USFWS annual surveys (Sowls *et al.* 1980; Carter *et al.* 1992 and 2000; Capitolo *et al.* 2004; and this study).

Fireworks displays are not the major cause for the long-term decline of Brandt's Cormorants on Gualala Point Island. A specific cause or set of causes remains unknown at this time. Given the sensitivity of Brandt's Cormorants to disturbance and the proximity of the colony to various human-related activities, human disturbance may be at least partially responsible for reductions in numbers. Thus, a major concern is that additional human disturbances, such as the recently instituted fireworks display, will add to the burden of impacts and will make future recovery of the colony less likely.

Common Murres, a species recovering in California from past human impacts that is undergoing a breeding population expansion in southern Mendocino County (Carter *et al.* 2001, Capitolo *et al.* 2006), were observed prospecting on several days in 2007 among the Brandt's Cormorant colony on Gualala Point Island. If properly protected, murres may begin nesting on the island in the near future and become the first documented colony in Sonoma County.

In addition to the importance of Gualala Point Island to nesting and roosting seabirds, the coast between Collins Landing and the Gualala River has been important for certain species, especially Pelagic Cormorants (Sowls *et al.* 1980, Carter *et al.* 1992). This species, which nests in more scattered and lower-density colonies, is also sensitive to both disturbance and shortages in prey supplies (Carter *et al.* 1984, Ainley and Boekelheide 1990). Given the similar proximity to developed areas, this local colony also may be jeopardized by increases in human disturbance. A remnant population of the federally threatened Marbled Murrelet (*Brachyramphus marmoratus*) uses the waters just off the mouth of the Gualala River (C. S. Strong, Crescent Coastal Research, pers. comm.). Intensifying human disturbance could jeopardize the well-being of this small group of birds.

LITERATURE CITED

Ainley DG; Boekelheide, RJ, eds. 1990. Seabirds of the Farallon Islands: ecology, dynamics and structure of an upwelling-system community. Stanford, CA: Stanford University Press. 450 pp

Beale, CM; Monaghan, P. 2004. Human disturbance: people as predation-free predators? Journal of Applied Ecology 41:335-343.

Birkhead, TR. 1977. The effect of habitat and density on breeding success in the Common Guillemot (*Uria aalge*). Journal of Animal Ecology 46(3): 751-764.

Capitolo, PJ; Carter, HR; Young, RJ; McChesney, GJ; McIver, WR; Golightly, RT; Gress, F. 2004. Changes in breeding population size of Brandt's and Double-crested cormorants in California, 1975-2003. Unpublished final report for contract #10154-2-G106 between Humboldt State University Foundation and USDI Fish and Wildlife Service. Arcata, CA: Humboldt State University, Department of Wildlife. 51 pp

Carney, KM; Sydeman, WJ. 1999. A review of human disturbance effects on nesting colonial waterbirds. Waterbirds 22(1): 68-79.

Carter, HR; Capitolo, PJ; McChesney, GJ; McIver, WR; Takekawa, JE. 2000. Population monitoring of seabirds in California: colony and subcolony databases for 1985-1995 surveys of breeding colonies of Common Murres, Brandt's Cormorants, and Double-crested Cormorants between Point Arena and Point Conception. Unpublished report. Dixon, CA: US Geological Survey, Western Ecological Research Center. 71 pp

Carter, HR; Hobson, KA. 1988. Crèching behavior of Brandt's Cormorant chicks. Condor 90(2): 395-400.

Carter, HR; Hobson, KA; Sealy, SA. 1984. Colony-site selection by Pelagic Cormorants (*Phalacrocorax pelagicus*) in Barkley Sound, British Columbia. Colonial Waterbirds 7(1):25-34.

Carter, HR; McChesney, GJ; Jaques, DL; Strong, CS, Parker, MW; Takekawa, JT; Jory, DL; Whitworth, DL. 1992. Breeding populations of seabirds in California, 1989-1991. Unpublished draft report, 2 volumes. Dixon, CA: USDI Fish and Wildlife Service, Northern Prairie Wildlife Research Center. Various pagination

Carter, HR; Wilson, UW; Lowe, RW; Rodway, MS; Manuwal, DA; Takekawa, JT; Yee; JL.. 2001. Population trends of the Common Murre (*Uria aalge californica*). In: Manuwal, DA; Carter, HR; Zimmerman, TS; Orthmeyer, DL, eds. Biology and conservation of the Common Murre in California, Oregon, Washington, and British Columbia. Volume 1: Natural History and population trends. Information and Technology Report, USGS/BRD/ITR-2000-0012. Washington, DC: USDI US Geological Survey. pp 33-132.

Ewins, PJ. 1993. Pigeon Guillemot (*Cepphus columba*). In: Poole, A; Gill, F, eds. The Birds of North America. No. 49. Philadelphia, PA: The Academy of Natural Sciences.

Giese, M. 1996. Effects of human activity on Adelie Penguin *Pygoscelis adeliae* breeding success. Biological Conservation 75:157-164.

Hunt, GL, Jr.; Pitman, RL; Naughton, M; Winnett, K; Newman, A; Kelly, PR; Briggs, KT. 1981. Summary of marine mammal and seabird surveys of the Southern California Bight area 1975-1978. Vol. III – Investigators' Reports. Part III. Seabirds – Book II. Publication PB-81-248-05. Springfield, VA: US Department of Commerce, National Technical Information Service. 337 pp

Jaques, D; Strong, C. 2002. Disturbance to Brown Pelicans at communal roosts in southern and central California. Report prepared for the American Trader Trustee Council. Astoria, OR: Crescent Coastal Research. 26 pp

Manna, J; Roberts, D; Press, D; Allen, S. 2006. Harbor Seal monitoring: San Francisco Bay area. Point Reyes Station, CA: USDI Point Reyes National Seashore. 22 pp

McChesney, GJ. 1997. Breeding biology of the Brandt's Cormorant on San Nicolas Island, California. M.S. Thesis. Sacramento, CA: California State University. 201 pp

McChesney, GJ; Eigner, LE; Poitras, TB; *et al.* 2007. Restoration of Common Murre colonies in central California: annual report 2006. Unpublished report, US Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, California. 70 pp

Rojek, NA; Parker, MW; Carter, HR; McChesney, GJ. 2007. Aircraft and vessel disturbances to Common Murres *Uria aalge* at breeding colonies in central California, 1997–1999. Marine Ornithology 35(1): 67–75.

Siegel-Causey, D; Hunt, GL, Jr. 1981. Colonial defense behavior in Double-crested and Pelagic cormorants. Auk 98(3): 522-531.

Sowls, AL; DeGange, AR; Nelson, JW; Lester, GS. 1980. Catalog of California seabird colonies. Report FWS/OBS 37/80. Washington, DC: USDI Bureau of Land Management / Fish and Wildlife Service, Office of Biological Services, Coastal Ecosystems Project. 371 pp

Thayer, JA; Sydeman, WJ; Fairman, NP; Allen, SG. 1999. Attendance and effects of disturbance on coastal Common Murre colonies at Point Reyes, California. Waterbirds 22(1): 130-139.

