

REPORT ON THE MONITORING OF BIRD ISLAND,  
ELLWOOD, SANTA BARBARA COUNTY, CALIFORNIA, 2006

prepared for  
the Santa Barbara Audubon Society  
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## SUMMARY

Bird Island monitoring in 2006 continued the process initiated in 2005. The old Bird Island was the remnant of a pier several hundred meters off Ellwood, Santa Barbara County, California, and home to nesting Brandt's Cormorants, roosting California Brown Pelicans (federally listed as endangered), and several other bird species. The old pier was removed in the fall of 2005 and replaced with four new structures designed to accommodate the nesting and roosting birds.

During January 2006, hour-long observational surveys were conducted twice a week to monitor bird activity on the new structures. These surveys continued the non-breeding season protocol, which had been followed in the monitoring of the new structures in December 2005, when construction was completed. In February, the breeding season protocol was initiated for the 2006 season. Surveys were conducted every third day under this protocol, until 17 August. Surveys were again conducted under the non-breeding season protocol from 21 August until the end of the year.

When the year began, numbers of Brandt's Cormorants had still not returned to the levels reached in September 2005, before the last remnant of the old pier had been demolished. But numbers quickly returned to preconstruction levels, and by the end of January birds were exhibiting breeding behavior, including apparent nest building. By early April, the number of active nests on the new Bird Island had exceeded the high number of nests counted on any survey in 2005. By the end of the breeding season in August, twice as many nests had been observed on the new structures compared with the old one, and twice as many nests had hatched young as had done so in the previous season. Timing of breeding was the same as on the old structures, with the peak numbers for extant nests and nests with young occurring on virtually the same dates as in 2005.

While Brandt's Cormorant numbers and breeding activity increased on the new structures versus the old, numbers of roosting Brown Pelicans were down for nearly the entire year. During the height of the cormorant breeding season, the cormorants crowded out the pelicans and other roosting species almost completely, with only 15 Brown Pelicans observed on the structures during the 6.5 months during which the breeding season protocol was active. Late in the season, Brown Pelican numbers did increase dramatically for a short period in December, but they dropped again by the end of the month. The Western and Heermann's Gulls and two roosting, exotic terrestrial species (the Rock Pigeon and the European Starling) were also recorded less often on the new structures, particularly during the breeding season. The new structures, which provide lots of open, flat areas, but fewer of the smaller and narrower perching areas that the old structure provided, appear to be particularly suited to cormorant nesting, and as a result may be less inviting for other species, which may be crowded out by the cormorants.

## INTRODUCTION

The old Bird Island was the remnant of an old pier and oil well service structure about 260 meters off Ellwood, Santa Barbara County, California (Padre Associates 2004), that supported many roosting birds, including the California Brown Pelican (*Pelecanus occidentalis californicus*) and nesting Brandt's Cormorants (*Phalacrocorax penicillatus*). The pelican is a subspecies that is federally listed as endangered, and that used the old Bird Island year-round for resting. The cormorant, although an abundant breeder on the Channel Islands, breeds nowhere else along the mainland coast between Pt. Conception and La Jolla, San Diego County (McChesney et al. 2000). It used the old Bird Island for nesting and raising young from late winter until late summer or early fall. The remainder of the year, this species, like the Brown Pelican, used the site for roosting.

The old Bird Island was removed in the fall of 2005 and replaced with four new structures designed to accommodate the roosting and breeding birds. The Santa Barbara Audubon Society began overseeing the monitoring of the old Bird Island during 2005 to gather baseline data on bird use of the structures. Late in that year, the monitoring of the new Bird Island began. Surveys continued under the non-breeding season protocol in January 2006, and breeding season surveys were conducted from February through mid-August. Non-breeding season surveys were resumed from that point until the end of the year. Similar monitoring is scheduled to continue for another four years. For the last five years of surveys (including 2006), we will chart the use of the structure and use the data from this phase to make comparisons with the preconstruction data and measure the success of the project.

The old structure was very irregularly shaped, with seven large concrete pilings supporting the remains of a metal framework on the northern half and an open, flat area on the southern half. Each of the four new structures consists of a large column supporting three more or less triangularly shaped platforms projecting out from the column in different directions and at slightly different heights. Below these three platforms is a circular ledge extending around the column. The structures are arranged in a line extending approximately from east to west, in more or less the same area as the old pier.

Monitoring was conducted under the breeding season protocol from 1 February through 17 August (see tab. 1). Since monitoring of the old structure did not start until 19 May 2005, the data set for the 2006 breeding season is more complete than that for 2005.

