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JSTOR

FOOD OF SOME UNCOMMON NORTH AMERICAN BIRDS

BY CLARENCE COTTAM AND PHOEBE KNAPPEN

FOR more than half a century the U. S. Biological Survey has been accumulating information on the food and economic status of birds. During this time considerably more than 200,000 bird stomachs have been assembled, mostly from birds collected primarily for other purposes. Approximately half this number have now been analyzed. Brief to comprehensive reports have been published on some two hundred species. Other species or groups of species have been partially worked, while with still others, relatively little detailed information on food preferences is yet available. Considering the time elapsed and the large number of birds collected, it is perhaps to be expected that the series would include representatives of some forms that are now extinct, rare, or at most only locally abundant. Many have great mobility, which, sometimes augmented by storms, results in their straggling far from their normal range; in this way certain exotic species of birds have come within our borders where a limited number have been collected. In most instances only one or a few stomachs of such wandering, rare, or extinct species have been available for study. The paper gives some information on the food of forty-seven species of birds and is based on the laboratory analysis of the contents of 239 stomachs. The number of stomachs for the various species varied from one to thirty-five. Unfortunately stomachs of all our rare or extinct birds were not available. However, the information presented, though limited and fragmentary, is of interest and value, and unless published in some such form as this, would largely remain buried in the files of the Biological Survey. It is the purpose of this paper to present such data as are available in the Food Habits laboratory of the Biological Survey on the food of nearly fifty uncommon, vanishing or extinct species. Papers from the Section of Food Habits usually treat groups of related species, but in this instance, a heterogeneous lot of species is discussed in systematic order. Among the rarer or extinct species included are the Passenger Pigeon, Carolina Paroquet, Eskimo Curlew, Trumpeter Swan, Ivory-billed Woodpecker, Great White Heron, Roseate Spoonbill, and Everglade Kite.

While the larger part of the laboratory examinations were made for this study by the writers, generous and willing assistance was received from several members of our Food Habits Staff—both present members and others who have worked in the laboratory in years gone by. To all of them and to those who have aided in other ways, we extend our sincere thanks.

YELLOW-BILLED LOON, *Gavia adamsi*.—The Yellow-billed Loon, a bird of the far north, although not regarded as an abundant species in North America, breeds in a

few localities on the Arctic coast of Alaska, the Mackenzie River delta, and on the Omolai River, Siberia. In winter it is widely distributed in northern Europe and Asia, occurs on the Pacific coast of Alaska, and has occasionally been recorded as far south as Vancouver Island, British Columbia.

But four stomachs of the Yellow-billed Loon, all from the Alaskan coast, have been examined in the Biological Survey, and one of them, containing only a few fish vertebrae, was too nearly empty to be used in tabulating food percentages. The food consumed is similar to that of the Common Loon (*Gavia immer*). Each bird had fed on what are believed to be the common and most readily available fishes in the waters where they were collected, namely, tomcod and sculpin. All three birds which contained sufficient food for consideration had fed on fish, one of them exclusively. The second bird took in addition a small mollusk, while the third had consumed two kinds of fishes, mollusks, crustaceans, and a polychaete. The crustaceans consisted of two species of amphipods (*Orchomonella* sp. and *Anonyx nugax*), one isopod (*Idothea* sp.), two species of shrimps (*Pandalus danae* and *Spirontocaris ochotensis*), and a hermit crab (*Pagurus* sp.), while the marine worm was identified as a species of *Nereis*. It is entirely possible that the minor food items were taken accidentally, incidentally, or were a secondary food.

A summary of the food of the three birds follows: *Leptocottus armatus*, 19.67%; *Myoxocephalus joak* (?), 13%; undetermined Cottidae, 56.67%; *Microgadus proximus*, 10%; crustaceans and mollusks, each 0.33%. From this it is noted that fish made up more than 99% of the food. It was somewhat surprising that gravel, which totaled 11% of the stomach contents, was found in each of the stomachs.

MEXICAN GREBE, *Colymbus dominicus brachypterus*.—The Mexican Grebe ranges from southern Lower California and southern Texas south to Panama. It is uncommon in the United States and little seems to have been published on its food. In August 1929, Dr. Francis Harper obtained five specimens in Cameron and Kenedy Counties, Texas, and on December 11, 1937, John J. Lynch collected one in Hidalgo County, Texas. Although too few stomachs are available to permit definite conclusions, the evidence at hand indicates that the Mexican Grebe is more insectivorous and less piscivorous in its feeding habits than are its widely distributed relatives occurring in the United States. This seems to confirm Dr. A. Wetmore's statement that it probably lives largely on aquatic insects (42, pp. 18-19). Moreover, it apparently consumes a smaller quantity of feathers.

Each of the six birds collected had a well-filled stomach and each had fed exclusively on insects. Aquatic beetles and true bugs supplied all but a small percentage of the food, forming 45.33% and 44.17%, respectively. Predacious diving beetles were a conspicuous part of each meal. Species of Dytiscidae, Hydrophilidae, and Halipidae constituted 24.83%, 11.33%, and 3.17% of the average meal. Giant waterbugs (*Belostoma* sp.) comprised 6% of the food while other waterbugs such as Corixidae, Notonectidae, *Buenoa* sp., and *Plea striola*, amounted to 42.67% of the total intake. Other bugs, including *Ranatra* sp., *Pelocoris femoratus* and Lygaeidae, contributed 1.5% of the menu. The aquatic nymphs of dragonflies and damselflies (Odonata) were next in order of importance and totaled 10.5% of the average meal, while other insects, arachnids, and indeterminable animal matter formed only a trace. There was an average of fifteen kinds of food per stomach. Some feathers were found in each stomach examined but they averaged only 6.67% of the volume as contrasted with an average of 27 to 70% reported in other North American grebes. Three of the six birds contained a few nematodes.

BLACK-FOOTED ALBATROSS, *Diomedea nigripes*.—Although the Black-footed Albatross occurs commonly at sea off the west coast of North America, it is rarely seen near the mainland. Only two stomachs taken from birds collected on the Aleutian Islands in June and August, 1936, were available for analysis. The bird is known to follow persistently in the wake of vessels and consumes any edible refuse that it can glean from the surface of the water. W. H. Dall (20, p. 31) reports that it seems to subsist to a considerable extent on a pelagic crab (*Pinnotheres* sp.). The two Aleutian Island birds had little opportunity to feed on ship refuse and had obtained their sustenance from natural sources. Both birds had fed on fishes (mostly rockfish, Scorpaenidae), which formed 35% and 92% of the two meals. The remains of seven fish were found in one stomach, along with six or more squids, and the common sea urchin (*Strongylocentrotus dröbachiensis*), totalling 55% and 2%. The other albatross consumed amphipod crustaceans (Gammaridea) to the extent of 1% of the meal. Drift plant fiber, consisting partly of brown algae, probably kelp, made up 8% and 7% of the contents of the two stomachs.

SLENDER-BILLED SHEARWATER, *Puffinus tenuirostris*.—According to the American Ornithologists' Union 'Check-list' (1, p. 7) the Slender-billed Shearwater, which breeds in Australian seas, ranges from the southern oceans northward in the Pacific to Bering Sea "and eastward, mainly on southward migration, to the coast of North America from Sitka to southern California." Although it annually occurs in fall migration at sea off the Pacific coast, it is rarely seen from our mainland.

For this study twelve stomachs collected in Alaska were available. All but one, obtained in May, were taken in July. Two of the stomachs were too nearly empty to be used in the percentage tabulations. A summary of the foods reveals that this shearwater is content to make a meal on relatively few items; only one bird had consumed as many as four kinds of animal matter, and the average was only one or two species per meal. A tabulation of the food is as follows: amphipods, 13%; schizopods, 15%; undetermined crustaceans, 20.8%; squid (*Loligo* sp.), 16.1%; undetermined marine-invertebrate flesh, possibly squid, 29.4%; and fish 5.7%. Gravel was found in each stomach and averaged only slightly less than 40% of the contents.

PINK-FOOTED SHEARWATER, *Puffinus creatopus*.—The Pink-footed Shearwater is largely restricted to eastern portions of the Pacific Ocean and is very uncommon along the western American coast. But two stomachs, one taken in August and one in July, were available for study. One of these was nearly empty, containing undetermined fish scales and the mandibles of a squid (*Loligo* sp.). The other stomach contained the remains of twelve or more squids and a few eye-lenses of fishes. Cooper, as recorded by Baird, Brewer, and Ridgway (7, p. 384), found them feeding commonly on fish "which they are most active in catching when the seas are rough as it enables them to scoop up small fish from the agitated tops of the waves."

GREAT WHITE HERON, *Ardea occidentalis*.—The Great White Heron is limited in distribution to Florida and the Florida Keys and for many years it has been progressively decreasing. The unparalleled Florida hurricane of 1935 almost put an end to the species, for Sprunt (39, pp. 405-411), found only 146 Great White Herons in a detailed survey of nine-tenths of its range in October, 1935. Fortunately, 412 individuals were found in October of the succeeding year (2, p. 458).

Nine stomachs of birds collected on the Florida Keys in December and January 1923-24 were examined, one of which was too nearly empty to be included in the food tabulation. Of the eight birds considered, six had drawn three-fourths or more of their rations from the fish fauna and the two other birds had fed almost exclusively

on shrimps (*Peneus* sp.). In summary, fish averaged 65.25% of the food. Availability seemed to be the principal factor governing feeding, consequently nearly all the fishes taken were of coarse, non-commercial varieties, such as toadfish, pipefish, and porcupine fish (Ophiethyidae, *Opsanus* sp., *Diodon* sp., *Calamus* sp., *Siphostoma* sp.). Of sixty-one fishes of five species identified in the stomachs, only one, a mullet (Mugilidae), could be considered of commercial value. The common edible shrimp (*Peneus* sp.) or some other crustacean entered into the menu of each of the birds, and formed the entire contents of two stomachs. Shrimp supplied 31% of the average meal, and crabs and other crustaceans made up 1.5% of the total food. Small gastropods were eaten by five of the eight birds, yet they formed only 1.37% of the average meal. Vegetable débris and root stocks were taken in small quantities by three of the birds, averaging 0.88% of the total food.

ROSEATE SPOONBILL, *Ajaia ajaja*.—One of America's most picturesque birds is the Roseate Spoonbill, a species that unfortunately has suffered a serious reduction both in numbers and in distribution. It is to be hoped that present conservation measures and interest evinced by national, state, and local organizations will restore the bird to at least its former abundance. A recent report of the National Association of Audubon Societies (3, p. 26) indicates that the bird seems to be increasing slightly in numbers although it is still dangerously rare in the United States. According to the 'Check-list of North American Birds,' (1, p. 34), the spoonbill breeds locally in southern Texas, Louisiana, Georgia, central and southern Florida, the Bahamas, Cuba, and Central Mexico, south to Argentina and Chile. Formerly it was casual in distribution north to Pennsylvania.

Relatively little study has been made of the food habits of this species, although casual observations have been recorded by a considerable number of observers. Audubon (4, p. 191) wrote: "They move their partially opened mandibles laterally to and fro with a considerable degree of elegance, munching the fry, insects, or small shellfish, which they secure before swallowing them." He further observed that while the birds were frequent visitors to artificial ponds in Florida "the shallow inlets in the great salt marshes of our southern coasts are their favorite places of resort."

N. B. Moore (13, p. 19) states that he has found fish, prawn or shrimp, and coleopterous insects in the stomachs of spoonbills. Maynard (33, p. 404) writes that a bird kept in confinement was fed principally upon small fishes, bread, and cooked sweet potatoes. From field and laboratory study, it is evident that the birds feed in both fresh and salt-water areas.

