

BREEDING BIOLOGY OF THE DOLPHIN GULL AT PUNTA TOMBO, ARGENTINA¹

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Abstract. Dolphin Gulls (*Larus* [*Leucophaeus*] *scoresbii*) at Punta Tombo, Argentina, aggregated in small colonies of 16–24 pairs to breed. Colony location varied among years. Nesting density was 1.02 to 1.6 pairs/m². Mean clutch size was 1.9 and 2.0 in 1987 and 1989, respectively, and egg volume was similar among years. Incubation took between 24 and 27 days, with chicks hatching from mid to late December. When chicks were two to five days old they followed their parents away from the nesting area and, as they grew older, they began crècheing in one or more groups. Egg mortality in 1987 and 1989 was 41% and 46%, respectively, mainly through disappearance and presumed predation. Breeding success from 1984 to 1990 was variable, ranging from complete failure to 0.86 chicks surviving to three weeks of age per active nest. After nest losses in 1986 and 1990 birds renested. During the breeding season Dolphin Gulls were specialized scavengers, mainly eating southern sea lion (*Otaria flavescens*) excrement and scraps of food dropped when Magellanic Penguins (*Spheniscus magellanicus*) and Imperial Cormorants (*Phalacrocorax atriceps*) fed their chicks. Dolphin Gulls also fed in the intertidal zone, stole cormorant and Kelp Gull (*Larus dominicanus*) eggs, and scavenged remains of penguin eggs already preyed upon by other species. They nested with other species and left the breeding area in February after the chicks fledged. They did not return to the breeding area in any numbers until September. The breeding biology of the Dolphin Gull appears to be largely influenced by their specialized scavenging habits and vulnerability to predation.

Key words: *Dolphin Gulls*; *Larus* [*Leucophaeus*] *scoresbii*; *breeding biology*; *reproductive success*.

INTRODUCTION

The Dolphin Gull (*Larus* [*Leucophaeus*] *scoresbii*) is restricted to the southern coasts of South America. Its breeding distribution on the Atlantic coast ranges from Tierra del Fuego north to Punta Tombo (44°02'S, 65°11'W), Argentina, including the Malvinas (Falkland) Islands, and north to Chiloe Island (42°), Chile, on the Pacific coast (Goodall et al. 1951, Harrison 1983). Dolphin Gulls have been variously assigned to the genera *Gabianus*, *Larus*, and *Leucophaeus*. Sibley and Monroe (1990) placed it in *Larus*, but Burger and Gochfeld (in press) retain it in *Leucophaeus* because of its unique plumages and bill shape as well as behavior. Dolphin Gulls have

unique coloration for gulls; gray with a large bright red-orange beak and a dark hood in the non-breeding plumage (Woods 1975, Devillers 1977a). In addition, juvenile plumage is uniform and chick plumage is grey with black spots (Devillers 1977a). Dolphin Gulls are fairly small gulls and exhibit several behavioral traits not found in most species of gulls. They are specialized scavengers, nest in close proximity to each other, adults and chicks leave the nest shortly after hatching, and chicks form crèches (Woods 1975, Devillers 1977a).

Few studies have focused on this unusual gull although some aspects of their general behavior (Moynihan 1962, Devillers 1977a) and plumage (Dwight 1925, Woods 1975, Devillers 1977a) have been described. Its diet and scavenging habits have been briefly discussed by Murphy (1936), Humphrey et al. (1970), Kury and Gochfeld (1975), Woods (1975) and Devillers (1977a). However, very little is known about the Dolphin Gull's breeding biology and behavior. This paper describes the breeding biology of the Dolphin Gull at Punta Tombo, Argentina.

¹ Received 20 July 1995. Accepted 14 December 1995.

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METHODS

We studied the breeding biology of Dolphin Gulls at Punta Tombo between 1985 and 1990. In addition, in 1983 and 1984 we made some opportunistic observations on breeding. During 1986 and 1987 we captured incubating adults at their nests using the Weaver and Kadlec (1970) technique. We banded birds with U.S. Fish and Wildlife Service metal bands on the right leg and with large numbered yellow laminated plastic bands on the left leg. The plastic bands were readable from up to 50 meters with a 20 \times spotting scope. At banding, we weighed adults using a 1,000 g Pesola scale, and used calipers to measure head length, culmen, bill depth and tarsus to the nearest 0.1 mm. We measured wing chord to the nearest mm.

