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# KLEPTOPARASITISM BY KELP GULLS ON ROYAL AND CAYENNE TERNS AT PUNTA LEON, ARGENTINA

FLAVIO QUINTANA AND PABLO YORIO
*Centro Nacional Patagónico and Wildlife Conservation Society*
*Blvd. Brown s/n, 9120*
*Puerto Madryn, Chubut, Argentina*

Abstract.—Several studies have shown that terms can be affected by kleptoparasitism from gulls. During 1992 and 1993 we studied kleptoparasitism at a mixed-species colony of Kelp Gulls (*Larus dominicanus*), Royal Terns (*Sterna maxima*), and Cayenne Terns (*S. eurygnatha*) at Punta León, Chubut, Argentina. Robbing behavior did not involve aerial chases. Kelp Gulls remained at the ternery periphery and stole food from adults flying low over the colony with food intended for chicks, from adult terms on the ground transferring food to their chicks, or from chicks. The percentage of food robbed by Kelp Gulls from both tern species was 8.8% of food brought to the colony ($n$ = 1131). Robbing efficiency was 58%. Kelp Gulls robbed significantly more food from Royal than Cayenne Terns (10.6 vs. 3.6%, respectively). The percentage of robbing attempts was also larger on Royal than Cayenne Terns (18.9 vs. 5.7%). Robbing efficiency, however, was similar for both tern species (56 and 63.2% for Royal and Cayenne Terns, respectively). Kleptoparasitism on Royal Terns within the colony was related to the age of their chicks, being higher on terns with chicks older than 20 days of age. The risk of a Royal Tern being robbed by Kelp Gulls was larger when it was feeding chicks at the colony than on the beach (14.9% vs. 4.5%), although differences observed were not significant.

**KLEPTOPARASITISMO POR *LARUS DOMINICANUS* EN *STERNA MAXIMA* Y *S. EURYGNATHA* EN PUNTA LEÓN, ARGENTINA**

Sinopsis.—Varios estudios han mostrado que miembros de la Familia Laridae pueden ser afectados por kleptoparasitismo de la misma familia. Durante el 1992 y 1993 estudiamos el kleptoparasitismo en una colonia mixta de *Larus dominicanus, Sterna maxima* y *S. eurygnatha* en Punta León, Chubut, Argentina. La conducta de robo no envolvió persecuciones aéreas. Los individuos de *Larus dominicanus* permanecieron en la periferia de la colonia y robó alimentos de los adultos que volaban bajo sobre la colonia con alimentos para sus crías, de adultos en el suelo transfriendo alimento a sus crías, o de las crías. El porciento de alimento robado por *Larus dominicanus* de las otras dos especies fue del 8.8% del alimento traído a la colonia ($n$ = 1131). La eficiencia de robo fue de 58%. Los individuos de *Larus dominicanus* robaron significativamente mas alimento de *Sterna maxima* que de *S. eurygnatha* (10.6% versus 3.6% respectivamente). El porcentaje de intentos de robo fué también mayor en *Sterna maxima* que en *S. eurygnatha* (18.9% versus 5.7% respectivamente). Sin embargo, la eficiencia de robo fué similar para las dos especies (56% para *Sterna maxima* y 63.2% para *S. eurygnatha*). El kleptoparasitismo en *Sterna maxima* dentro de la colonia se relacionó a la edad de las crías, siendo mayor en aves con crías de más de 20 días de edad. El riesgo de que un individuo de *Sterna maxima* sea robada por individuos de *Larus dominicanus* fué mayor cuando estaba alimentando crías en la colonia que en la playa (14% versus 4.5%), aunque las diferencias observadas no fueron significativas.

Kleptoparasitism, the robbing by one individual of the food already captured by another individual, is frequently observed in several seabird species (Furness 1987). Although some individual kleptoparasites may benefit from robbing behavior, for most hosts it is one of the potential costs of colonial breeding (Wittenberger and Hunt 1985). Interspecific kleptoparasitism during the breeding season may result in negative effects

on host species due to the reduction in food availability to chicks, time and energy spent avoiding parasitism (which increases the cost of prey acquisition), and loss of prey to kleptoparasites (Nettleship 1972, Hulsman 1976, Forssgren 1981, Furness 1987).