During the cormorant breeding season, we recorded observations relating to the breeding cycle of the cormorants and, every 20 minutes, counted all birds on the structure and in the water in the immediate vicinity of the structure, within approximately 300 meters. (For more detail on the breeding season and non-breeding season protocols, see the Appendix "Protocol for Monitoring Bird Island.")

Table 1. Breakdown of Monitoring Surveys at Bird Island, 2006			
	<i>Initial Survey</i>	<i>Final Survey</i>	<i>Total Surveys</i>
Non-breeding season protocol (prebreeding)	4 January	18 January	5
Breeding season protocol	1 February	17 August	66
Non-breeding season protocol (postbreeding)	21 August	27 December	37

Prior to the breeding season (through 18 January), we conducted two surveys per week, and we again cut the frequency of surveys to this level (about eight per month) after the breeding season, that is, beginning on 21 August 2006. Under the non-breeding season protocol, every ten minutes (six times per hour-long survey) we recorded numbers for all species on the structures and for all species resting on the surrounding waters within about 300 meters.

#### IMPORTANT SPECIES USING BIRD ISLAND

The brief accounts below relate natural history information about Brandt's Cormorant and the California Brown Pelican that is relevant to each species' status at Bird Island—as a breeder in the case of the cormorant, and as a roosting species in the case of the pelican.

*Brandt's Cormorant:* This species nests in colonies, mostly on rocky islets and cliffs. The cormorants generally choose flat areas or ledges to place their “large and untidy” nests (Wallace and Wallace 1998). Males gather most of the nesting material, before and after pairing. In a study at the Farallon Islands, the incubation period ranged from 28 to 32 days (Boekelheide et al. 1990). In cases of nest failure, replacement clutches are laid, but pairs are not known to raise multiple broods in a season. After hatching, young are brooded continually for up to 10 days. Adults may leave young unattended as early as 20 days, at which time young, still unable to fly, may leave the nest in the parents' absence and form tightly gathered groups known as “creches” with young from other, nearby nests. It is not known at what age young are independent from their parents (Wallace and Wallace 1998).

*California Brown Pelican:* The Brown Pelican was listed as endangered by the U.S. Fish and Wildlife Service in 1970. The California Department of Fish and Game further protected the California subspecies by listing it as endangered in 1971. The California Brown Pelican breeds in the Gulf of California (in northern Mexico) and the California Bight north to the Channel Islands. The established breeding colony nearest to Bird Island is at Anacapa Island (approximately 45 miles southwest of Bird Island); the only other established colony north of Mexico is on Santa Barbara Island. Also, an aerial survey reported 43 nests on Prince Island, a major seabird breeding site off San Miguel Island (also approximately 45 miles from Bird Island), on 16 May 2006, the first recorded nesting in this area since 1939 (CDFG and UCSC 2006). In addition to nesting habitat, the California Brown Pelican requires “offshore habitat with an adequate food supply” and “appropriate roosting sites for both resident and migratory” individuals. For both

breeding and non-breeding pelicans, “offshore rocks and islands, river mouths with sand bars, and many breakwaters, pilings and jetties along the U.S. and Mexican west coasts are important . . . as roosting sites” (Gress and Anderson 1983). At the nesting sites, pelicans in the Bight of California may lay eggs as early as December, with peak egg-laying occurring from February to May (Gress and Anderson 1983), meaning that peak breeding activity extends more or less through August. For nesting birds, roosting sites such as Bird Island, which are far from breeding sites, may be less critical during this time. However, non-breeding birds still require roosting sites during the breeding season.

## RESULTS: BREEDING SEASON

### BRANDT’S CORMORANT

Measured in terms of active nests, peak nesting activity for Brandt’s Cormorants in 2006 came on 20 May, when 75 nests were at different stages on the structures. On 23 June, 72 nests could still be seen.<sup>1</sup> Thereafter, the number of active nests dropped quickly; by 5 July, only 41 nests could be seen, and by the end of July, only 7 nest structures remained. The last day in which any young were seen at even a partial nest structure with an adult was 21 August. The first clear sign of fledged young came on 18 July, when 3 were observed in the water begging and being fed by an adult. Regular feeding of young kept up until 29 August, and isolated instances of feeding were witnessed until mid-November (see tab. 2).

The timing of breeding events in 2006 was much as it was on the old Bird Island in 2005, when the peak number of nests counted came on 19 May and the first fledged young were recorded on 21 July. In 2005, the first young in a nest were not observed until 22 May, but the surveys did not begin until 19 May, and young may have been missed during the initial survey.