During 1985, 1986, and 1990, we visited the colony irregularly to measure eggs and determine breeding success. During the 1987 and 1989 breeding seasons, we visited the colony every two to five days, from the beginning of November to mid January, to record settlement patterns, timing of nest initiation, egg laying dates, clutch size, hatching dates and breeding success. We weighed eggs and chicks with 100 g and 500 g Pesola scales to the nearest 1 and 5 g respectively, and measured them with calipers to the nearest 0.1 mm. We calculated egg volumes (V) as: $V = \text{length} \times \text{width}^2 \times 0.52$ (Preston 1974). We measured the distance between nests (center to center) to the nearest cm during 1987. We marked chicks at hatching with a fiber-tape band. We calculated breeding success as the number of chicks surviving to three weeks of age per nest with eggs.

We watched the colony from a high point 20 m from the nests. From this distance birds could be easily observed without apparent disturbance. We made continuous observations during daylight hours (0600–2000) on 30 December 1987 and 6, 9, 13, and 17 January 1988. We recorded incubation shifts, feeding frequency, feeding behavior, and parental behavior.

During 1986 and 1987, we surveyed the Punta Tombo area every four days to determine the foraging areas of the Dolphin Gulls and to observe their feeding activities. We used opportunistic sightings to determine winter dispersal.

Several other seabird species breed at Punta Tombo: Magellanic Penguins (*Spheniscus magellanicus*), Imperial Cormorants (*Phalacrocorax atriceps*) ("albiventer" color morph, Rasmussen 1991), Rock Shags (*P. magellanicus*).

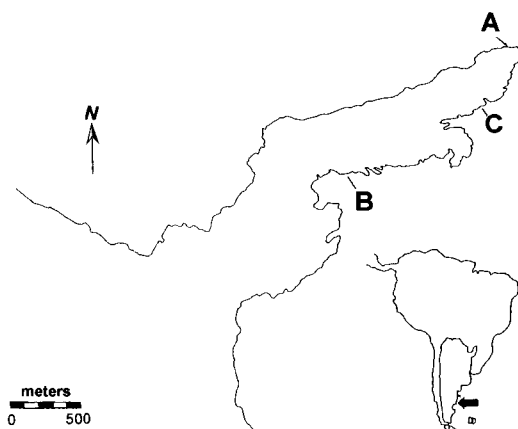


FIGURE 1. Breeding sites of Dolphin Gulls (A,B,C) at Punta Tombo, Chubut. A: 1983 to 1987, B: 1988 to 1990, C: re-nesting 1986.

Kelp Gulls (*Larus dominicanus*) and skuas (*Catharacta* sp.) (Fig. 1). A colony of 250–500 southern sea lions (*Otaria flavescens*) is located on a small islet about 500 m north of Punta Tombo. Magellanic Penguins and Imperial Cormorants lay eggs in mid-October, hatch chicks in mid-November and fledge chicks beginning in mid-January.

Values listed in the text are means \pm SD (n).

RESULTS

ADULT SIZE AND GENERAL BEHAVIOR

Dolphin Gulls are fairly small gulls, with an average adult weight of 524 g (SD = 51, $n = 42$). They are sexually dimorphic (Table 1), with the presumed male being significantly larger than its mate in weight, bill, and tarsus. Wing chord did not differ significantly between larger and smaller members of a pair. Like other gulls, sexes appear similar in behavior with both taking part in incubation, chick feeding, and the defense of the nest and offspring.

