nest or in the gullets of the nest mates. After searching on the ground around the nest we found part of the synsacrum and a tarsus void of meat.

Ingram (1959, Auk 76: 218–225) hypothesized that fratricide and cannibalism could only occur when there are considerable differences in the ages of the nestlings. He also suggested that the reason for fratricide and cannibalism was the large brood size with an inadequate food supply to rear a well-nourished brood. Our findings support this hypothesis in that the broods in both cases were the largest for their respective years and the difference in ages between the youngest and oldest nestling was 4 days in 1974 and 5 days in 1975, the greatest for their respective years.

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Land Birds in the Stomachs of Tiger Sharks *Galeocerdo cuvieri* (Peron and Lesueur)

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The tiger shark (*Galeocerdo cuvieri*) is a large neritic shark (adults maturing at total lengths exceeding 295 cm) with a tropical-subtropical center of distribution in all major oceans. It regularly includes a variety of food items in its diet, rendering its feeding habits distinctive from those of other large western Atlantic carcharhinid and sphyrnid sharks, which are chiefly piscivorous predators. The tiger shark devours such items as birds, turtles, conches, and discarded trash (Bigelow and Schroeder 1948, Fishes of the western north Atlantic. Part I. Lancelets, cyclostomes and sharks. Mem. Sears. Fdn. Mar. Res. (1): 1–576; Springer 1963, pp. 95–113 *in* Gilbert, ed. Sharks and survival, Boston, D.C. Heath and Co.; Clark and von Schmidt 1965, Bull. Mar. Sci. 15 (1): 13–83). Published accounts of land bird species in the stomachs of tiger sharks have been limited to the report of a single Yellow-billed Cuckoo (*Coccyzus americanus*) taken from the stomach of a tiger shark captured on the central Florida Gulf coast (Saunders and Clark 1962, Auk 79: 118).

The stomachs of 315 sharks over 100 cm in length and representing 12 species were examined by the senior author between 19 November 1974 and 6 July 1977. Landings were made within 600 m of shore from Melbourne Beach (28°03.8′N) and southward 20 km along the central Florida east coast. Bird remains were found only in tiger shark stomachs; five of the 15 specimens in which food items were found contained bird remains. Birds were found in tiger sharks landed during February, April, May, and September (twice). Identifiable remains were found in two tiger sharks landed during May and September 1976. On the night of 11 May 1976 a 182-cm female tiger shark was caught 250 m from shore at Melbourne Beach. The stomach of this shark contained a chunk of wax, a piece of turtle shell, two horse conch (*Pleuroplaca gigantia*) opercula, one whelk (*Busycon* sp.) operculum, and the remains of one Yellow-billed Cuckoo, one Bahama Yellowthroat (*Geothlypis rostrata*), and one Mourning Dove (*Zenaida macroura*). On the night of 24 September 1976 a 246-cm male tiger shark was caught 400 m from shore near the southern end of the fishing area. The stomach of this shark contained one octopus, two horse conch opercula, and the remains of two Wood Thrushes (*Hylocichla mustelina*).

The presence of small birds in the stomachs of tiger sharks during the spring and fall and their absence during June, July, and August, when the majority of the tiger sharks were landed, suggests that small migratory birds may on occasion fall prey to tiger sharks during unsuccessful migratory flights over open water. The Yellow-billed Cuckoo, Wood Thrush, and Bahama Yellowthroat are all weak migratory

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flyers. These birds could easily have been forced down at sea by a sudden squall or become exhausted fighting less severe but constant spring and fall winds. Once on the sea surface they were probably picked up at night by the tiger shark, which tends to be a crepuscular feeder and normally does not approach the surface by day (Springer, ibid.). The presence in the tiger shark of a Mourning Dove, a nonmigrant found adjacent to the beaches in this region, may be the result of this bird having been swept seaward by a strong offshore wind, or already dead, possibly swept out to sea from the adjacent estuary.

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Foraging Success in Three Age Classes of Glaucous-winged Gulls

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A small proportion of bird species delay the onset of breeding past the age of 1 yr. Lack (1954, 1966) explained delayed maturation as a means of maximizing lifetime reproductive output, contending that breeding subjects individuals to increased risk of mortality and that younger individuals, being less experienced, are both more susceptible to the strain of breeding and less likely to produce surviving young, if there is competition for resources during the breeding season. Therefore, in species in which some aspect of breeding, such as gathering food for young, is particularly difficult, lifetime reproductive output may be maximized by delaying the onset of breeding until necessary skills have been developed.

One type of evidence for Lack's hypothesis is that foraging efficiency is lower in younger, nonbreeding age classes than in adults in species with delayed maturation. Juveniles have been shown to be less successful at catching fish in Little Blue Herons (*Florida caerulea*) by Recher and Recher (1969), in Brown Pelicans (*Pelecanus occidentalis*) by Orians (1969), and in Sandwich Terns (*Sterna sandvicensis*) by Dunn (1972). On the other hand, Buckley and Buckley (1974) found that juvenile Royal Terns (*Sterna maxima*) are just as successful in fishing as adults in terms of fish caught per attempt. In this paper, I examine fishing skill in three age classes of another species with delayed maturation, the Glaucous-winged Gull (*Larus glaucescens*).

The study was conducted at the Crittenden Locks in Seattle, Washington during July and August of 1975 and 1977. Ten or more Glaucous-winged Gulls are usually present at the locks, feeding on small fish brought to the surface by an upwelling of water caused by filling and emptying the locks. These gulls use two foraging methods, similar to those used by Black-legged Kittiwakes (*Rissa tridactyla*) (Burtt 1974): (1) "dive foraging" in which a bird dives through the air and enters the water head first, and (2) "surface foraging" in which a bird feeds while swimming on the water surface. Only data on dive foraging will be considered here.

Three age classes were distinguished by plumage and bill color according to the following criteria (see Dwight 1925): (1) yearlings have light brown heads, gray-brown backs, and dark bills; (2) two-year-olds have white heads streaked with brown, gray backs, and bills dark at the tip and drab at the base; and (3) adults have white heads, gray backs, and yellow bills. Three-year-olds have been included with adults though breeding does not start until four (Vermeer 1963).

Data were taken by two observers, who attempted to record every foraging attempt within view. A foraging attempt was recorded whenever a gull dove through the air and entered the water so as to totally submerge its bill. A success was recorded if a fish was seen to be swallowed. If no fish was seen in the bill after an attempt, or if a fish escaped before being swallowed, a failure was recorded. Observations on the three age classes were made simultaneously so that conditions of wind velocity, fish abundance, and cloud cover would be identical for each age class.

In 1975, adults were successful on a greater proportion of attempts than were yearlings on all 5 days of observation (see Table 1), but none of the differences was significant. Adults were more successful than two-year-olds on the 3 days that more than one attempt by two-year-olds was observed, but again none of the differences was significant. Combining the data for the different days, adults were successful in 66.7% of their attempts, which was not significantly better than the 56.8% success rate of yearlings

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