

NOTES ON THE FOOD OF THE CALIFORNIA CLAPPER RAIL

By JAMES MOFFITT

Comparatively little has been published upon the food habits of the California Clapper Rail (*Rallus obsoletus obsoletus*). Grinnell, Bryant and Storer (Game Birds of California, 1918:288) devoted but one short paragraph to a summation of the information then available. Laidlaw Williams (Condor, 31, 1929:52-56) contributed an important paper on the subject.

Because this is a "threatened species" which has been greatly reduced in numbers for various reasons in the past 50 years, knowledge of its natural history is especially desirable. The "spotty" distribution of this rail, its abundance in some localities and absence from others seemingly as suitable, suggests that ecological differences fundamental to rails exist in marshes of similar external appearance. For instance, clapper rails are extremely abundant in the unreclaimed parts of south San Francisco Bay, where tide-flooded salicornia marsh provides the preferred habitat. Yet similar marshes in the northern part of the Bay and at the south end of Tomales Bay, Marin County, support but a small population of rails. The species is apparently unknown from Suisun Bay and the entire delta area above Carquinez Strait, where extensive salicornia marshes also exist. This region is one of reduced salinity, with quite fresh water seasonally in the spring, which may possibly affect rail distribution through influence upon food supply. This statement is necessarily pure surmise because of our meager knowledge of the ecology of the marshes and of the clapper rail. There is indeed need for a comprehensive study of the natural history of the species along the lines suggested by the writer (The Gull, 22, 1940: 45-46).

Because the information on clapper rails' food is so incomplete and because food supply may importantly influence their distribution, this contribution, based upon analyses of stomach contents of 18 individuals, is thought to be justified. This number of specimens was collected by Dr. R. T. Orr and the writer on February 4, 1939, for the ornithological collection of the California Academy of Sciences. The rails were taken at the interval of a high tide (9.1 feet), from noon to 1:30 p.m., in flooded salicornia marshes bordering San Francisco Bay about 3 miles southeast of Palo Alto, Santa Clara County. Rails were extremely abundant there. Although no population densities were estimated, at least 100 rails were noted within an area of less than a square mile, considerable part of which consisted of a broad slough that would have held some water even at periods of low tide.

Stomachs of these rails were preserved and sent to the Fish and Wildlife Service, United States Department of the Interior, where their contents were examined by John C. Jones. Reports of these analyses form the basis for this paper. Grateful acknowledgment of this service is hereby made.

The condition of the stomachs ranged from one-tenth full (0.2 cc. volume) to gorged (7.8 cc. volume). The average content was 2.1 cc., which represented a well filled stomach. All of the food was contained in the stomachs, the gullets being empty, as might be expected in rails collected at high tide, since most food is available at periods of low water.

Volumetric content averaged over 85 per cent animal matter, and 14.5 per cent vegetable matter. No gravel was found in any stomach. Perhaps this is not available in the muddy marshes and doubtless it is unnecessary, its place being taken by the hard refuse, shells, etc., from the rails' food.

The table provides an itemized list of the stomach contents and includes all items which composed more than one per cent of the average content. Items which comprised less than this percentage by volume are mentioned in footnotes to the table.

Analyses by volumetric percentage of contents of 18 stomachs of *Rallus obsoletus obsoletus* from San Francisco Bay

