## THE MISSISSIPPI KITE IN ARIZONA

SEYMOUR H. LEVY
Route 9, Box 960
Tucson, Arizona 85705

The Mississippi Kite (*Ictinia misisippiensis*) is generally considered a bird of south-central and southeastern United States, breeding from Kansas and South Carolina south to Texas and Florida (AOU, Check-list of North American birds. Fifth ed. AOU, Baltimore. 1957, p. 101). In recent years it has been found breeding in southeastern New Mexico (J. P. Hubbard, Check-list of the birds of New Mexico, New Mexico Ornithol. Society Publ. No. 3, 1970).

It was, therefore, quite a surprise when my brother John and I found four individuals of this species on 7 June 1970 about 5 mi. S of Winkelman in Pinal County, Arizona, along the lower San Pedro River. The sight of these kites feeding on the wing among the giant cactus (*Carnegiea gigantea*) and other desert vegetation was unusual indeed.

We returned to this area on 9 June 1970 and found one pair in flight, feeding over the desert. Another pair was sighted in flight directly over the town of Hayden, Gila County, Arizona, about 2 mi. NW of Winkelman.

On 15 June 1970, we returned to this area and counted at least eight Mississippi Kites along the San Pedro River downstream from the mouth of Aravaipa Creek to the Gila River. One of them was bar-tailed, indicating that it had been raised in 1969. An adult female was collected and is deposited in the National Museum of Natural History, Washington, D. C. She had slightly enlarged ovaries and what appeared to be the beginning of a brood patch.

On our next visit to the area, 24 July 1970, my brother and I located a kite nest. An adult was shading a downy chick, approximately three weeks old, from the intense heat in the nest located about 40 ft up in a pole-sized cottonwood (*Populus fremontii*).

Judging from the amount of riparian habitat available along this stretch of the San Pedro River, the number of individuals sighted, and their distribution, it is our calculated guess that as many as 10 pairs of Mississippi Kites inhabit this particular area. Amadeo M. Rea found nine individuals in the Mammoth area along the San Pedro River about 20 miles above Winkelman on 19 August 1970. At least seven of these were in adult plumage (pers. corr.).

This species has not heretofore been recorded in Arizona. Phillips et al. (The birds of Arizona, Univ. of Ariz. Press, Tucson, 1964) do not mention the species in their definitive work.

It is interesting to speculate on whether this colony represents newly occupied territory, or whether it merely has been overlooked in the past. With the many ornithologists, past and present, investigating southern Arizona, it seems unlikely that so conspicuous a bird could be overlooked. Phillips commented on the absence of the Mississippi Kite in Arizona in light of its recent range expansion into New Mexico (The instability of the distribution of land birds in the Southwest. Papers Arch. Soc. New Mexico 1:153, 1968).

One thing is sure! Be this species an ancient or recent arrival in Arizona, its elimination appears virtually certain. The riparian habitat it requires along the San Pedro River south of Winkelman is scheduled for phreatophyte eradication and river channelization by the U. S. Army Corps of Engineers, for water salvage and flood control purposes (R. R. Manes and B. Bristow, The Fatal Future, Wildlife Views, Ariz. Game and Fish Dept., June 1970) and there will end the life of the Mississippi Kite in Arizona!

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## CENSUS OF THE BIRDS OF CLIPPERTON ISLAND, 1968

JEAN P. EHRHARDT
Division de Biologie Générale et Ecologie du
Centre de Recherches du Service de Santé des Armées
Museum d'Histoire Naturelle
57, Rue Cuvier
Paris, France

No one reading the literature on Clipperton Island (Sachet 1960) can fail to be struck by the statements concerning the number of the birds living on this island. When the American captain, Benjamin Morell, went ashore at Clipperton on 17 August 1825, he found "myriads of sea-birds." Later, in 1839, Sir Edward Belcher, drawing the first map published by the British Navy from Clipperton, stated that "the whole island was covered with birds." In 1858, when the lieutenant commander Le Coat de Kerveguen took possession of Clipperton on behalf of the French government, he affirmed, "the number of the birds on this island is innumerable." More recently the French geologist, A. G. Obermuller (1959), asserted, "the island is inhabited by a multitude of birds, the number of which is difficult to appreciate, but there is no doubt that there are more than 50,000 individuals."

Nobody else seems to have taken a census of the birds on this island, the emerged surface of which is not over 1.8 km$^2$. As I had already committed myself (with a group of 16 men) to count the very abundant landcrabs (*Gecarcinus planatus* Stimpson, Ehrhardt 1968a), I undertook to determine the bird populations (Ehrhardt 1968b). The group of 16 was divided into eight teams, each in charge of a particular area. This procedure enabled us to determine not only total numbers but also the distribution on the island of each species.

