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Prey robbery by nonbreeding Magnificent Frigatebirds (*Fregata magnificens*).—Age- and sex-related differences have been reported in attack frequencies and success rates for several species of pirating frigatebirds (*Fregata* spp.) (Verner 1965, Diamond 1975, Nelson 1976, Gochfeld and Burger 1981). Here we present data on prey robbery in a nonbreeding population of Magnificent Frigatebirds (*Fregata magnificens*) on Daphne Major Island, Galapagos, Ecuador. Our objectives were to (1) examine host use in relation to host abundance, (2) determine whether differences in frequency and success of piracy existed between age- and sex-classes of frigatebirds, and (3) consider whether aggressive interactions between individual frigatebirds might account for observed patterns of prey robbery.

Methods.—Daphne Major is a sparsely vegetated crater, 120 m high and 32 ha in area, about 8 km north of Santa Cruz Island (Grant et al. 1975). Blue-footed Boobies (*Sula nebouxii*), Masked Boobies (*S. dactylatra*), Red-billed Tropicbirds (*Phaethon aethereus*), and Swallow-tailed Gulls (*Creagrus furcatus*) breed on the island (Table 1). About 46 Magnificent Frigatebirds used the island as a roost but did not breed there. The nearest nesting colony of this species was about 8 km west of Daphne on Seymour Island (Harris 1974).

We watched frigatebirds at 2 sites on the island from 1 February to 18 May 1982. There was no substantial difference in frigatebird or seabird behavior between areas, and data from both sites were combined. Birds were watched on 12 occasions for from 2.5 to 12 h each time (99 h total).

The frigatebird population on Daphne was censused at the roost at 05:45 h before 5 watches. Most frigatebirds remained in the roost until then. Numbers of host species were determined in February 1982 by direct counts of nests (Blue-footed and Masked boobies) and by combining nest counts and visual estimates of population sizes (Red-billed Tropicbirds and Swallow-tailed Gulls).

We defined attempted prey robbery as an interaction in which a frigatebird, alone or as part of a group of attackers, actively pursued to within 5 m of another seabird. For each attack we recorded time, age, and sex of the attacker(s) (male, female, or juvenile as distinguished by plumage characters [Nelson 1976]), host species, occurrence of physical contact, and outcome of attack. We assume that most hosts that were attacked carried food, although we did not determine this directly.

We also noted the age and sex of pairs of frigatebirds involved in any intraspecific aggressive interactions. To examine the effects of aggressive interactions on frigatebird activity patterns we recorded, in two of the watches at 15 min intervals, the number, age, and sex of frigatebirds in the roost and those flying low (< 100 m) or high (> 150 m) above the island.

We used Chi-square tests, Fisher's Exact Probability tests (FEP), and Binomial tests to analyze the data. Attack and success "rates" are reported as either the percent of the total attacks made by each group or the percent of total successful attacks. The relative abundance of birds in different age- and sex-classes was estimated by mean numbers of each class present in the roost.

Results.—The number of frigatebirds at the roost averaged 46.3 ± 18.5 [SD] (N = 5) and averaged 23% adult males, 69% adult females, and 8% juveniles. The relative proportion of males : females : juveniles observed in the roost remained relatively constant (3:10:1) during the study ($\chi^2 = 2.41$, df = 8, $P = 0.95$). At 06:00, most frigatebirds left the roost and either flew out to sea, presumably to feed, or remained in the vicinity of the island. An average of 20.9 ± 15.6 (N = 96) individuals remained near the island throughout the day.

We observed a total of 435 piratical attacks, most of which (78%) were made on tropicbirds (Table 1). Of the total attacks on all seabirds, 36 (8.3%) were successful. Success rates varied among host species ($\chi^2 = 36.38$, df = 3, $P < 0.01$) (Table 1). Attacks on Swallow-tailed

TABLE 1

PIRATICAL ATTACKS ON SEABIRDS BY THE MAGNIFICENT FRIGATEBIRD ON DAPHNE MAJOR, GALAPAGOS, ECUADOR, 1982

Host species	Estimated number of individuals[a]	Type of attack			% success rate
		Aerial	Nest	Total	
Blue-footed Boobies	876	10 (3)[b]	73 (100)	83 (19)	11
Masked Boobies	696	3 (1)	0	3 (1)	0
Red-billed Tropicbirds	300	338 (93)	0	338 (78)	8
Swallow-tailed Gulls	50	11 (3)	0	11 (3)	22

[a] In local population.
[b] N (% of column total).

Gulls were most productive. Success rates on all other host species were significantly lower and not different from each other ($P > 0.05$).