USDI Bureau of Land Management; The Sea Ranch CCNM Stewardship Task Force. 2008. Protocol documentation for seabird and marine mammal monitoring on offshore rock islands in Sonoma and Mendocino counties, California: 2007. Unpublished report. Sacramento, CA: USDI Bureau of Land Management, California State Office. 46 pp.

Wallace, EAH; Wallace, GE. 1998. Brandt's Cormorant (*Phalacrocorax penicillatus*). *In* The Birds of North America, No. 362 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Wengert, Greta M.; Gabriel, Mourad W. 2002. Waterbird chick mortality associated with fireworks during the breeding season. Manuscript. McKinleyville, CA: Integral Ecology Reseach Center. 11 pp

Appendix 1

Histories of Brandt's Cormorant nest and territorial sites recorded in aerial photographs, Gualala Point Island, 30 May to 12 July 2007.[1]

Nest #	Status	30 May	5 June	5 July	7 July	12 July	Fate as of 12 July
1	B	V	V	SF	SF	SW	S
2	B	V	T	SF	SF	failedT	F
3	B	V	SF	SW	SW	SW	S
4	B	V	SF	SW	SW	failedDE	F
5	B	SW	SW	SW	SW	SW	S
6	B	V	V	SW	failedDE	T	F
7	B	DPE	SF	failedV	V	V	F
8	B	SF	SW	SW	SW	SW	S
9	B	SF	SF	SW	SW	SW	S
10	B	T	SF	SW	SW	failedDE	F
11	B	V	SF	SF	SW	SW	S
12	B	SF	SW	SW	SW	SW	S
13	B	SW	SW	SW	SW	SW	S
14	B	SW	SW	SW	SW	DC	S
15	B	SW	SW	SW	SW	DC	S
16	B	SW	SF	SW	failedE	T	F
17	B	SW	SW	SW	SW	SW	S
18	B	SW	SF	SW	SW	SWG	S
19	B	SW	SW	DC	DC	DC	S
20	B	V	SW	SW	SW	SW	S
21	B	SW	SF	SW	SW	DC	S
22	B	SW	SW	DW	DC	DC	S
23	B	SW	SW	SW	SW	DC	S
24	B	SW	SW	SW	SW	C	S
25	B	SW	SW	DC	DC	DC	S
26	B	SW	SW	DC	DC	DC	S
27	B	SF	SW	SF	SF	SW	S
28	B	SW	SW	DC	DC	DC	S
29	B	SW	SW	failedT	V	DF(E in alt photo)	F
30	B	SW	SW	SW	SW	SW	S
31	B	SW	SW	DC	SW	DC	S
32	B	SW	SW	SW	SW	SW	S
33	B	V	SP	SF	SF	DC	S
34	B	SW	SW	DC	SW	DC	S
35	B	T	SF	SF	SW	SW	S
36	B	SW	SW	SW	failedE	SW(E in alt photo)	F
37	B	SW	SW	SW	SW	DC	S
38	B	SW	SW	SW	DC	DC	S
39	B	SF	SW	SW	SW	DC	S
40	B	T	SP	SF	failedV	DC	F
41	B	SF	SW	SW	SW	DC	S
42	B	T	SP	SW	SW	SW	S

Nest #	Status	30 May	5 June	5 July	7 July	12 July	Fate as of 12 July
43	B	SW	SW	failedV	V	V	F
44	B	SW	SW	SW	DC	DC	S
45	B	SW	SW	DC	DC	DC	S
46	B	SW	SF	SF	SW	SW	S
47	B	SW	SW	SW	SW	DC	S
48	B	SW	SW	SW	SW	SW	S
49	B	SW	SW	SW	SW	DC	S
50	B	SW	SW	DW	SW	DC	S
51	B	V	SF	SF	failedV	T	F
52	B	SP	SW	failedDPE	V	V	F
53	B	SW	SW	SW	SW	DC	S
54	B	T	SF	SW	SF	SW	S
55	B	SF	SF	SW	failedE	DC	F
56	B	SW	SW	DC	DC	DC	S
57	B	SW	SW	SW	DC	DC+	S
58	B	SW	SF	DW	SC	DC	S
59	B	SW	SW	DC	SW	DC	S
60	B	SW	SW	failedDE	V	T	F
61	B	SF	SF	DW	DC	DC	S
62	B	SW	SW	SW	SW	failedDE	F
63	B	SW	SW	DC	SW	DC	S
64	B	SW	SW	DC	DC	DC	S
65	B	DPE	SF	SW	SW	DC	S
66	T	T	SP	T	V	DC	na
67	B	T	SF	SW	SW	SW	S
68	B	T	SW	SW	SW	SW	S
69	B	V	SW	SW	SW	SW	S
70	B	SW	SW	SW	SW	failedV	F
71	B	V	SW	SW	SW	DC	S
72	B	SW	SW	SW	SW	DC	S
73	B	SW	SW	SW	SW	DC	S
74	B	SW	SF	SW	SW	SF	S
75	B	V	SF	SF	SF	SF	S
76	T	T	DF	V	V	V	na
77	B	SW	SW	SW	SW	failedDE	F
78	B	SW	SF	SW	failedE	DC	F
79	B	SW	SW	SW	SW	DC	S
80	B	SP	SF	SW	SW	DC	S
81	B	SW	SF	SW	SW	SW	S
82	B	SW	SW	SW	SW	DC	S
83	B	SW	SW	SW	SW	DC	S
84	B	SW	SW	SW	SW	DC	S
85	B	SF	SF	SF	SW	DC	S
86	B	SP	SF	failedV	V	V	F
87	T	V	T	V	V	V	na
88	B	SW	SW	DC	DC	DC	S
89	B	SW	SW	SW	SW	DC	S
90	B	SW	SF	SW	SW	DC	S

Nest #	Status	30 May	5 June	5 July	7 July	12 July	Fate as of 12 July
91	B	SF	n/a	SF	SF	SFG	S
92	B	DF	n/a	SW	SW	failedV	F
93	B	SF	SF	SW	SW	SW	S

[1] Codes are as follows:

Status: B = breeding site
T = territorial site

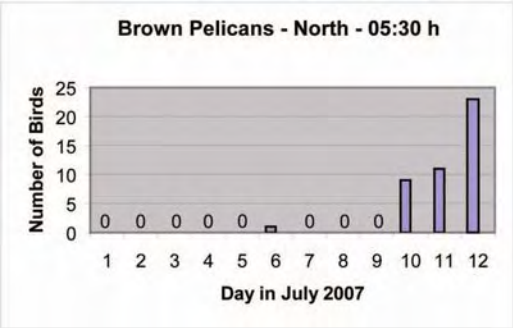
Nest Site Condition by Date: C = chick(s) visible in nest
D = adult standing at nest site
E = empty nest
F = fairly well built nest
G= egg(s) visible in nest
P = poorly built nest
S = adult sitting on nest
T = adult bird(s) on territory with little or no nest material
V = vacant site
W = well built nest
failed = first survey when nest discovered to be failed
n/a = no photo coverage

