

peratures regularly exceed 38°C. Braun (1969) reported the upper limit of thermoneutrality in Gila Woodpeckers to be approximately 35°C. Thermoregulation at higher temperatures may require expenditure of water, which is scarce in the desert in mid-summer. Heat stress on the young and eggs may be even more severe than that on the adults. Thus, the tendency for northern orientation of nest entrances is probably an adaptive response to environmental conditions as is the southern orientation documented for nests in cooler environments (Crockett and Hadow 1975, Inouye 1976).

We found considerable scatter in the orientation of the nest entrances (Fig. 1). If Gila Woodpeckers excavate new cavities for roosting, this variation may reflect selection for different microhabitats at different times of the year. Cooler, north-facing nests may reduce water loss in hot summer months, while warmer south-facing nests may reduce energy expenditures in the winter. A study of nests used by birds at different seasons might provide evidence to test this hypothesis.

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OBSERVATIONS OF FEEDING AT SEA BY A PEREGRINE FALCON AND AN OSPREY

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While birds of a number of non-oceanic species have been reported to land on ocean-going vessels, they rarely do more than rest briefly aboard the ship (e.g., Bailey 1913, Cowan and Cowan 1961, Willis 1961, Buchanan and Fierstein 1964, Harris 1966, pers. observ.). From 23 October through 28 October 1976, while working aboard the *R/V David Starr Jordan*, operated by the National Oceanic and Atmospheric Administration (NOAA), and the *Elizabeth C.J.*, a privately owned tuna seiner under contract to NOAA, we repeatedly observed an immature Peregrine Falcon (*Falco peregrinus*) and an Osprey (*Pandion haliaetus*) as they fed in the waters adjacent to the two vessels. The ships were operating in the eastern tropical Pacific tuna grounds where we were investigating deaths of porpoises in the purse seines of the U.S. tuna industry. Observations of the birds were incidental to the porpoise work and were not recorded systematically. However, our records probably reflect accurately the full extent of the birds' presence.

The Osprey was seen from 23 October through 27 October while the falcon was seen from 23 October through 28 October. Both birds were first observed about 2,600 km west of Costa Rica and approximately 65 km northeast of Clipperton Atoll (10°51'N, 107°45'W). We know of one record of an Osprey from Clipperton

Atoll but none of Peregrine Falcons (Stager 1964). The Osprey was last seen at 9°49'N, 105°46'W and the falcon at 9°33'N, 106°02'W; during the birds' stay, the vessels ran an irregularly-shaped track approximately 580 km in length.

For two and one-half days prior to the arrival of the birds we had encountered a storm with choppy high seas, rain squalls, and easterly winds up to about 30 knots. The storm lessened in severity by the time of the first sighting and the weather was stable and clear for most of the five days that the birds were seen. The day after we last saw the falcon and two days after we last saw the Osprey a new storm arrived, also from the east. Other observations of raptors at sea have occurred in conjunction with storms in the same fashion as ours (e.g., Bailey 1913, Voous 1961, Craddock and Carlson 1970). However, both Peregrine Falcons and Ospreys are known to migrate offshore in many parts of their ranges (Bent 1938b, Henny and van Velzen 1972). Thus, they regularly occur over water, although storms may push them out to sea farther than they might normally occur.

Both birds appeared to move back and forth between the two vessels. The locations of the birds when they were not reported near either ship are not known although it is likely they were in the vicinity of other boats known to have been operating in the area.

During the day the birds most commonly occupied the yardarms above the flying bridge on the *Jordan* (ca. 19 m above the water) and the crow's nest on the seiner (ca. 25 m above the water). During the night, when aboard the *Jordan*, the Osprey usually perched on the lower, broader, more stable radar antenna frame (ca. 15 m above the water) while the falcon remained higher, either on the yardarms or, in one instance, on the weather vane (ca. 21 m above the water). The nocturnal roosts of the birds on the *Elizabeth C.J.* are not known.

Whenever possession of a perch was in question, the

falcon appeared to dominate the Osprey and repeatedly displaced it from the higher perches. The Osprey was also displaced on various occasions by individual Brown Boobies (*Sula leucogaster*); this was never the case with the falcon.

The falcon took only Leach's Storm-Petrels (*Oceanodroma leucorhoa*). These were the only storm-petrels seen while the falcon was aboard. Eleven attempts at predation were observed and at least eight storm-petrels were taken during this time. Groups of storm-petrels contained anywhere from one to nine birds. The falcon appeared to track the storm-petrels from its perch as the birds pattered back and forth across the water while feeding. As the vessel approached to within about 50 m the falcon dived from its perch, flew directly toward an individual storm-petrel and struck it close to the water. All observed successful attempts were accomplished on the first pass. The falcon usually removed the head and wings of the storm-petrel in the air while returning to its perch.

We never witnessed the high climb reported by Craddock and Carlson (1970) in which the falcon gained altitude after leaving its perch before diving on prey. Nor did we see the falcon make a second strike from the air at a bird it had missed. It always returned to the ship after a single attempt, successful or not. Differences between the bird we watched and the one reported by Craddock and Carlson (1970) may be related to the fact that ours was an immature falcon and thus was probably less experienced than the mature bird they observed.

In addition to direct observations of predation, we retrieved one storm-petrel wing and three regurgitated pellets containing storm-petrel remains from near the falcon's perch. Earlier accounts of Peregrine Falcons taking prey near ships at sea also reported storm-petrels of various species as the prey (Grayson 1872, Dementiev 1950, Voous 1961, Craddock and Carlson 1970). None of these authors mentioned other species the falcons might conceivably have fed upon. For example, Peregrine Falcons at sea were reported by Casement (1973) to feed on "small landbirds" and one was seen taking a tropicbird. Other non-raptorial avian species seen while the falcon was aboard the *Jordan* included one Pintail (*Anas acuta*), one Cliff Swallow (*Petrochelidon pyrrhonata*), two Magnolia Warblers (*Dendroica magnolia*), and one Common Yellowthroat (*Geothlypis trichas*); the falcon took no apparent notice of any of these birds, although these species or similar ones have been reported as prey items of Peregrine Falcons (Bent 1938b, Cade 1960).

While Ospreys have been reported to seek refuge on ocean-going ships (e.g., Bailey 1913, Stager 1958, Casement 1973, 1979), we have been unable to find any accounts of their taking prey far at sea, although Casement (1978:35) reported an Osprey in "Aden outer harbor" which "took [its] catch to [the] top of [the] foremast" of a vessel. Like the falcon, the Osprey perched on the ship and waited for the ship to approach its prey, which in the four attempts we observed were flying fish (Exocetidae). Three of the four attempts were successful; the Osprey took a single individual in each case. As a school of fish scattered in front of the *Jordan* the Osprey dropped from its perch and swooped low over the water, captured the victim just beneath the surface, and returned to the perch to consume its prey. We never saw the Osprey hover over a spot as they do when hunting in their more usual haunts (Bent 1938a).

Although Ospreys have been reported occasionally to take prey other than fish (Wiley and Lohrer 1973), we did not witness any attempts on anything but flying fish. None of the bird's droppings contained any iden-

tifiable material, such as fish bones, or otoliths, and thus only feeding on flying fish can be confirmed.

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