COLONY SIZE, SETTLEMENT AND NESTING

At Punta Tombo, the number of breeding pairs of Dolphin Gulls varied from a high of 24 in 1989 to a low of 16 in 1990. The location of the Punta Tombo Dolphin Gull breeding colony changed among seasons (Sites A to C, Fig. 1). Two of these sites have been used in the past, site B in the 1970s (Conway, pers. comm.) and site C in 1981 (Passera, pers. comm.). All nesting

TABLE 1. Body measurements (mean \pm SD) of Dolphin Gull breeding pairs ($n = 16$) at Punta Tombo, Argentina.

| Variable | Larger of pair | Smaller of pair | Paired t-test |
|------------------|-----------------|------------------|------------------|
| Weight (g) | 544 \pm 32.7 | 489 \pm 30.0 | $t = 5.27^{***}$ |
| Culmen (mm) | 40.1 \pm 1.4 | 37.9 \pm 2.5 | $t = 3.63^*$ |
| Bill depth (mm) | 15.6 \pm 0.7 | 14.5 \pm 0.8 | $t = 4.11^{**}$ |
| Head length (mm) | 91.1 \pm 1.9 | 86.9 \pm 2.2 | $t = 5.92^{***}$ |
| Wing chord (mm) | 339.4 \pm 8.9 | 339.4 \pm 10.5 | $t = 1.36$ NS |
| Tarsus (mm) | 67.1 \pm 1.9 | 63.3 \pm 2.4 | $t = 4.57^{***}$ |

* $P < 0.002$.** $P < 0.001$.*** $P < 0.0001$.

sites were close to or among other colonial seabirds, Kelp Gulls, Imperial Cormorants or Magellanic Penguins, and all were on bare irregular volcanic rock, a few meters from the edge of the water.

During early September, only a few birds (one to seven) were regularly present at Punta Tombo. By early October, more Dolphin Gulls arrived and started to attend the Magellanic Penguin and Kelp Gull colonies. Even though some Dolphin Gulls were at their colony site by late September (generally one to five birds), most did not regularly attend their nesting area until the first or second week of November. Dolphin Gulls began courtship feeding in November. The few food pellets from courtship feeding that we obtained contained only partly digested fish.

The first nests appeared in late November, in both 1987 and 1989. Nests were made mainly with algae, but grasses, feathers, bones and sticks were also used. Mean external diameter of nests during 1987 was 28 cm \pm 2.3, (range = 25–32, $n = 20$) and mean internest distance measured from center to center of the nests was 41.3 \pm 5.3 cm ($n = 21$). During all years, nests were as close together as substrate irregularities allowed and were often touching one another. Nesting density in 1987 was 1.0 pairs/m², although the density of the main group of 18 nests was 1.6 pairs/m².

As a result of this close nesting proximity Dolphin Gulls were commonly engaged in physical contact, such as jostling and grabbing one another's bills.

EGG LAYING AND INCUBATION

Time between the commencement of nest building and the laying of the first egg in the colony was only two to three days. Egg laying in most years started during the last days of November. Although nests were not checked regularly during egg laying in 1985, the first hatching dates suggest the eggs were laid a week earlier in 1985 than in the other years. Egg laying continued for nearly a month, with the last eggs laid on 23 December in 1987 and 30 December in 1989. About 60% of the nests had complete clutches by 9 December in 1987, and 50% had complete clutches by 7 December in 1989.

Mean clutch size was 1.9 \pm 0.6 ($n = 21$) in 1987 and 2.0 \pm 0.6 ($n = 23$) in 1989. In 1987 and 1989, respectively, 9.5% and 20.8% of the clutches contained three eggs. Eggs averaged 61 \times 42 mm (Table 2). Calculated egg volume was significantly correlated with egg weight (Pearson $r = 0.73$, $P < 0.001$, $n = 136$). Egg volume was similar among years (ANOVA $F = 0.21$; $df = 3$, 132; $P = 0.89$) and between first and second eggs within the same clutch (Wilcoxon $Z = 1.68$, $P =$

TABLE 2. Dolphin Gull egg length, width, volume and weight (mean \pm SD) at Punta Tombo, Argentina.