For the present study only four stomachs were available, all of which were obtained in Florida in February and March. Three of these were gorged or well filled, while the fourth, which was nearly empty, contained 90% bone fragments of sheepshead minnow and 10% wood pulp. The food in the first three stomachs consisted of 80.67% fishes, 11.33% water beetles, 4.67% shrimps, 3.33% plant material, with a trace of miscellaneous aquatic bugs and gastropods. All of the fishes consumed were of non-commercial varieties. As would be expected those forms most readily obtainable, such as killifish, made up most of the menu.

As evidence of a surprising capacity the following foods were consumed for one meal: nineteen top minnows (*Zygonectes nolti*), 9%; twenty-one killifishes (*Fundulus* sp.), 9%; three sheepshead minnows (*Cyprinodon variegatus*), 2%; four killifishes (*Jordanella florida*), 2%; forty-six top minnows (*Mollienesia latipinna*), 17%; fragments of undetermined top minnows and killifishes (Cyprinodontidae and Poeciliidae), 43% (total of 246 fish amounting to 82% of one meal); fragments of undetermined fish eggs, trace; and of one ground beetle (*Bembidium* sp.), trace; forty-nine

predacious diving beetles (*Thermonectes basilaris*), 5%; fragments of twenty-three or more water-scavenger beetles (*Tropisternus glaber*), 2%; fragments of twenty-one or more water boatmen (Corixidae), trace; one pseudoscorpion, trace; one gastropod (*Ammicola* sp.), trace; 152 or more shrimps (*Palaemonetes exilipes*), 9%; cone fragment of pine (*Pinus* sp.), trace; sedge (Cyperaceae) plant fiber, trace; wood pulp and vegetable débris, 2%; and feather fragment, trace.

TRUMPETER SWAN, *Cygnus buccinator*.—The Trumpeter Swan was formerly a common American species occurring as a breeder from Alaska, Mackenzie, and James Bay, south to British Columbia, Alberta, Manitoba, Montana, Wyoming, Nebraska, Iowa, Missouri, and Indiana, and as a winter visitor southward to the Gulf of Mexico and southern California. Diminution of this majestic bird commenced fifty to sixty years ago and by 1930 only a few individuals were left. The Biological Survey, the National Park Service, National Parks Bureau of Canada, and private individuals have extended complete protection to the Trumpeter Swan for nearly two decades. At present there are flocks in British Columbia and Alberta, Canada, one in Yellowstone National Park, and one on the Red Rock Lake Migratory Waterfowl Refuge in Montana, and possibly another at Henry Lake, Idaho. There are, no doubt, other places where isolated pairs or small groups breed.

We regret that the Trumpeter Swan must now be listed among ornithological rarities and we hope it may some day again become abundant—a possibility suggested by the history of the flock at the Red Rock Refuge established April 22, 1935, primarily to protect these swans. In the first two years there was a 50% increase in the swans which numbered thirty-nine adults and fifty-one young in April, 1937. Though census figures are not available for 1938, seventy-eight swans of which about 50% were juveniles were observed on a day's field trip on March 1.

Far too little is known of food preferences of this rare bird and unfortunately only three stomachs have been examined in the Biological Survey. One of these was practically empty of food, and the two others, while full, were from birds that had died of lead poisoning. Consequently, it is not known whether their food was entirely typical. These birds died in the first week of April, 1937, at Red Rock Lake, Montana. Each stomach was about one-third filled with sand; one was from an adult while the other was from an immature bird. The trumpeter feeds, like all swans, by immersing the long neck and head and digging its food from the bottom.

Results of the stomach analyses are as follows:

No. 212892.—Leaves and stems of the white water-buttercup (*Ranunculus* sp., probably *R. trichophyllus*), 70%; aquatic mosses (*Amblystegium* sp., 30%, and *Fissidens* sp., trace), 30%.

No. 212894.—Plant fiber of the white water-buttercup (*Ranunculus* sp., probably *R. trichophyllus*), 63%; aquatic mosses (*Amblystegium* sp., 1%; *Fissidens*, probably *F. grandifrons*, 30%, and *Calliergon* sp., 3%), 34%; buds and leaves of pondweed (*Potamogeton panormitanus*), 1%; three seeds of claspingleaf pondweed (*P. perfoliatus*), trace; seven seeds of two species of sedge (*Carex* spp.), trace; undetermined plant fiber, 1%; three caddisfly larvae of three species (Trichoptera), 1%; fragment of one predacious diving-beetle larva (Dytiscidae), trace; mollusk shell fragment (Mollusca), trace.

The bird whose stomach was nearly empty contained a single seed of claspingleaf pondweed (*Potamogeton perfoliatus*), moss and undetermined plant fiber.

Dixon (22, p. 492) in a public appeal to save this vanishing species described the habits of this swan in the Yellowstone, as follows: "The favorite food of the adult birds was the sprouting white underwater stalk of the tule which was secured by

tipping up and reaching down with their long, muscular necks. In pulling up such tender, sprouting tule stalks, the parents often dislodged water boatmen and other aquatic insects that had taken refuge in the algae and moss. Such insects were instantly gobbled up by the cygnets, which were soon leading instead of following their parents about. During the first ten days of their lives I found that insect food formed the major portion of their diet. However, as they grew they began to pick up more and more of the bits of vegetation that had been pulled up and loosened by their parents."

Forbush (25, p. 477) states that it feeds chiefly on water plants but also consumes succulent parts of terrestrial species along with some shellfish and crustaceans. Bruette (16, p. 415) adds that it also feeds on insects, leaves, seeds and roots. Audubon (5, p. 223) affirmed that they consume snails, small reptiles, and quadrupeds. On the Columbia River, Hughes (29, p. 283) found that its favorite food was the wapato (*Sagittaria variabilis*) and reported finding a bird that had been strangled by having a large tuber lodged in its throat.

BARNACLE GOOSE, *Branta leucopsis*.—The Barnacle Goose, a native of northern Europe and Greenland, seems to be especially fond of succulent grasses found along the water's edge and is said normally to be a land feeder. From the single stomach, available in the files of the Biological Survey, collected on Clavering Island, Greenland, August 6, 1931, it appears to forage upon grasses and sedges. The last meal of this bird consisted of plant fibers: sedge (*Carex* sp.), 40%; grass (Gramineae, probably *Poa* sp.), 35%; and undetermined, 25%.

EMPEROR GOOSE, *Philacte canagica*.—The justification for including the Emperor Goose in this study is based largely on the fact that its distribution is restricted to the cold and inhospitable shores of northern Alaska and Siberia, rather than to any alarming rarity of the species. Elliott (23, p. 130) points out that it remains longer in the Far North than any other goose, lingering until the whole seacoast is fringed with ice. In winter it may be considered a rare or accidental visitor south of the Aleutian Islands.

For the present study thirty-five stomachs of birds were available of which two were not suitable for percentage tabulation. But one of the remaining thirty-three stomachs—from a bird collected at Netarts, Oregon, on the last day of the year in 1920—was taken south of Alaska. One other bird was obtained at St. Lawrence Bay, Siberia, in July 1914. In seasonal distribution twenty of the birds were taken in May, seven in June, two in July, and one each in April, August, September, and December. This report may therefore be considered as applying in general to spring and early-summer foods.

The data here presented do not confirm most published accounts of the food tendencies of this interesting species. Most writers speak of it as being predominantly an animal feeder. William Bruette (16, p. 392) writes that its "flesh is strongly tainted with fish for this goose is an animal feeder," and adds that they live "almost entirely upon the crustaceans and mussels obtained on their favorite feeding grounds." Other writers affirm that it feeds principally upon the blue mussel (*Mytilus edulis*) and other shellfish. Grinnell, Bryant, and Storer (27, p. 245) inform us that "at times it resorts to heath berries which are available on the tundras closely adjacent to the seashore."

Of the food in thirty-three stomachs sufficiently full to enter into the percentage tabulation, 91.58% was of vegetable, and only 8.42% of animal origin. Only two of these birds had fed predominantly on animal life, and only four others had consumed more than a trace of animal matter. In contrast twenty-seven, or more than four-

fifths of the birds, had made their last meals wholly of plant tissues. The major groups of food consumed were: algae, 30.73%; eelgrass and other pondweeds, 13.91%; grasses and sedges, 24.94%; undetermined and miscellaneous plant fiber, 22%; bivalve mollusks (Pelecypoda), 3.66%; crabs and other crustaceans, 2.18%; rodents and fishes, 1.76%; and miscellaneous animal life, 0.82%.

In view of published information on the food preferences of the Emperor Goose, the results of the present study summarized in Table 1 give further evidence that laboratory analyses are indispensable in determining food habits. They should, of course, be supplemented by adequate field observations in order that results may be properly interpreted. From the facts available it appears that algae are a favored food, nearly one-third of the total diet (30.73%) consisting of these plants. Sea lettuce (Ulvaceae, including both *Ulva* and *Enteromorpha*), occurred in twelve of the thirty-three stomachs, constituting the sole item of food for five of the meals, and averaged 17% of the total. Undetermined green algae (Chlorophyceae) comprised 13.24% and other algae made up approximately one-half of one per cent. Much of the undetermined green algae appeared to be Ulvaceae. Feeding on Ulvaceae and other algae may be the reason why the flesh of the bird is not particularly appetizing, as such foods normally cause the flesh of birds feeding thereon to have a strong, so-called 'fishy' flavor. This may have suggested to some writers that the bird was principally an animal feeder.

Tender shoots of sedges and grasses were second in importance, forming 24.94% of the total food and occurring in eighteen of the thirty-three stomachs examined. Plant fiber of sedge (*Carex* sp.) amounted to 15.03% and meadowgrass (*Poa* sp.) formed 2.27% of the total. None of the other grass or sedge material could be identified beyond the families Gramineae or Cyperaceae. Undoubtedly much of the undetermined plant fiber, which comprised 21.55% of the total consumption, was ground up sedge and grass; certainly little of it was algae.

That eelgrass (*Zostera marina*) is a favored food is shown by the fact that it averaged 12.37% of the total consumption and formed from 88 to 99% of the food of four birds. Sago pondweed (*Potamogeton pectinatus*) was eaten by two birds and averaged 1.51% of the total food of the thirty-three tabulated. Miscellaneous vegetable fiber or seeds, including moss debris, seeds and plant tissue of surfgrass (*Phyllospadix* sp.), mare's tail (*Hippuris vulgaris*), crow-berry (*Empetrum nigrum*), and bedstraw (*Galium* sp.), comprise the remaining 0.48% vegetable food.

Only six of the stomachs contained more than a trace of animal matter; two of these, however, contained 98 and 92 per cent, respectively. The most important of the animal foods were bivalves, forming 3.66%, of which the razor clam (*Siliqua* sp.) averaged 2.91% and the blue mussel (*Mytilus edulis*) 0.45%. Crustaceans, which were a close second with an average of 2.18%, consisted mostly of horse crabs (*Telmessus cheiragonus*), 2.12%. One of these measured 39 mm. across and formed 70% of the meal. Vertebrate animals contributed 1.76% to the menu and consisted of rodents and fishes. One bird had consumed a lemming mouse (*Lemmus* sp.) and a field mouse (Microtinae), forming 36% of its meal; but only 1.09% of the average food of the thirty-three birds. Remains of fishes, mostly Cottidae, were found in three stomachs, in volume forming only a trace in two meals and 22% of a third; the average for the whole group was only 0.67%. The miscellaneous animal foods, which totalled 0.82%, were consumed by nine of the thirty-three birds, yet in two only did they form as much as one per cent of a meal. One bird had made 22% of its meal on sponges while another had drawn upon hydroids to the extent of 5% of its meal.