	Volume of contents (cc.)	Total percentage of animal food	Percentages of individual animal foods					Vegetable food <i>Spartina</i> <i>liciantha</i>
			<i>Modiolus demissus</i>	Lycosidae	<i>Macoma balthica</i>	<i>Hemigrapsis oregonensis</i>	<i>Ilyanassa obsoleta</i>	
J. M. 2139 ¹	1.3	100	16	72		12		
J. M. 2140 ²	4.0	60	48	10			1	40
J. M. 2141	7.8	92	19	73				8
J. M. 2142 ³	0.6	100	98	Tr*		2		Tr
J. M. 2143	1.3	100	89	Tr	Tr		11	
J. M. 2144	1.3	99	65	34	Tr			1
J. M. 2145 ⁴	1.6	100	97					Tr
R.T.O. 1738	0.2	100	98	Tr	2			
R.T.O. 1739	0.7	52	52	Tr				48
R.T.O. 1740 ⁵	1.1	96	52	42	2			4
R.T.O. 1741 ⁶	1.7	100	22	36	30			Tr
R.T.O. 1742	4.0	59	55	1	Tr		3	41
R.T.O. 1743	5.1	42	24	Tr		4	14	58
R.T.O. 1744 ⁷	0.7	100	96	Tr	3			
R.T.O. 1745	0.7	99	84	1	14			1
R.T.O. 1746 ⁸	0.6	91	51	Tr		40		9
R.T.O. 1747	2.7	48	37	2	1		8	52
R.T.O. 1748	2.7	100	15	Tr	85			Tr
Average:	2.1	85.44	56.5	15	7.6	3.2	2	14.55

*Tr=Trace=less than one per cent of volume.

¹ One predaceous ground beetle (*Bembidion*) comprised trace of stomach contents.

² Remains of 8 or more worms (Nereidae) comprised one per cent of contents.

³ One bee or wasp (Hymenoptera) comprised trace of contents.

⁴ Jaws of 14 or more worms (Nereidae) comprised 3 per cent of contents.

⁵ One small snail (*Syncera translucens*) comprised trace of contents.

⁶ Bone fragments of a brush rabbit (*Sylvilagus bachmani*), no doubt obtained as carrion, comprised 12 per cent of stomach contents.

⁷ One fly (Otitidae) comprised one per cent of contents.

⁸ One mud beetle (*Heterocerus*) comprised trace of contents.

Animal food.—Eight of the 18 stomachs contained animal food exclusively, except for traces of vegetable matter in four of them. All but two of the stomachs contained a preponderance of animal matter, the exceptions containing 42 and 48 per cent of animal substance.

It is interesting that the exotic plaited horse-mussel, *Modiolus (Volsella) demissus*, should form so high a percentage of the birds' food. This species is thought to have been introduced into San Francisco Bay with shipments of eastern oysters prior to 1894, and it is now established as a common inhabitant of the mud flats (Hanna, Bull. Dept. Agr. Calif., 28, 1939:305). It was represented in all of the stomachs by numerous shell fragments. This mollusk amounted to over 66 per cent of the rails' animal food. This is of interest because it has not previously been reported as being a food of *Rallus obsoletus*, and further, because De Groot (Condor, 29, 1927:266) has accused it of being an enemy of the rails by trapping them by the bill or toes between its shells. Several of the rails whose stomach contents are here considered were missing one or more toes, presumably from this cause. In view of the important place that this mussel occupies in the diet of the present sample of rails, it cannot now be regarded

entirely as an enemy of the bird. It is even conceivable that its presence may be more beneficial than detrimental to the rail population, which is another matter that cannot be answered short of conducting a careful study.

Spiders of the family Lycosidae, common inhabitants of wet and marshy places, were second in importance. Fragments of these spiders occurred in all save one of the stomachs, and in measurable quantities in half of them. Two stomachs contained 73 and 72 per cent, respectively, of remains of these animals; in the latter case the percentage represented more than 12 spiders. This food amounted to 15 per cent of the whole and over 17½ per cent of the animal matter found in the entire lot. Spiders have not previously been reported as being a food of this bird.

The little macoma clam (*Macoma balthica*), represented by shell fragments found in 10 stomachs, occurred in measurable quantities in only 7 examples. Except in two instances where this mollusk constituted 85 and 30 per cent of a stomach's contents, this item did not assume important proportions. It formed 7.6 per cent of the diet of the aggregate and nearly 9 per cent of the animal food. The low rank of this food among the present sample is in contrast to Williams' (*op. cit.*) observations from which he concluded that the clam was the principal article of food of rails which he observed in November and December of 1928. His records were made within three miles of the locality in which the present lot of birds was collected and are accompanied by excellent photographs and a description of how the rails procure and eat this clam.