Total individuals<sup>2</sup> during the breeding season in 2006 averaged 175.3 per survey and ranged from 51 on 8 August to 282 on 26 June (see fig. 1). The second-lowest figure, 112, was recorded on 23 April, before any significant number of juveniles was recorded, and before all breeding pairs were present. Numbers subsequently rose as the number of nesting pairs peaked and the number of young grew. The total of 51 on 8 August, which parallels the occurrence of the low (112) on 5 August in the 2005 breeding season, may in part reflect the fact that many young had fledged and most adults were no longer tied

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<sup>1</sup> These figures reflect the number of nests that could be detected from the observation point, including partial nests in some cases. Before young cormorants are able to fly, they walk out of the nest and join young cormorants from other nests in creches, although for a time they continue to return to the nest where they were born, and they remain under parental care (Wallace and Wallace 1998). With unfledged young in the nest at some times, and not at others, it can be difficult to determine the stage of nesting. However, since nests are generally dismantled when nesting is finished (pers. obs.), and even partly dismantled while young are still present, even a partial nest can be a good indication of continued breeding activity.

<sup>2</sup> “Total individuals” refers to the high number counted on the structures at any one time during a survey. So if the counts of Brandt’s Cormorants for three different intervals during a one-hour survey were 105, 125, and 115, then the total individuals for that survey was 125. During the non-breeding season, the highest of six totals recorded during an hour was considered the total number of individuals for a survey.

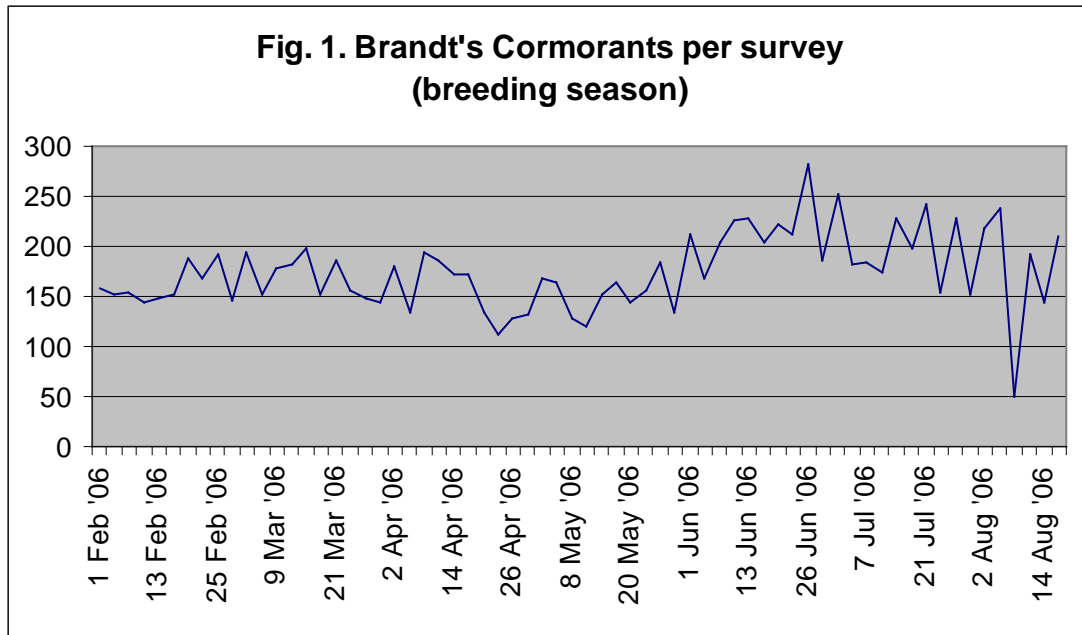
to the structures because of dependent, unfledged young. This does not mean that these birds had departed, but that they were now more mobile and could spend more time away from the structures during the course of the day. In fact, cormorant numbers on the structures varied greatly during early August, with 238 recorded on 2 August 2006, only three days before the low of 51 was recorded.

Breeding Event	2005		2006	
	date	#	date	#
Peak number of active nests	19 May	37	20 May	75
Young first observed in nests	22 May	3	11 April	1
Peak number nests observed to have young	9 June	23	10 June	39
Trampolining young first observed*	12 July	?	5 July	2
Last date any nests intact	19 July	2	29 August	1
First young clearly fledged	21 July	5	18 July	3
Last feeding witnessed	9 Sept.**	3	15 Nov.***	1

\* Trampolining: jumping up and exercising wings; a prelude to fledgling.

\*\* The next latest feeding witnessed took place on 27 July 2005.