Aerial attacks (83% of total attacks; 7.5% success rate) occurred when frigatebirds harassed seabirds by diving quickly at the intended victim and chasing it briefly (<5 sec). Successful attacks on tropicbirds occurred only after a frigatebird grabbed a host's tail in its bill for 2–3 sec, but in 35 of the 62 attacks involving tail-grabs, no food was obtained by the frigatebird.

Frigatebirds also attacked Blue-footed Boobies at their nests (17% of total attacks; 11% success rate), primarily by interrupting food transfer between parents and chicks. The success rate of these attacks was the same as for aerial attacks on all species ($\chi^2 = 0.008$, df = 1, $P = 0.94$).

We also observed sequential attacks by different birds on the same host as well as interactions in which several frigatebirds attempted to rob food that had already been obtained from a host by another frigatebird.

We classified 131 attacks (36.2% of the aerial attacks; 31.0% of all attacks) as parts of sequential attacks on single hosts (N = 34). Only 4 attacks at the nest (5.4%) fell in this category. Proportionately more of the sequential attacks occurred in the air than at nests (FEP, $P < 0.01$). Regurgitation rates were similar in singly attacked and sequentially attacked victims (FEP, 10% vs 14%, $P = 0.31$).

In 7 of 21 instances of intraspecific piracy (nest and aerial attacks combined) in which a mean of 3.5 ± 3.2 individuals attempted to gain the original attacker's stolen prey, at least one attacking frigatebird obtained food. The success rate per bird is similar to the overall success rate for interspecific piracy (8.3% vs 7.5%, $\chi^2 = 0.25$, df = 1, $P = 0.88$).

Male frigatebirds attacked seabirds much more frequently (N = 365; 84% of all attacks) than did females (49; 11%) or juveniles (23; 5%). When the relative abundance of different classes of birds was accounted for, we found no effect of age on attack frequency (adult males and females vs juveniles, $\chi^2 = 0.17$, df = 1, $P = 0.26$), but a strong effect of sex (males vs females, $\chi^2 = 100.37$, df = 1, $P < 0.0001$), with proportionately more attacks by adult males than by adult females. There was no difference in the success rates of adult males and females (8.2% vs 6.1%, $\chi^2 = 0.052$, df = 1, $P = 0.82$), nor in the success rates of adults and juveniles (8.0% vs 13.0%, $\chi^2 = 0.22$, df = 1, $P = 0.68$).

Frigatebirds frequently acted aggressively towards each other even when they were not carrying any prey (N = 140). These interactions usually ended with the chased bird leaving the area in which the interaction occurred. Most chases involved 2 males (N = 64; 54% of total) or one male and one female (N = 16; 18% of total). Males chased females in 12 of

16 instances (Binomial test, $P = 0.07$), and they dominated juveniles in 20 out of 21 interactions ($P < 0.01$).

When the number of birds seen high (>150 m) or low in the sky were summed over 2 days, males were seen within 150 m of the surface a greater proportion of times (45% of 267 observations) than were females (4% of 149 observations) ($\chi^2 = 80.46$, df = 1, $P < 0.001$) or juveniles (16% of 31 observations; $\chi^2 = 8.11$, df = 1, $P < 0.01$). Most piratic attacks were initiated within 100 m of the island surface.

Discussion.—Tropicbirds may have been attacked more frequently than boobies because their smaller bodies and long tails were more easily grabbed during aerial attacks by frigatebirds than were the larger and more compact boobies.

Although Gochfeld and Burger (1981) reported that, overall, pirating adult Magnificent Frigatebirds obtained more food than pirating juveniles, when they calculated success on a per attack basis, adults and juveniles were equally successful. Burger et al. (1980) and Verbeek (1977) also reported a lack of age effects on piracy success rates in *Larus* gulls.

Gochfeld and Burger (1981) also noted male-biased attack rates by Magnificent Frigatebirds. They suggested the bias results because males are more common at nonbreeding sites as they provide only limited care and may leave breeding colonies more quickly than females. This hypothesis does not explain the bias in male frigatebird piracy we observed, as females were more abundant than males on Daphne. Attack rates could simply reflect differences in diurnal activity patterns of male, female, and juvenile frigatebirds. Roost and sky counts, however, indicated that a mean of 7 ± 3.3 males and 14 ± 10.5 females and juveniles (grouped to reflect classes of frigatebirds with high and low attack rates, respectively) were near or on the island during the day. When compared with mean roost counts, these values showed no evidence of a disproportionate number of males being present in the vicinity of the island. Alternatively, aggressive interactions between conspecifics may determine differences in attack rates. Male dominance may limit the opportunity that females and juveniles have to rob other seabirds. Adult males may dominate juveniles simply because of their greater experience, and they may dominate adult females because of their lower wing-loading (cf. Harrington et al. 1972). As Andersson and Norberg (1981) have shown that maneuverability in birds is negatively correlated with wing-loading, males, which have 12% lower wing-loading than females, may be more agile, and this could give them an advantage in aggressive interactions where maneuverability is important.