As with all other species of waterfowl, sand or gravel is extensively ingested, and in the birds here reported upon formed 27.85% of the total volume of the stomach

TABLE 1
Summary of Food of Thirty-three Emperor Geese

Month and number	Animal food	Vegetable food	Gravel	Chlorophyceae	Phaeophyceae	Potamogeton pectinatus	Zostera marina	Gramineae	Cyperaceae	Cyperaceae or Gramineae	Miscellaneous plants	Undetermined plant fiber	Mollusca	Crustacea	Miscellaneous invertebrates	Pisces	Mammalia
April 198770	tr.	100	62	38	1				45			16					
April 145836	—	100	5	100													
May 145837	—	100	8	100													
May 145886	—	100	40	100													
May 145887	—	100	8	100													
May 171592	8	92	42	50					19		tr.	92	8				
May 171593	tr.	100	33	10					10		1	30					
May 171594	tr.	100	20	10					10		4	86					
May 171605	tr.	100	17	80					1		1	9					
May 171606	tr.	100	97	97					1		tr.	2					
May 171611	tr.	100	37	90					1		9	1					
May 171612	98	2	tr.	tr.		10			1		4	50	97	1			36
May 171625	36	64	50	8					55			37					
May 174096	tr.	100	65	5			95					tr.					
May 174121	—	100	22	5			90					2					
May 174122	—	100	46	8			32				1	2	9		22		
May 174123	31	69	45	34			1		70	15		14	tr.		tr.		
May 174124	tr.	100	23	11			tr.		75			21			tr.		
May 174125	tr.	100	26	4			2		83			12			tr.		
May 174126	tr.	100	13	3								60					
May 174127	tr.	100	45	5	15	40			90			10					
June 171634	—	100	45	5								10					
June 171658	—	100	20	11								35					
June 171676	tr.	100	20	11								20					
June 171687	tr.	100	68	14							5	35					
June 174008	—	100	14	14					80	40		15					
July 174009	—	100	65	55					85			32					
July 123875	13	87	tr.				1				tr.	4			5	tr.	
July 174229	92	8	tr.									60					
August 171843	—	100	25														
September 134937	—	100	1	100													
December 160410	tr.	100	40				99	tr.			tr.				tr.		
Totals:	8.42	91.58	27.85	30.24	0.49	1.52	12.36	3.33	18.64	2.97	0.48	21.55	3.66	2.18	0.82	0.67	1.07

contents. Most geese consume relatively few species of items per meal, being content to make their entire meal, within limits, of what is most available. The thirty-three birds here discussed averaged four different items per meal. From this study it may be concluded that although the Emperor Goose is predominantly phytophagous, it seems also to be somewhat omnivorous.

PINK-FOOTED GOOSE, *Anser brachyrhynchus*.—The Pink-footed Goose which breeds in Spitsbergen, Iceland, and eastern Greenland and winters throughout northern Europe through Russia, has been taken once in Massachusetts.

The stomach contents of two birds taken on Clavering Island and Hudson's Land, northeast Greenland, on July 31 and August 6, have been examined. Both had taken only a trace of animal foods—an amphipod and an insect, respectively, but had foraged extensively on sedges and grasses, stripping the heads of ripening seeds.

The food of the two birds consisted of fibers and seeds of sedge (*Carex* sp.), 54.5%; meadowgrass (*Poa* sp.) and undetermined grasses (*Gramineae*), 32.5%; bulblets of Arctic smartweed (*Polygonum viviparum*), 3%; moss debris (three species), 2.5%; and undetermined plant material, 7.5%. Fine sand comprised nearly half of the gross contents of these well-filled stomachs.

EUROPEAN WIDGEON, *Mareca penelope*.—The European Widgeon, a close relative of our American Widgeon or Baldpate, occurs casually in the western hemisphere, and has been collected on both coasts as well as at several localities in the interior. In recent years it has been regularly observed in small numbers at a few points on the Atlantic seaboard and on a few occasions larger numbers have been noted.

In their food habits the two species have much in common. Though readily accepting seeds, both feed to an extent unusual among ducks, upon plant stems and foliage.

For this study twenty-two stomachs were available from seven States and two Canadian provinces, but of these five have already been reported upon by Mabbott (31, pp. 16-17). Because of the rarity of the species in North America and the fact that some of these collections have not previously been recorded, the data are here given in Table 2.

In its choice of food the European Widgeon appears to be almost entirely vegetarian as not one of the twenty-two stomachs of birds examined for this paper contained even a trace of animal matter. Seeds undoubtedly are relished, yet their consumption usually appears to have been incidental to foraging on the plant shoots. Only one of the twenty-two birds here considered had fed exclusively on seeds, and that was one taken in Massachusetts late in the fall, which had consumed those of the salt-marsh bulrush (*Scirpus robustus*). All the other birds had fed largely, and some of them exclusively, on plant stems and foliage. When an acceptable item of food is found, this widgeon does not seem averse to making an entire meal of it. Ten of the birds had fed exclusively on a single species of plant and not one had diversified its menu to the extent of more than six items.

It is significant that approximately three-fourths of the total food consisted of sago pondweed (*Potamogeton pectinatus*) and other Najadaceae. As a group, sedges were second in importance and undetermined plant fiber a close third, comprising more than ten per cent of the total intake. Sea lettuce (*Enteromorpha* sp.) made up 95 per cent of the meal of one bird taken in coastal Massachusetts. Of the ten widgeons that had made an entire meal of a single plant species, eight had fed on vegetation and seeds of sago pondweed, one widgeongrass (*Ruppia maritima*), and one seeds of salt-marsh bulrush. Gravel was taken in considerable quantity and composed forty-six per cent of the gross volume of the stomach.

Variations in the food of this bird in its native land are noted by J. G. Millais (34, pp. 43-44). He refers to finding the widgeon feeding extensively on eelgrass (*Zostera marina*) in Scotland. Although the birds are normally vegetarian, he states that "sometimes widgeon, which are both conservative as to their beats and modes

TABLE 2
Data for Stomachs of European Widgeon

Food Habits Accession No.	Locality	Date	Collector	Remarks
84442 ♂	Currituck Sound, N. C., at Currituck Club.	12-3-09	W. L. McAtee	Collector's No. 913
154042	Currituck Sound, N. C.	11-17-19	W. F. Kubichek	Taken on open bay Collector's No. 1
101505 ♂	Back Bay, Va.	1-22-12	A. H. Helme	Collector's No. 18
101506 ♂	Back Bay, Va.	2-2-12	A. H. Helme	Collector's No. 19
159233	Back Bay, Va.	12-16-20	M. A. Church	
186405 ♂	Aquia Creek, Potomac River, Va. (near Washington, D. C.)	12-24-27	U. T. Brooks	
95038	Susquehanna Flats near Havre de Grace, Md.	3-28-11	W. T. Jackson	Taken on open bay
86831	Ipswich, Mass.	10-25-09	John Hardy	Collected in salt marsh—No. 22
156354	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156355	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156356	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156357	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156358	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156359	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156360	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
156361	Marthas Vineyard, Mass.	12-1-19	J. C. Phillips	Squibnocket Pond
166299 ♀	Near Eastham, Mass.		H. E. Maynard	
203729	Lochaber, Que.	Fall of 1926	G. R. White	Collected in a duck marsh, No. 2788
166271 ♂	Port Clinton, Ohio	10-3-22	A. B. Fuller	Collected in a cat-tail marsh at 7.00 a. m. No. 175
177357	Monroe, Michigan	4-3-27	W. B. Tyrell	Collected in marsh at 11.30 a. m. No. 10
197218	Nisqually Flats, mouth of Nisqually River, Wash.	12-6-32	T. H. Scheffer	
146853	Okanagan, B. C.	1-24-18	J. A. Munro	Collected in Okanagan Lake at 3.30 p. m. No. 3349

of life, will pay little attention to a vegetable diet, but live almost exclusively on animal food. Such I find to be the case with the birds living on the sandy coast near the town of Dornoch in Scotland, where all conditions are purely marine. The widgeon here feed by day and live entirely on small cockles. This renders their flesh poor, bitter, and quite uneatable. I have shot a good few of them there and found all to be the same, whilst birds from the other side of the same firth, and living on the *Zostera* beds, to the west of Tain, were fat and as good as widgeon generally are. In spring widgeon are great grass eaters, and later on, like teal and garganey, they devour an

TABLE 3
Summary of Food of twenty-two European Widgeon

Number	Animal food	Vegetable food	Gravel	Chara sp.	Enteromorpha sp.	Potamogeton pectinatus	Potamogeton spp.	Ruppia maritima	Zostera marina	Najas spp.	Najadaceae	Gramineae or Cyperaceae	Scirpus robustus	Scirpus spp.	Miscellaneous plants	Undetermined vegetable debris
84442	-	100	80						100							
86831	-	100	70										100		36	
95038	-	100	65				64	95	5							
101505	-	100	50					100								
101506	-	100	40													
148853	-	100	38				10	15		30	35					10
154042	-	100	55	80		20										
156354	-	100	55			100										
156355	-	100	30			100										
156356	-	100	40			100										
156357	-	100	35			100										
156358	-	100	30			100										
156359	-	100	25			100										
156360	-	100	30			100										
156361	-	100	55			100				25	30					10
159233	-	100	35			35	91							8	tr	1
166271	-	100	55											8		1
166299	-	100	-		95				4							39
177357	-	100	40													
186405	-	100	44			75										100
197218	-	100	60													70
203729	-	100	80										9		1	
	-	100.00	46.00	3.64	4.32	42.27	7.50	9.55	4.95	2.50	5.23	2.18	4.95	0.73	1.68	10.50

enormous quantity of flies." He reports finding them in Iceland feeding extensively on flies.

A summary of the food of the twenty-two birds taken in North American waters is given in Table 3.

EUROPEAN TEAL, *Nettion crecca*.—The European Teal occasionally wanders to North America. Though recorded in the interior, it is most frequently found along the coasts of Alaska and Canada, and has been reported from the United States. While of less frequent occurrence in America than the European Widgeon, it has been reported many times, particularly in coastal New England and on Long Island.

But five stomachs (four taken in Alaska and one in Virginia) were available for this study and unfortunately three of these were less than a fourth full and none was well filled. Gravel constituted 48.8% of the gross content. Consequently, the data obtained can be considered as only suggestive of food tendencies. Like its congener, the American Green-winged Teal, the European species appears to be adaptable in its feeding and patronizes a considerable variety of plant and animal life; no fewer than eighteen items have been found in one of the stomachs. When an acceptable item is present in abundance this species seems content to make an entire meal of it; three out of four birds taken in coastal Alaska had fed almost exclusively on soft-bodied crustaceans. This made the percentage of animal forms (80.2) occurring in the stomachs conspicuously high. Gastropods (noted in two stomachs, and forming 85% of the food of the bird taken in Virginia) equalled 17.2% of this teal's food, and were surpassed as a food only by crustaceans. These, present in the four Alaskan stomachs, formed the bulk of the animal food, totalling 60% as follows: soft-bodied crustaceans, 44%; gammarids, 12%; isopods, 4%; and entomostracans, trace. Insects, largely midges (Chironomidae, 2.4%) totalled 2.6% and formed 13% of the contents of the only stomach in which they were found. Miscellaneous animal foods including hydrozoans, spiders, mites, eggs and fragments of fish and unidentifiable material, amounted to 0.4%. Algae supplied 5% of the total food (present to the extent of 25% of one of the Alaskan stomachs); grasses and sedges (*Panicum* sp., 0.2%; *Scirpus validus*, 0.4%; *Carex* sp., 9.4%; miscellaneous and unidentified, traces) formed 10.6%; crowberry (*Empetrum* sp.) equalled 1.6% and mosses, mare's-tail (*Hippuris* sp.) and plant débris contributed 2.6% to a total vegetable food content of 19.8%. From our knowledge of American teal foods, it is felt that these results are not typical and that the collection of a larger and more representative series of birds would noticeably reduce the percentage of animal food. G. H. Mackay (32, p. 294) reports collecting a bird of this species on March 16, 1890, the stomach of which contained only a few seeds of *Ranunculus* (? *septentrionalis*).