Among seabirds, terns are frequently kleptoparasitized (Ansingh et al. 1960, Hatch 1970, Dunn 1973, Langham 1974, Hulsman 1976, Fuchs 1977, Burger and Gochfeld 1991). Terns breed in dense colonies and return to feed their chicks in a predictable way with whole prey visible in their beaks. At Punta León, Chubut, Argentina, Kelp Gulls (*Larus dominicanus*), Royal Terns (*Sterna maxima*), and Cayenne Terns (*S. eurygnatha*) breed in close proximity. The number of Kelp Gulls in this mixed-species colony has increased during the last decade (Yorio et al. 1994). Because this gull species has been previously reported to kleptoparasitize other seabird and shorebird species (Brooke and Cooper 1979, Hockey 1980, Duffy 1983), we expected that kleptoparasitism by Kelp Gulls would be a common feeding strategy at Punta León. In this paper we present information on kleptoparasitic interactions among gulls and terns at Punta León. We analyze the existence of kleptoparasitism, describe the behavior of parasites and hosts, and quantify food robbing during the tern chick-rearing period.

## METHODS

Punta León (43°04'S, 64°29'W) is located 10 km south of the mouth of Golfo Nuevo. The coast in this area is characterized by extensive coastal cliffs 30–100-m high with gravel beaches along the shoreline. A silt platform of approximately 5 ha lying to the seaward of the cliffs, is covered by vegetation consisting mainly of *Suaeda divaricata, Atriplex lampa,* and *Lycium chilense* and is used for nesting by several seabird species, including Kelp Gulls, Royal and Cayenne Terns, Imperial Cormorants (*Phalacrocorax atriceps*), Neotropic Cormorants (*P. brasilianus*), Rock Shags (*P. magellanicus*), and Guanay Cormorants (*P. bougainvillii*) (Yorio et al. 1994).

Royal and Cayenne Terns start to settle in the colony and lay eggs in the second week of October, chicks hatch during the second or third week of November, and when approximately 20 days of age, the tern chicks abandon the colony to form crèches at the beach. Both tern species nest together, with a density of 9–11 nests/$m^2$ (Yorio et al. 1994, Quintana and Yorio 1997). Kelp Gulls start to arrive at the colony in late August and lay from the second week of October to mid-December, with peak egg laying during the last week of October (Yorio et al. 1994).

We made observations during the tern chick stage in 1993. We divided this stage into three periods: (1) chicks younger than a week of age within the colony (chicks remain at the nest or do not move more than 0.5 m from their nest), (2) chicks between 1 wk to approximately 20 days of age (age at which chicks start to permanently abandon the colony to form crèches at the beach or form groups at the colony periphery), and (3)

chicks older than 20 days of age (in crèches on the beach or groups at the colony periphery) (Quintana and Yorio 1997).

During 1989 we conducted a pilot study on a haphazard sample of terns flying with food in their beaks ($n$ = 220). During that study, we did not observe robbing attempts by gulls through aerial chases before terns arrived at the colony. Therefore, during 1992 and 1993, we only made observations on terns carrying prey just prior to landing on the colony or at groups of chicks on the beach. We made observations from a cliff while chicks were still at the colony and from observation points in the beach once the first groups of chicks moved to the beach.

We randomly selected a total of 1131 terns arriving with food (598 and 533 in 1992 and 1993, respectively) during 70 h of observation (33 and 37 for 1992 and 1993, respectively). During each observation hour, we followed with binoculars (8 × 20) the terns carrying food that went through the sector of the colony or chick group under observation until prey was delivered, eaten, or stolen.

In each case we recorded the identity of the parasite and host, if the robbing attempt was successful or not, and the behavior used by the parasite to steal the food. In four of the 1131 arrivals, the species of tern could not be determined. We considered a robbing attempt as such when a Kelp Gull made a short flight, jump, or run towards a tern with prey in its beak. An attempt was considered a successful attack when the parasite took the fish from the adult's or chick's beak, even if it was partially taken. We defined robbing efficiency as the number of successful attacks divided by the total robbing attempts.

## RESULTS

Kelp Gulls at Punta León were never seen robbing food from the terns using aerial chases ($n$ = 220). Kelp Gulls remained at the periphery of the tern colony and stole food from the beaks of adult terns that were flying low over the colony, from adult terns that were on the ground transferring food to their chicks, or from chicks that did not swallow fish immediately. Robbing behavior occurred both in the colony and on the beach, and all attacks involved a single Kelp Gull. Two strategies were used by gulls when robbing terns: (1) a gull stood on the ground or on a bush at the colony periphery, and after a short flight, jump, or run stole the fish from a tern that was landing or had already landed nearby, and (2) a gull flew above the tern colony or groups of chicks on the beach and attacked a tern from the air. On a few occasions, food was stolen before the tern had landed.