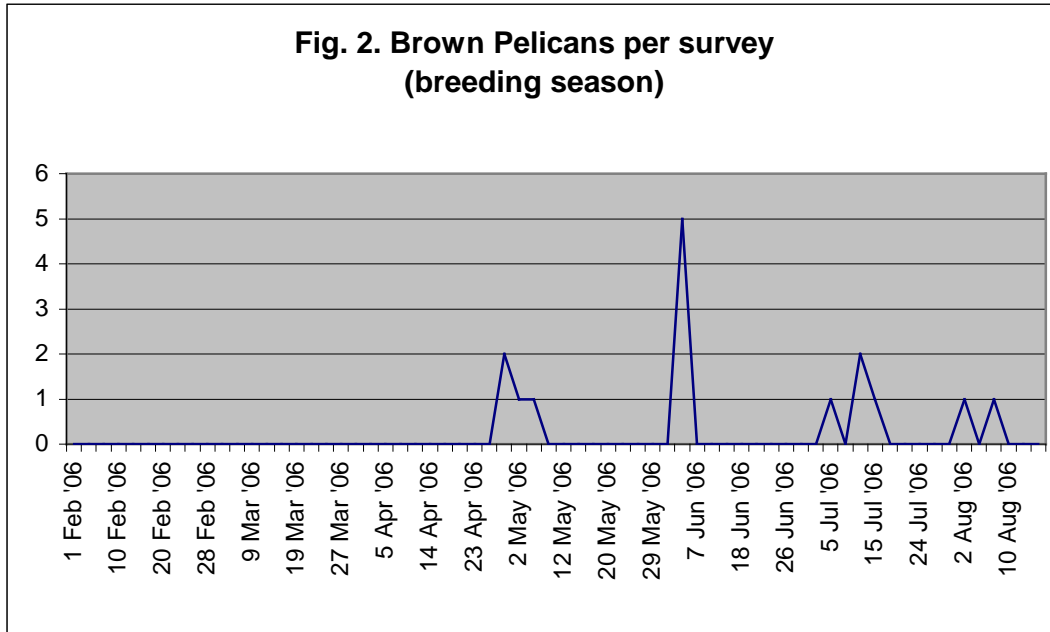
\*\*\* The next latest feedings witnessed took place on 18 October 2006 (2); prior to that, no feedings had been witnessed since 29 August.



Throughout the breeding season, the distance between the observation point and the structures, and the similarity in appearance between adults and large young, made it impossible to obtain reliable figures for adults, immature birds (birds not yet of breeding age but born in a previous year), and larger young of the year. While the 78 nests observed during the season is an indication of how many breeding pairs were present, non-breeding birds may have visited the pier during the breeding season.

**BROWN PELICAN**

Brown Pelicans were never present in high numbers on Bird Island during the cormorant breeding season; in fact, this species was completely absent from the structures from February through April (see fig. 2). The high count for this species was 5 on 4 June. While Brown Pelicans were not present in great numbers on the old Bird Island during the cormorant breeding season in 2005, they were a consistent presence, and numbers frequently reached double figures, even rising above 30 on two occasions during the breeding season.



**OTHER SPECIES**

Numbers of all species regularly using the old Bird Island during the cormorant breeding season in 2005 were down during the breeding season of 2006 (see tab. 3). Besides Brandt’s Cormorant and the Brown Pelican, the only species with a regular presence on the structures during the 2006 breeding season was the Western Gull, which was recorded on 45 of 66 surveys. The next most often recorded species was Heermann’s Gull, which was recorded only nine times. The Rock Pigeon (recorded five times in 2006) and the European Starling (once), two species that used the structures regularly during 2005, were nearly absent in the breeding season in 2006. As many as 224 European Starlings were recorded coming in to roost in the evening in late summer 2005, but the only starling to land on the structures in the 2006 breeding season was recorded on 25 February. While Rock Pigeons never used the old Bird Island in large numbers, they were regular visitors in 2005, being recorded on 30 of 33 breeding season surveys. A complete list of species using Bird Island (old and new) during the breeding seasons in 2005 and 2006 can be seen in table 4.