EVERGLADE KITE, *Rostrhamus sociabilis plumbeus*.—It has been a source of deep regret to ornithologists and bird lovers that the Everglade Kite, which formerly ranged throughout the Everglades, has gradually diminished in numbers and possibly faces extirpation from the United States. This unhappy state of affairs is due to this kite's almost complete dependence for food upon a single species—the Everglade snail (*Pomacea depressa*, formerly known as *Ampullaria*) which is restricted to swamps of the southeast, particularly Florida. The numbers and distribution of this snail have been greatly curtailed by drainage operations and with this diminution the Everglade Kite has likewise dwindled in numbers.

The examination of four stomachs and crops of birds taken in Florida—two in May, and one each in March and December—confirms field observations that it subsists on the flesh of the freshwater Everglade snail (Maynard, 33, pp. 191-192; Howell, 28,

pp. 168-171; and Baker, 8, p. 140). Three of the stomachs contained nothing but the fleshy remains of this snail, and the remaining bird which had both crop and gizzard gorged, contained 97% of the Everglade snail and 3% plant débris. This vegetable material was probably consumed accidentally in capturing and extracting the snail. Two mites (Galumnidae) and a midge larva (Chironomidae) were also present. It was surprising to find that eight whole snails and fragments of at least twelve others had been consumed.

It is said that each Everglade Kite has a favorite perch to which it carries most of the snails captured and after skilfully extracting the animal with its well-adapted bill, drops the shell to the ground.

SHORT-TAILED HAWK, *Buteo brachyurus*.—But a single stomach of the Short-tailed Hawk, a *Buteo* ranging from Florida (sparingly), eastern Mexico and Central America south to Peru, Bolivia, and Brazil, has been examined in the Biological Survey. This bird, taken in February at Lake Harney, Orange County, Florida, had fed exclusively on a Sharp-shinned Hawk (*Accipiter velox*).

SENNETT'S WHITE-TAILED HAWK, *Buteo albicaudatus hypospodius*.—Little reliable information is available on the food and economic status of Sennett's Hawk. This is probably due to its limited distribution in the United States, occurring as it does only in restricted parts of southern Texas in the lower Rio Grande Valley.

For the present study four stomachs of this bird, collected by Dr. Francis Harper in Kenedy County, in August 1929, were available for laboratory analysis. Unfortunately, two of these were only about one-tenth full. The others were well filled and both held remains of frogs, snakes, and insects. One crop contained a recently swallowed leopard frog (*Rana pipiens*), and the stomach of the same bird showed fragments of another victim of the same species. Together they comprised 55% of the meal. Remains of a medium-sized snake, possibly a bull-snake (*Pituophis* sp.), amounted to 14% of the volume, and the remains of a ten-day-old quail chick (*Colinus virginianus texanus*) supplied an additional 27%. A centipede (Chilopoda), four grasshoppers (Acrididae), and two crickets (*Gryllus assimilis*) comprised the remaining 4% of the meal.

The second hawk had consumed one leopard frog (*Rana pipiens*), forming 99% of the contents, and a snake (possibly *Coluber* sp.), which supplied the remaining 1%. Well-digested remnants of grasshoppers and crickets also were noted, along with small beetles, water insects (such as larvae of dragonflies), true bugs, and lepidopterous larvae, and were considered to be the food of the vertebrates captured by the hawks. The two partially filled stomachs indicated a similar choice of foods since they both contained remains of amphibians, reptiles, grasshoppers, crickets, large beetles (Scarabaeidae), ants, and plant fiber.

It is probable that Sennett's Hawk is normally beneficial in its food tendencies. Bendire (10, p. 235), quoting W. H. Hudson, says that the closely related subspecies that occurs in Argentina feeds exclusively on large insects. Bent (15, p. 220) reports that various observers have noted that "cotton rats, quails, snakes, lizards, frogs, grasshoppers, and beetles are among the food of this hawk, in the United States."

MEXICAN BLACK HAWK, *Urubitinga anthracina anthracina*.—The Mexican Black Hawk is another southern raptor, whose range extends northward only slightly beyond the extreme southern boundary of the United States. This species normally occurs as a summer resident at the northern limits of its range from southern Arizona to the lower Rio Grande in Texas.

Scattered published information indicates that its diet is varied. Bailey (6, p. 161) states that its food consists of small mammals, reptiles, crustaceans, insects, and rarely birds. From Fisher's early bulletin (24, pp. 84, 85) on hawks and owls we learn that it feeds on frogs, fishes, and snakes. Bendire (10, pp. 248-249) quotes Colonel A. J. Grayson as stating that in northwestern Mexico this hawk is common at all seasons and is usually found about the *esteros* and marshes near the seacoast, subsisting chiefly upon land crabs. "Occasionally," he writes, "one is seen eating a fish upon the sandy margin of the river." G. B. Thomas (41, p. 117) also informs us that in British Honduras the Mexican Black Hawk subsists almost entirely upon land crabs. Ridgway (37, p. 581) reports it feeding on a Curassow (*Crax globicera*).

The writers were able to examine the stomach and crop contents of two specimens collected in May 1928 near the international border south of Cloverdale, New Mexico. Both birds had fed principally upon snakes, although each also had eaten a small bird, several beetles, and other large insects.

Following are the principal food items recorded in the two stomachs:

No. 179780.—Remains of a small passerine bird, trace; one medium-sized snake (*Coluber* sp.), 86%; one lizard (*Sceloporus* sp.), 2%; one large centipede, 2%; four water bugs (*Belostoma* sp.), 4%; five Dobson-fly larvae (*Corydalus cornuta*), 3%; one large butterfly larva (Lepidoptera), 1%; large scarab beetles (*Xylosytes* sp.), 2%; and one other beetle (Alleculidae), trace.

No. 179781.—One Fringillidae, possibly a Dickcissel (*Spiza americana*), 15%; fragments of one snake (*Coluber* sp.), 83%; four beetles (one *Brachinus* sp., one *Trichoton sordidum*, one *Chlaenius cumatilis*, and one undetermined Tenebrionidae), 1%; two wasps (*Polistes* sp.), 1%; *Camponotus* sp. and other ants, trace.

GRAY SEA EAGLE, *Haliaeetus albicilla*.—The Gray Sea Eagle, a casual wanderer to Alaska and the Aleutian Islands from the northern regions of the Old World, is represented in the Food Habits collections of the Biological Survey by two stomachs. The contents of these suggest that the bird's feeding propensities are similar to those of its common American relative, the Bald Eagle. Probably like other large predacious or scavenging birds, its daily menu consists usually of few items. The two birds here reported upon had each fed on a single object. One, taken May 14, 1922, by J. Mackinan in an icy strait at Hoonah Island, Alaska, had dined on a large sculpin (*Triglops beani*). The general appearance of the food indicated that it was carrion. The second bird, collected by Edward Prenschoff on April 10, 1923, at Lung Island, Alaska, had made its last meal on a duck of the genus *Nyroca*, most likely a scaup.

Major Charles Bendire (10, p. 273) says that its food consists of fish, sea fowl, and occasionally carrion. Dixon states: "Within my own observation, the favorite food . . . is the stranded fish and shore garbage on the beach of its maritime haunts; while farther inland a dead carcass or a weakly bird or animal are shared with the ravens and crows." A. Hagerup (18, p. 292), observes that in Greenland it feeds extensively on Eider Ducks and Murres.

PEALE'S FALCON, *Falco peregrinus pealei*.—Because of their remarkable skill, daring, and perhaps unexcelled speed of flight, the Peregrine Falcons are objects of special interest. Despite the fact that they subsist almost exclusively upon other bird life, America would suffer an irreparable loss should they ever become exterminated. Fortunately, many of these birds breed in inaccessible recesses of the Far North. The Duck Hawk, though uncommon, is rather generally distributed, at least in migration, and is much the more common of the peregrines. Its close relative, Peale's Falcon, the subject of this brief account, is restricted to the North Pacific

coast, breeding in the Aleutian and Commander Islands and wintering along the coast as far south as Oregon.

But seven stomachs and crops taken in July, October, November, and December, at Seaside, Oregon, and Amak Island, Alaska, have been submitted to the Biological Survey. All of these were filled with the carefully picked, fleshy remains of birds. Three of the falcons had each captured a duck, two had fed on Tufted Puffins (*Lunda cirrhata*), and one each on a grebe (*Colymbus* sp.), and a gull (? *Larus* sp.). One of the ducks captured was identified as a Pintail, one was thought to be a scoter, and the third was indeterminable. The falcon that preyed upon a Pintail had both crop and stomach so gorged that after a week of air-drying the contents weighed 56.6 grams and when well packed measured 152 cc.

Undoubtedly many species of birds fall prey to this raptor. Wetmore in his field notes of June 1911, described how one struck down and carried off a male ptarmigan at Kiska Island, Alaska. Darcus (21, p. 47) found Peale's Falcons feeding extensively on seabirds, especially upon Cassin's Auklets, Marbled and Ancient Murrelets, and California Murres. He reports finding an eyrie of a falcon situated in the midst of a large nesting colony of Tufted Puffins and Violet-green Cormorants. The eyrie contained four well-grown young, yet this nest was within four feet of a brooding cormorant on the same ledge.

That the Peale's Falcon is a bird of extraordinary skill of wing is shown by the fact that it flies far out over the open ocean, catches such swiftly flying prey as shorebirds and not infrequently eats them while on the wing. Wetmore in his field notes of September 1, 1911, tells of a falcon that caught a Least Sandpiper (*Pisobia minutilla*), some fifty miles off the Alaskan coast and proceeded to pick the prey while in flight. Chase Littlejohn states (12, pp. 276-277) that it takes great numbers of Ancient Murrelets, even pursuing them at sea and eating the captured ones while hovering in the air.

CHACHALACA, *Oreortyx pictus*.—This interesting denizen of Mexico, southern Texas, and the lower part of the Rio Grande valley, doubtless owes its scarcity in the United States in part to the fact that it is a much-pursued gamebird.

A single stomach collected near Point Isabel, Texas, in August 1929, by Dr. Francis Harper, has been examined. It appeared to be a little over half-full and contained 2.5 cc. of plant food as follows: seventy-six seeds with adherent fruit pulp of hackberry (*Celtis pallida*), 72%; eight seedless husks of mesquite (*Prosopis glandulosa*), 28%; in addition there were traces of feathers probably from its own body.

MASKED BOB-WHITE, *Colinus ridgwayi*.—The Masked Bob-white, extirpated from the United States, but formerly ranging from southern Arizona to northern Sonora, Mexico, has recently been re-introduced into its ancestral range in southern Arizona. Plantings have also been made in New Mexico. Because food is a primary requisite for any species, summary of the stomach contents of even ten specimens should be of some value in connection with management of the species. These stomachs were collected on a grassy plain some six miles west of Teporica, Mexico, on October 30, 1931, by D. M. Gorsuch. Their contents indicate that the bird is primarily a vegetarian, 79.1% of the food being drawn from the plant kingdom. Seeds of acacia, mostly *Acacia angustissima*, which were consumed by eight of the ten birds, were of first importance, supplying 18.8% of the total. No fewer than sixty-six seeds (53% of that meal) were taken by one bird. The seeds of ground cherry (*Physalis* sp.), which entered into the diet of every bird, were of only slightly less value, averaging 16.3% of the total. One bird had obtained some 380 of these seeds, another more than 300, and several others only slightly smaller numbers. Panic grasses, including *Panicum*

hallii (12.0%), *P. stramineum* (2.3%) and *P. arizonicum* (0.3%), were next in order of importance, totalling 14.6%. These seeds and other parts of panic grasses were ingested by eight of the ten birds, and while with some of the birds they formed only a trace or small per cent of a meal, in three cases they had been taken extensively, in one up to about 475 seeds along with floral heads and leafy fragments. Miscellaneous grasses comprised 3.4% of the average meal. The seeds of day flower (*Commelina elegans*) which were noted in nine of the stomachs, supplied more than a tenth (10.8%) of the food and amounted to as much as 46% of one meal. Seeds of wild bean (*Phaseolus ritensis*) had been eaten freely by four of the birds and for the group averaged 3.8%. Indian mallow seeds (*Abutilon crispum*, 1.9%; *A. incanum*, 1%; and *A. arizonicum*, trace) contributed 2.9% of the total and entered into the diet of all but one of the birds. However, only one had made more than a tenth of its last meal from these plants. The seeds of the partridge pea (*Cassia leptadenia*), which entered into the diet of but four birds, were of only slightly less value, forming 2.5% of the total food. They were followed by morning-glory (*Ipomoea* sp.), 2.3%, and milk pea (*Galactia* sp.), 1.5%. Seeds of the former had been taken by five of the birds, while only two had eaten the milk peas.