The yellow shore-crab or mud crab (*Hemigrapsis oregonensis*), was found present in only four instances. In each case, remains of a single crab were found. Based upon both this low frequency and the low percentage by bulk, amounting to only 3.22 per cent of the whole, this crustacean played a minor part in the rails' diet. This is in contrast to Grinnell, Bryant and Storer's account (*loc. cit.*) where it is stated that parts of this crab were the only food found in stomachs of several clapper rails collected at Bay Farm Island, Alameda County.

The worn-out nassa, *Ilyanassa (Nassarius) obsoleta*, is a small snail, which, like the plaited horse-mussel, was introduced into San Francisco Bay with shipments of eastern oysters (see Hanna, *op. cit.* :304). Williams (*op. cit.* :56) mentions that these snails, which were lying about on the surface of the mud, were apparently untouched by the birds. The present analyses seem to confirm this observation, for if the snails were also abundant where the rails were collected, few were taken by the birds. The percentages in the table for individual stomachs represent from one to more than nine snails in five instances. The low aggregate percentage by bulk (2 per cent) indicates that this is not an important food item, and this is supported by Williams' observations.

Emerson (Orn. and Ool., 10, 1885:142) stated that worms and insects mostly composed the clapper rail's food. This statement is probably in part responsible for Grinnell, Bryant and Storer's contention that "the food is made up almost entirely of animal matter—worms, crustaceans and the like." It has already been remarked that crustaceans composed only a little more than three per cent of the present birds' food. Worms (Nereidae) occurred in almost negligible amount. Remains found in only two stomachs represented at least 8 and 14 worms, respectively, and amounted to one and three per cent of the individuals' diet. In the last instance, jaws of 14 worms comprised this percentage of bulk; before digestion the worms themselves would doubtless have contributed a higher percentage. Nevertheless, this item was inconsequential in the present sample.

Insects of four kinds occurred in as many instances. In each case, only a single insect was found (see footnotes to table). In all save the case of the fly, this material did

not occur in measurable quantities. It should be borne in mind that these rails were collected in mid-winter, when insect life was at a low ebb. Higher percentages of insect food are probably taken in summer.

The instance in which brush rabbit (*Sylvilagus*) bones formed 12 per cent of a rail's stomach contents is noteworthy as indicating the omnivorous character of the bird. Doubtless this material was obtained in the form of carrion.

Vegetable food.—Seed and hull fragments of the marsh cordgrass (*Spartina leiantha*) occurred in all but four of the stomachs. Measurable quantities were found in ten stomachs and amounted to as high as 58 and 52 per cent in two instances. In terms of percentage by bulk of the aggregate, this food ranked third in importance, averaging $14\frac{1}{2}$ per cent. It was therefore an item of some significance. Because the rails were collected in mid-winter, it is likely that the percentage represents about the maximum of vegetable diet. This is the only vegetable species that was found in the stomachs. It is an abundant plant of the margins of the salt marshes. Williams mentioned that clapper rails sometimes feed near the grasses fringing their territories along sloughs. It is also possible that our rails show an abnormally high percentage of grass seed because they were collected during an unusually high tide when the grass was still exposed but most of the animal food deeply submerged.

SUMMARY

Ecological differences, perhaps differences in food supplies, may account for the irregular distribution of the California Clapper Rails of San Francisco Bay. Little has been published on the species' food habits.

The present contribution is based upon a sample of 18 rail stomachs collected near Palo Alto on February 4, 1939. Analyses were made by the U. S. Fish and Wildlife Service. Animal food constituted 85.5 per cent and vegetable food (seeds of *Spartina leiantha*), 14.5 per cent by bulk. No gravel was found.

A breakdown of the animal food indicated that the exotic horse-mussel (*Modiolus demissus*) was of greatest importance, amounting to 66 per cent of the animal food. This mollusk has been stated to be an enemy of clapper rails. Spiders were next among animal foods and were followed in importance by mud clams. Mud crabs and snails constituted low percentages. Worms and insects occurred in negligible quantities. Rabbit remains (carrion?) were found in one stomach.

California Academy of Sciences, San Francisco, California, June 18, 1941.