	<i>Non-Breeding Season</i>			<i>Breeding Season</i>		
	2005	2006	% decrease	2005	2006	% decrease
Heermann's Gull	2.60	2.21	15.0	2.20	0.23	89.5
Western Gull	2.50	0.79	68.4	1.93	1.09	43.5
Rock Pigeon	0.80	0.42	47.5	1.30	0.14	89.2
European Starling	75.6	2.83	96.2	34.77	0.02	99.9

	2005	2006
Brown Pelican ( <i>Pelecanus occidentalis</i> )	x	x
Brandt's Cormorant ( <i>Phalacrocorax penicillatus</i> )	x	x
Double-crested Cormorant ( <i>Phalacrocorax auritus</i> )		x
Pelagic Cormorant ( <i>Phalacrocorax pelagicus</i> )	x	
Snowy Egret ( <i>Egretta thula</i> )	x	
Little Blue Heron ( <i>Egretta caerulea</i> )	x	
Heermann's Gull ( <i>Larus heermanni</i> )	x	x
California Gull ( <i>Larus californicus</i> )	x	x
Western Gull ( <i>Larus occidentalis</i> )	x	x
Rock Pigeon ( <i>Columba livia</i> )	x	x
Cliff Swallow ( <i>Petrochelidon pyrrhonota</i> )	x	
European Starling ( <i>Sturnus vulgaris</i> )	x	x
blackbird sp. (family Icteridae)	x	

## RESULTS: NON-BREEDING SEASON

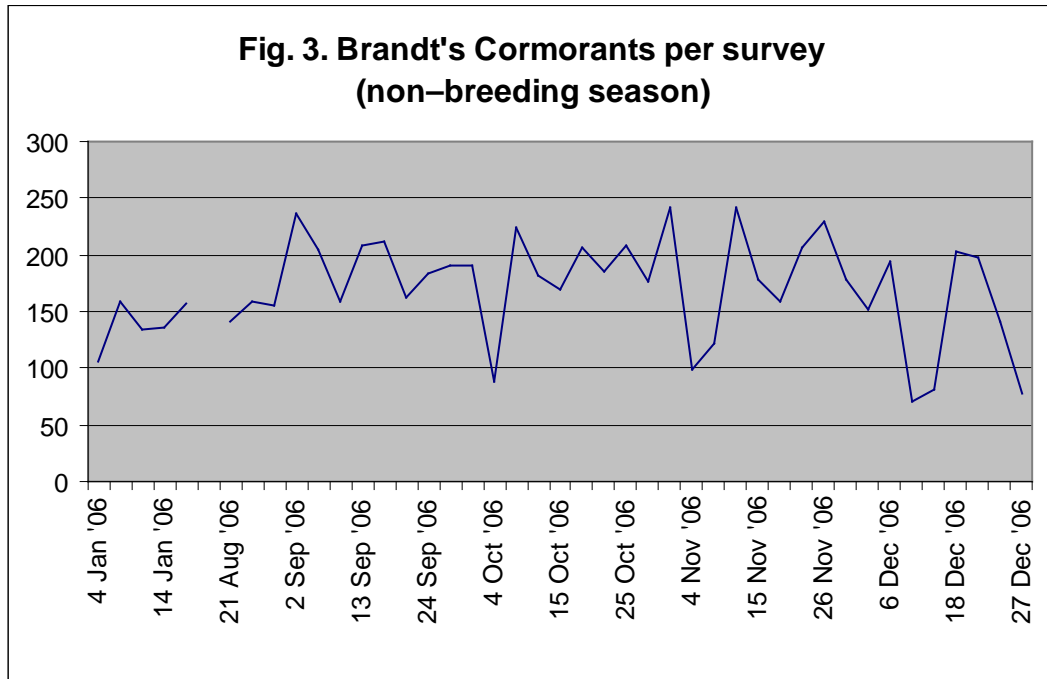
### BRANDT'S CORMORANT

As in the breeding season, numbers of Brandt's Cormorants using Bird Island were high in the 2006 non-breeding season (see fig. 3). The average number of this species recorded using Bird Island when the non-breeding season protocol was in place was 158.0, which is comparable to the figure for the breeding season (175.3). The average for the five surveys in January (138.0) was lower than the average for the 37 surveys beginning on 21 August (173.4), which may be related to the fact that in January 2006 cormorant use had not fully rebounded since these birds had been displaced by the demolition of the old Bird Island in the fall of 2005. The overall average for Brandt's Cormorants during the non-breeding season was down slightly in 2006, compared to numbers on the old Bird Island in 2005 (171.5), before construction (see tab. 5).

The Bird Island annual report for 2005 noted the appearance of small numbers of Double-crested Cormorants at the new Bird Island in the last survey of that year. One or more of this species remained on the structures on every survey through 18 January 2006, but only one individual was recorded after February. The occurrence of this species (common onshore but far less abundant offshore and on the Channel Islands compared with the



Brandt's Cormorant) in December 2005–February 2006 may have been due to the low numbers of Brandt's Cormorants following demolition of the old Bird Island.



