Deonier for identifying insects, to my wife Carol, Patrick Dougal and the Green brothers for assistance in the field. Data are taken from a M.Sc. thesis submitted to Miami University. This is Welder Contribution 195.—GODFREY R. BOURNE, *Institute of Environmental Sciences, Miami Univ., Oxford, Ohio 45056. (Present address: School of Natural Resources, Univ. Michigan, Ann Arbor, Michigan 48109.)* *Accepted 3 Nov. 1980.*

Wilson Bull., 93(4), 1981, p. 554

House Sparrows flushing prey from trees and shrubs.—House Sparrows (*Passer domesticus*) exhibit much foraging adaptability (Potter, Condor 33:30, 1931; Bent, Life Histories of North American blackbirds, orioles, tanagers, and allies, U.S. Natl. Mus. Bull. 211, 1958; Summers-Smith, The House Sparrow, Collins, London, England, 1963; Marti, Wilson Bull. 85:483, 1973). Guillory at Eunice, St. Landry Parish, Louisiana, on 22 August 1976, and Deshotels at Kaplan, Vermilion Parish, on 13 September 1977, each observed a House Sparrow displaying previously unreported foraging behaviors.

In Eunice, a female was seen searching in a loose 30 × 46 cm cluster of dry southern red oak (*Quercus falcata*) twigs and leaves located on peripheral branches approximately 6 m above ground. The bird shook the leaf cluster by momentarily grasping a twig with her feet and vigorously flapping her wings. The bird repeated this while hopping from twig to twig in the cluster. The bird flushed an unidentified white moth (Lepidoptera) (2.5 cm), captured it in flight and fed it to one of her nestlings. She returned to the same cluster and twice repeated the above actions, catching two more white moths of similar size and fed them to her nestlings. The bird returned to the cluster, probed among the leaves and caught a brown moth (2.5 cm).

In Kaplan, a male House Sparrow was seen flushing beetles (Coleoptera) and white moths from a densely vegetated, flat-topped hedgerow ca. 30 cm high. Prey were flushed from the top of the hedgerow by hopping and wing flapping similar to that of the aforementioned female. The bird stopped occasionally and probed among the leaves and branches, presumably for insects. The bird hovered near moving insects, apparently attempting to flush them. Prey leaving the shrubbery was captured in flight or on a nearby sidewalk, crushed on the concrete, and then consumed.

These behaviors are further examples of opportunistic foraging by House Sparrows.

We wish to thank Dwight J. LeBlanc for his helpful criticisms of the manuscript.—HARLAND D. GUILLORY, *Div. Sciences, Louisiana State Univ. at Eunice, Eunice, Louisiana 70535* AND JACK H. DESHOTELS, *Lot 4, Azalia Drive, Youngsville, Louisiana 70592.* *Accepted 6 Oct. 1980.*

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Differential predation by two species of piscivorous birds.—The piscivorous Double-crested Cormorant (*Phalacrocorax auritus*) and White Pelican (*Pelecanus erythrorhynchos*) use distinctly different foraging techniques (Palmer, Handbook of North American Birds, Vol. 1, Yale Univ. Press, New Haven, Connecticut, 1962). Cormorants dive to depths of 20 m and pursue fish. Pelicans scoop fish "dip-net fashion" in water to depths of 1 m.

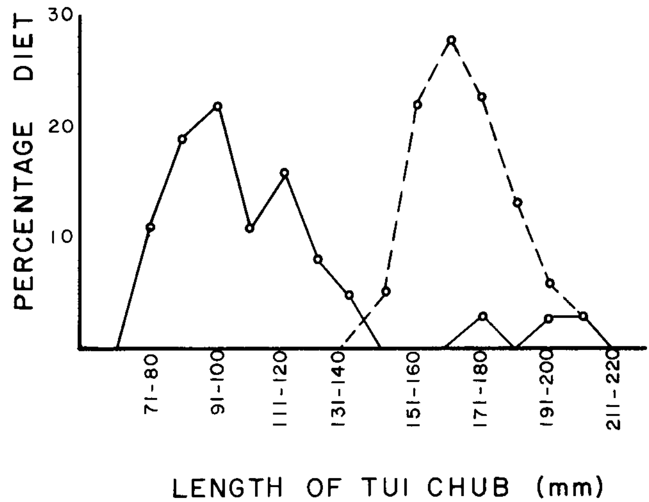

FIG. 1. Percentages of tui chubs of different standard lengths observed in the diets of White Pelicans (solid line) and Double-crested Cormorants (dashed line) at Pyramid Lake, Nevada.