### CENSUS TIME AND AREAS

The time to start the counting was an important factor. Indeed, such an operation made in broad daylight would have given misleading results because most birds would have been fishing. We also had to take account of the different times of return of all species. For example, the terns (*Anous stolidus ridgwayi* and *A. tenuirostris diamesus*) return between 16:00 and 17:00 (sierra time), while the boobies (*Sula leucogaster nesiotes* and *S. dactylatra granti*) are still fishing, and the frigatebirds are flying off and soaring. At 17:30 the first boobies are returning,

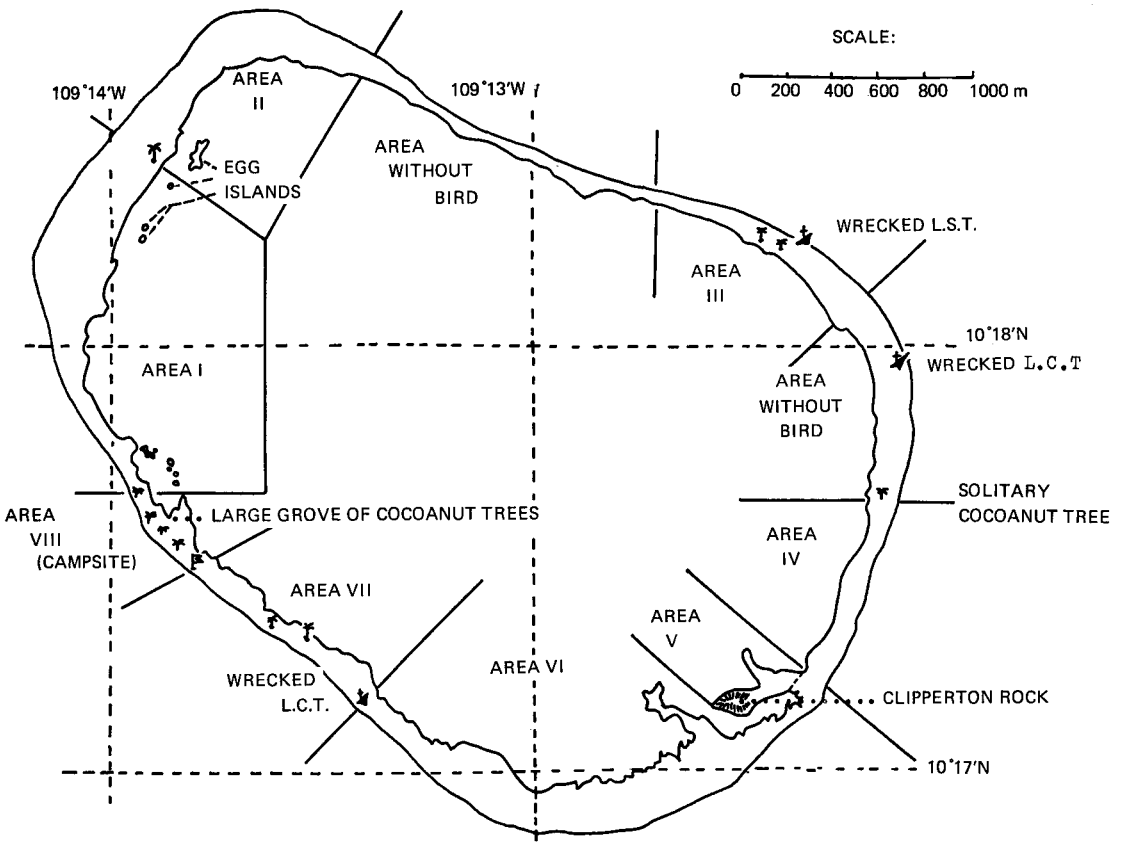


FIGURE 1. Map of Clipperton Island, with the census areas.

and by 18:00 most are back. At 18:30 all birds are at rest, and the census time therefore began at 18:50 on 23 July 1968.

In order to synchronize the operation, the teams of men were taken by car to their respective areas before the fixed time, permitting the birds to become accustomed to the men who had to count them when the car went way. In order to count all the birds in each of the eight designated areas, one member of the team counted the birds present on one side of the road running over the island while the other checked those on the opposite side. Each one also enumerated the flying birds (those returning from their fishing, or those flying off).

The eight areas, their limits, and the landmarks are shown on the map in figure 1. The stretch of land between Areas II and III, 1500 m long and 50–100 m wide, was free of birds. That long sand area was occasionally covered by the waves during storms and also by high tides (Sachet 1960). Similarly, there were no birds between the Areas III and IV.