Our results indicate that behavioral dominance may provide an important alternative to frequency-dependence (Brockman and Barnard 1979) as the process leading to intraspecific specialization of piracy in Magnificent Frigatebirds.

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LITERATURE CITED

ANDERSSON, M. AND R. A. NORBERG. 1981. Evolution of reversed sexual size dimorphism and role partitioning amongst predatory birds with a size-scaling of flight performance. Biol. J. Linn. Soc. 15:105–130.

BROCKMAN, H. J. AND C. J. BARNARD. 1979. Kleptoparasitism in birds. Anim. Behav. 27: 487–514.

BURGER, J., M. FITCH, G. SHUGART, AND W. WERETHER. 1980. Piracy in *Larus* gulls at a dump in New Jersey. Proc. Colonial Waterbird Group 3:87–98.

DIAMOND, A. W. 1975. Biology and behavior of frigatebirds *Fregata* spp. on Aldabra Atoll. Ibis 117:302–323.

GOCHFELD, M. AND J. BURGER. 1981. Age-related differences in piracy of frigatebirds from laughing gulls. Condor 83:79–82.

GRANT, P. R., J. M. N. SMITH, B. R. GRANT, I. J. ABBOTT, AND L. K. ABBOTT. 1975. Finch numbers, owl predation and plant dispersal on Isla Daphne Major, Galapagos. Oecologica (Berl.) 19:239–257.

HARRINGTON, B. A., R. W. SCHREIBER, AND G. E. WOOLFENDEN. 1972. The distribution of male and female Magnificent Frigatebirds (*Fregata magnificens*) along the coast of Florida. Am. Birds 26:927–931.

HARRIS, M. P. 1974. A field guide to Galapagos birds. Collins, London, England.

NELSON, J. B. 1976. The breeding biology of frigatebirds—a comparative review. Living Bird 14:113–155.

VERBEEK, N. A. M. 1977. Comparative feeding ecology of Herring Gulls (*Larus argentatus*) and Lesser Black-backed Gulls (*Larus fuscus*). Ardea 65:25–42.

VERNER, J. 1965. Flight behavior of the Red-footed Booby. Wilson Bull. 77:229–234.

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The nest, eggs, and young of the White-whiskered Spinetail (*Synallaxis [Poecilurus] candei*).—Ovenbirds (Furnariidae) show a remarkable diversity of nest types, and the structure and location of the nest are of taxonomic importance in this New World family (Vaurie 1980). The nest structure of *Synallaxis candei* is of particular interest because a previous account apparently is in error. The only information available to Vaurie (1980) came from a nest from Colombia described by C. J. Marinkelle, who wrote that the nest of *S. candei* is ". . . made of grass and fine twigs, with side entrance, in (a) natural cavity of (a) rotten tree at ground level" (p. 87). Vaurie was hesitant to accept such information, as the nest structure of *Synallaxis* is remarkably constant, and no species had ever been reported building a nest within a tree cavity. Nevertheless, he surmised that ". . . it is possible that this nest is an exception without precedent in the normal location of the nest in this genus" (p. 87). More recently Serna (1984) made a brief account of a nest from northern Colombia. That nest contained 2 eggs, was placed 1 m above the ground in an orange tree, was very large, and was made from twigs. We know of no other report of the nest of this species.

Further interest in the nest structure and nesting habits of *S. candei* stems from the fact that there has been uncertainty about the taxonomic affinities of this species. Todd (1917) proposed the monotypic genus *Poecilurus* for *candei*, and later authors (Peters 1951) included *kollari* and *scutatus* in *Poecilurus*. More recent reviews of furnariids (Vaurie 1971, 1980) include the genus within *Synallaxis*. Vuillemier has further suggested that all 3 species could be considered allospecies of a single superspecies (Vaurie 1980:120). *Poecilurus*, however, is still accepted in some recent works (e.g., Meyer de Schauensee and Phelps 1978). The purpose of this note is to document fully the nest of *S. candei* in an attempt to provide further information on its taxonomic relationships. In addition, we provide brief information on the eggs and young of this species, which may help in further establishing its affinities within the ovenbirds.

S. candei is chiefly a bird of arid regions (thornscrub) of coastal northwestern Venezuela