The remaining 2.2% plant food was drawn from sixteen different species, none of which supplied as much as 1% of the meal. These miscellaneous plants included: species of *Acanthus*, tick-trefoil (*Meibomia* sp.), *Waltheria americana*, three-seeded mercury (*Acalypha* sp.), morning-glory (*Evolvulus arizonicum*), and false mesquite (*Calliandra reticulata*).

Animal foods (19.3% consisting primarily of grasshoppers and other Orthoptera) formed 20.9% of the total. These were apportioned as follows: grasshoppers, *Melanoplus* sp. (which formed 88% of the meal of one bird), 8.8%; *Romalea* sp. (obtained by three birds), 7.1%; undetermined grasshoppers (taken by four birds), 2.5%, and undetermined Orthoptera (obtained by four birds), 0.9%. Miscellaneous animal foods contributing the remaining percentage included the stink bug (*Euschistus zopilotensis*) and undetermined Pentatomidae, 1.4%; cutworms (Noctuidae), 0.2%; and traces of a beetle (Coleoptera); an ant (*Pogonomyrmex* sp.), and a fly (*Phora* sp.). Gravel formed 11.4% of the gross stomach content.

Major Bendire (10, p. 11), examined three stomachs of the Masked Bob-white and reports that "one contained a species of mustard seed, a few chaparral berries, and some 6 or 8 beetles and other insects ranging in length from half an inch down to the size of a pin-head. The second was similarly provided, but contained in lieu of mustard seed, a grasshopper fully an inch in length. These two were taken on the mesa. The third, from a bird taken in the valley, contained about 20 medium-sized red ants, several crescent-shaped seeds, and a large number of small fleshy, green leaves."

LAPWING, *Vanellus vanellus*.—This European wanderer, with its contrasting green and white plumage and large graceful crest, is perhaps one of the most beautiful and striking of the shorebirds that occasionally reach our coasts. Its normal range extends from the Arctic Circle of the Eastern Hemisphere south to India and northern Africa. Following severe storms during the periods of migration, the Lapwing has been recorded on the Atlantic coast of North America from Baffin Island to North Carolina as well as on islands in Norton Sound, Alaska. One of the most notable of these invasions took place in 1927-28 when hundreds of Lapwings were observed or shot. The single bird here reported upon was collected by H. H. Brimley, Jr., at Siler City, in central North Carolina, on November 12, 1926. Unfortunately, its stomach was nearly empty, ten pieces of gravel present comprising 85% of the

contents. The bird had consumed two ground beetles (*Scarites subterraneus* and an undetermined Carabidae), an ant, and a little vegetable débris. So far as this goes, it is in line with the results of the eminent English investigator Collinge (19, pp. 231-235), who examined some sixty-nine Lapwing stomachs and found that beetles, including ground beetles, were favored foods.

ESKIMO CURLEW, *Phaeopus borealis*.—This curlew, once called the Prairie Pigeon because it came in sky-darkening numbers like the Passenger Pigeon, and like the latter was exploited for the urban market to an extent no species could support, once bred in the Barren Grounds, reaching them in the spring by way of the Mississippi Valley and in the fall, taking off for South America from the North Atlantic coast. The numerical diminution of this species followed closely upon that of the Passenger Pigeon, being first noted in 1870 to 1880, and by 1890 the bird was rare. The last specimen recorded for North America was taken at Norfolk, Nebraska, in April 1915. Hopes for the survival of the species were raised by the recording of a flock in Brazil in February, 1925.

One of the four Eskimo Curlews upon which this note is based was collected in 1887, in New York, two were taken in 1888 in Massachusetts, and the fourth bird was shot in 1912 in Wisconsin. All were taken during September.

Most writers state that this curlew fed largely upon the crowberry (*Empetrum nigrum*), but our specimens all came from south of the range of that plant. They contained mostly animal foods as follows: spiders, 2%; dragonfly (Odonata), 0.5%; grasshoppers (Acrididae), 20.75%; field crickets (*Gryllus assimilis*), 69%; beetles, including ground beetles, scarab beetles and weevils (Carabidae, Scarabaeidae and *Phytonomus punctatus*), 3.25%; moths (Lepidoptera), 1.25%; ants (Formicidae), 0.25%. The plant food consisted of algae, 2.5%, and vegetable débris, including a single seed of panic-grass (*Panicum* sp.), 0.5%. These stomachs were respectively one-half, two-thirds, three-fourths, and completely full, gravel or grit averaging 7.5% of their contents.

Without doubt grasshoppers and crickets were the favored food, no stomach having less than 85% of the two together, and one curlew had consumed twenty-four cricket nymphs. The only other item that appeared more than once was spiders in the two stomachs from Massachusetts.

WHISKERED AUKLET, *Aethia pygmaea*.—The pelagic bird life of the North Pacific, although exceedingly abundant, includes a number of species that are relatively uncommon or only locally abundant. Among the latter group may be included the Whiskered Auklet, which ranges from the Commander Islands to Kamchatka and Japan, occurring rarely east to Unalaska in the Aleutian chain.

But little is known of its food habits, consequently, any additional information is of value. For the present study, six stomachs taken from birds collected on various islands of the Aleutian chain in June 1936, were available. One of these was entirely empty. Three of the remaining five contained copepods (*Xanthocalanus* sp.), exclusively. One other bird consumed 60% of soft-bodied crustaceans, including amphipods, isopods and copepods, 40% of a single fish (Scorpaenidae), and a trace of spider. The sixth bird had made 10% of its meal of unidentifiable soft-bodied crustaceans and 90% of fragments of what appeared to be mollusk eggs. This brief series of food analyses indicates that the Whiskered Auklet subsists primarily on soft-bodied crustaceans, animals known to be particularly abundant in northern waters. These results support the observation of Dr. Stejneger (40, p. 32) in 1885, that the species fed principally on gammarids.

WHITE-CROWNED PIGEON, *Columba leucocephala*.—This fine pigeon occurs somewhat irregularly on the Florida Keys and has been taken about a dozen times in the southernmost tip of Florida. Maynard (33, pp. 191–192) states that the sea-grape is one of the important foods of the White-crowned Pigeon. One of the two species of sea-grape (*Coccolobis laurifolia*) found on the Keys is called pigeon-plum—good evidence that it is a pigeon food. The stomach of a single specimen taken by A. H. Howell, five miles north of Cape Sable on March 26, 1926, was nearly full (no crop has been received). As usual with Columbidae there was little animal matter present, 2% as compared with 98% of vegetable content. Items identified were nineteen seeds of Florida-privet (*Forestiera* sp.), 93%; approximately 150 seeds of wild fig (*Ficus* sp.), 4%; three fig insects (*Blastophaga* sp.), a midge (*Chironomus* sp.), twelve wasps (*Callimome* sp.), and eight parasitic Hymenoptera (*Eupelmus* sp.), totalling 2%; and nine galls, equalling 1%. A fragment of feather was present. The relatively soft nature of the food and the presence of hard pits of one of the items may explain the complete lack of sand or gravel.

PASSENGER PIGEON, *Ectopistes migratorius*.—One of the darkest pictures in American treatment of wildlife is the wanton destruction and final extermination of the Passenger Pigeon, a bird that once was considered inexhaustibly abundant. No attempt is here made to present a comprehensive treatment of the food of this bird because good accounts have already been published by Forbush (26), Bent (14) and Mitchell (35). Inasmuch as these summaries are based largely on field observation and published notes, it is of interest to report upon laboratory examinations of eleven stomachs of the species in the Food Habits collection of the Biological Survey. Eight of these were collected in Illinois by Professor S. A. Forbes, and three were from birds shot by John H. Sage, at Portland, Connecticut; J. Ford Sempers, near Port Deposit, Maryland; and H. W. Henshaw, in Washington, D. C. Three months—February, August, and October—are each represented by one stomach; and four months—March, May, June, and September—by two stomachs, each. Both stomach and crop contents were available from the Maryland bird, and probably also for the District of Columbia specimen, but the material from the others had every appearance of being stomach contents only.

Judged by the amount of material contained in the crops and stomachs of Mourning Doves, those of the larger Wild Pigeons probably were not full or even nearly full, except in one case. Ten of the stomachs' contents included gravel varying from a trace in one to 48% of the entire bulk from an apparently well-filled stomach containing wheat. The large size and amount of the gravel was striking. One of two pebbles in a stomach (No. 5503, D. C.) measured 5/16 by 6/16 by 3/16 inches, while the largest in another (No. 45926, Illinois) measured 7/16 by 6/16 by nearly 7/32 inches. Two stomach contents contained traces of feathers; in one the feather was undoubtedly, in the other, possibly, that of a pigeon. A third stomach contained a mass of Passenger Pigeon feathers totaling 2% of the gross content. The presence of small amounts of feathers in the stomach is the rule in the dove family.

Animal food, though entirely lacking in one stomach and forming but a trace in seven, constituted 9.36% of the total food in the eleven stomachs. The traces noted consisted of fragments of chitin, and in two cases of the head of an ant (*Lasius* sp.). A cocoon of an anthomyiid fly (*Helina* sp.) formed 1% of the food of the District of Columbia bird, and cynipid larvae, from oak galls made up 2% of the food of the Maryland-taken pigeon. An adult May-beetle (*Phyllophaga tristis*), the only item in one stomach (No. 45928), contributed most to the apparently rather high percentage of animal food for the eleven birds.