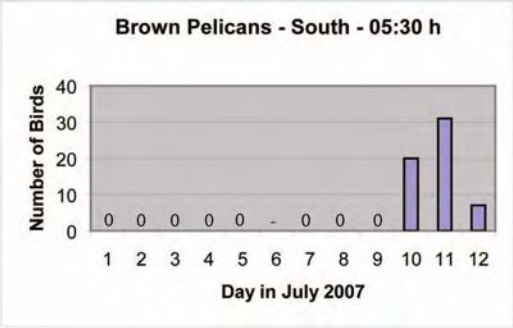
Fate as of 12 July: F = failed
S = successful
n/a = no nest established during the count period

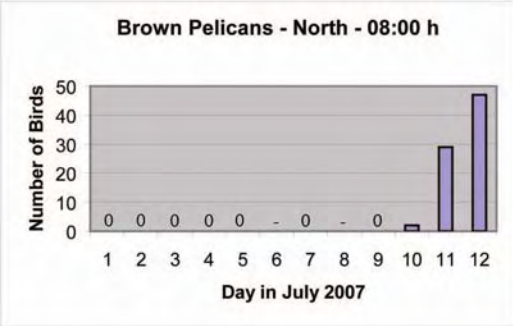
Appendix 2

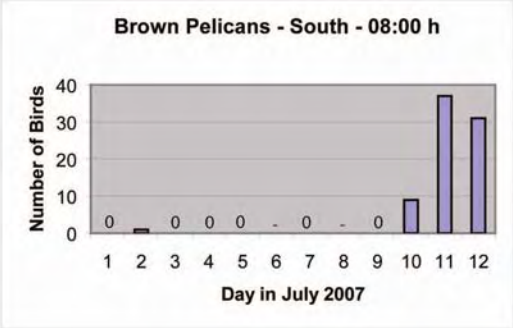
Bird Census Totals by Species, Vantage Point and Time of Day, 1 to 12 July 2007

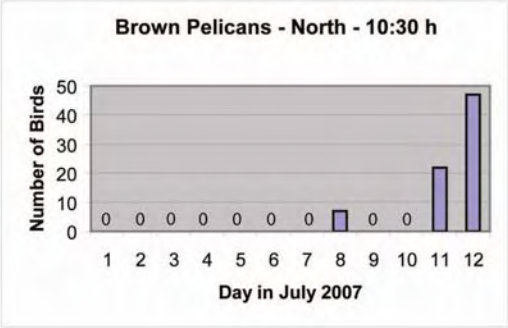
0 = no birds observed – = no data available because of poor visibility

