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OCCURRENCE AND BREEDING BEHAVIOR OF LESSER FRIGATEBIRDS (*FREGATA ARIEL*) ON TERN ISLAND, NORTHWESTERN HAWAIIAN ISLANDS

Donald C. Dearborn and **Angela D. Anders**

Abstract: The Pacific breeding range of Lesser Frigatebirds (*Fregata ariel*) is primarily equatorial. However, a small number of males are regularly seen in a breeding colony of Great Frigatebirds (*F. minor*) on Tern Island, in the Northwestern Hawaiian Islands. In 1998, a female Lesser Frigatebird was present on Tern Island; the ensuing nesting attempt by a pair of Lesser Frigatebirds is the first breeding record for the Hawaiian Islands. In addition, male Lesser Frigatebirds on Tern Island engage in reproductive behaviors directed at female Great Frigatebirds, including courtship displays and extra-pair copulations. The presence of a potential hybrid in this colony suggests that such attempts may sometimes be successful.

Key words: breeding record, extra-pair copulation, Fregata ariel, Fregata minor, *Great Frigatebird, Hawaiian Islands, hybrid, Lesser Frigatebird*

In the course of studying sexual selection in a population of Great Frigatebirds (*Fregata minor*) on Tern Island (23° 45' N, 166° 17' W), in the Northwestern Hawaiian Islands (Dearborn in review, Dearborn et al. in review), we made several notable observations of Lesser Frigatebirds (*F. ariel*) well outside of their normal breeding range.

Lesser Frigatebirds breed in the tropical Pacific, Indian, and Atlantic oceans. In the Pacific, breeding has been noted as far north as Washington Island in the Line Islands (04° 40' N) and as far south as New Caledonia (22° 38' S), but most breeding colonies occur between Christmas Island (01° 50' N) and the Fiji Islands (18° 57' S) (Sibley and Clapp 1967, Nelson 1975, Harrison 1983). Lesser Frigatebirds are not known to breed at Johnston Atoll (16° 40' N) or in the Hawaiian Archipelago farther to the north (Sibley and Clapp 1967, Amerson and Shelton 1976; B. Flint, pers. comm.; USFWS, unpubl. data).

The non-breeding distribution of Lesser Frigatebirds is more widespread. In the central Pacific, they disperse from their breeding areas and tend to follow prevailing winds west across the Pacific and then north towards the Philippines and Japan (Sibley and Clapp 1967). Non-breeding individuals have occasionally been seen at Johnston Atoll (Amerson and Shelton 1976) and at Kure Atoll in the Northwestern Hawaiian Islands (Woodward 1972).

OCCURRENCE OF LESSER FRIGATEBIRDS ON TERN ISLAND

Tern Island is located in French Frigate Shoals in the Northwestern Hawaiian Islands (see Amerson 1971 for more details) and is more than 2,000 km from the nearest breeding colony of Lesser Frigatebirds (Fig. 1). Tern Island is 14 ha in size and is a breeding site for 15 species of seabirds totaling over 200,000 individuals (Amerson 1971, Harrison et al. 1984). Roughly 4,000 Great Frigatebirds come to Tern Island to breed (unpubl. data).

Tern Island is part of the Hawaiian Islands National Wildlife Refuge and has been staffed by a small number of USFWS employees and volunteers since 1979. During that time, sightings of vagrant birds have been opportunistically recorded. Lesser Frigatebirds were noted as present on Tern Island during each year from 1983 to 1987, 1989 to 1990, and 1997 to 1999. When notes were recorded in sufficient detail, they generally indicated the presence of a single individual for a limited number of days or weeks. Because of the opportunistic nature of the sightings and their subsequent notation, the absence of a sighting for a particular year does not necessarily mean that no Lesser Frigatebirds visited Tern Island that year. Despite the limitations of this data set, it is clear that Tern Island has been visited frequently by a small number of Lesser Frigatebirds over the past 15 years.

We made observations of Lesser Frigatebirds on Tern Island during our field work with Great Frigatebirds from December 1997 through July 1998 and January to May 1999. Observations in 1998 were made opportunistically, but we never saw more than 2 males and 1 female on the island at any given time. In general, males were noted in the colony relatively often, but females were present only rarely.