Except for Area VII, where the low density of birds allowed a relatively precise counting (an error of less than 2 per cent), the results admit a margin of error of about 10 per cent.

## RESULTS AND DISCUSSION

Table 1 summarizes the total 1968 population by family and species. The estimate by Obermuller (1959), which is twice as large as the population found in our census, seems excessive. Even if a margin of error of 10 per cent is added, our total (25,662) is less by 30,000 birds.

Our census shows a predominance of boobies (77.29 per cent of the total population) and, more particularly, the predominance of the White-bellied Booby (*Sula leucogaster nesiotes* or *S. leucogaster brewsteri*); in 1958 the population of these Sulidae did not exceed 500 individuals (Stager 1964). A factor which limited the expansion of boobies nesting on the land was the presence on the island of about 50 pigs that ate the eggs and even the young boobies. The extermination of these pigs in 1958 (Sachet 1960; Stager 1964) allowed this apparent population explosion. For the same reason the population of Blue-faced Boobies has now reached more than 4000 individuals, while in 1958 Stager indicated a "small number."

Concerning the Red-footed Boobies, Stager (1964) found only one specimen, which he designated as belonging to the subspecies *Sula sula websteri*. He states that this "solitary Red-footed Booby was observed sitting atop a coco palm at the east side of Clipperton" and "was again observed in the same grove of coco palms" four days later. The next day two others were seen on the fronds of a coco palm in the main grove on the west side of the island. We have seen, as did Niaussat et al. (1968) before us, Red-footed Boobies nesting on the coco palms in the main grove in which our camp was situated. This fact is striking because, among the Sulidae of the island, they are the only ones to build their nest in a tree rather than on the ground or in the cavities of

TABLE 1. Overall numbers of birds found on Clipperton Island, 1968.

| Species | *n* | % of total | % of family |
|---|---|---|---|
| White-bellied Boobies (*Sula leucogaster nesiotes*) | 15,300 | 59.6 | 77.14 |
| Blue-faced Boobies (*Sula dactylatra granti*) | 4,239 | 16.5 | 21.28 |
| Red-footed Boobies (*Sula sula websteri*) | 293 | 1.2 | 1.58 |
| Total boobies | 19,832 | 77.3 | |
| Brown Noddies (*Anous stolidus ridgwayi*) | 3,374 | 13.1 | 68.05 |
| White-capped Noddies (*Anous tenuirostris diamesus*) | 1,374 | 5.3 | 27.30 |
| Sooty Terns (*Sterna fuscata crissalis*) | 200 | 0.8 | 4.33 |
| White Terns (*Gygis alba candida*) | 10 | 0.1 | 0.32 |
| Total Terns | 4,958 | 19.3 | |
| Great Frigatebirds (*Fregata minor ridgwayi*) | 642 | 2.5 | |
| American Coots (*Fulica americana americana*) | 200 | 0.8 | |
| Greater Yellowlegs (*Totanus melanoleucus*) | 6 | * | 30.00 |
| Lesser Yellowlegs (*Totanus flaviceps*) | 14 | 0.1 | 70.00 |
| Total yellowlegs | 20 | 0.1 | |
| Red-tailed Tropicbirds (*Phaethon rubricauda melanorhynchos*) | 6 | * | |
| Wedge-tailed Shearwaters (*Puffinus pacificus*) | 4 | * | |
| Grand Total | 25,662 | | |

* Less than 0.05 per cent of total.

the Clipperton Rock. At the time of the census nearly 300 boobies belonging to the species *Sula sula* could be counted. Three among them were completely white (white phase), 100 were brown but had white tail and underparts (brown phase), and the rest were entirely brown, very likely young individuals of this species.

The terns were far from "representing 95 per cent of the avifauna living on the island," as Obermuller (1959) said. At the time of our count, they numbered about 5000 individuals, or 19.3 per cent of the total population. This decline from dominance is partly a result of the increase in the booby population, and partly a result of the absence, at the time of our count, of the majority of the Sooty Terns. Indeed, since 1958, Stager (1964) reported the existence of two big colonies of 1000 individuals each. Both of these colonies have been seen again by Niaussat et al. (1968) in 1967 (one of them appears distinctly on the film he has taken) and by Lafaix (1969), who succeeded me on this island in 1968.

As to the frigatebird population, it seems to have doubled since 1958. That year the group perching on the boulders on the east side of the atoll (Area IV) numbered 250 individuals (Stager 1964). In 1968, 530 individuals were counted at the same spot. As with Niaussat et al. (1968) and Lafaix (1969), we could not find the nest of a frigatebird on the atoll, thus confirming the observation by Stager (1964).