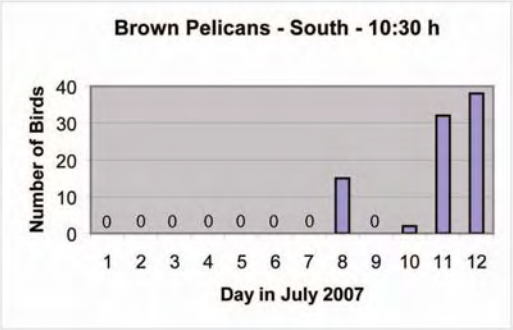


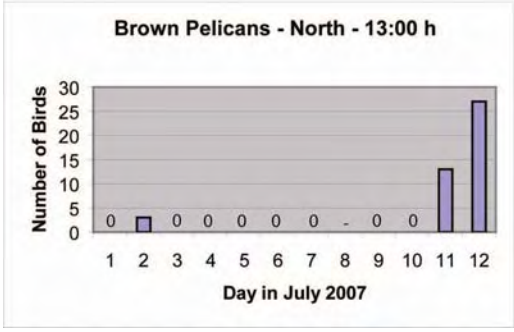


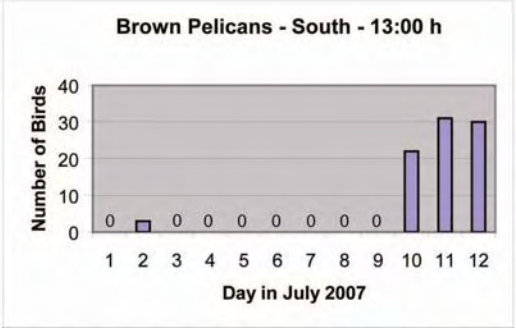


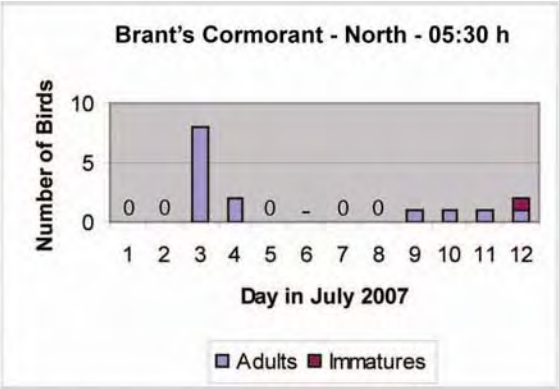


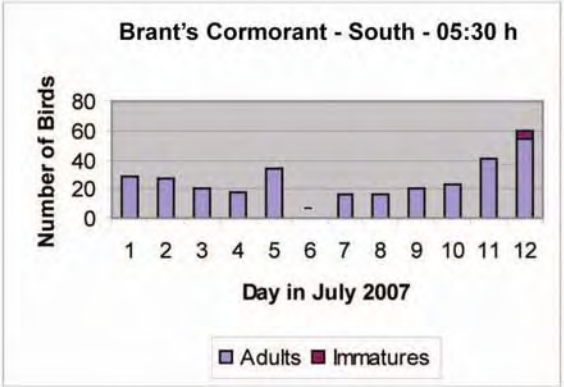


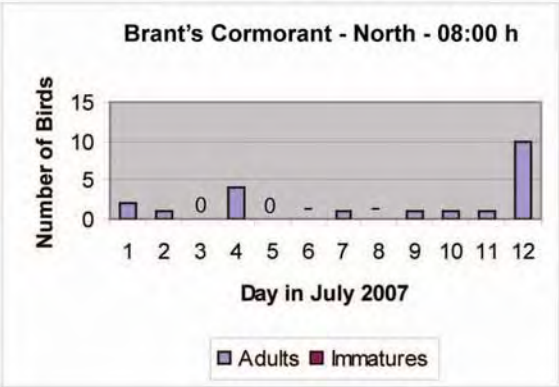


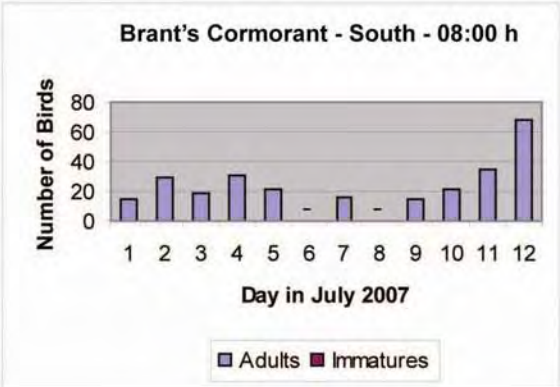


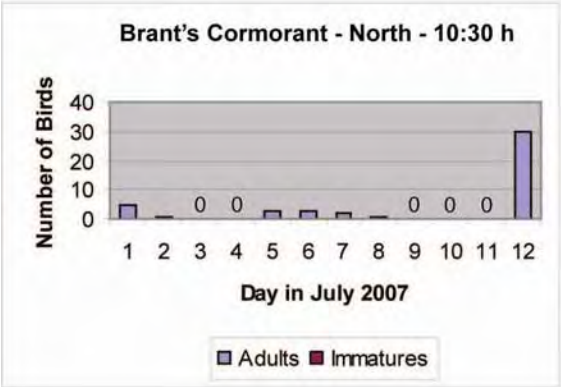


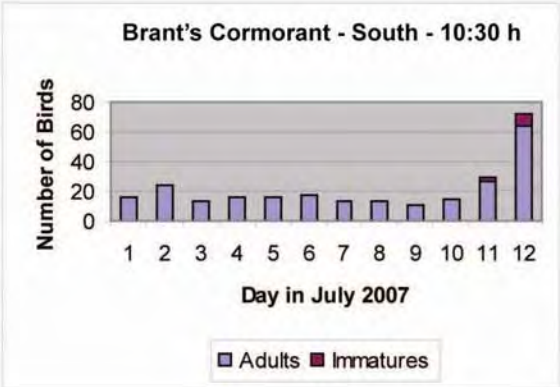

Brant's Cormorant - North - 05:30 h
Number of Birds
10
5
0
0 0 0 - 0 0
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

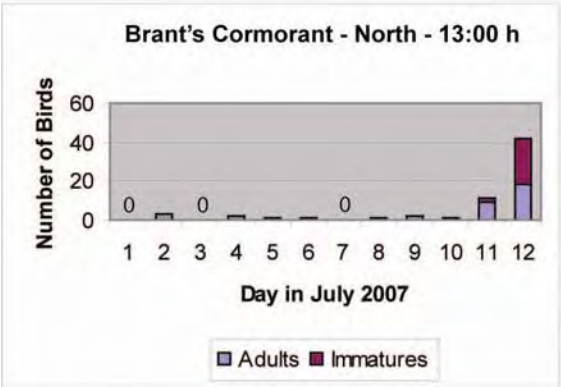

Brant's Cormorant - South - 05:30 h
Number of Birds
80
60
40
20
0
-
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

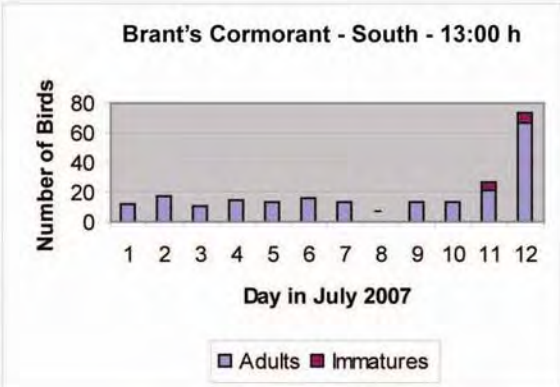

Brant's Cormorant - North - 08:00 h
Number of Birds
15
10
5
0
0 0 - -
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

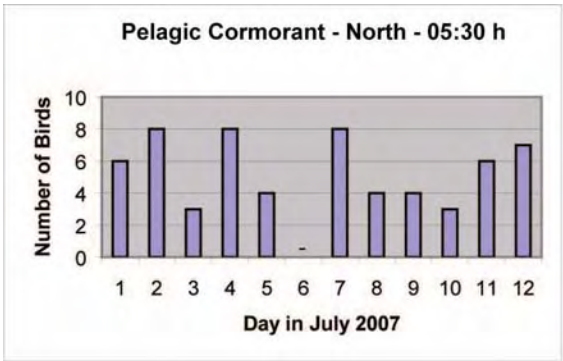

Brant's Cormorant - South - 08:00 h
Number of Birds
80
60
40
20
0
- -
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

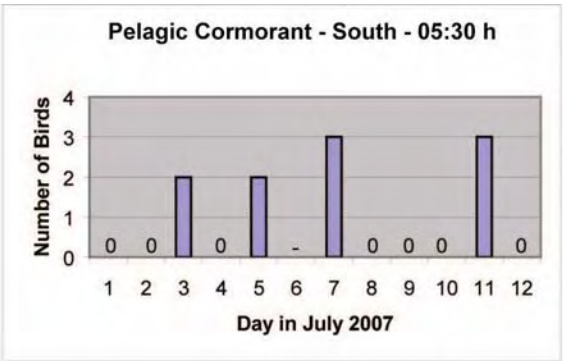

Brant's Cormorant - North - 10:30 h
Number of Birds
40
30
20
10
0
0 0 0 0 0
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

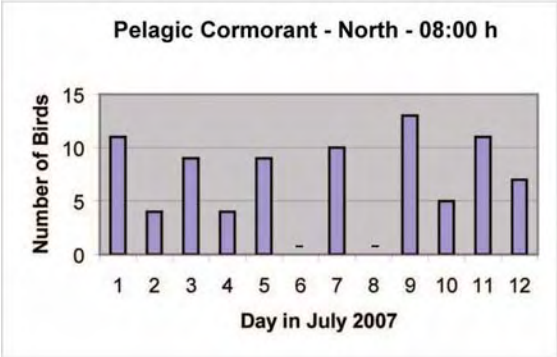

Brant's Cormorant - South - 10:30 h
Number of Birds
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

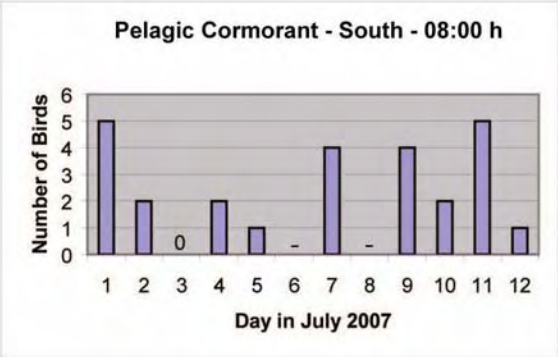

Brant's Cormorant - North - 13:00 h
Number of Birds
60
40
20
0
0 0 0
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

