that at least in the past thousands of pelicans were able to thrive there. In addition, natural food was greatly supplemented by large quantities of non-commercial fishes that were thrown overboard from the numerous trawlers returning to port. Similar circumstances existed at the Port St. Joe, Florida subadult-dominated colony in 1972.

Based on these observations, we believe that the age of first breeding in Brown Pelicans may be lower in new colonies than in established colonies. However, the species is clearly capable of successful breeding at three years of age.

This is in part a contribution of the Federal Aid to Wildlife Restoration Program, Florida Pittman-Robertson Project, W-41. We wish to thank Lawrence J. Blus and R. W. Schreiber for suggestions on the manuscript.—LOVETT E. WILLIAMS, JR., *Wildlife Research Projects Office, Florida Game and Fresh Water Fish Commission, Gainesville, Florida 32601 and* TED JOANEN, *Refuge Division, Louisiana Wildlife and Fisheries Commission, Grand Chenier, Louisiana 70643.* *Accepted 10 May 1974.*

Aerial hunting by Little Blue Herons.—Aerial hunting methods have been described for several species of herons, including the Snowy Egret, *Egretta thula* (Kushlan, 1972); Louisiana Heron, *Hydranassa tricolor* (Kushlan, 1972); Great Egret, *Casmerodius albus* (Rodgers, 1974); Gray Heron, *Ardea cinerea* (Marshall, 1961); Great Blue Heron, *A. herodias* (Hedeen, 1967); and Yellow-crowned Night Heron, *Nyctanassa violacea* (Parmer, 1968). Diving from flight was briefly noted in Little Blue Herons, *Florida caerulea*, by Dickinson (1947) and Jenni (1969), but has not been described in detail.

In the period from late July to September 1972, I observed a total of 162 aerial dives by adult and immature Little Blue Herons during 11 periods of observation at the Welder Wildlife Refuge, San Patricio County, Texas. Such behavior was first noted on 26 July, although I had been studying Little Blue Heron feeding habits since April. Interestingly, the more typical Wade/Walk Slowly method of feeding (Meyerriecks, 1962) was not often observed during this July-to-September period.

Observations were made from a car using a 15-60X spotting scope. The herons dived and caught prey as close as 30 m from me, without indicating awareness of my presence. The sites of observation were at Encino and Pollito Lakes on the refuge. During late summer these lakes become covered with an opaque mat of vegetation, consisting of *Najas guadalupensis*, *Heteranthera dubia*, and green algae. The herons' activities were primarily at the edges of the lakes in areas of floating lotus (*Nelumbo lutea*) and tall, emergent grasses (*Paspalum* spp., *Panicum* spp.).

Aerial hunting behavior was variable in the herons, but typically it began with the bird flying from an elevated perch out over the lake, frequently banking sharply and emitting loud calls. In contrast to normal flight positioning, the neck was partially extended and the legs dangled. Before diving the heron usually hovered like a tern. The dive was performed feet-first, unless the bird was diving from five m or higher. In that case the bird plummeted head-first, righting itself just above the surface to enter the water feet-first. Frequently there was a last-moment directional change before the bird reached the water. As it contacted the water the heron speared its prey with a normal bill-thrust. If the water was too deep for standing, the bird swam on the surface; if the water was very shallow it might run a few steps as it struck. Hunting flights were usually brief and low, one to three meters above the water, though sometimes a dive was made from up to 10 m.

Ninety percent of the aerial hunts were accompanied by calls, during flying, hovering, or diving. These calls varied in tone, duration, and pitch, but may be represented as *croak* or *creek*. There are several possible functions for the calls. As the heron often made a directional change while diving, I suspect that frogs (the usual prey) might have reacted to the call, leaping as the bird descended. It is possible that such leaping would commit a frog to one direction of escape and improves the heron's chances of intercepting it. On the other hand, it has been reported that frogs exhibit "physical immobility and reduced responsiveness" when frightened by a noise (Nash et al., 1970; Boice and Williams, 1971). Perhaps the heron can effectively immobilize some prey by calling. Finally, the calling may also serve a social function, as the same calls typically are given during intraspecific chases about the feeding areas. Often several herons aerial-hunted on the same lake simultaneously, but in such cases they did not feed in close proximity; thus cooperative hunting seems highly unlikely.

Of the 25 identified prey items taken by aerial hunting, 23 (92 percent) were frogs (*Rana pipiens* and/or *R. catesbeiana*)—eight to 13 cm long, and two were small fish. This differs greatly from the diet obtained by Little Blue Herons using the common Wade/Walk Slowly method. From 4 April to 31 July I recorded 152 captures by the latter technique in adults and juveniles. Sizes estimates of each item, made through comparison with the heron's bill, showed the prey to be almost entirely fish and crayfish, with a mean body length of slightly greater than two cm. Using a length-weight curve plotted for 60 small fish trapped in the vicinity, I determined that the average prey item taken by wading weighed slightly less than one gram. By contrast, the aerial method resulted in the capture of frogs that were eight to 13 cm long and which weighed considerably more.