In contrast to but four species of insects, thirteen kinds of plants were consumed, though some bent (*Agrostis* sp.) and pigeon or foxtail grass (*Setaria* sp.) and sida represented by one or two seeds, each formed but a trace. A samara of the yellow birch (*Betula lutea*), made up 1% of the contents of the Connecticut stomach and formed a little less than 0.01 in the average for all of the birds. Other items each forming less than 1% of the pigeons' food, were forty-four seeds of the large-seeded smartweed (*Polygonum pennsylvanicum*), totaling 6% in the Maryland stomach; fragments of the seeds of wild black cherry (*Prunus serotina*), making a trace in one and 2% in another, while two whole pits amounted to 5% in a third stomach; and four seeds of the frost grape (*Vitis cordifolia*), to 2% of the contents of the stomach from the District of Columbia. Wheat (*Triticum aestivum*) formed 98% of the

TABLE 4

Summary of Stomach Contents of Eleven Passenger Pigeons

Number	45926	5503	20157	45928	45929	45927	45930	45932	45931	45270	14197	Total per-cent-ages
	Feb.	Mar.	Mar.	May	May	June	June	Aug.	Sept.	Sept.	Oct.	
State	Ill.	D. C.	Md.	Ill.	Ill.	Ill.	Ill.	Ill.	Ill.	Ill.	Conn.	
Animal food	—	1	2	100	trace	trace	trace	trace	trace	trace	trace	9.36
Plant food	100	99	98	—	100	100	100	100	100	100	100	90.64
Gravel and feathers	7	4	3	—	trace	10	25	20	48	30	20	15.36
Miscellaneous insect material	trace	1	2	trace	trace	trace	trace	trace	trace	trace	trace	0.27
May beetle				100								9.09
Miscellaneous plant material		2	6		5				2		1	1.45
Wheat									98			8.91
Corn										100		9.09
Acorn mast	100		86		95	100	100	100				52.82
Pokeberry		97										8.82
Oak galls			6								99	9.55

contents of one stomach; corn (*Zea mays*) composed the entire contents of another, and pokeberry (*Phytolacca americana*) made up 97% of a third. Though important foods, these did not vie with acorns which formed 96% and 95%, respectively, of the contents of two stomachs and practically the entire contents of four others. The acorns were of two types: those in five stomachs were from the pin oak (*Quercus palustris*), and those in the sixth possibly from the willow oak (*Q. phellos*). In either case the records are of interest, as the literature states that Passenger Pigeons fed on the acorns of the white oak (*Q. alba*), not on those of the red or black-oak group to which the species here identified belong. Another item of particular interest was oak galls made by Cynipidae, found in only two stomachs, but contributing approximately a tenth of the total food. In one stomach some of the larvae were found separated from the gall and assigned a percentage as animal food. Fragments of acorns also were present in this stomach. In the other stomach, which contained no acorns, the larvae were all encased in the hard galls. There is little doubt that these galls were taken as articles of plant, not animal food, as they closely resemble small berries or nuts, and were taken in quantity with an ample supply of gravel.

The contents of the stomach of the Passenger Pigeon from the District of Columbia were coated with the so-called 'pigeon's milk', a product of the cells lining the crop and used in feeding the young birds.

The food content of the eleven stomachs examined is summarized to indicate the percentages of the major items in the diet (Table 4). In order to make a more nearly complete tabulation, records of actual stomach or crop contents have been culled from the literature and are listed in Table 5 together with the items found in stomachs examined in the Biological Survey. As percentages were not available in the published notes this second table has been constructed to show occurrences of items, though in certain entries the number of specimens of a single item (as twenty-five sugar-maple seeds) has been given for its interest.

WHITE-FRONTED DOVE, *Leptotila fulviventris angelica*.—This dove which is limited to southern Texas and northern Mexico, is represented in the Food Habits collection by a single stomach from a bird taken eight miles northwest of Point Isabel, Texas, on August 28, 1929. The gizzard of this bird was half full, the crop two-thirds full, and the total food content 8.79 cc. The items identified were: two seeds of panic grass (*Panicum dichotomiflorum* and *Panicum* sp. (formerly designated as *P. arizonicum* and *P. fasciculatum*), trace; 135 seeds and fruit pulp of hackberries (*Celtis pallida*), 41%; six seeds of mesquite (*Prosopis glandulosus*), 4%; twenty-three seeds of prickly ash (*Zanthoxylum* near *fagara*), 24%; thirty-five large euphorbiaceous seeds, 10%; ten seeds of an unknown plant, 3%; seventeen seeds of marine-ivy (*Cissus incisa*), 7%; thirteen seeds of a prickly-pear cactus (*Opuntia* sp.), 1%; three seeds of Indian mallow (*Abutilon incanum*), six of viper's bugloss (*Echium vulgare*), one of leaf-cup (*Polymnia* sp.), and vegetable debris, 6%. One leg of a camel cricket (*Ceuthophilus* sp.) was the only animal matter present. One of the few positive observations on the food of the White-fronted Dove, made by Smith (38, p. 95) is that "they feed almost entirely on small herb and grass seed, rarely partaking of the mesquite or ebony bean."

CAROLINA PAROQUET, *Conuropsis carolinensis carolinensis*.—This paroquet once regularly occurred from southern Virginia southward through Georgia, Alabama, and Florida, appearing sporadically farther north. Its appearance was dreaded by farmers as the paroquets were regarded as agricultural pests to be shot on sight. Bendire (11, pp. 2-3) compiled from various sources a full account of their feeding habits, mentioning their partiality for cultivated fruits, resulting in considerable damage to orchards, and their fondness for corn in the milk; he notes also their habits of feeding on cockleburs (*Xanthium strumarium*), sand burs (*Cenchrus tribuloides*), fruits, and seeds of various native trees, including pines.

The Section of Food Habits had one stomach and crop of a Carolina Paroquet which was examined for this paper. It was collected on October 24, 1885, near Fort Drum, Florida, by Walter Hoxie, whose field notes for 1888 in East Florida contain the following comments: "They feed upon seeds of pine and cypress, and also upon cockle burs and sand spurs. They are said to damage corn at times by eating out the germ, but their visits to settled portions of the country are at such rare intervals they cannot be very destructive."

The stomach was apparently about half full and the crop one-third full, their total content amounting to 1.5 cc. Except for two rabbit hairs, two bits of the bird's own feathers, and two fragments of an indeterminable ant, which formed only traces, the entire content consisted of the remains of no fewer than thirty-two seeds of loblolly pine (*Pinus taeda*). Neither stomach nor crop contained any sand or gravel.

THICK-BILLED PARROT, *Rhynchopsitta pachyrhyncha*.—This parrot occurs only occasionally in the United States, venturing from its native Mexican tableland into Arizona by way of the Chiricahua Mountains.

Our very meager information on the food habits of this interesting parrot was gathered during two such incursions. In June, 1900, Lusk (30, p. 129), investigated the stomachs of several members of a flock, and reported that they were feeding upon immature pine seeds. In March 1918, F. H. Hands sent the stomachs and crops of two Thick-billed Parrots to the Biological Survey, with a letter in which he mentioned that ten or fifteen parrots were noted feeding in the Chihuahuas pines. These birds were collected on March 27, 1918, in Pinery Canyon, Chiricahua Mountains, Arizona. The stomachs and crops of both birds were well filled, containing 4.1 cc. and 7.4 cc. of food, respectively, and each stomach held 1% of fine gravel; while 136 and 284 or more seeds of the Chihuahuas pine (*Pinus chihuahuana*) comprised the entire food contents of the two birds. The pine seeds were in all stages from entire seeds to a pulverized mast-like debris. The larger of the two stomachs contained a fragment of one of the bird's own feathers.

In 1919, Dr. Alexander Wetmore (43, pp. 18–21), interviewed Hands and several others who were familiar with this parrot from the Chiricahua occurrences of 1904, 1917 and 1918, recording that yellow pine and pinyon were eaten as well as the Chihuahuas pine. After the pine harvest was over the parrots fed on the oaks and, despite reports to the contrary, did not attack cultivated crops in this part of Arizona.

HIMALAYA CUCKOO, *Cuculus optatus*.—So far as the writers know there is but a single American record of this exotic—a bird taken on St. Paul's Island in the Pribilofs, Bering Sea. This bird had fed exclusively on crane-flies (Tipulidae), its well-filled stomach containing the remains of more than a hundred individuals with many eggs.

MAYNARD'S CUCKOO, *Coccyzus minor maynardi*.—Maynard's Cuckoo is a summer resident of lower Florida, ranging thence eastward to the Bahama Islands and Cuba. Full stomachs of two birds obtained in the Everglades, Florida, on March 15, 1919, were available for laboratory analysis and these indicate that the food of the species is similar to that of other American cuckoos. Both birds had fed extensively (averaging 44.5%), on hairy caterpillars, including Aretiidae, Hesperidae, and Notodontidae, as well as upon a few smooth-skinned kinds. With the pupae that were consumed by both birds (averaging 5.5%) lepidopterous forms supplied just one-half of the total intake. As with many cuckoos the stomachs of the birds were fairly well lined with the bristly hairs of caterpillars.

Next in order of importance were the remains of several praying mantids (including *Stagmomantis* sp.) which supplied a little more than a fourth (26%) of the total food. Long- and short-horned grasshoppers (Locustidae and Acrididae) followed with 19% and 2.5%, respectively. Ten pupa cases of a hymenopteran parasitic on caterpillars, which may have been taken incidentally with the larvae, formed 1%, while spider fragments supplied the remaining 1.5%, and ants (Formicidae) a mere trace.

MERRILL'S PAURAUQUE, *Nyctidromus albicollis merrilli*.—Specimens of this goat-sucker were collected by Dr. Francis Harper, near Sarita (Kenedy County), Texas, in early August 1929. This is near the northern limit of its breeding range which extends from the Gulf Coast and Rio Grande valley in Texas, south to Tamaulipas.

Like its relatives in our fauna, the Whippoorwill, Chuck-will's-widow and Poor-wills, the Pauraque is highly insectivorous, and the three stomachs examined con-

tained only insect material, with no traces of other animal food, plant material or grit. The food items were as follows:

TABLE 6
Nyctidromus albigollis merrilli Sennett—food

Common Name	Scientific Name	188320	188321	188328	Average Percent
Ant lions	Myrmeleonidae (?)			trace	trace
Stink bugs	Pentatomidae	15 %		trace	
Stink bugs	<i>Euschistus</i> sp.	1 %			
Soldier-bugs	<i>Acrosternum</i> sp.	2 %			6.00 %
Locusts	<i>Spharagemon</i> sp.			14 %	4.67 %
Locusts	(?) <i>Pleotomus pallens</i>	3 %			
Click beetles	Elateridae	5 %			
Click beetles	<i>Lacon rectangularis</i>	3 %		10 %	89.00 %
Click beetles	<i>Crigmus</i> sp.	7 %	12 %	74 %	
Tiger beetles	<i>Cicindela</i> sp.			trace	
Ostomid beetles	<i>Temnochila virescens</i>		4 %	trace	89.00 %
Twig-borer	<i>Apatides fortis</i>	20 %			
Carrot muck beetle	<i>Ligyris gibbosus</i>	38 %	53 %	2 %	
Long-horned beetles	<i>Chion cinctus</i>	6 %			0.33 %
Long-horned beetles	<i>Cyllene crinicornis</i>		4 %		
Long-horned beetles	(?) <i>Pantomallus ovicollis</i>		26 %		
Butterflies or moths	Lepidoptera	trace	1 %	trace	trace
Bees or wasps	Hymenoptera			trace	

From the table it may be noted that true bugs formed 6%, grasshoppers 4.67%, beetles 89%, and lepidopterans 0.33%; and hymenopterans but a trace of the total contents.

RIVOLI'S HUMMINGBIRD, *Eugenes fulgens*.—Hummingbirds—the smallest of birds and among the most gorgeously colored—are exclusively a New World family with their center of abundance in the tropics. Of more than six hundred species and varieties only the Ruby-throated occurs east of the Mississippi River, and only sixteen species are known north of Mexico. Half of these come but a short distance north of the international boundary of the extreme southwestern United States and are distinctly rare.

Unfortunately only a few stomachs of but four species of these southwestern hummers were available for laboratory analysis. Furthermore, it should be pointed out that because of their highly specialized feeding habits laboratory analysis can reveal only part of their food preferences. Hummingbirds are known to feed extensively on the nectar of flowers, a food ordinarily not detectable in preserved stomachs, unless possibly by chemical analysis.

Rivoli's Hummingbird occurs in the mountains of southeastern Arizona and southwestern New Mexico, southern Mexico, and in Central America south to Nicaragua. The stomachs of three birds from the Huachuca Mountains of Arizona, 6000 to 8700 feet elevation, collected late in July 1932, were available for study. All had fed extensively on minute insects probably obtained at the base of a floral cup.