In 1999, we counted Lesser Frigatebirds during daily censuses of the entire colony of Great Frigatebirds. From 23 January to 1 May 1999, there were 59 days on which we saw no male Lesser Frigatebirds, 26 days on which we saw 1, 11 days on which we saw 2, and 2 days on which we saw 3. These sightings of males were spread across the pair-formation part of the Great Frigatebird breeding season (Fig. 2). No females were seen during this time period (23 January - 1 May).

Male Lesser Frigatebirds were frequently seen perched in bushes occupied by male Great Frigatebirds. When birds were perched in this manner, we did not observe unusual interactions between males of the two species. However, when a male Lesser attempted to land in such a bush already occupied by male Greats, the perched males would often snap/bite and vocalize towards the landing Lesser. This behavior is sometimes directed towards conspecifics in a similar context, but our impression is that Lesser males are targets of this

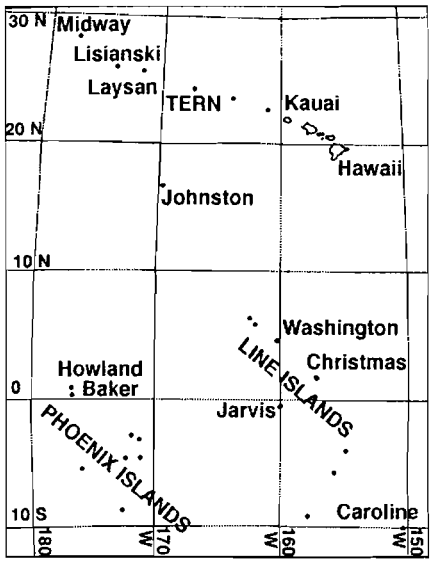

FIGURE 1. Lesser Frigatebirds regularly breed as far north as Christmas Island and Baker Island, near the equator. Our observations of Lesser Frigatebirds on Tern Island comprise the first documented breeding attempts in the Hawaiian Islands.

type of aggression much more often than are Great males.

BREEDING BEHAVIOR OF LESSER FRIGATEBIRDS ON TERN ISLAND

In 1998, we documented the first known nesting attempt by a pair of Lesser Frigatebirds in the Hawaiian Islands. On 22 May, a male Lesser Frigatebird began to occupy and display from a failed nest of a Great Frigatebird on Tern Island. Displaying from failed nests is common among Great Frigatebirds in this colony, perhaps due in part to the limited availability of nest material (unpubl. data). The next day, the Lesser Frigatebird was replaced by a Great Frigatebird. The nest was re-occupied by a male Lesser Frigatebird (unknown if the same individual) 3 days later (26 May). On 27 May, a female Lesser was perched at the nest with the male. On 29 May the male and female Lesser Frigatebirds began alternating occupancy of the nest, and the female laid an egg on 1 June. On 16 June, the male's third incubation shift ended in failure after 7 days. When we checked the nest at 07:50 HST the male was incubating, and when we checked again at 17:15 there was no adult at the nest, and the egg was cracked and on the ground. The female Lesser was seen at the nest site the following afternoon, approximately 24 hr after nest failure. After nest failure, the egg was intact enough for us to measure; it was 61.4 mm long and 42.3 mm wide, with a mass of 57 g.

As previously mentioned, Lesser Frigatebird females are rarely present on Tern Island. In the absence of Lesser females, Lesser males frequently directed reproductive efforts at female Great Frigatebirds. Courtship behavior in male frigatebirds consists of many behavioral elements, including gular pouch inflation, head tilting, head wagging, wing fluttering, and vocalizations (Nelson 1975), but inflation of the gular pouch is the one component common to all levels of involvement in display behavior (unpubl. data). Of the 54 sightings of Lesser males during the daily counts in 1999, 13 were of males with uninflated gular pouches, 30 were of males with partially inflated pouches, and 11 were of males with fully inflated pouches. Thus, despite the absence of Lesser Frigatebird females on Tern Island in 1999, Lesser males were frequently performing courtship displays.