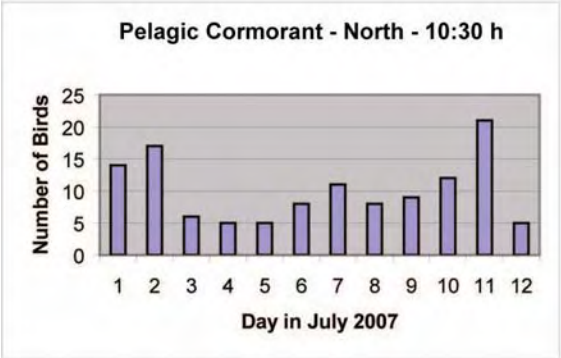

Brant's Cormorant - South - 13:00 h
Number of Birds
80
60
40
20
0
-
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007
Adults Immatures

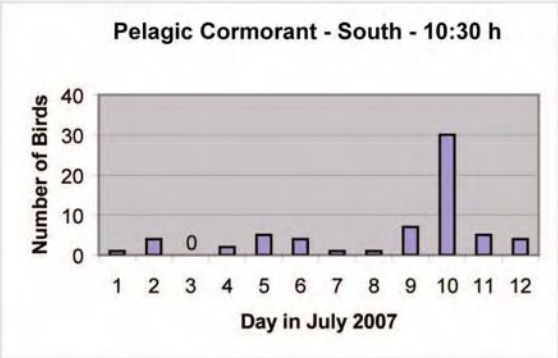

Pelagic Cormorant - North - 05:30 h
Number of Birds
Day in July 2007

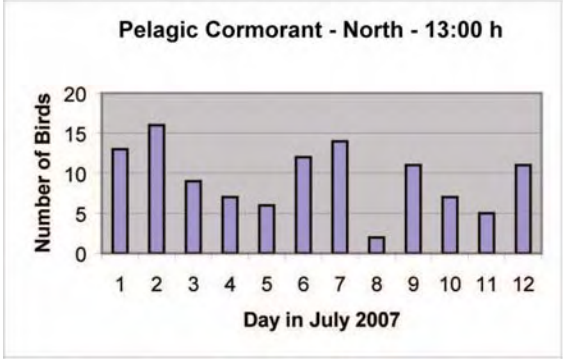

Pelagic Cormorant - South - 05:30 h
Number of Birds
Day in July 2007

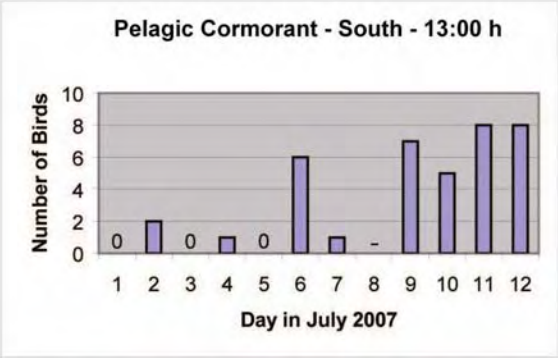

Pelagic Cormorant - North - 08:00 h
Number of Birds
Day in July 2007

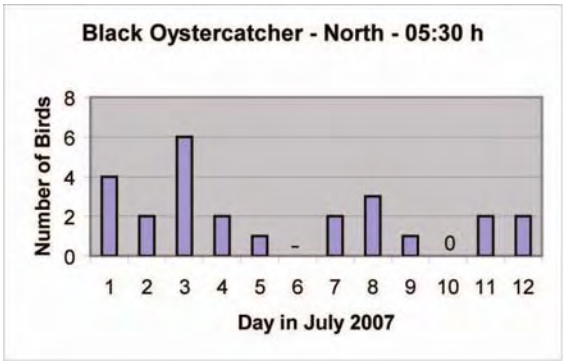

Pelagic Cormorant - South - 08:00 h
Number of Birds
Day in July 2007

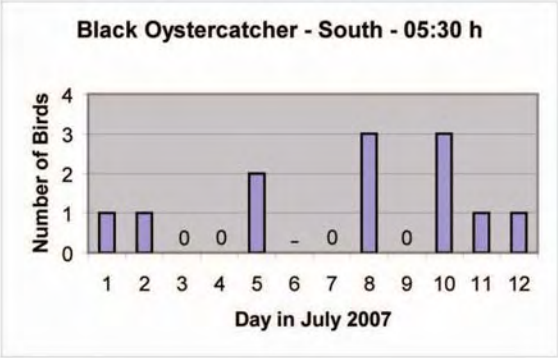

Pelagic Cormorant - North - 10:30 h
Number of Birds
Day in July 2007

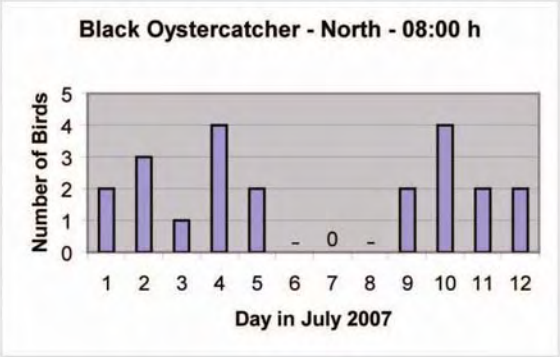

Pelagic Cormorant - South - 10:30 h
Number of Birds
Day in July 2007

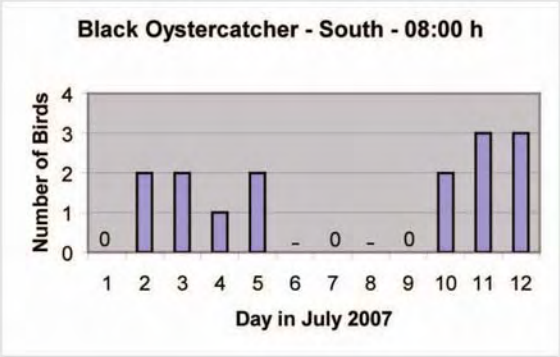

Pelagic Cormorant - North - 13:00 h
Number of Birds
Day in July 2007

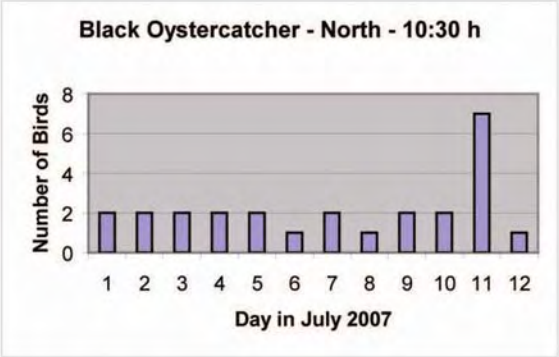

Pelagic Cormorant - South - 13:00 h
Number of Birds
Day in July 2007

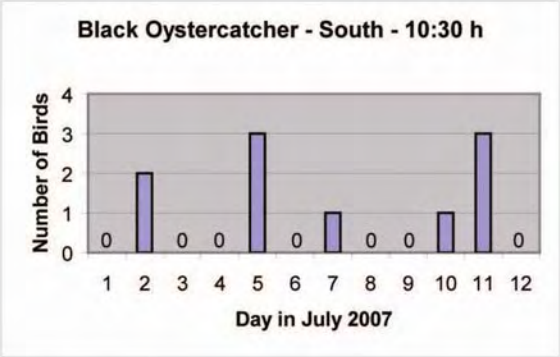

Black Oystercatcher - North - 05:30 h