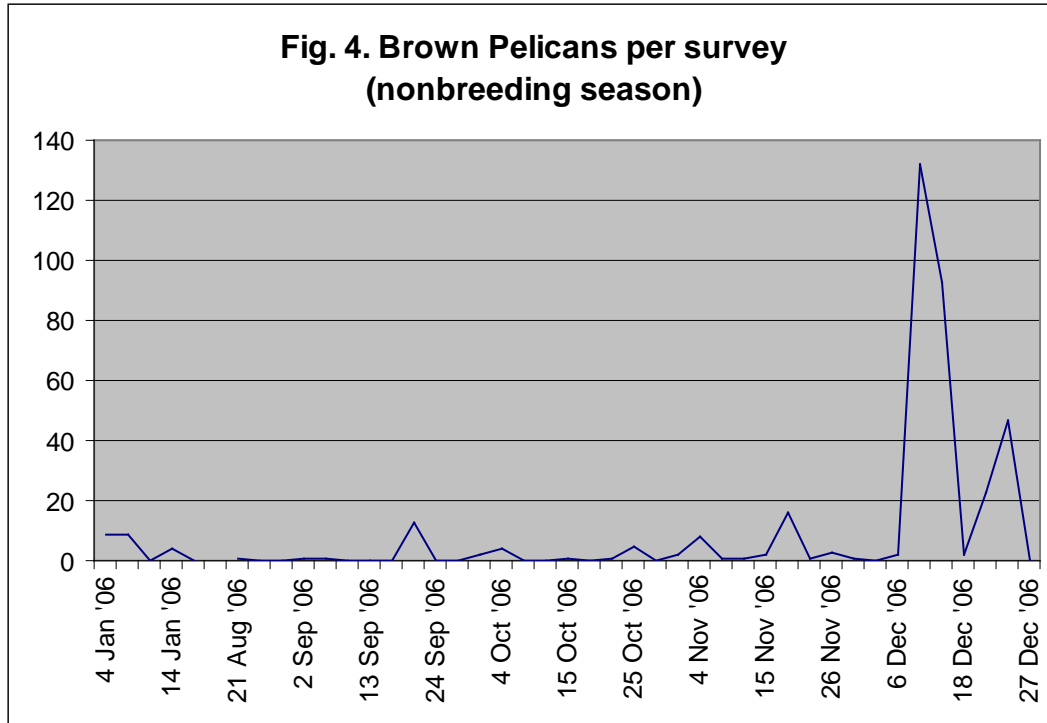
	2005		2006	
	breeding surveys (29)	non-breeding surveys (10)	breeding surveys (66)	non-breeding surveys (45)
Brandt's Cormorant	160.9	171.5	175.3	158.0
Brown Pelican	10.7	4.8	0.2	8.6

**BROWN PELICAN**

The Brown Pelican's use of the structures averaged much greater after the non-breeding season protocol was reinstated on 21 August 2006 (9.2 per survey, and 8.6 overall for non-breeding season surveys; see tab. 5, fig. 4). However, the higher average was mostly due to a large influx of Brown Pelicans in December. Of the 385 Brown Pelicans recorded during the non-breeding season, 225 (58.4%) were recorded on the two surveys conducted on 11 and 14 December. An additional 72 were recorded over the next three surveys (18–25 December), meaning that 77.1% were recorded over a five-survey period, out of the 42 non-breeding season surveys conducted in 2006. In January 2006, before the institution of the breeding season protocol in February, the average number of Brown Pelicans present on the structures was only 4.4.

As in 2006, Brown Pelican use of the structures in 2005 experienced a surge in December, when 9.2 were present per survey, compared with 4.9 in the month before the

old Bird Island was demolished. While the figures for December were lower in 2005, fewer Brown Pelicans were recorded in mid-August to mid-September 2006 compared with 2005, the brief period during which the non-breeding season protocol was followed before demolition of the old structure.



#### OTHER SPECIES

Among species other than the Brown Pelican and Brandt's Cormorant, the Heermann's Gull (37 times) and the Western Gull (28 times) were the most often recorded during the non-breeding season. Rock Pigeons (five times) were recorded about as often as during the breeding season, but European Starlings (nine times) were recorded more often, either very early in the morning or late in the day, as they were leaving or returning to their roost on the underside of the structures. Still, starlings were present in far smaller numbers compared with 2005, with a high of 56 on 26 November, as opposed to a high of 224 in 2005, on 16 September.