In at least some instances, Lesser males are successful at courting Great females on Tern Island. In 1998, we witnessed two extra-pair copulations between a mated female Great Frigatebird and an unmated male Lesser Frigatebird. The first incident was not recorded in great detail. In mid-February 1998, a male Lesser copulated briefly with a female Great on a nest and then flew away. The female appeared cooperative during the copulation (female Great Frigatebirds are capable of refusing copulation attempts by males). She remained on the nest and was seen later that day and on many subsequent days with a male Great Frigatebird. She and a male Great shared incubation duties until the nest failed partway through incubation.

The second extra-pair copulation was noted on 13 March 1998. A female Great Frigatebird was seen on a nest in a copulatory posture (head down, tail raised) with a male Lesser standing on her back. They attempted copulation for approximately 45 sec, but we could not tell if cloacal contact actually occurred. The male Lesser flew away, and within the next minute a male Great arrived with nest material. He landed at the nest and remained perched by the female after giving her the nest stick. The male Lesser reappeared, hovering 1 m above the nest, but was ignored by both the male and female on the nest. He flew away, and the Great Frigatebird pair remained perched on the nest. An egg was laid during the following week. After the chick hatched, blood samples were taken from the chick and from the male and female Great Frigatebird. As part of a study of extra-pair paternity in this population (Dearborn et al. in review), we used multilocus minisatellite DNA fingerprinting to ascertain whether the extra-pair copulation by the male Lesser Frigatebird resulted in fertilization. The genetic analyses revealed that the social father (the Great Frigatebird that helped incubate the egg) was also the chick's genetic father (Dearborn et al. in review).

Although these two interspecific reproductive attempts by Lesser Frigatebird males were not successful, in 1998 we noted a female frigatebird that appeared to be a potential hybrid between Lesser and Great Frigatebirds. This female was brooding a 6-week-old chick and was socially paired with a typical-looking Great male. The potential hybrid female was intermediate between Great and Lesser Frigatebirds in both plumage and body size. Two plumage features that distinguish Lesser females from Great females are a black throat extending in a 'V' onto the breast and a white collar around the nape of the neck (Diamond 1975, Nelson 1975, Harrison 1983). This female had a black throat with a pronounced black 'V' extending onto the breast. This region of black feathers measured 10.3 cm from the tip of the 'V' to the exposed base of the lower mandible. A collar of white feathers encircled the nape of her neck, but it was quite narrow (1.0 to 1.3 cm). Female Great Frigatebirds have a white

breast and a white or grayish-white throat, and they lack a white collar or nape (Diamond 1975, Nelson 1975, Harrison 1983). This female had a pinkish-red eye ring and a light flesh colored bill (traits found both in Lesser and Great Frigatebird populations and therefore not informative about species identity; Nelson 1975).

The exposed culmen length of the potential hybrid female was 104.5 mm, flattened wing chord was 58.7 cm, and mass was 1.32 kg. These values are smaller than those for female Great Frigatebirds at Tern Island [mean culmen = 118.6 mm (range = 112.2 - 123.0), mean wing chord = 61.2 cm (59.4 - 63.2), mean mass = 1.64 kg (1.43 - 1.92); all n = 20]. No measurements of Lesser Frigatebirds are available from Tern Island, and detailed comparison to data from other island should be made cautiously because there is substantial intraspecific variation in body size between different Pacific islands, both for Great (Nelson 1975, Schreiber and Schreiber 1988) and Lesser Frigatebirds (Nelson 1975). However, this female is substantially larger than female Lessers from Malaya (culmen range = 88 - 95 mm, wing chord range = 52.6 - 58.0 cm; Nelson 1975), the Coral Sea (mean culmen = 88 mm, mean wing chord = 54.7 cm; Nelson 1975), and Aldabra Atoll [mean culmen = 87mm, mean wing chord = 55.3 cm, mean mass = 0.858 kg (range = 0.760 - 0.955 kg), n = 45; Diamond 1975, Nelson 1975]. Thus, the size of the potential hybrid female is larger than female Lessers, smaller than Greats from Tern Island, but within the range of "small-bodied" Greats from Christmas Island and Aldabra (Nelson 1975, Schreiber and Schreiber 1988).

