

Co., London, 1956) listed "small dragonflies" as food of the Common Swift (*Apus apus*). If food-robbing was not the purpose, perhaps this swift and the other three (a family group?) were "playfully" harassing the martin. Swifts are common near this martin colony, and martins and swifts forage together there. I have seen Chimney Swifts frequently chase Purple Martins for 3–10 sec. Only on this occasion was a swift seen attempting to steal food from a martin, but it now appears that food piracy may be a possible motive for some of these chases. Because dragonflies are large and visible whenever martins juggle them in flight and transport them to the young, capture of these prey by martins may present swifts with suitable robbing opportunities.—CHARLES R. BROWN, 2601 Turtle Creek, Sherman, TX 75090. Received 27 March 1980; accepted 5 May 1980.

**Opportunistic Scavenging by Shorebirds: Feeding Behavior and Aggression.**—

Many species of shorebirds feed opportunistically and can exploit invertebrates and even plant foods in different habitats or at different seasons (Bent, U.S. Natl. Mus. Bull. 142, 146, 1927, 1929). Relatively few species of shorebirds feed regularly on live fish, although a few feed occasionally on small fish (Bent, op. cit.; Witherby et al., Handbook of British Birds, Witherby Co., London; Rand, Wilson Bull. 69:186–187, 1957). Several species feed on flies and maggots associated with fish offal (Bent, op. cit.) or with seal carcasses (Preble and McAtee, N. Am. Fauna, No. 146, 1923; Stejneger, U.S. Natl. Mus. Bull. 29, 1885). A few shorebirds also feed occasionally on dead animals. Bent (op. cit.) reports a Black-bellied Plover (*Pluvialis squatarola*) eating a dead crab, and Weston (Auk 80:550–551, 1963) reports Killdeer (*Charadrius vociferus*), Common Snipe (*Gallinago gallinago*), and Greater Yellowlegs (*Tringa melanoleucus*) feeding on pollution-killed fish during a winter storm. Sanderlings (*Calidris alba*) and Ruddy Turnstones (*Arenaria interpres*) occasionally eat dead fish (Rand, op. cit.; Boer and VanOrden, Limosa 36:141–183, 1962).

On 3 and 4 January 1979, on a beach at Galveston, Texas, we observed a group of gulls and shorebirds feeding on the fish carcasses that had been discarded by commercial seine fishermen. The fish included mullet (*Mugil* spp.), sheepshead (*Archosargus probatocephalus*), speckled sea trout (*Cynosion nebulosus*), red drum (*Cyanops ocellata*), and sea catfish (*Arius felis*). Within 10 min after the men departed each day, Herring Gulls (*Larus argentatus*) began feeding, and shorebirds immediately joined the group.

One area we studied contained 24 mullet (snout–vent lengths 24–45 cm) scattered along 140 m of beach just below the high tide line. The fish had been dead since the previous day, and their condition varied from intact with only the eyes removed to completely disembowelled. None of the fish contained maggots, and the birds we watched definitely ate bits of flesh, not just flies or maggots.

We counted the birds within 50 m of the fish, those feeding on the carcasses, and timed feeding bouts (length of time spent feeding at a particular fish before stopping or switching fish). We divided the data into two sets, one for high bird density (number of birds greater than number of fish), and one for low bird density (occurring at high tide when the birds moved away from the advancing water). Interactions between species and age classes of the gulls were noted as follows. Young gulls were birds hatched the previous year (about 7 months old), subadult Herring Gulls were 1.5 to 3.5 years old, and subadult Ring-billed Gulls (*L. delawarensis*) were 1.5 to 2.5 years old (Burger and Gochfeld, Auk 96:806–808, 1979).

*Feeding behavior.*—The numbers of birds present are shown in Table 1. All shorebirds present within 50 m of the fish were actually feeding on them, except for four Sanderlings. The single Black-bellied Plover fed for less than 5 min, and it did not interact with other birds. It fed by pecking at the abdominal cavity of several fish for periods of less than 5 sec, and then fed continuously on another fish for 117 sec. All four Turnstones fed throughout the observation period, mainly by pecking at the fish orbits. Turnstones were among the first birds to leave when the tide rose. The Willet (*Catoptrophorus semipalmatus*) pecked rapidly (about 3 pecks/sec) at the orbits and gills of the dead fish. Sanderlings moved about quickly from fish to fish, feeding mainly by pecking at the orbits. One Sanderling repeatedly pecked at the exposed abdominal flesh of one fish to which it returned several times. The gulls were responsible for opening up the fish by tearing

TABLE 1.  
Aggressive interactions among gulls and shorebirds feeding on carrion.

Loser	Num- ber pres- ent at car- rion	Winner						Wil- let	San- der- ling	Ruddy Turn- stone
		Herring Gull			Ring-billed Gull					
		Adult	Sub- adult	Young	Adult	Sub- adult	Young			
Herring Gull										
Adult	1	X <sup>1</sup>	0	0	0	0	0	0	0	0
Subadult	2	0	0	4	0	0	0	0	0	0
Young	5	0	0	8	0	0	0	0	0	0
Ring-billed Gull										
Adult	3	0	2	2	2	2	0	0	0	0
Subadult	2	0	0	7	1	0	2	0	0	0
Young	1	0	1	1	0	0	X	0	0	0
Willet	1	0	0	4	2	1	0	X	0	0
Sanderling	24	0	0	4	1	1	1	7	25	8
Ruddy Turnstone	4	1	0	1	1	2	0	0	0	0

<sup>1</sup> X = only one individual present, hence no intraspecific aggression possible.

loose pieces of the flesh. After a gull had opened a fish and then departed, shorebirds began feedling.

