differential. Our hybrid is consistently larger and its measurements appear to be more typical of *atricapilla*.

Despite the size differential, these two specimens are quite similar, lending support to Miller's speculation that his hybrid may be of the first filial generation. The fact that they were captured 21 years apart in time but only about 30 air miles apart in distance makes one wonder if they may have come from the same breeding population.—MARTIN L. MORTON and L. RICHARD MEWALDT, *Department of Biological Sciences, San Jose State College, San Jose, California, July 20, 1960.*

Changes in Food Habits of Short-eared Owls Feeding in a Salt Marsh.—Predation by Short-eared Owls (*Asio flammeus*) on the inhabitants of a salt marsh was reported for a four-year period (1952–1955) by Johnston (Wilson Bull., 68, 1956:91–102), who randomly collected and examined owl pellets from San Pablo salt marsh, near Richmond, Contra Costa County, California. The present author collected and examined owl pellets on this same marsh during 1959 with a view to demonstrating suspected changes in the predator-prey relationships there. A total of 170 food items was recorded and percentages of the prey species computed for comparison with the figures available for this marsh. A description of the habitat involved is given in Johnston's paper (*op. cit.*: 91). As in Johnston's report, all owls involved here are migrants or winter visitants. One owl, however, remained through June, 1959, although departure for the breeding grounds usually occurs in early May. The total number of owls feeding on the marsh was probably six to eight, a figure comparable to the estimate made by Johnston (*op. cit.*: 93).

The data in table 1 were assembled in the manner followed by Johnston with the exception that counts of humeri (left or right, whichever was higher) instead of skulls only were made for mammals. This resulted in a slightly higher number than if skulls alone had been counted. In the column of the table headed "change from 1952–1955," a percentage is considered different if it is outside the range of Johnston's figures (*op. cit.*: 95). A few species listed by him were not recorded in 1959, but these form only a very small part of the diet of the Short-eared Owl on San Pablo salt marsh.

Examination of the present table and that of Johnston (*loc. cit.*) shows that most prey items have been taken at a constant rate over the five years for which data are available. However, notable fluctuations did occur in the numbers of the Norway rat (*Rattus norvegicus*) and the Water Pipit (*Anthus spinoletta*).

Johnston (*op. cit.*: 96) noted that there was apparently some relationship between the numbers of the California vole (*Microtus californicus*) and *Rattus* in the pellet samples. From 1952 through 1955 the numbers bore an inverse relationship as the rats increased in number in the sample. However, my data for 1959 show the situation is more comparable to 1952 when the rat population was apparently low and *Microtus* apparently high. The probable reason for this was that during the period from 1952 to 1955 rats inhabiting the nearby dump had direct access to the marsh. The Richmond city dump then in operation was located on the southeast side of the marsh and dumping was directly onto the marsh. A suggestion by Davis (Quart. Rev. Biol., 28, 1953:397) indicates that it is probable that competition resulting from high rat populations forces subordinate individuals to move out in search of more favorable conditions. Emigrating individuals forced out by an increase in the dump population here could easily move out into the marsh. In January, 1956, this dump was closed and a new dump on the north side of the marsh was placed in full operation. The new dump is connected to the marsh study area only by a secondary road, and rats do not have the free access to the marsh that they had previously. In addition, burning of refuse, practiced in the old dump, may have driven some rats into the marsh. Burning is prohibited in the present dump. The policy now in use of burying refuse continually changes the dumping area, a factor which presumably helps check the population of rats at the dump.

Johnston (*loc. cit.*) pointed out that the population of *Rattus* at the dump supplied animals to the marsh but that the rats also lived successfully there. However, it is probable that the rats actually do not live permanently in this marsh in large numbers without regular emigration into it. When the first dump was closed, rats no longer invaded the marsh and so the population dwindled. I have seen only a few rats and trapped just one in 20 months of mammal studies on San Pablo salt marsh. Furthermore, during the winter high tides which flood the marsh and force mammals into the open,

no rats were seen. Therefore, it appears that rats have been effectively eliminated from the marsh and owls once more rely on *Microtus* as their dominant food item.

The change in the number of Water Pipits in the pellet sample may be attributable to the change in the rat population. Large numbers of pipits roosted on the marsh during the winter periods of 1959. Probably those birds were not present in such large numbers in the period from 1952 to 1955 because of disturbance and predation by rats. Now, with the rat population practically eliminated, these birds abound on the marsh. When roosting, pipits are considerably more exposed than any of the resident bird species and so are more easily procured by Short-eared Owls.

Table 1

Food Items in Pellets of the Short-eared Owl, 1959

Species	Frequency	Per cent of total	Change from 1952–1955
Microtus californicus	86	50.6	None
Reithrodontomys spp.	17	10.0	None
Mus musculus	7	4.1	None
Rattus norvegicus	4	2.4	4.8 per cent below lowest yearly percentage; 15.6 per cent below four-year average
Sorex vagrans	4	2.4	None
Mammals: total	118	69.5	5.1 per cent below lowest yearly percentage; 10.3 per cent below four-year average
Erolia-Ereunetes	14	8.2	None
Anthus spinoletta	9	5.3	4.8 per cent above highest yearly percentage; 5.1 per cent above four-year average (only one recorded previously)
Unidentified birds	5	2.9	None
Sturnella neglecta	4	2.4	None
Passerculus sandwichensis	4	2.4	None
Limnodromus griseus	3	1.8	Not significant
Melospiza melodia	2	1.2	None
Birds: total	41	24.2	3.6 per cent above highest yearly percentage; 8.7 per cent above four-year average
Stenopelmatus (sand-cricket)	9	5.3	None
Unidentified insects	2	1.2	Not significant
TOTAL	170	100	

A further consequence of the removal of the dump area is the change in the foraging behavior of the owls. Johnston (*op. cit.*: 93) stressed the "almost complete absence of daytime feeding" on this marsh. He attributed this to the mobbing of owls by gulls gathered about the dump. The old dump was located at the upper edge of the marsh, and gulls had to fly across the marsh to it. The new dump is located directly on the bay, and gulls no longer need to fly over the marsh to reach it. As a result the owls can now forage during the daytime also as is common on their breeding grounds (Errington, Condor, 34, 1932:178). The owls seldom, if ever, forage in the dump, presumably because of the constant presence of gulls.

Therefore, with the virtual elimination of gulls and rats from the marsh area, the Short-eared Owls have changed their foraging habits and their dominant prey item. Unavailability of rats forced them to consume more *Microtus* again, but apparently this alone was not sufficient in 1959. In spite of a distinct preference for small mammals over small birds as food items (Errington, *loc. cit.*), the owls also utilized small birds, particularly Water Pipits, the most readily available, to augment their food supply.—GEORGE F. FISLER, *Museum of Vertebrate Zoology, Berkeley, California, August 17, 1960.*