The intermediate nature of the plumage and size of this bird suggests that she may be a hybrid. If so, her parents may have bred in an area where Lesser and Great Frigatebirds co-occur in large numbers (e.g., Phoenix Islands). Alternatively, her parents may have been a Tern Island Great and a vagrant Lesser, as Great Frigatebirds in French Frigate Shoals exhibit some degree of natal site fidelity (unpubl. data).

In summary, Tern Island is regularly visited by a small number of breeding-condition male Lesser Frigatebirds, despite the large distance between Tern Island and the regular breeding range of this species. Successful reproduction by Lesser Frigatebirds on Tern Island may occasionally occur via either conspecific pairings or hybridization with Great Frigatebirds. It is not clear if the performance of reproductive behaviors by Lesser Frigatebirds on Tern Island is a manifestation of ongoing range expansion, nor is it known to what extent hybrid introgression may impact the population genetic structure of Great Frigatebirds.

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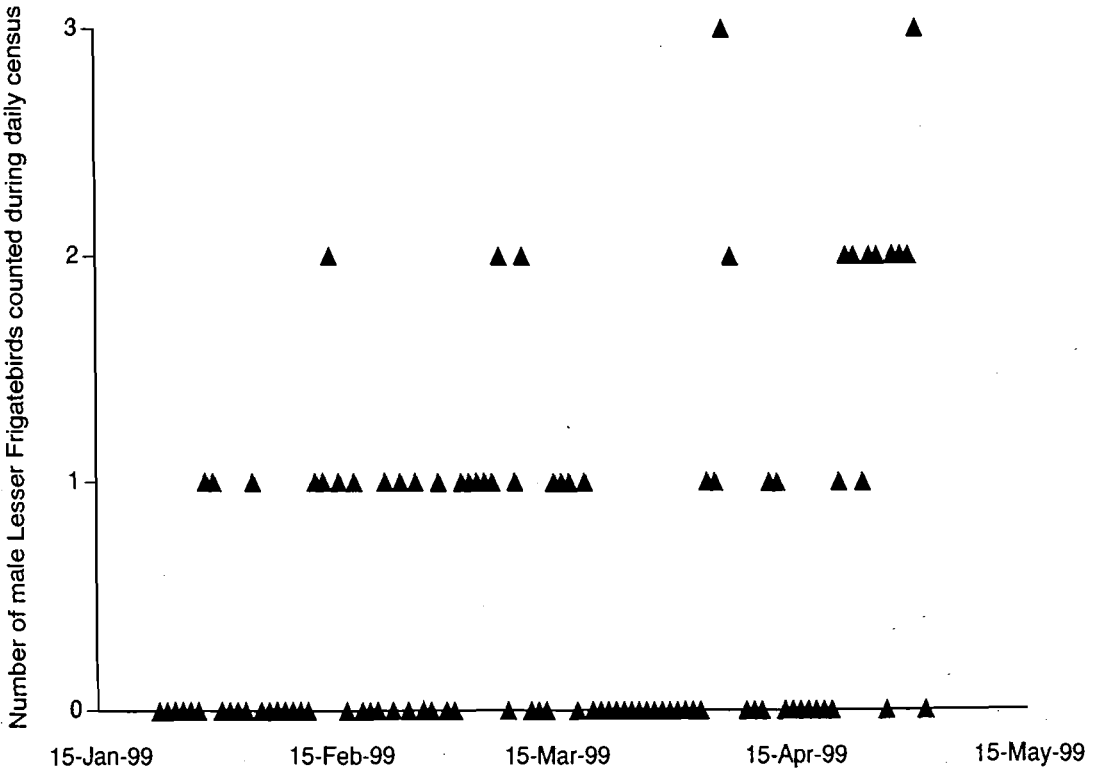

FIGURE 2. A small number of male Lesser Frigatebirds were present in the Tern Island colony of Great Frigatebirds from January to May 1999