Number of Birds
Day in July 2007

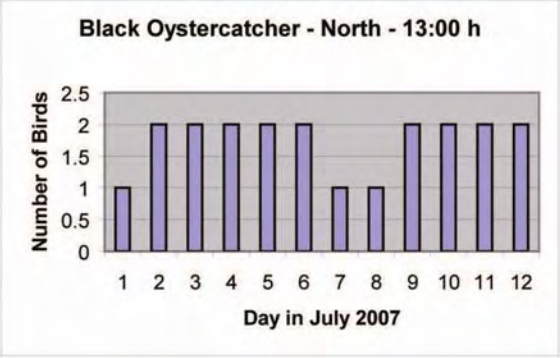

Black Oystercatcher - South - 05:30 h
Number of Birds
Day in July 2007

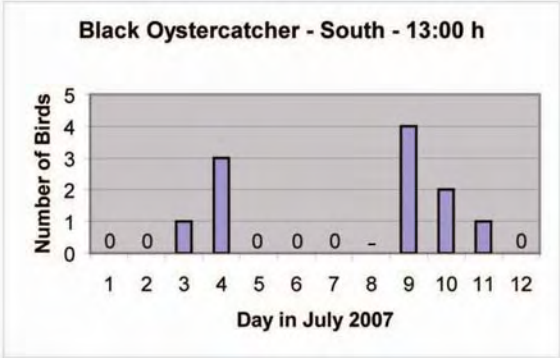

Black Oystercatcher - North - 08:00 h
Number of Birds
Day in July 2007

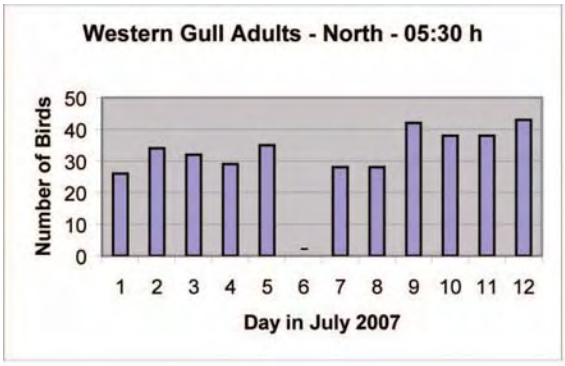

Black Oystercatcher - South - 08:00 h
Number of Birds
Day in July 2007

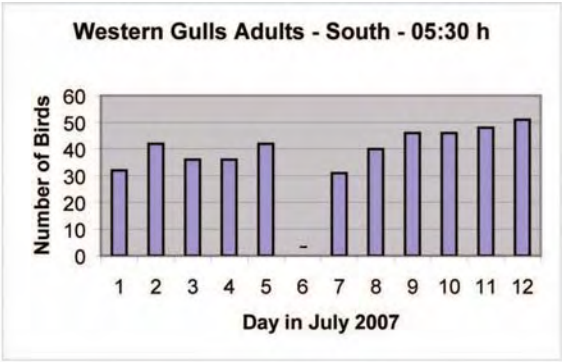

Black Oystercatcher - North - 10:30 h
Number of Birds
Day in July 2007

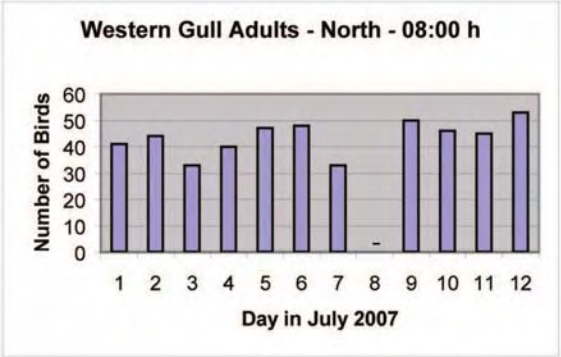

Black Oystercatcher - South - 10:30 h
Number of Birds
Day in July 2007

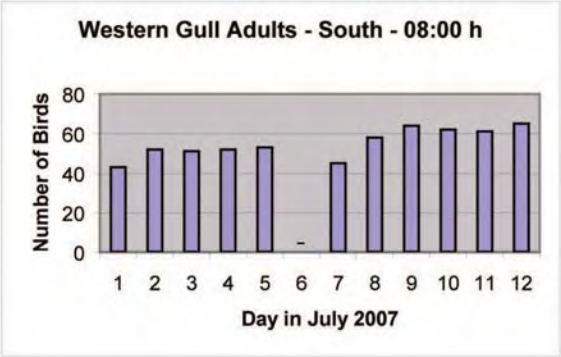

Black Oystercatcher - North - 13:00 h
Number of Birds
Day in July 2007

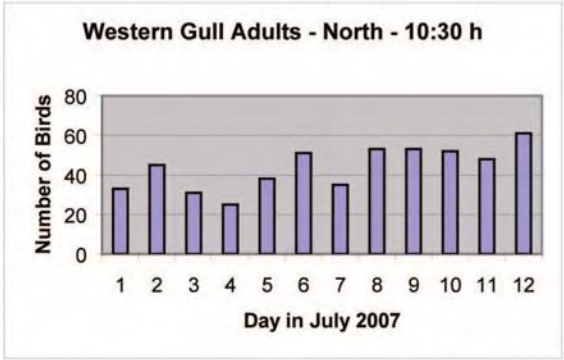

Black Oystercatcher - South - 13:00 h
Number of Birds
Day in July 2007

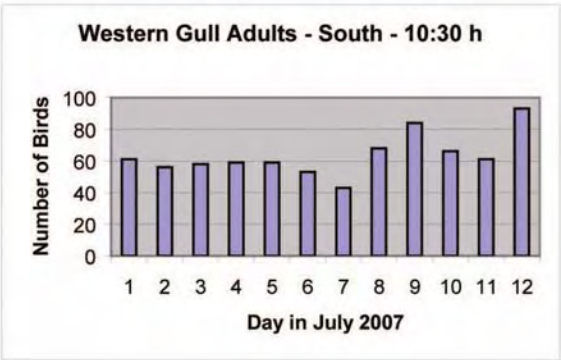

Western Gull Adults - North - 05:30 h
Number of Birds
0 10 20 30 40 50
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

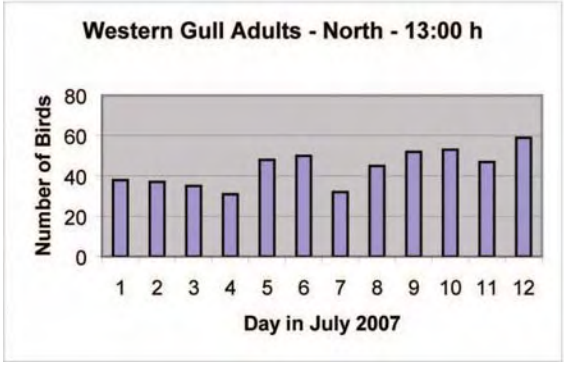

Western Gulls Adults - South - 05:30 h
Number of Birds
0 10 20 30 40 50 60
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