The numbers for all four of these species were down in the 2006 non-breeding season, compared with 2005 before demolition of the old structures (see tab. 3). Several other species landed on the structures at least once. See table 6 for a complete list of these species for 2005 (before construction) and 2006.

## DISCUSSION

Comparison of data for the old Bird Island in 2005 and the new Bird Island in 2006 suggest that in some ways the new structures have provided new benefits to the birds that use them. Approximately twice as many Brandt's Cormorants bred on the new structures as on the old one. The large, flat, open areas on isolated structures offshore seem well suited to nesting by this species. However, likely because of the irregularity of the old structure in its most recent form, during the breeding season it appears to have provided better opportunity for use by species other than the Brandt's Cormorant, including the endangered California Brown Pelican. On the old structure, there were enough areas poorly suited to cormorant breeding that other species could find places to rest. The large metal frame on the top of the northern half the pier remnant, for example, provided a good roosting place for pelicans, while few cormorants nested in this area. While the new structures appear to provide excellent habitat for breeding cormorants, other species have relatively little space to roost when the structures are crowded with nesting cormorants. At other times of year, this seems to be less of a problem.

While the California Brown Pelican, as a state and federally listed taxon, is the most significant species competing with Brandt's Cormorants for use of the structures, the Western and Heermann's Gulls also have used Bird Island consistently. Fewer Western Gulls were seen on the new Bird Island throughout the year, while Heermann's Gulls almost disappeared from the area during the breeding season. However, in what may be regarded as a positive effect of the Bird Island project, two common exotic species, the Rock Pigeon and the European Starling, have not found the new structures as welcoming as the old one.

Table. 6. All Species Recorded on the Structures during the Non-breeding Season		
	2005 Precon- struction	2006
Brown Pelican ( <i>Pelecanus occidentalis</i> )	x	x
Brandt's Cormorant ( <i>Phalacrocorax penicillatus</i> )	x	x
Double-crested Cormorant ( <i>Phalacrocorax auritus</i> )		x
Pelagic Cormorant ( <i>Phalacrocorax pelagicus</i> )		x
Great Egret ( <i>Ardea alba</i> )		x
Snowy Egret ( <i>Egretta thula</i> )	x	
Heermann's Gull ( <i>Larus heermanni</i> )	x	x
California Gull ( <i>Larus californicus</i> )		x
Western Gull ( <i>Larus occidentalis</i> )	x	x
Rock Pigeon ( <i>Columba livia</i> )	x	x
phoebe sp. ( <i>Sayornis</i> sp.)		x
European Starling ( <i>Sturnus vulgaris</i> )	x	x
blackbird sp. (family Icteridae)	x	

## CONCLUSION

The monitoring of the Bird Island structures has shown some clear patterns in bird use so far. But with only one year of postconstruction data gathered to date, firm conclusions cannot be drawn. The puzzling patterns of use by the California Brown Pelican, particularly as shown by the substantial spike in use in late 2006, after this species had been virtually absent for most of the year, is the best evidence that we still have much to learn about how birds will use these structures in the long run.

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## APPENDIX: PROTOCOL FOR MONITORING BIRD ISLAND

The general question to be answered by this project is: Which species roost and nest on the Ellwood pier remnant (or on the structures that will be replacing it), and how does each species' use of the structures (in terms of abundance and breeding activity) vary seasonally, daily, and in different weather conditions?

One species, the Brandt's Cormorant, has been known to nest on the pier remnant. The protocol should give special attention to breeding activity of this species. Separate protocols will be developed to be used during the nonbreeding and breeding seasons of the Brandt's Cormorant.

*Nonbreeding Season Protocol*

The nonbreeding season will begin when juvenile Brandt's Cormorants are no longer under the care of their parents. In years when cormorants are recorded nesting on the structures, four visits must pass during which no young are seen being fed by adults before the breeding season protocol can be terminated for that year and the nonbreeding season protocol can be implemented. These criteria may be adjusted if other species are found to breed on the structures.

## NUMBER AND DURATION OF VISITS

Two visits per week (a week being Sunday through Saturday), normally with no more than three and no fewer than two days in between, will be made to the site between the end of one breeding season and the beginning of the next. For example, if the first survey of the week is conducted on Monday, the next survey should be conducted on Thursday or Friday.

Each visit will be one hour in duration.

## TIMING OF VISITS

Each visit will be made during one of four periods during the course of the day, between sunrise and sunset: *early morning* (Period I), *late morning/early afternoon* (Period II), *early/mid-afternoon* (Period III), and *late afternoon/early evening* (Period IV). During the first week of the season, the first visit will occur during Period I and the second visit will occur during Period II. During the second week, the first visit will occur during Period III and the second visit will occur during Period IV. Then the cycle will be repeated.