| Year | n | Length (mm) | Width (mm) | Volume (cm ³) | Weight (g) |
|-------|-----|----------------|----------------|---------------------------|----------------|
| 1983 | 39 | 60.8 \pm 2.2 | 42.2 \pm 1.0 | 57.0 \pm 4.1 | 56 \pm 5 |
| 1985 | 33 | 60.9 \pm 2.5 | 42.2 \pm 1.1 | 56.5 \pm 4.1 | 56 \pm 6 |
| 1986 | 25 | 60.6 \pm 2.3 | 42.2 \pm 1.5 | 56.3 \pm 4.9 | 52 \pm 6 |
| 1987 | 39 | 61.0 \pm 2.0 | 42.1 \pm 0.9 | 56.3 \pm 2.9 | 57 \pm 3 |
| Total | 136 | 60.9 \pm 2.2 | 42.3 \pm 1.1 | 56.6 \pm 3.9 | 55.4 \pm 5.2 |

0.09, $n = 10$). In seven clutches that had three eggs, one egg, presumably the third one laid, was significantly smaller than the other two eggs (Kruskal-Wallis $\chi^2 = 9.51$, $P = 0.009$, $n = 21$). The two larger eggs in each of these clutches were similar in volume (Mann-Whitney $U = 17$, $P = 0.34$).

The length of the incubation period in 1987 was estimated to be between 24 and 27 days. Like other gull species, both sexes incubated the eggs. In four nests where pairs were followed throughout the daylight hours (14 hours), the birds traded incubation duties on average 6.0 ± 0.8 times, (range = 5–7).

CHICK STAGE

Chicks were first seen on 16, 22, and 29 December in the 1985, 1986, and 1987 breeding seasons, respectively. In 1987, chicks weighed at hatching an average of 41 g (Table 3).

The average number of brooding exchanges during the daylight hours for pairs with chicks under 5 days old was 10.33 ± 3.08 ($n = 6$), and mean number of chick feeding bouts per day was 7.5 ± 2.43 ($n = 6$). Chicks grabbed regurgitated food from the parent's beak, and food not taken was again swallowed by the parent. During each meal, a parent regurgitated one to seven times ($\bar{x} = 2.27 \pm 1.46$ ($n = 44$)). A meal lasted 9 to 80 minutes ($\bar{x} = 45.5 \pm 21.9$, $n = 18$). Most food appeared to be Southern Sea Lion dung or fish probably scavenged from Magellanic Penguins.

When chicks were two to five days old they followed their parents a few meters away from the nesting area down toward the water where they remained with their parents but separate from other broods. As chicks grew older, they crèched in one or more groups. Chicks grouped tightly together and moved as a unit, often surrounded by adults. They remained in the vicinity of the colony, where they were guarded and fed by their own parents until fledging.

ANTIPREDATOR BEHAVIOR

Unlike most other gulls, incubating Dolphin Gulls stayed at their nest when approached, and often did not leave their nest until we were less than a meter away. In some instances, only the birds closest to us moved, while birds a meter or two away remained incubating. Birds that left generally flew up, vocalizing loudly, defecating, dive bombing, and even hitting us. Individuals that flushed often landed a few meters away, called,

TABLE 3. Dolphin Gull chick weight and size at hatching during 1987 ($n = 14$, except weight $n = 13$).

| Variable | Mean \pm SD |
|-----------------|----------------|
| Weight (g) | 41 \pm 3.0 |
| Culmen (mm) | 15.1 \pm 0.4 |
| Bill depth (mm) | 7.0 \pm 0.3 |
| Wing (mm) | 33.4 \pm 1.6 |
| Tarsus (mm) | 29.9 \pm 2.4 |

approached and performed aggressive head-tossing.

On occasion, gulls flew directly towards us when we were still approximately 50 m away from the colony, swooping and vocalizing before returning to their nest. Such intimidation behavior, performed individually or in groups, also occurred away from the colony in areas where birds were feeding or resting.

Adults followed their chicks closely as they moved. When the crèche was approached by a potential predator such as Kelp Gulls or skuas, adults actively defended their chicks. Defense behavior consisted of head-tossing, calling from the ground, mock charges, physical attacks, and/or flights towards the intruder, defecating and circling while calling before returning to the group of moving chicks. The frequency of calling and aggressive displays increased when the group was disturbed, and chicks gathered more closely when approached by an intruder. Chicks older than two to three weeks sometimes fled briefly into the water, followed by adults.