Percentage of food robbed by Kelp Gulls from both tern species was 8.8% of food brought to the colony ($n$ = 1131). Robbing efficiency was 58%. Kelp Gulls robbed significantly more food from Royal than Cayenne Terns. While 10.6% of food brought by Royal Terns was successfully stolen, only 3.6% was taken from Cayenne Terns ($\chi^2_1 = 14.6$; $P < 0.01$). The percentage of robbing attempts was also larger on Royal than Cayenne Terns (18.9 vs. 5.7%, $\chi^2_1 = 32.0$, $P < 0.01$; Table 1). Robbing efficiency,

TABLE 1. Robbing efficiency and percentage of robbing attempts and successful attacks (percentage in parenthesis) by Kelp Gulls on Royal (RT) and Cayenne (CT) terns at Punta León during 1992 and 1993.

| | No. terns observed | | Robbing attempts | | Successful attacks | | Robbing efficiency | |
|---|---|---|---|---|---|---|---|---|
| Year | RT | CT | RT | CT | RT | CT | RT | CT |
| 1992 | 394 | 203 | 70 (17.8) | 8 (3.9) | 38 (9.6) | 6 (2.9) | 54.3 | 75.0 |
| 1993 | 400 | 130 | 80 (20.0) | 11 (8.5) | 46 (11.5) | 6 (4.6) | 57.5 | 54.5 |
| Total | 794 | 333 | 150 (18.9) | 19 (5.7) | 84 (10.6) | 12 (3.6) | 56.0 | 63.2 |

however, was similar for both term species (56 and 63.2% for Royal and Cayenne Terns, respectively; $\chi^2_1$ (Yates's correction) = 0.12, $P > 0.05$; Table 1).

During 1993, the rate of kleptoparasitism on Royal Terns was related to chick age ($n = 267$). The probability of being robbed by Kelp Gulls was different between Royal Terns delivering food to chicks of all three age classes within the colony ($\chi^2_2 = 6.4$, $P < 0.05$) (Table 2). However, significant differences were only found between chicks older than 20 days of age grouped at the colony periphery (25%, $n = 56$) and both younger age classes (12.3%, $n = 211$) ($\chi^2_1 = 5.6$, $P < 0.05$). Sample size for Cayenne Terns was not large enough to conduct any statistical analysis because the rate of successful attacks was too low. The risk of a Royal Tern being robbed by Kelp Gulls was larger when it was feeding chicks at the colony (14.9%, $n = 267$) than on the beach (4.5%, $n = 44$), although differences observed were not significant ($\chi^2_1 = 3.52$, $P > 0.05$).

## DISCUSSION

Several studies have shown that terns can be affected by kleptoparasitism from gulls. Gulls can be opportunist kleptoparasites, and are thus likely to cause host population instability (Furness 1987). Forssgren (1981) has suggested that the number of Caspian Tern (*Sterna caspia*) colonies decreased as a result of the high rate of kleptoparasitism by

TABLE 2. Frequency of robbing attempts and successful attacks (percentage in parenthesis) by Kelp Gulls on Royal Terns with chicks of three age classes in the colony (see text) at Punta León during 1993.

| Age class | No. arrivals | Robbing attempts | Successful attacks |
|---|---|---|---|
| 7 days | 42 | 10 (23.8) | 7 (16.7) |
| 7–20 days | 169 | 34 (20.1) | 19 (11.2) |
| >20 days | 56 | 22 (39.3) | 14 (25) |

Lesser Black-backed Gulls (*Larus fuscus*). Smith (1975) and Veen (1977) also mention kleptoparasitism by Black-headed Gulls (*Larus ridibundus*) as one of the factors responsible for the low breeding success in Sandwich Terns (*Sterna sandvicensis*).

Our study describes for the first time kleptoparasitism by Kelp Gulls on Royal and Cayenne Terns. The results show that kleptoparasitism by Kelp Gulls on Cayenne Terns was lower than on Royal Terns. During the chick stage in both study seasons, Kelp Gulls robbed between 9.6 and 11.5% of the food brought back to the colony by adult Royal Terns. Similar rates of kleptoparasitism in other studies (Huslman 1976, Furness 1987) have been considered high and have been assumed to have caused negative effects on host populations. Even though it is difficult to evaluate if the rate of kleptoparasitism observed at Punta León had an effect on chick survival, the low chick mortality due to starvation observed in the colony during the study years (Quintana and Yorio 1997) suggests that food robbing by gulls did not significantly affect tern breeding success. However, it cannot be ruled out that the loss of food to kleptoparasites had an effect on chick mass and, therefore, on chick survival after fledging.

The higher robbing attempt and successful attack rates observed on Royal Terns during both study years might be explained by the apparent tendency for Royal Terns to bring back larger prey (Quintana and Yorio, unpubl. data). Several studies have shown that larger prey increase the probability of food robbing due, mostly, to an increase in handling time (Hopkins and Wiley 1972, Hulsman 1984, Furness 1987, Hackl and Burger 1988). Even if prey handling times are equal for Royal and Cayenne Terns, the larger prey brought back by Royal Terns should make them more profitable targets for parasistism by Kelp Gulls.