The timing of these windows will vary with seasonal changes in the timing of sunrise and sunset, as follows:

- Period I will begin when there is enough light to see the structures and end at the midway point between sunrise and 12:00 standard time or at the midway point between sunrise and 13:00 daylight time.
- Period II will begin at the end of Period I (see above) and end at 12:00 standard time or 13:00 daylight time.
- Period III will begin at 12:00 standard time or 13:00 daylight time and end at the halfway point between the beginning of the period and sunset.
- Period IV will begin when Period III ends and end when it is too dark to see the structures adequately.

#### OBSERVATION POINT

The observation point will be located at a designated spot on the road running along the east side of the hill that is immediately west of the lagoon at the mouth of Bell Creek.

#### FORMS AND DATA RECORDING

During each visit, the observer will record information on the species resting on the structures and the surrounding waters. The hour will be divided into 6 ten-minute periods, during which the observer will record on the usage form (see appendix A) the four-letter American Ornithologists' Union code for each species and the number of that species resting anywhere on the structures during each period. When possible, numbers of adults vs. immature birds will be noted. (Due to the distance of the structures offshore, the poor light at some times of day, and the difficulty of distinguishing between adults and subadults of some species, including the Brandt's Cormorant, this information need not be recorded for all species).

In addition to recording species and numbers on the structures, the observer will record the same information for species in the water within approximately 300 meters of the structures (keeping in mind that the old structure was approximately 270 meters offshore). For this purpose, the surrounding ocean waters will be divided into four quadrants: East, South, West, and North (see appendix B).

The protocol for the nonbreeding season will be terminated for the season when cormorants begin building nests, *but not earlier than 1 February*. The breeding season protocol will then be implemented.

#### *Breeding Season Protocol*

#### NUMBER AND DURATION OF VISITS

One visit every three days will be made during the season when Brandt's Cormorants are breeding.

Each visit will be one hour in duration.

## TIMING OF VISITS

Visits will be made during four different periods over the course of the day. These periods are outlined in the Nonbreeding Season Protocol, under “Timing of Visits.” Observers will alternate between visits during Period IV and visits made during each of the other three periods in turn. Therefore, the initial, third, and fifth visits will occur during Period IV, the second visit will occur during Period I, the fourth visit will occur during Period II, and the sixth visit will occur during Period III. The sequence will then be repeated over the next six visits (see table 1).<sup>3</sup>

Table 1: Sequence of breeding season visits

<i>Visit#</i>	<i>Period</i>
1	IV
2	I
3	IV
4	II
5	IV
6	III
7	begin repeat of sequence

## OBSERVATION POINT

The observation point will be located at a designated spot on the road running along the east side of the hill that is immediately west of the lagoon at the mouth of Bell Creek, the same location used during the nonbreeding season.

## FORMS AND DATA RECORDING

During each visit, the observer will record information on the species resting on the structures and the surrounding waters, as will be done under the nonbreeding season protocol. However, this information will be recorded only three times during the course of the hour. Thus each hour-long visit will be divided into three 20-minute periods. Species and numbers on the structures and in the surrounding waters will be recorded at the beginning of each 20-minute period. The remaining time will be used to record information relevant to the breeding of Brandt’s Cormorants, as outlined in the following two paragraphs.

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<sup>3</sup> In this protocol, the timing of visits during the nonbreeding season was determined due to considerations relating to the quality of light at different times of day and the difficulty of distinguishing between adult Brandt’s Cormorants and large nestlings and fledglings and of recording other information relevant to breeding. Because monitoring the breeding activity of this species is a major task being conducted under the breeding season protocol, it is essential to have good light to discern the presence of small nestlings, to distinguish between adults and large young, and to gather other breeding information. The best conditions for viewing the structures from the observation point occur at or just before sunset under clear conditions.

When cormorants begin building nests, the location of the nests will be noted on the "Breeding Form" (see appendix C), with a circle representing a single nest. Observers will use a series of one- and two-character codes (see appendix C) to note various indications of breeding and breeding behaviors, including empty nest, adult near/standing on nest, adult incubating/sitting, adult feeding young, adults switching at nest, (# of) young in nest, nest occupied – unknown age, courtship, and nest building.

During the height of the nesting season, priority should be given to recording the location of each nest and the basic situation at that nest (e.g., incubation, young in nest, nest building). The location of each visible nest and some indication of the stage of nesting (lighting and visual obstructions allowing) should be recorded during every visit in the nesting season.

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