*Aggression.*—Aggressive interactions were frequent and most feeding bouts were terminated because of interruption by an approaching bird. Table 1 is a matrix of aggressive interactions showing winners and losers. Gulls and shorebirds defended fish against smaller intruders. Young Herring Gulls were the most aggressive gulls and won 79% of their encounters. All species except the plover had at least one unsuccessful encounter with gulls.

Sanderlings moving rapidly among fish were frequently involved in brief fights. One bird fed at a fish for over 1 min, successfully fending off two intruding Sanderlings, then

TABLE 2.  
Mean feeding bouts during period of high density (14 gulls, 29 shorebirds). Times are given in seconds.

	Bouts	Mean	SD	Range
Herring Gull				
Subadult	6	35.3	20.4	10-72
Young	8	152.7	46.6	40-184
Ring-billed Gull				
Adult	10	11.3	4.6	3-17
Subadult	3	25.7	a	17-42
Young	3	16.7	a	6-32
Willet	12	30.8	19.4	4-65
Sanderling	16	9.2	6.6	1-21
Turnstone	8	20.6	13.2	6-38

a = too few to compute standard deviation.

quickly moving to drive conspecifics from three nearby fish, pausing at each briefly to take one peck at the fish. This behavior seemed to be territorial defense of an area rather than defense of a particular food item (see Myers et al., *Studies in Avian Biology* 2:231–246, 1979).

The Willet avoided aggression with the gulls by choosing fish not favored by them, and by moving quickly away when the gulls approached. Several Sanderlings fed at fish near the end of the line of fish and thus were less frequently displaced. Turnstones invariably displaced Sanderlings simply by walking up to a fish.

*Feeding times.*—Table 2 gives mean feeding bouts for the different species at high density. For young Herring Gulls the feeding bouts increased significantly from 120 sec at high density to over 300 sec at low density (Mann-Whitney  $U = 0$ ,  $P < .001$ ). The single Willet showed an increase (high density mean of 31.8 sec vs. low density mean of 44.2 sec,  $U = 29$ ,  $P < .01$ ), but this bird usually fed on the edge of the group. At low densities only 3 young and 1 subadult Herring Gull were present to chase the shorebirds.

Although only four times (mean = 100.1 sec) were obtained for Sanderlings at low density (when only 9 were present), these were significantly longer than the times at high density when 24 were present ( $U = 2$ ,  $P < .001$ ). Half of the high-density feeding bouts were less than 7 sec in duration, and all terminated due to aggressive displacements. At high density we recorded times for four Sanderlings feeding on the ends of the row of fish. These bouts averaged 41.5 sec, significantly longer than the comparable high-density times for birds in the center of the fish where the gulls fed ( $U = 0$ ,  $P < .001$ ), but they were not different from the times obtained at low density ( $U = 11$ ,  $P < .10$ ).

The opportunistic use of carrion by shorebirds is undoubtedly more frequent than is apparent from the literature. At Galveston where commercial netting of fish occurs regularly, shorebirds have ample opportunity to exploit this food source. Such opportunism indicates that shorebirds can switch to a readily available food supply when their usual food is unavailable. Our observations were made during a period of very cold temperatures for Galveston. In the two preceding days the air temperatures fell below 0°C, and 3 January 1979 was the coldest 3 January in 50 years. Under these conditions shorebirds were having trouble obtaining their usual food. Energy requirements would also be higher under these conditions (see Goss-Custard, *Studies in Avian Biology* 2:247–258, 1979).

Carrion-feeding was not without cost since the shorebirds were frequently interrupted by aggression. Only a small percentage of the gulls within 50 m were feeding on the dead fish at any one time. Had more of the gulls concentrated at the carrion, the shorebirds would have been denied access. Sanderlings displaced conspecifics 25 times in 30 min, and the average feeding bout lasted only 9.2 sec, indicating that interruption was a serious problem.—MICHAEL GOCHFELD, *Environmental Health, Columbia University School of Public Health, 600 West 168th St., New York, NY 10032*, and JOANNA BURGER, *Department of Biology, Livingston College, Rutgers University, New Brunswick, NJ 08903*. Received 1 May 1980; accepted 17 July 1980.

**Mockingbird's Defense of a Winter Food Source.**—A Mockingbird (*Mimus polyglottos*) continually used the city lot surrounding my home in Oxford, North Carolina, throughout the winter of 1978–1979 without observed conflict with other birds, except during two days. During the period 8–9 February 1979, following a snowfall of 14 cm on 7 February, this bird repeatedly drove approaching Starlings (*Sturnus vulgaris*) from a fruit-laden pyracantha bush. During the period 0900 to 1400, 23 chases were made, with as many as five Starlings involved in some chases.

Michener and Michener (Condor 37:99, 1935) noted that Mockingbirds defend a territory throughout the year, with the defense in winter being much more vigorous than in summer and centering on a food source. This Mockingbird showed defensive activities only when snow cover restricted the available food supply. Thus, the vigor in defense of a winter territory or food supply may indicate the amount of difficulty a given Mockingbird encounters in finding food or the relative amount of available food.—PAUL A. STEWART, 203 Mooreland Drive, Oxford, NC 27565. Received 3 December 1979; accepted 5 May 1980.