BREEDING SUCCESS

Egg mortality in 1987 and 1989 was similar and more than 40% of the eggs did not hatch (Table 4). Since there were no large storms and no egg remains were found within or near the colony, eggs that disappeared were probably taken away by predators, such as Kelp Gulls and skuas, which were regularly seen in the vicinity of the colony. Similarly, no chick carcasses were found.

Breeding success was highly variable among seasons, ranging from complete failure during 1984, 1986, 1988, and 1990 to 0.86 chicks surviving to three weeks of age per active nest in 1985 (Table 5). In both 1984 and 1986, complete failure was caused by storms that washed away all nests and their contents during late December, before hatching in the former year and during hatching in the latter. Renesting occurred after

TABLE 4. The percent of Dolphin Gull eggs added, broken, or lost to predators at Punta Tombo, Argentina. Sample size in parentheses.

| Year | Eggs laid | % Added (<i>n</i>) | % Broken (<i>n</i>) | % Predation (<i>n</i>) | Total (<i>n</i>) lost |
|------|-----------|----------------------|-----------------------|--------------------------|-------------------------|
| 1987 | 39 | 10.25 (4) | 2.56 (1) | 28.20 (11) | 11.03 (16) |
| 1989 | 47 | 8.51 (4) | 4.26 (2) | 34.04 (16) | 46.81 (22) |

nest losses from storms in 1986 and 1990, although replacement clutches were also lost.

ADULT SURVIVAL

Of the 37 birds banded at Punta Tombo during the 1986 breeding season, 33 (89%) were sighted in the following year. During 1989, 20 (54%) of the gulls originally banded in 1986 were resighted at the breeding colony, but this is undoubtedly an underestimate of survival because surveys of the banded population were not made through the whole breeding season. During 1994, at least seven birds banded in 1986 bred at the Punta Tombo colony (Boersma, pers. obs.), showing that some breeding adults survived more than eight years.

FEEDING ECOLOGY

During the breeding season, Dolphin Gulls mainly scavenged within the southern sea lion, Magellanic Penguin, and Imperial Cormorant colonies. Individual birds were seen repeatedly at the same place, suggesting individuals have an affinity for particular foraging locations.

Dolphin Gulls were never seen stealing eggs from penguin nests, although they fed on eggs stolen by other predators such as Kelp Gulls or skuas. When Dolphin Gulls tried to steal the egg or scavenge the remains ($n = 41$) from another predator, they got some egg contents one out of

four times. During interspecific feeding interactions, Dolphin Gulls were always displaced by skuas, Kelp Gulls, and Snowy Sheathbills (*Chionis alba*). Dolphin Gulls occasionally preyed upon cormorant and Kelp Gull eggs, and were particularly adept at taking advantage of a disturbance to gain access to eggs. Kury and Gochfeld (1975) and others report predation on cormorant eggs, whenever the incubating cormorants are disturbed by human intruders. The gulls anticipate this food source by associating with humans as they approach the cormorant colony.

Dolphin Gulls regularly fed on the scraps of food dropped while Magellanic Penguins and cormorants were feeding their chicks. Usually, Dolphin Gulls moved quickly around a penguin that was feeding chicks until it dropped the food, which commonly happened when the penguin interrupted feeding the chick to attack the gull. When food was dropped, the gull often waited until the penguin moved, allowing it to safely dart in and steal the dropped food.

From September to February, Dolphin Gulls also scavenged on southern sea lion excrement and fed in the intertidal zone. Dolphin Gulls were more likely to feed in the intertidal zone before Magellanic Penguin or Imperial Cormorant chicks hatched ($\chi^2 = 10.77$, $df = 1$, $P < 0.005$). Occasionally, they picked through kelp that washed ashore after storms.