Following is a summary of the three meals: leaf bugs (Miridae), 1.67%; plant lice (Aphididae), 11.67%; leaf hoppers (Cicadellidae), 10%; parasitic wasps (Chalcididae), 10%; beetles (*Anaspis* sp.), 4%; flies (*Diptoxa* sp., *Agromyza* sp., *Chrysotus* sp., *Chloropisca* sp. and undetermined Diptera), 26%; fragments of moth (Lepidoptera),

3.33%; fragments of undetermined insects, 1.67%; and of spiders, 31.66%. No fewer than eight species of insects and spiders were noted in one stomach.

Bendire (10, p. 190), quotes a Mr. Price, as follows with respect to Rivoli's Hummer: "During the flowering season, it feeds extensively in the flowers of the *Agave parryi* in the Huachuca Mountains. In the Chiricahuas, I have found it early in the morning in open glades feeding on the flowers of an iris." Otho C. Poling (36, p. 402) writes that the bird arrives in May, but is nowhere plentiful until the mescal (Agave) begins to bloom about the middle of June. This plant normally occurs on hillsides below the pine belt.

ARIZONA BLUE-THROATED HUMMINGBIRD, *Lampornis clemenciae bessophilus*.—The Blue-throated Hummer like the preceding (Rivoli's Hummer) is one of the larger representatives of the family. It inhabits the mountains and canyons of southern Arizona and New Mexico and the Sierra Madre Mountains of Mexico. The species appears much more retiring than its relatives and is little known. Bendire (10, p. 191) quotes Dr. A. K. Fisher as saying that the birds are partial to the flowers of the shrubby honeysuckle (*Lonicera involucrata*), and that "it is probable the flowers attract large numbers of insects which in turn attract the birds, for the gullets of the hummers secured were filled with them."

For the present study three stomachs were available, the contents of which indicate that the birds were seeking insects and pollen. Two of the birds had consumed pollen representing 10% and 15%, respectively, of the stomach contents. Small insects and spiders seem to have been taken indiscriminately. One bird had made 92% of its meal on seven specimens of a fly (*Hypocera johnsoni*), which is rare in collections. A summary of the food of these three birds follows: fragments of true bugs (Hemiptera), 1.67%; of small beetles (Coleoptera), 1.33%; seven flies (*Hypocera johnsoni*), 30.67%; other flies (Diptera), 15%; wasps (Ichneumonidae), 5%; spiders (Arachnida), 26.33%; daddy-longlegs (Phalangidae), 10%, and undetermined pollen grains and plant fiber, 10%.

WHITE-EARED HUMMINGBIRD, *Hylocharis leucotis leucotis*.—The delicately-tinted White-eared Hummingbird is confined largely to the mountains of Mexico, although it occurs sparingly in those of southern Arizona. It is comparatively little known both in life history and in food preferences. Only a single half-filled stomach of this diminutive bird has been examined. It was found to contain the remains of six flies (? *Dilophus* sp.), forming 92% of the meal and fragments of other but undetermined Diptera, 8%. Mrs. F. M. Bailey (6, p. 244) records that it feeds on insects found in honeysuckle and other flowers. Dr. A. Wetmore (44, p. 36) notes also that the bird "feeds principally at blossoms."

BROAD-BILLED HUMMINGBIRD, *Cynanthus latirostris*.—The handsome Broad-billed Hummer is at home in the foothills of the small mountain ranges of southern Arizona and southwestern New Mexico and ranges southward to Mexico City. Wetmore (44, p. 36) informs us that "it inhabits arroyos, canyons, and the borders of streams, perching on dead twigs at the top of bushes or low trees, resting in the sun on cool mornings and in shade in the heat of the day."

Its feeding habits are similar to those of the other hummingbirds here described, although it is perhaps less active than some of its congeners. Wetmore (44, p. 36) observed the birds feeding at flowers and also gleaning small insects and spiders from the under side of branches and leaves. Four stomachs of birds collected at Dragon Mountain, Arizona, in July, and one taken the latter part of March from the Rinconosa Mountains of the same State, show that the bird feeds primarily on small insects and

spiders. The food of all the birds was similar except that the bird obtained in March had taken pollen.

A summary of the food in the stomachs is as follows: fragments of: plant lice (Aphidae), 7%; leaf-hoppers (Cicadellidae), 18.4%; jumping plant lice (Psyllidae), 6%; miscellaneous bugs (Hemiptera), 1.8%; root gnats (*Sciara* sp.), 5%; flower flies (Syrphidae), 18%; miscellaneous flies (Diptera), including dance flies (*Rhamphomyia* sp. and other Empididae), *Chrysotus* and *Orthocladus* sp., 25%; ants (Formicidae), 1%; parasitic wasps (Figitidae), 4.2%; Serphoidea, 2.6%, and Chalcididae, 1.2%; miscellaneous Hymenoptera, 4%; undetermined insects, 1%; spiders, 3%; daddy-longlegs (Phalangidae), 1.2%; and pollen grains, 0.6%.

COPPERY-TAILED TROGON, *Trogon ambiguus ambiguus*.—The solitary Coppery-tailed Trogon is largely an exotic which occurs in limited numbers in the United States, usually in the pines and oaks of remote canyons from southern Arizona to the lower Rio Grande valley of Texas. Even though it is decked with flashy colors and has been described for more than a century, it still remains little known.

For this food-habit sketch but two well-filled stomachs were available. One was from a bird collected June 9, 1892, by Dr. A. K. Fisher in the Huachuca Mountains, Arizona, and the other from a trogon obtained October 10, 1931, south of the international boundary near Teporica, Mexico, by D. M. Gorsuch. The June bird had fed exclusively on the adults and larvae of lepidopterous insects. The October bird had drawn upon insects to the extent of 68% of its meal; the remaining 32%, however, consisted of fruits of cut-leaved cissus (*Cissus incisa*), 2%; fruit of red pepper (*Capsicum baccatum*), 14%; and undetermined plant fiber, 6%. The animal items in the food of this bird included fragments of: one grasshopper nymph (Acrididae), 1%; long-horned grasshopper eggs (Locustidae), trace; three Mantidae, 4%; three stink bugs, *Brochymena* sp., and other Heteroptera, 6%; one leaf-beetle (Chrysomelidae), 1%; one very large larva of a hawk-moth (Sphingidae), 56%; larvae of undetermined Lepidoptera, 9%; and two sawfly larvae (Tenthredinidae), 1%.

Dr. Fisher, according to Bendire, reported that fruit, caterpillars, grasshoppers, and other insects commonly enter into the bill of fare and that the birds catch insects on the wing in the manner of a flycatcher.

IVORY-BILLED WOODPECKER, *Campephilus principalis*.—As with most of the species so rare as to be on the verge of extinction, the amount of accurate information available as to the food of the Ivory-billed Woodpecker is exceedingly limited. This majestic bird—the largest of our species—which once ranged from North Carolina and Indiana to Texas is represented in the Biological Survey collection by three stomachs. Two of these were collected on November 26, 1904, at Tarkington, Texas, by Vernon Bailey, and the third at Bowling Green, West Carroll Parish, Louisiana, on August 19, 1903, by E. L. Mosely.

The first two stomachs were well filled and though only the contents of the third were received, it probably was also well filled. Only this last stomach contained gravel, a trace being present. Forty-six per cent of the combined food of the three birds was of animal origin, long-horned beetles (Cerambycidae, including *Parandra polita* and *Stenodontus dasystomus*) comprising 45.33%, while the remaining 0.67% consisted of three different species of engraver beetles (*Tomicus* spp.). Southern magnolia (*Magnolia grandiflora*) seeds, formed 14% of the vegetable food; hickory (*Carya* sp.) and pecan (*Carya illinoensis*) nuts, 27%; and poison-ivy fruits (*Rhus radicans*), 12.67%. Fragments of an unidentified gall formed 0.33% of the contents.

SULPHUR-BELLIED FLYCATCHER, *Myiodynastes luteiventris swarthi*.—The Sulphur-bellied Flycatcher nests in the mountains of southern Arizona, migrating to Central

America and probably also to western South America. Like its relatives, it is insectivorous and probably content with whatever comes its way of appropriate size. The single stomach examined was collected in the Huachuca Mountains, of southern Arizona, on May 28, 1922. It contained fragments of: one long-horned beetle (*Chrysobothris* sp.), 16%; weevils (Curculionidae), 3%; undetermined beetle (Coleoptera), 3%; four or more stink bugs (Pentatomidae), 20%; other true bugs (Hemiptera, including Lygaeidae), 13%; four indeterminable parasitic wasps of three or more species, 25%; other wasps including one *Cerceris* sp., one *Odynerus* sp., one Chalcididae, 15%; fly, 1%; undetermined insect, 2%; and spiders, 2%.

OLIVACEOUS FLYCATCHER, *Myiarchus tuberculifer olivascens*.—This small cousin of our common Northern Crested Flycatcher occurs from southern Arizona south through western Mexico to Oaxaca. While the bird is fairly well known, very little is on record as to its food tendencies. We report here on the food of three birds obtained in June and July 1919, in the Chiricahua Mountains of southern Arizona by Dr. Alexander Wetmore. The evidence seems to indicate that any moving insect of small size is acceptable, one bird having ingested some twenty kinds of insects.

The following is a summary of the contents of the three full stomachs. Fragments of: grasshopper (Acrididae), 0.33%; termites (Isoptera), 6.67%; ant-lion (Myrmelconidae), 4.67%; mayflies (Ephemeridae), 0.67%; tree-hoppers (including *Cyrtolobus* sp., *Stictocephala* sp., and other Membracidae), 14%; miscellaneous bugs, including *Sinea* sp. and other assassin bugs, leaf-hoppers (Cicadellidae), spittle bugs (Cercopidae), squash bug (Coreidae) and undetermined Homoptera and Heteroptera, 7.67%; beetles, including wood-borers (*Agilus* sp.), and weevils (*Pandeleteius depressus*), 2.67%; snipe-flies (*Cyrtopogon* sp.) and other Diptera, 30.66% (this group of insects formed the principal item in each stomach); moths (Lepidoptera) mostly adult (eight individuals, seven adults, and one larva comprised 27% of one meal), 16%; bees and wasps (including Apidae, Sphecidae, *Odynerus* sp., Eucharidae), 9%; undetermined insects, 3%; and spiders, 4.66%.

BUFF-BREADED FLYCATCHER, *Empidonax fulvifrons pygmaeus*.—Because of its retiring nature and restricted distribution in the sparsely settled areas of southern Arizona, New Mexico, and adjacent northern Mexico, the little Buff-breasted Flycatcher is one of the least known of its group.

From the limited data available, it apparently like others of its kin feeds on those insects that are most available. The contents of the single stomach (from Huachuca Mountains, Arizona, June 17, 1922) available for laboratory analysis, suggests that the bird is a beneficial species. Fragments of the following insects were noted: five beetles (including one *Bembidion* sp., one *Agilus* sp., one *Pachybrachys* sp. and one Rhynchophora), 6%; one short-horned grasshopper (Acrididae), 1%; true bugs, including leaf-hoppers (Cicadellidae), chinch-bugs (Lygaeidae) and big-eyed bugs (*Geocoris* sp.), 13%; more than forty ants of three genera (*Formica* sp., *Myrmica* sp., and *Solenopsis* sp.), 65%; and undetermined hymenopterous fragments, 15%.