It was not possible to determine the result of all dives into vegetated areas, but of the 101 "scoreable" dives, 25 (25 percent) were successful in capturing prey. This is a much lower success rate per strike than that attained by the Wade/Walk Slowly method. My data show 152 captures out of 271 strikes (56 percent accuracy) for wading Little Blue Herons, and comparable figures derived from Recher and Recher (1969) show an accuracy of 58 percent. In my data on aerial hunting, adults (dark plumage) were not found more efficient than juveniles (white plumage)—and as demonstrated by Recher and Recher (1969) for wading hunting; however, my sample size is too small for proper analysis of this aspect.

Wading hunting is surely less energy-consuming and more accurate than aerial hunting, but it provides smaller prey. It is not known how much more energy is used in flying, so direct comparison of the overall efficiencies of the two hunting methods is not possible.

As aerial hunting was observed only in the late summer, it may involve certain advantages that disappear by late September. Several factors may be important: 1, the tadpoles of *Rana pipiens* and *R. catesbeiana* metamorphose in late summer into air-breathing, surface-dwelling adults (thus making a new food source potentially available to the herons); 2, these frogs tend to move into shallower water and generally swim poorly during the metamorphic process (Goodyear and Altig, 1971); 3, the vegetation mat becomes densest at that time of year, hiding the fish and thereby rendering this normal food source less accessible to the herons; 4, the aquatic grasses grow tall enough to render the newly-metamorphosed frogs inconspicuous to a wading but not to a flying heron; and 5, the lotus leaves reach peak development then, providing convenient but vulnerable places for frogs to bask in the sunshine. Aerial hunting was most common during dawn and dusk periods of the day, when frogs are most likely to be warming

themselves at the water's surface or on the lotus leaves (Brattstrom, 1963). The disappearance of aerial hunting in autumn is probably associated with the recession of the various forms of aquatic vegetation, the passing of the frogs from a particularly vulnerable phase in their development, and/or the frogs' dispersal from the vicinity. Aerial hunting, then, may be a behavioral adaptation for exploiting an ephemeral, large-item food source; or, it may be an alternate strategy that the herons must resort to when their usual food source is temporarily unavailable.

During this study I received financial support from an N.I.H. Training Grant (No. 5 TO1 GM01779) of the Department of Ecology and Behavioral Biology, University of Minnesota, and a research fellowship from the Rob and Bessie Welder Wildlife Foundation, Sinton, Texas. Acknowledgment is made to Dr. Frank McKinney (University of Minnesota) for research advice and editorial assistance and to Dr. Clarence Cottam (Director, Welder Wildlife Foundation) for supervision and assistance in the field.

LITERATURE CITED

BOICE, R. AND R. C. WILLIAMS. 1971. Delay in onset of tonic immobility in *Rana pipiens*. Copeia, 1971 (4) :747–748.

BRATTSTROM, B. H. 1963. A preliminary review of the thermal requirements of amphibians. Ecol., 44:238–255.

DICKINSON, J. C. 1947. Unusual feeding habits of certain herons. Auk, 64:306–307.

GOODYEAR, C. P. AND R. ALTIG. 1971. Orientation of bullfrogs (*Rana catesbeiana*) during metamorphosis. Copeia, 1971 (4) :362–364.

HEDEEN, S. 1967. Feeding behavior of the Great Blue Heron in Itasca State Park, Minnesota. Loon, 39:116–120.

JENNI, D. A. 1969. A study of the ecology of four species of herons during the breeding season at Lake Alice, Alachua County, Florida. Ecol. Monogr., 39:245–270.

KUSHLAN, J. A. 1972. Aerial feeding in the Snowy Egret. Wilson Bull., 84:199–200.

MARSHALL, R. V. A. 1961. Herons fishing from the air. Brit. Birds, 54:202.

MEYERRIECKS, A. J. 1962. Diversity typifies heron feeding. Nat. Hist. Mag., 71:48–59.

NASH, R. F., G. G. GALLUP, JR., AND M. K. MCCLURE. 1970. The immobility reaction in leopard frogs (*Rana pipiens*) as a function of noise-induced fear. Psychon. Sci., 21:155–156.

PARMER, H. E. 1968. Unusual behavior of a Yellow-crowned Night Heron. Migrant, 39:12.

RECHER, H. F. AND J. A. RECHER. 1969. Comparative foraging efficiency of adult and immature Little Blue Herons (*Florida caerulea*). Anim. Behav., 17:320–322.

RODGERS, J. A. JR. 1974. Aerial feeding by Snowy and Great Egrets in Louisiana waters. Wilson Bull., 86:70–71.

DOUGLAS W. MOCK, *Department of Ecology and Behavioral Biology, J. F. Bell Museum of Natural History, University of Minnesota, Minneapolis, Minnesota 55455.* *Accepted 11 April 1974.*

Use of artificial nest structures by Everglade Kites.—The Everglade Kite (*Rostrhamus sociabilis plumbeus*), a form now endangered in the United States, breeds regularly in the marshes on the west side of Lake Okeechobee, Glades County, Florida. In 1972 and 1973 about 80 percent of known U. S. nests were in this area. The nests are typically placed in cattails (*Typha domingensis*) and were in both those years. Of the