Birds of the order Pelecaniformes were the most abundant, comprising about 80 per cent of the population. There are three families: Sulidae, Fregatidae, and Phaethontidae. The first is unquestionably the most important with 77 per cent of the total population. The second is represented by only one species, but it ranks third by order of importance (2.5 per cent of the total population). The last is represented by only a few individuals

The Charadriiformes (only 19 per cent of the total population) included two families when the census was taken: the Laridae, living permanently on the island, and the Scolopacidae, whose presence seems occasional. The Laridae, including four species, rank second in order of numerical importance, after the Sulidae and before the Fregatidae. There were only two species of the Scolopacidae, heretofore unknown in the island, *Totanus melanoleucus* and *T. flavipes*; the whole lot did not exceed some 20 individuals. A third family, the Charadriidae, absent during the census, is at times represented by some individuals of *Squatarola squatarola* (Sachet 1962; Stager 1964).

New species recorded on the island since the checklist made by Stager (1964) include: *Porphyrula martinica* (Haeze et al. 1967; Niaussat et al. 1968), *Bubulcus ibis* (Haeze et al. 1967; Niaussat et al. 1968), *Coccyzus americanus americanus* (Niaussat et al. 1968), *Totanus melanoleucus* (Ehrhardt 1968b), *Totanus flavipes* (Ehrhardt 1968b), and *Puffinus pacificus* (Ehrhardt 1968b), raising to 40 the number of species known on Clipperton.

Of these 40 species, only 11 (27.5 per cent) live there permanently. Ten of the resident species are oceanic forms, such as boobies, frigates, terns, tropicbirds, and shearwaters. The eleventh resident species, *Fulica americana*, lives exclusively on the closed lagoon of Clipperton. Except for the frigates, all of these species utilize the atoll as a breeding ground.

The remaining 29 species (72.5 per cent) are migratory forms for which Clipperton represents a resting place during their trip or a shelter at the time of meteorological disturbances.

The results of the census by area (table 2) show a predominance of Blue-faced Boobies (*Sula dactylatra granti*) on the west and the north sides of the island (Areas I and II, fig. 1) and of White-bellied Boobies (*Sula leucogaster nesiotes*) elsewhere, except in the southwest (Area VIII), the French Missions camp site since 1966. In this sector noddies are more abundant, with the Brown Noddy (*Anous stolidus ridgwayi*) most frequently represented (48 per cent of the population), followed by the White-capped Noddy (*Anous tenuirostris diamesus*) with 22 per cent.

The frigatebirds confine themselves to the east (82 per cent of their population has been counted in Area IV, just north of Clipperton Rock) and to the south (14 per cent in each of Areas VII and VIII).

The ornithological fauna of the lagoon was represented by the coots belonging to the species *Fulica americana*, as reported by Stager (1964), and not *Fulica caribea* as I said two years ago (Ehrhardt 1968b).

The presence of the Greater Yellowlegs (*Totanus melanoleucus*) and the Lesser Yellowlegs (*T. flavipes*) on Clipperton constitute the first record of these species for the island.

In addition to the species included in table 1, we saw and captured, during our three-month stay, some examples of *Progne subis*, whose presence on the island seems to be occasional according to Stager's observations (1964).

TABLE 2. Distribution of Clipperton Island birds by census areas, 1968.

| Species | Areas | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I West | | II North | | III Northeast | | IV East | | V The rock | | VI Southeast | | VII South | | VIII Southwest | | Lagoon | | Unsettled | |
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| White-bellied Boobies | 830 | 40.7 | 65 | 2.6 | 2409 | 88.0 | 1164 | 67.9 | 5761 | 71.1 | 4310 | 73.4 | 645 | 77.5 | 116 | 6.8 | | | | |
| Blue-faced Boobies | 1027 | 59.3 | 1879 | 76.0 | 172 | 6.3 | | | 336 | 4.1 | 510 | 8.7 | 135 | 16.2 | | | | | | |
| Red-footed Boobies | | | | | | | | | | | | | | | 293 | 17.2 | | | | |
| Brown Noddies | | | 327 | 13.2 | 152 | 5.5 | 20 | 1.2 | 900 | 11.1 | 1020 | 17.8 | 30 | 3.6 | 825 | 48.3 | | | | |
| White-capped Noddies | | | | | | | | | 1100 | 13.6 | | | | | 374 | 21.9 | | | | |
| Sooty Terns | | | 200 | 8.1 | | | | | | | | | | | | | | | | |
| White Terns | | | | | 2 | 0.1 | | | | | 4 | 0.1 | 2 | 0.2 | 2 | 0.1 | | | | |
| Great Frigatebirds | | | | | | | 530 | 30.9 | | | | | 20 | 2.4 | 92 | 5.4 | | | | |
| American Coots | | | | | | | | | | | | | | | | | 200 | 100 | | |
| Greater Yellowlegs | | | | | | | | | | | | | | | | | | | 6 | 30 |
| Lesser Yellowlegs | | | | | | | | | | | | | | | | | | | 14 | 70 |
| Red-tailed Tropicbirds | | | | | 2 | 0.1 | | | 2 | * | | | | | 2 | 0.1 | | | | |
| Wedge-tailed Shearwaters | | | | | | | | | | | | | | | 4 | 0.2 | | | | |
| Area totals | 2037 | | 2471 | | 2737 | | 1714 | | 8099 | | 5844 | | 832 | | 1708 | | 200 | | 20 | |