GREEN JAY, *Xanthoura luxuosa glaucescens*.—The Green Jay is essentially a species of northern Mexico and southern Texas, ranging northward through the Rio Grande valley to Laredo. Most of its biographers give it a decidedly evil character. For instance, Austin Smith (38, p. 96), who spent several months at Port Isabel, Texas, in 1908, has the following to say: "What do they forage on? Well, during the nesting time for small birds, I judge upon Thrashers, Orioles, Sparrows, Wrens, Chats, Mockingbirds, etc., both in the embryo and down; at other seasons, mostly on seeds and insects. In winter the seeds of the Ebony (*Siderocarpus*) is the main reliance;

also in less quantity the fruit of the Palmetto, to secure which they will travel far into the open." Smith's indictment is not confirmed by the only previous record of stomach contents with which the writers are familiar—that from Vernon Bailey's field notes for April–May 1900, at Brownsville, Texas: "Stomach contained one grasshopper, beetles, small insects, and part of a kernel of corn." Except for the corn this food listed by Bailey is similar to that found by us in the stomach of a Green Jay collected by Dr. Francis Harper near Norias, Texas, on August 17, 1929. One per cent of the food consisted of fragments of two seeds of a bristlegress (*Setaria* ? *grisebachii*), seed fragments of prickly-ash (*Xanthoxylum clava-herculis*), and undetermined plant fiber. The remainder of the food was animal in origin, including fragments of: sixteen or more stink bugs (*Brochymena* sp.), 79%; several coreid bugs (*Acanthocephala* sp.), 8%; finely ground indeterminate bugs (Heteroptera), trace; a short-horned grasshopper nymph (Acrididae), 1%; a field cricket nymph (*Gryllus assimilis*), 1%; a beetle, probably a click-beetle (? Elateridae), 1%; a hymenopteran, trace; indeterminate insect, trace; and a fragment of a spider, 1%. Gravel formed 1% of the gross contents.

SENNETT'S THRASHER, *Toxostoma longirostre sennetti*.—Sennett's Thrasher is a bird of the Lower Austral and Upper Tropical zones, occurring from the lower Rio Grande valley and the Gulf coast of southern Texas, south to central Nuevo Leon, Tamaulipas, Coahuila and San Luis Potosi, Mexico.

On the basis of laboratory analysis of three stomachs obtained by Francis Harper in extreme southern Texas in August, it appears that the bird may be slightly more insectivorous than our common Brown Thrasher. The fact, however, that one bird made 23% of its last meal on hackberries, indicates that fruits form an acceptable item of diet. That it feeds quite indiscriminately is shown by two of the birds having each consumed twenty-one different kinds of food for their last meals, while the third had taken thirteen items. The indications are that the bird is normally beneficial.

A summary of the food of the three specimens follows: ant-lions (Myrmeleonidae), 4% (one bird had consumed eight larvae of these peculiar insects and a second bird, one individual); termites, 1%; grasshoppers, locusts, etc., 5% (some obtained by each bird); stink bugs (Pentatomidae) including *Brochymena* sp. and *Euschistus* sp., 9%; miscellaneous true bugs, 6.67%, formed a part of each meal and included negro bugs (*Aethus* sp., *Galgapha* sp., Fulgoidae and Reduviinae); beetles including *Oedionychis* sp., *Choeridium lecontei*, *Ataenius* sp., 30%; *Onthophagus* sp., *Pseudocanthos* sp., *Eleodes veterator*, *E. tricolorata*, *Blapstinus* sp., and other Tenebrionidae, 30%; ants (including *Camponotus* sp. and *Formica* sp.), 13.33%; other Hymenoptera, 1%; moth, 11.67%; miscellaneous insects, 2.67%; spiders, 2.67%; centipedes, 1.67%; fragments of a small frog, 1.33%; fruit of hackberry (*Celtis pallida*), 7.33%; undetermined plant fiber, 2.66%.

AZURE BLUEBIRD, *Sialia sialis fulva*.—The Azure Bluebird like others of its kind is cherished wherever found by those whose souls are attuned to the grace and beauty of Nature. Unfortunately, its distribution in the United States is extremely limited. It breeds southward from the mountains of southern Arizona to Jalisco, Oaxaca and Vera Cruz in Mexico and its winter range extends to northern Guatemala.

The single stomach available (collected during May in the Huachuca Mountains, Arizona) contained fragments of: one larval ant-lion (Myrmeleonidae), 3%; one grasshopper (Acrididae), 15%; two pygmy locusts (Tettigoniidae), 15%; one field cricket (*Nemobius* sp.), 5%; two crickets (*Gryllus assimilis*), 18%; one scarabaeid beetle, 3%; three or more carpenter ants (*Camponotus* sp.), 15%; other ants (Formicidae), 13%; larva of a sawfly (Tenthredinidae), 2%; a wasp (Hymenoptera), 5%; and

spiders, 6%; besides finely ground plant débris from the alimentary tracts of the grasshoppers and crickets.

EUROPEAN WHEATEAR, *Oenanthe oenanthe oenanthe*.—This bird though breeding throughout the northern portion of both hemispheres is certainly not common in North America. The single stomach here reported on was collected by Alfred M. Bailey, at Hooniah Sound, Alaska, May 12, 1920.

The food, almost entirely of plant origin, included thirty unidentified bulblets and fragments of many more, totalling 96%, and undetermined plant fiber, 3%. The animal matter consisted of one jumping spider (Attidae), 1%; fragment of another spider, trace; and fragment of an undeterminable insect, trace. Gravel constituted 5% of the total content. Bean records the Wheatear feeding on grass and saxifrage seeds at Cape Lisburne, but most of the published records of the food of this species indicate that it is primarily an insect feeder—especially upon flies and parasitic wasps.

LARGE-BILLED SPARROW, *Passerculus rostratus rostratus*.—The Large-billed Sparrow has a very peculiar distribution; restricted during the breeding season to the Lower Austral Zone about the head of the Gulf of California, yet during the remainder of the year it spreads widely, covering the entire coastline of Lower California and also that of the southern third of California.

Twenty-eight stomachs were available; fourteen taken in December, three in January, and eleven in March. One each was obtained at Pasadena and El Monte, California, and the remainder at Alamitos Bay, California, and at San Luis Island, Gulf of California. The food of these winter-collected birds was 39.21% animal, and 60.79% vegetable. A full stomach contained about three-quarters of 1 cc.

Of the animal foods various crustaceans, both soft-bodied forms and crabs, were consumed to the extent of 22.67% of the total intake. Of these, crabs of various species formed 10.71%. A variety of insects were next in order of importance supplying 8.36% of the food. Beetles (Coleoptera) composed 4.68%, and unidentified insects, ants, and a lepidopterous cocoon (Tineidae) made up the remaining 3.68%. But one of the twenty-eight birds had fed on spiders and this one had made 11% of its last meal thereon. As an average for all birds collected, spiders comprised but 0.39% of the total food.

That small gastropods are readily acceptable is shown from the fact that ten of the eleven birds collected in March at San Luis Island, Gulf of California, had ingested a relatively thin-shelled snail (*Marinula rhoadsi*) in amounts varying from a trace to 55% of their meals. For the eleven birds collected during March, snails supplied 18.45% of the food, but all of the twenty-eight birds averaged only 7.25%. Miscellaneous gastropods contributed another 0.54%, making the total consumption of these mollusks 7.79%.

A surprising amount (30.87%) of the plant material consumed could not be identified other than as seed fragments, woody débris, or rubbish. Grain supplied 22.96%, distributed as follows: barley (*Hordeum vulgare*), 3.57%; barley or wheat, 3.57%; wild oats (*Avena fatua*), 12.25%; oats (*Avena sativa*), 3.57%; while seeds of storksbill (*Erodium* sp.) and *Solanum* sp. supplied the remaining 3.57% and 3.39% respectively.

A considerable difference was noted in the food of birds collected in March at San Luis Island and of those taken in December at Alamitos Bay, California. The former group had subsisted on animal food, mostly crustaceans and gastropods, to the extent of 53.73%, while the California birds had taken insects, crustaceans and gastropods only to the extent of 22.29%. This would indicate that the species is adaptable, feeding within limits on whatever is most readily obtainable.

Cassin (17, p. 226) who studied these birds in 1856, wrote: "In those localities, frequently of difficult access, these birds rear their young in comparative safety, subsisting on seeds and insects and seldom attracting attention. They may occasionally be seen, too, on the bare sands of the beach searching for small marine animals thrown up by the waves."

BOTTERI'S SPARROW, *Aimophila b. botterii*.—Botteri's Sparrow is a little-known sparrow of the prairies of southern Arizona and the lower Rio Grande valley of Texas; its range extends south over the Mexican tableland to Chiapas.

For the present study fourteen stomachs were available, of which two were taken at about 5000 feet elevation in the Huachuca Mountains of Arizona, five miles south-east of Fort Huachuca. One was obtained June 20 and the other July 13, 1932, by Alexander Walker. The other twelve birds were secured by Dr. Francis Harper in August 1929, some twelve miles southeast of Brownsville and near Point Isabel, Cameron County, Texas.

From this study, it is apparent that during the summer the species is predominantly insectivorous, although it does not ignore seeds. The fourteen birds had drawn 86.08% of their food from the animal, and 13.92% from the plant kingdom. Five had fed exclusively on insects and other animal foods, while six others had taken only from a trace to 12% of plant items. The remaining three birds had made 44.48%, and 71% of their last meals on plant foods. In all, fifty kinds of insects and spiders and thirteen plant species were identified. The average meal consisted of 8.8 items; the maximum number in any meal was fifteen and the minimum three.

Eight of the birds had eaten one or more spiders, which averaged 3% of the total food, but aside from these all other animals taken were insects. Orthoptera, consumed by every bird examined, were first in order of importance, supplying a total of 48.29% of the entire food. Of these, grasshoppers, including a number of *Melanoplus*, made up 35.01%, mantids, including *Litaneutria* sp., and phasmids each contributed 5.07%, while pygmy locusts (Tettigonidae) added another 3.07%. The remaining 0.07% consisted of crickets (Gryllidae). No fewer than six grasshoppers and two pygmy locusts were obtained at a single meal. Other destructive insects consumed included a number of species of bugs (Hemiptera), 13.27%. This included cicadas (*Tibicen* sp.), 6.71%; leafhoppers (Cicadellidae), 1.64%; stink bugs (*Nezara* sp.), 2%, *Podops* sp., 1.21%; and shield-backed bugs (*Homaemus* sp.), 0.86%. The fact that some of the bugs consumed are among the most objectionably odoriferous, from man's viewpoint, would indicate that this quality is ineffectual as a protection against birds.

As further evidence that the feeding habits of this bird may be a benefit to agriculture, it may be stated that of a total of the 14.82% beetles entering into the bill of fare, 8.33% consisted of weevils (Curculionidae) and 5.71% of leaf-beetles (Chrysomelidae). The remaining 0.78% coleopterous food was drawn from among the ground beetles (Carabidae), wood-borers (Buprestidae), and pea-weevils (Mylabridae). Twelve of the fourteen birds had eaten these beetles and three of them to the extent of more than 40% of their meals. One bird had consumed no fewer than fourteen weevils and one leaf-beetle, while two others had taken nine and eight, respectively.

If further evidence is needed that destructive insects are eaten, it may be pointed out that termites (Isoptera) were consumed by three birds and made up 57% of the last meal of one of them, and as an average they comprised 4.14% of the total intake. One bird had eaten at least thirty-five of these pests. Caterpillars (Lepidoptera larvae) entered into the diet of five of the birds, making more than one-quarter of the

meal of one of them and 2% of the total food of all the birds. The remaining 0.56% insect food consisted of ants and other Hymenoptera and nerve-winged insects (Neuroptera).

Nine of the fourteen birds consumed plant material in some form, although with but one bird did seeds or other plant products supply as much as half of the meal. Spurge seeds, totalling 5.95% (and including *Acalypha* sp., 2.74%, and *Phyllanthus* sp., 3.23%), taken by six birds, were of first importance. Seeds of panic grass (*Panicum* sp.), eaten by five of the birds, were only slightly less important and contributed 4.59% of the total food. These were followed by purslane seeds (*Portulaca retusa*), which added 2.22% to the menu. A sedge (*Scirpus* sp.), 0.79%, and a *Ruellia*, 0.36%, contributed the remaining vegetable percentage, although other grasses, sedges, and a legume were represented by traces.

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