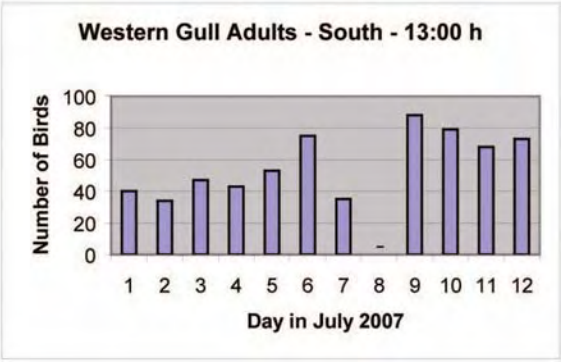

Western Gull Adults - North - 08:00 h
Number of Birds
0 10 20 30 40 50 60
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

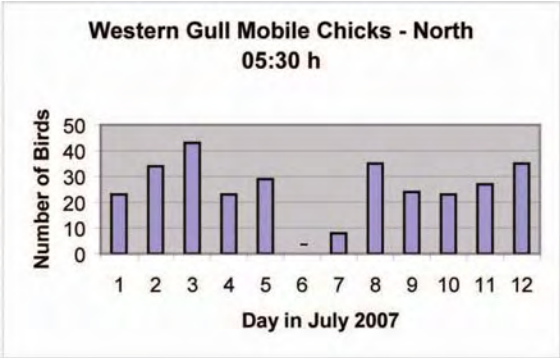

Western Gull Adults - South - 08:00 h
Number of Birds
0 20 40 60 80
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

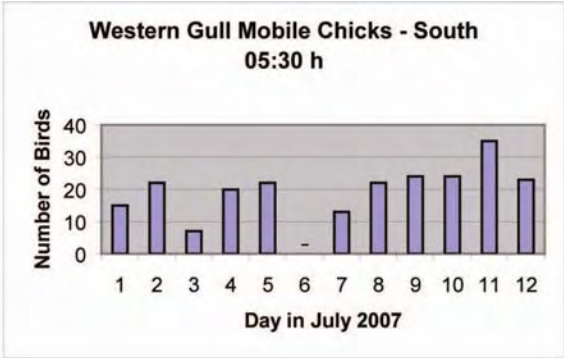

Western Gull Adults - North - 10:30 h
Number of Birds
0 20 40 60 80
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

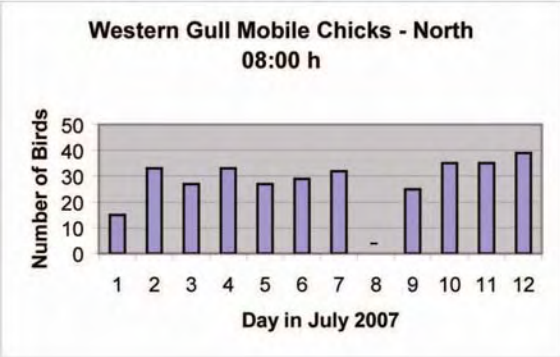

Western Gull Adults - South - 10:30 h
Number of Birds
0 20 40 60 80 100
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

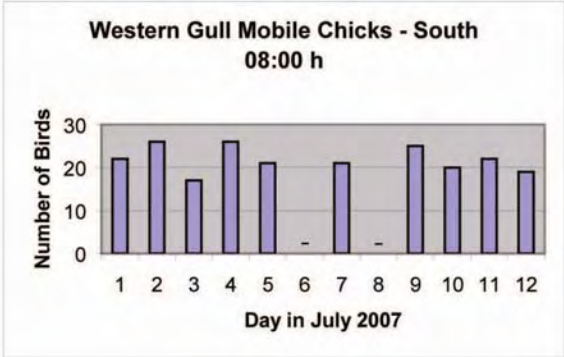

Western Gull Adults - North - 13:00 h
Number of Birds
0 20 40 60 80
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

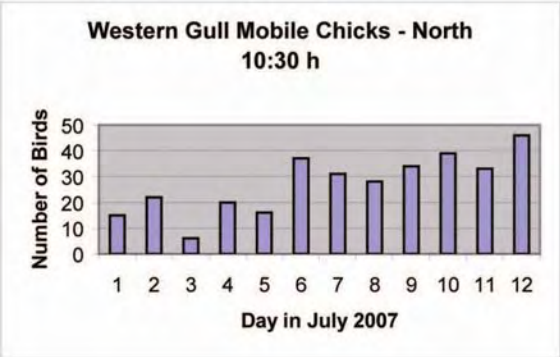

Western Gull Adults - South - 13:00 h
Number of Birds
0 20 40 60 80 100
1 2 3 4 5 6 7 8 9 10 11 12
Day in July 2007