POST BREEDING DISPERSAL

After they finished breeding in late February, most Dolphin Gulls left Punta Tombo, apparently moving north. By late March, only a few birds were seen near the colony. Sightings of banded individuals were only to the north of the breeding colony ($n = 11$). However, human habitation and our sighting efforts were mainly northward, so it is possible that some birds moved south. Dolphin Gulls were regularly seen at the southern sea lion and Imperial Cormorant colonies at Punta León (43°04'S, 64°29'W). At Punta León, of 21 adults seen on 17 September 1987,

TABLE 5. Breeding success of Dolphin Gulls breeding at Punta Tombo, Argentina.

| Year | Nests with eggs | Empty nests | Eggs laid | Chicks hatched | Chicks fledged | Mean chick per nest |
|------|-----------------|-------------|-----------|----------------|----------------|---------------------|
| 1984 | — | — | — | 0 | 0 | 0 |
| 1985 | 22 | 0 | — | — | 20 | 0.86 |
| 1986 | 15 | 6 | 26 | 8 (*) | 0 | 0 |
| 1987 | 21 | 0 | 39 | 23 | 14 | 0.66 |
| 1989 | 24 | 0 | 47 | 25 | 21 | 0.83 |
| 1990 | 16 | 1 | 28 | 3 | 0 | 0 |

(*) Storm washed away nests before all chicks hatched.

eight were banded Dolphin Gulls that bred at Punta Tombo in 1986. Dolphin Gulls from Punta Tombo were also seen at the southern sea lion colonies on Peninsula Valdés at Puerto Pirámides (42°35'S, 64°19'W) and Punta Delgada (42°43'S, 63°38'W), 200 km north of Punta Tombo during the nonbreeding season. A dead banded bird was recovered from the Rio Chubut (43°21'S, 65°03'W) in 1987, and a live banded gull was seen along the beach near the mouth of this river in 1989 (Passera, pers. comm.). Dolphin Gulls started returning to Punta Tombo in September and by October most of the birds were present.

DISCUSSION

Dolphin Gulls at Punta Tombo exhibit several behavioral traits that are atypical for most gull species. Their nests are packed close together, commonly have a two-egg clutch, adults and chicks leave the nesting territories when the latter are a few days old, chicks form well-defined crèches, birds remain at the nest when disturbed only mobbing when approached within a few meters, and are primarily specialized scavengers during the breeding season.

The dense nesting of more than one pair/m² observed at Punta Tombo is a common behavior throughout the Dolphin Gull's range (Philippi et al. 1954; Humphrey et al. 1970; Woods 1975; Devillers 1977a; Yorio, pers. obs.). Most other species of gulls, even small gulls, have much greater inter-nest distances. The dense nesting aggregation of Dolphin Gulls is most comparable to the density reported for the Black-billed Gull (*Larus bulleri*), Red-billed Gull (*Larus novae-hollandiae scopulinus*) (Beer 1966), and Olog's Gull (*Larus atlanticus*) (Devillers 1977b).

Small internest distance and thus, high density in this species may be important in predator defense. Predator defense should be more effective when nests are more clumped (Kruuk 1964, Wittenberger and Hunt 1985). Predation of Dolphin Gull eggs by Kelp Gulls was observed at Punta Tombo, and more than 25% of the eggs were lost each season to predation. High predation from skuas was reported in the Malvinas (Falkland) Islands (Vallentin 1924). Nesting habitat used by Dolphin Gulls at Punta Tombo, i.e., bare volcanic rock close to the water and to other colonial species, is not limited and thus, habitat limitations for the Dolphin Gull cannot explain the small internest distances as in other seabird spe-

cies (Buckley and Buckley 1977, Siegel-Causey and Kharitonov 1990).

For most gulls, clutch size is three eggs (Lack 1968, Reid 1987), with a few exceptions where clutch size is two eggs (Cullen 1957, Beer 1965, Lack 1968, Mills 1973). Dolphin Gulls at Punta Tombo lay a clutch of two eggs, with less than 20% of nests having three eggs. Three-egg clutches have been reported at other sites such as the Malvinas (Falkland) Islands (Vallentin 1924, Woods 1975) and Chile (Goodall et al. 1951).