Despite these differences, the species often have similar diets where sympatric (Behle, The Bird Life of Great Salt Lake, Univ. Utah Press, Salt Lake City, Utah, 1958). Such dietary overlap is pronounced at Pyramid Lake, Nevada, where the birds feed heavily upon an indigenous population of tui chub (*Gila bicolor*) which spawns in shallow (<1 m) water from about 1 June–15 August (Kucera, Great Basin Nat. 38:203–207, 1978), during the nestling and pre-fledging phases of cormorant and pelican chick development (Hall, Condor 27:127–160, 1925; Hall, Condor 28:87–91, 1926). Cormorants feed at the lake throughout this period, whereas pelicans forage there only during June (Knopf and Kennedy, Western Birds 11:175–180, 1980). In this study we assessed characteristics of *G. bicolor* preyed upon by the two bird species at Pyramid Lake.

Chicks of cormorants and pelicans readily regurgitate fish if disturbed shortly after they are fed. We collected fish regurgitated in this manner at nesting sites on Anaho Island National Wildlife Refuge, Washoe Co., Nevada on 30 June 1976, within 30 min after chicks were fed. We weighed and measured the fish within 1 h of collection.

We collected 94 *G. bicolor*, totalling 10,625 g, regurgitated by cormorant chicks and 236 fish, totalling 8681 g, regurgitated by pelican chicks. Sixty-four and 37 of these fish, respectively, were intact and could be measured (Fig. 1). The distance from the snout to end of the vertebral column (standard length) of *G. bicolor* regurgitated by cormorant chicks averaged 171.6 mm (SD $\pm$ 14.3 mm) while that of fish from pelican chicks averaged 110.1 mm (SD $\pm$ 29.7 mm). This difference is statistically significant (t adjusted = 9.22, $P < 0.001$). The variance in length of *G. bicolor* collected from cormorants and pelicans was tested (Lewontin, Syst. Zool. 15:141–143, 1966) and also found to be significantly different (F = 10.47, $P <$

0.001). Since the mean standard length of fish regurgitated by cormorants is greater than that of pelicans, this test is conservative.

All fish collected from cormorant chicks were *G. bicolor*. In contrast, of the 344 fish collected from pelican chicks, *G. bicolor* comprised only 39.5% (by weight). Carp (*Cyprinus carpio*) was the predominant fish in the pelican diet (58.6% by weight). White crappie (*Pomoxis annularis*), Tahoe sucker (*Catostomus tahoensis*), Sacramento perch (*Archoplites interruptus*) and brown bullhead (*Ictalurus nebulosus*) comprised only 1.9% of the diet by weight. Carp, plus the other fishes in the pelican diet, are rare or do not occur in Pyramid Lake, and these species were captured by pelicans foraging in outlying wetlands.

Prey size (Storer, Auk 83:423–436, 1966; Ashmole, Syst. Zool. 17:292–304, 1968) and variation in prey size (MacArthur, Geographical Ecology, Harper and Row, New York, New York, 1972; Reynolds, Foods and habitat partitioning in two groups of coexisting *Accipiter*, Ph.D. diss., Oregon State Univ., Corvallis, Oregon, 1979) tend to increase with predator size. Pelicans often take carp up to 68 cm (Hall 1925), thus supporting those studies. Our data on *G. bicolor* are not comparable, however, since they represent only a portion of the pelican diet.

Cormorants and pelicans exploited the *G. bicolor* population differently, apparently relative to their respective foraging techniques. Prior to spawning, *G. bicolor* forms large swarming schools at the lake's surface. Both bird species are attracted to the schools where they forage simultaneously. Cormorants dive and select only the larger chubs from schools, presumably offsetting the greater energetic costs of underwater pursuit. Pelicans remain at the surface and take available fish, capturing many smaller fish but with less effort.

The diet of cormorants at Pyramid Lake is likely opportunistic in that they cannot fly efficiently to outlying wetlands to forage, and must forage from the predominantly chub fish community. However, the cormorants' species- and size-specific diet is atypical relative to its food habits in other regions of North America (Robertson, Condor 76:346–348, 1974). Pelicans, also opportunistic, often fly great distances from nests to feed (Low et al., Auk 67:345–356, 1950; Lingle and Sloan, Wilson Bull. 92:123–125, 1980) and probably nest on Anaho Island since no other suitable islands for nesting occur in the area. The pelican exploits the large *G. bicolor* population when available, but does not demonstrate the reliance of the cormorant upon that fish species.

Piscivorous bird species reduce competition for food where they coexist by foraging on different sizes of fish, at different distances from nests, or by having non-overlapping breeding seasons (Cody, Ecology 54:31–44, 1973). We are uncertain whether cormorants and pelicans compete for *G. bicolor*. The potential for competition is high, since of the five fish species in Pyramid Lake, *G. bicolor* comprises 86% of all fish (by numbers) available to cormorants in water 0–15 m deep (Vigg, Calif. Fish and Game 66:49–58, 1980) and virtually all fish available to pelicans in water 0–1 m deep. The cormorant population appeared below the area's carrying capacity since cormorants historically nested also on rocky pinnacles jutting from the north end of the lake (Marshall and Giles, Condor 55:105–116, 1953) where 272 nest structures were present, but unused, 1976–1977.

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