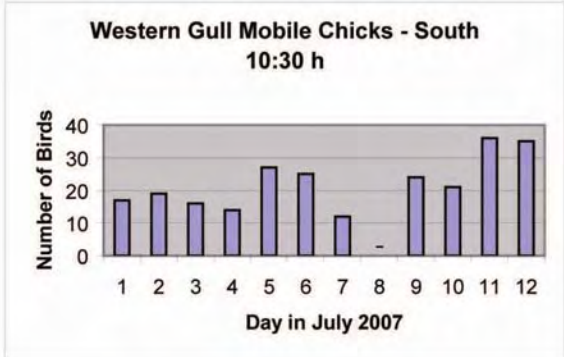

Western Gull Mobile Chicks - North
05:30 h
Number of Birds
Day in July 2007

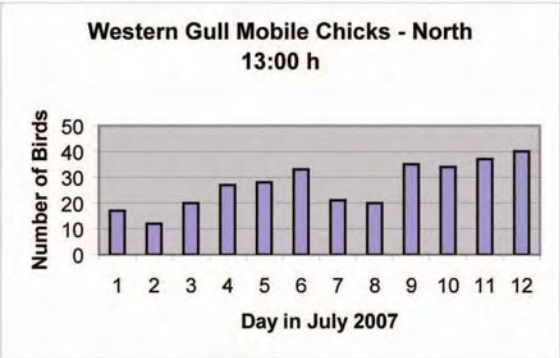

Western Gull Mobile Chicks - South
05:30 h
Number of Birds
Day in July 2007

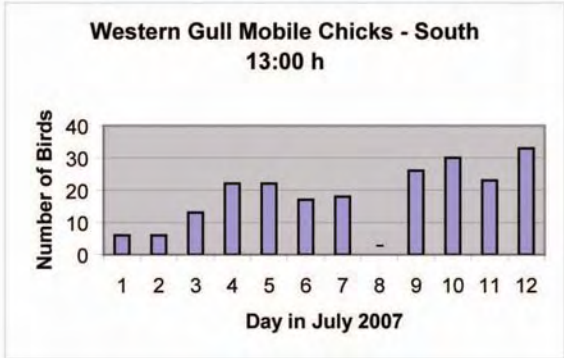

Western Gull Mobile Chicks - North
08:00 h
Number of Birds
Day in July 2007

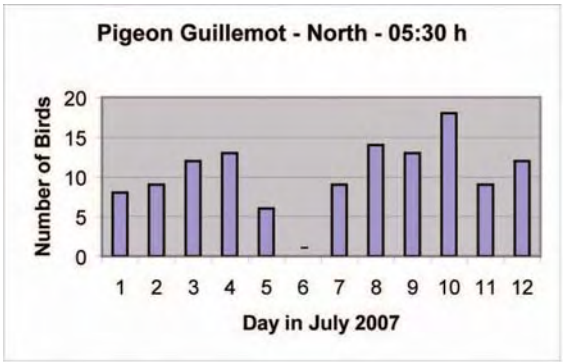

Western Gull Mobile Chicks - South
08:00 h
Number of Birds
Day in July 2007

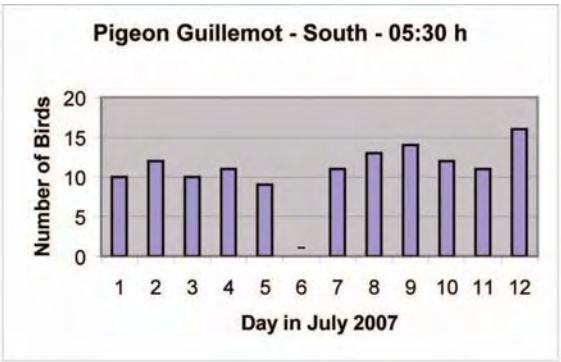

Western Gull Mobile Chicks - North
10:30 h
Number of Birds
Day in July 2007

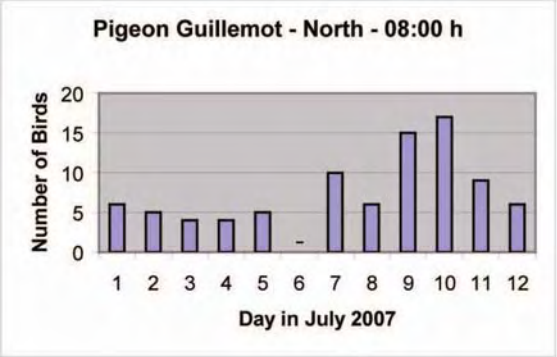

Western Gull Mobile Chicks - South
10:30 h
Number of Birds
Day in July 2007

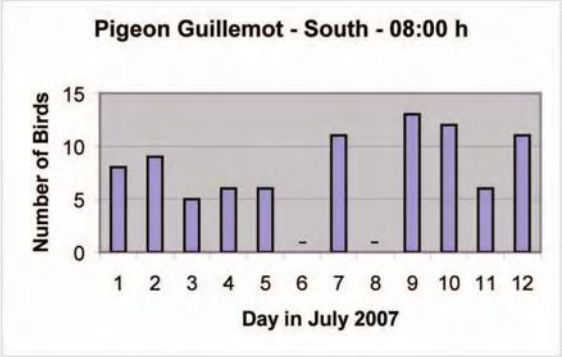

Western Gull Mobile Chicks - North
13:00 h
Number of Birds
Day in July 2007

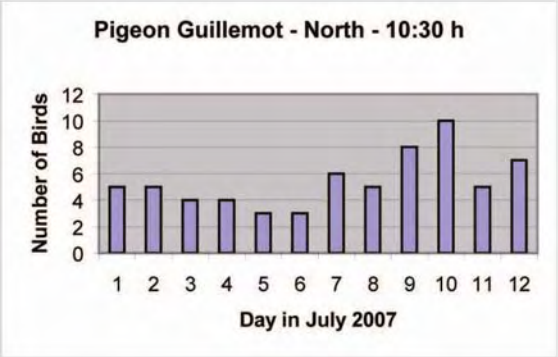

Western Gull Mobile Chicks - South
13:00 h
Number of Birds
Day in July 2007

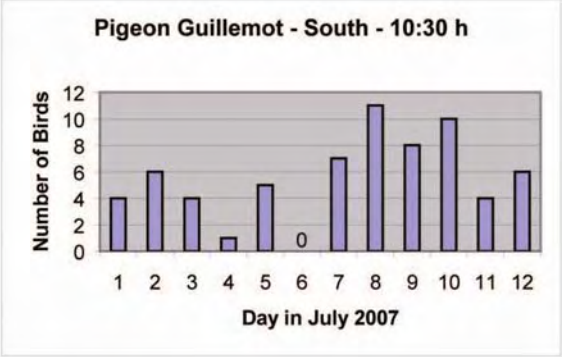

Pigeon Guillemot - North - 05:30 h
Number of Birds
Day in July 2007

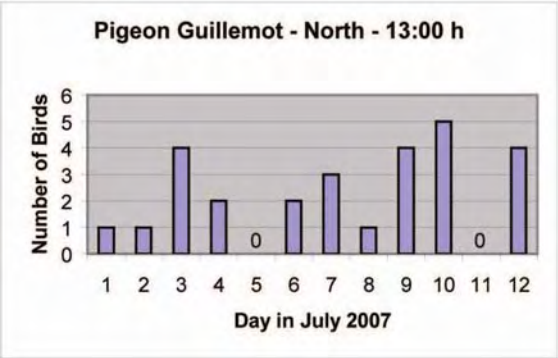

Pigeon Guillemot - South - 05:30 h
Number of Birds
Day in July 2007

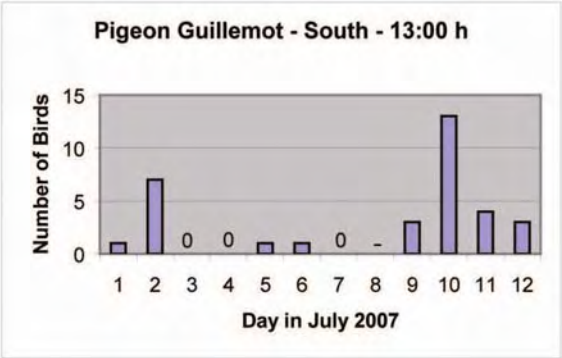

Pigeon Guillemot - North - 08:00 h
Number of Birds
Day in July 2007


Pigeon Guillemot - South - 08:00 h
Number of Birds
Day in July 2007


Pigeon Guillemot - North - 10:30 h
Number of Birds
Day in July 2007


Pigeon Guillemot - South - 10:30 h
Number of Birds
Day in July 2007


Pigeon Guillemot - North - 13:00 h
Number of Birds
Day in July 2007


Pigeon Guillemot - South - 13:00 h
Number of Birds
Day in July 2007