In contrast to most gulls where broods begin to leave the vicinity of the home territory at several weeks of age or at fledging (Tinbergen 1953; Burger 1974, 1984), Dolphin Gull chicks at Punta Tombo abandon the colony area at two to five days of age. In most gulls, movement of young chicks is restricted to the vicinity of the nest site (Burger 1984) and chicks that trespass into other territories are pecked and may be killed (Hunt and Hunt 1976). Like Dolphin Gulls, adults and chicks of Black-billed and Olog's Gulls permanently leave their nesting territories when chicks are a few days old (Beer 1966, Devillers 1977b). Once Dolphin Gull chicks leave the nest, they aggregate and form crèches very close to the colony site. Chick crèching is also an uncommon gull feature, and has only been reported for the Slender-billed Gull *L. genei* (Isenmann 1976) and the Black-billed Gull (Beer 1966). Crèche formation may reduce predation (Evans 1980, Davis 1982). Dolphin Gull chicks group tightly together, move as a unit and are often surrounded by adults, which should reduce their vulnerability to skuas or Kelp Gulls.

Dolphin Gulls at Punta Tombo also differ from most other gulls in that they are onshore foragers, mainly feeding by scavenging during the breeding season on food dropped by other colonial seabirds and on sea lion excrement. Scavenging appears to be a common trait of the Dolphin Gull throughout its range (Reynolds 1935, Castellanos 1935, Woods 1975, Devillers 1977a, Parmelee and MacDonald 1975). This species always breeds in association with other colonial seabirds and marine mammals, mainly with cormorants, penguins, gulls and sea lions (Vallentin 1924; Woods 1975; Devillers 1977a; Yorio, pers. obs.). Their arrival at their breeding colony at Punta Tombo occurs after egg laying of other seabirds has begun and their departure occurs before chicks of other seabirds have fledged. Their timing of breeding at Punta Tombo coincides

with the peak breeding activity of both Magellanic Penguins and Imperial Cormorants. Dolphin Gulls started breeding earlier during 1985, which was also an early year for penguins (Boersma et al. 1990), further suggesting their dependency on penguins at Punta Tombo.

Most Magellanic Penguins at Punta Tombo feed their chicks early and late in the day, although some penguins arrive with food at other times (Boersma, unpubl.). Food from penguins is therefore not available uniformly throughout the day. Cormorant food scraps and sea lion excrement, in contrast, are available throughout the day. Because these food sources are relatively predictable in space and time. Dolphin Gulls may have stronger associations with sea lions and cormorants than with penguins.

Colony size at Punta Tombo was relatively small. Dolphin Gulls along the eastern coast of Patagonia commonly nest in small colonies of less than 25 pairs, although colonies range between 2 to 210 pairs (Yorio, unpubl.; Schiavini and Yorio, in press.). In the Malvinas (Falkland) Islands, 85% of the known colonies are less than 100 pairs (Croxall et al. 1984). At Punta Tombo, colony size throughout the last three decades has never been more than 29 to 31 pairs (Conway, pers. com.). Unlike most gulls and more similar to terns, the location of the colony at Punta Tombo changed among seasons.

Colonial breeding and colony size can be influenced both by predation and feeding ecology (Wittenberger and Hunt 1985). The observed colonial and foraging habits of the Dolphin Gulls is consistent with Götmark's (1982) hypothesis that colony size in gulls increases with foraging range and unpredictability of food sources. This positive correlation between coloniality and foraging range has also been found in other seabirds (Lack 1967, 1968, Erwin 1977, 1978).

Predation appears to be a strong selective force for the Dolphin Gull, as evidenced by several aspects of their breeding biology. Many of the behaviors Dolphin Gulls exhibit, such as changing nest location, high nesting densities, reduced mobbing response, early abandonment of the nest site and crèching, are also present in Crested Terns, *Sterna bergii* (Buckley and Buckley 1972, Veen 1977, Langham and Hulsman 1986, Yorio and Quintana, unpubl.). The unusual aspects of the breeding biology of the Dolphin Gull appear to be largely influenced by their dependency on scavenging and to some extent by predation.

ACKNOWLEDGMENTS

Research was funded by Wildlife Conservation Society, and made possible by a joint agreement between the Society and the Organismo Provincial de Turismo of Chubut. Gabriela Bidart, Dianne Decker, Gene Fowler, Liz Gray, Anne Handley, Arthur Kettle, Maria Elena Lizurume, Andrés Maldonado and Javier Lopez de Casenave, helped gather these data. We also thank William Conway for helpful comments on earlier drafts of this paper.

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