Robbing efficiencies were high compared to those reported for other species (Furness 1987). High success rates attained at Punta León might be the result of the strategy used by gulls to rob terns, as food is stolen only from the ground at the tern colony and from a short distance from victims nesting at a relatively high density. Robbing behavior used by Kelp Gulls is similar to that described for Black-headed Gulls robbing Sandwich Terns (Fuchs 1977) and for some Silver Gull (*Larus novaehollandiae*) individuals robbing Crested (*Sterna bergii*) and Lesser Crested Terns (*S. bengalensis*) (Hulsman 1976).

It has been argued that a reduction in the number of potential victims, lower food availability, and an increase in the number of parasites, can result in an increase in the negative effects of kleptoparasitim (Fuchs 1977, Furness 1987, Rice 1987). Therefore, if the Kelp Gull population at Punta León continues to expand, or the number of terns decreases, the effects of kleptoparasitism on both tern species may increase.

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## LITERATURE CITED

ANSINGH, F. H., H. J. KOELERS, P. A. VAN DER WERF, AND K. H. VOOUS. 1960. The breeding of the Cayenne or Yellow-Billed Sandwich Tern in Curacao in 1958. Ardea 48:51–65.

BROOKE, R. K., AND J. COOPER. 1979. What is the feeding niche of the Kelp Gull in South Africa? Cormorant 7:27–29.

BURGER, J., AND M. GOCHFELD. 1991. The Common Tern: its breeding biology and social behavior. Columbia University Press, New York. 413 pp.

DUNN, E. K. 1973. Robbing behaviour of Roseate Terns. Auk 90:641–651.

DUFFY, D. C. 1983. The foraging ecology of Peruvian Seabirds. Auk 100:800–810.

FORSSGREN, K. 1981. Kleptoparasitic behaviour of the Artic Skua, *Stercorarius parasiticus,* and the Lesser Black-backed Gull, *Larus fuscus,* with the Caspian Tern, *Hydropogne caspia.* Mem. Soc. Fauna Flora Fenn. 57:5.

FUCHS, E. 1977. Kleptoparasitism of Sandwich Terns *Sterna sandvicencis* by Black-headed Gulls *Larus ridibundus.* Ibis 119:183–190.

FURNESS, R. W. 1987. Kleptoparasitism in seabirds. Pp. 77–100, *in* J. P. Croxall, ed. Seabirds: feeding ecology and role in marine ecosystems. Cambridge University Press, Cambridge, United Kingdom.

HACKL, E., AND J. BURGER. 1988. Factors affecting piracy in Herring Gulls at a New Jersey landfill. Wilson Bull. 100:424–430.

HATCH, J. J. 1970. Predation and piracy by gulls at ternery in Maine. Auk 87:244–254.

HOCKEY, P. A. R. 1980. Kleptoparasitism by Kelp Gulls *Larus dominicanus* of African Black Oystercatchers *Haematopus mochini.* Cormorant 8:97–98.

HOPKINS, C. D., AND H. W. WILEY. 1972. Food parasitism and competition in two terns. Auk 89:583–594.

HULSMAN, K. 1976. The robbing behaviour of terns and gulls. Emu 76:143–149.

———. 1984. Selection of prey and success of Silver Gulls robbing Crested Terns. Condor 86:130–138.

LANGHAM, N. P. E. 1974. Comparative breeding biology of the Sandwich Tern. Auk 91:255–277.

NETTLESHIP, D. N. 1972. Breeding success of the Common Puffin, *Fratercula arctica,* on different habitats at Great Island, Newfoundland. Ecol. Monogr. 42:239–268.

QUINTANA, F., AND YORIO, P. 1997. Breeding biology of Royal (*Sterna maxima*) and Cayenne (*S. eurygnatha*) terns at Punta León, Chubut. Wilson Bulletin 109:650–662.

RICE, J. 1987. Behavioural responses of Common Puffins to Kleptoparasitism by Herring Gulls. Can. J. Zool. 65:339–347.

SMITH, A. J. M. 1975. Studies of breeding Sandwich Terns. Brit. Birds 68:142–156.

VEEN, J. 1977. Functional and causal aspects of nest distribution in colonies of the Sandwich Tern (*Sterna sanvicensis* Lath.). Behaviour Suppl. 10:1–193.

WITTENBERGER, J. F., AND G. L. HUNT. 1985. The adaptative significance of coloniality in birds. Pp. 1–77, *in* D. S. Farner, J. R. King, and K. C. Parker, eds. Avian biology, vol. 8. Academic Press, New York.

YORIO, P., F. QUINTANA, C. CAMPAGNA, AND G. HARRIS. 1994. Diversidad, abundancia y dinámica espacio-temporal de la colonia mixta de aves marinas en Punta León, Patagonia. Ornitología Neotropical 5:69–77.

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