* Less than 0.05 per cent.

SUMMARY

The first census of the avifauna of Clipperton Island was made in July 1968; it revealed the presence of about 26,000 individuals. The boobies are the most numerous (77.3 per cent of the total population), followed by the terns (19.3 per cent), and the frigates (2.5 per cent).

While the White-bellied Boobies and the terns spread out over the whole island, the Blue-faced Boobies inhabit mainly the northern and western sides of Clipperton, and the frigates, the eastern and southern sides.

The boobies and frigates were found in greatly increased numbers, as compared with the numbers reported by visitors to the island in 1958, while the number of terns was found to be relatively reduced, partly as a result of the Sooty Terns' absence at the time of our stay.

Since the last check made in 1958, some new species have been recorded on the island, raising to 40 the number of species reported from the atoll.

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# A NOTE ON FORAGING OVERLAP IN WINTER BIRDS OF DECIDUOUS WOODS

MARY F. WILLSON

Department of Zoology
Vivarium Building
University of Illinois
Champaign, Illinois 61820

Field data on the foraging behavior of woodpeckers, nuthatches, and Brown Creepers (Willson 1970) have been analyzed with respect to differences in bill size. Overlap, indexed by $R_o$ (Horn 1966), between pairs of species and sexes (when distinguishable in the field) was calculated for utilization of tree species, foraging sites, and foraging heights, and compared with the amount of difference in bill length, depth, and width (measurements given in Willson 1970). During the winter, differences in bill size show no statistically significant ($P \geqslant 0.05$) relationship to differences in foraging behavior, with a single exception: an inverse correlation of difference in bill length and overlap of foraging height (fig. 1). In spring, again no correlation was found between bill size differences and overlap of tree types or foraging sites, but a negative correlation can be shown between differences of bill length and depth, and foraging height (fig. 1). Thus size differences of bills and foraging overlap are independent of each other except with respect to height, where similarity of bill size is sometimes associated with similarity of foraging behavior.

Pairs with less difference in bill size have more overlap in foraging height. The pairs especially involved are: Red-bellied Woodpecker, male vs. female; red-belly vs. Red-headed Woodpecker; Downy Woodpecker, male vs. female; and for length: Brown Creeper vs. downy, in spring; and in winter, red-belly vs. red-head; downy, male vs. female; creeper vs. nuthatch and vs. downy male and female; nuthatch vs. downy male and female. Clearly, an increase in bill size difference does not permit greater overlap in foraging behavior.

One might conclude that, despite a similarity in foraging height and in bill size, resources are partitioned in other ways. However, overlap values for tree species and foraging sites tend to fall in the medium-to-high range for all pairs concerned. Therefore one cannot conclude that those pairs similar in bill size and foraging height transfer their major mode of resource partitioning to either tree species or foraging sites. However, in most cases there are noticeable differences (between creeper and downy, nuthatch and downy, and red-head and red-belly) in the use of special foraging techniques such as hammering (Willson 1970) and perhaps to some extent also in food items. According to Martin et al. (1951), both red-heads and red-bellies are largely vegetarian during the winter months, and nuthatches then also eat a surprising amount of plant food, while downies and creepers are mainly insectivorous. The fruits of oaks and corn are major winter plant foods for the three winter vegetarians. All species are more insectivorous in spring and summer.

Seasonal changes in the amount of behavioral overlap are quite marked in many cases. Overlap between many pairs (22 of 43) is noticeably (difference $\geqslant 0.0500$) less in spring than in winter. In only six cases does overlap increase greatly in spring: downy vs. red-bellies of both sexes (height); downy female and male vs. red-head (height); and downy female vs. red-belly female (height). Character difference is large in all six pairs, and there frequently are significant differences in their use of special