Summer food of river otter in north coastal California lakes.—The literature reveals several studies of river otter (*Lutra canadensis*) food habits (Grinnell et al. 1937, Lagler and Ostenson 1942, Wilson 1954, Greer 1955, Ryder 1955, Hamilton 1961, Sheldon and Toll 1964, Erlinge 1968, Knudsen and Hale 1968, Toweill 1974). Only Sheldon and Toll (1964) and Greer (1955) analyzed scats, both expressing results in frequency of occurrence; neither expressing a volumetric evaluation. This paper is based on 100 scats analyzed for frequency of occurrence and volumetric relationship of food items present. Lagler and Ostenson (1942) believed that stomach and intestinal analysis yield more specific determination of food items than scats, but full protection of river otter in California prevented such a study. This study presents information on food items consumed by river otters in brackish water of northwestern California. The only previously published study of California otters was conducted in fresh water (Morejohn 1969).

We believe our data represent the food of no more than four adult otters and their young. One observation revealed two large otters and four smaller ones, and tracks indicated that there may have been two family units using the study area.

STUDY AREA

The study was conducted on three bodies of water approximately 6.5 km north of Crescent City, a coastal city about 32 km south of the Oregon border and 400 km north of San Francisco, in Del Norte County, California. The study area includes three lakes: Lake Talawa (200-250 ha), Lake Earl (1200 ha) and McLaughlin's Pond (4 ha), which are grouped in a circle with a radius of about 3 km (figure 1).

Lake Talawa is separated from the Pacific Ocean by a sand spit varying in width from 60 m to 1 km at the southern end. This spit is blasted periodically to lower the water level and furnish more grazing land for dairy ranching. This occurrence coupled with high tides and stormy seas permits salt water and accompanying organisms to move into the lake. The lake is characterized by sterile shores and a sandy bottom. Lake Earl has a muddy bottom with bulrush (*Scirpus americanus* and *S. acutus*), spike-rush (*Eleocharis* sp.), and cat-tail (*Typha* sp.) around the shores. McLaughlin's Pond is very similar to Lake Earl except for being smaller and having an abundance of water lily (*Nuphar* sp.) in its southern end. The most abundant aquatic plants of the Lake Earl area, which includes the study area, are discussed by Johnson and Yocom (1966).

Early dune succession characterizes the surrounding area. Predominate species are: beach strawberry (*Fragaria chiloensis*), Oregon grape (*Mahonia nervosa*), cinquefoil (*Potentilla* sp.), willow (*Salix* sp.), beach pine (*Pinus contorta*), rush (*Juncus* sp.), vetch (*Vicia* sp.), and sedge (*Carex* sp.).

METHODS

One hundred usable otter scats were collected from four locations during June through August 1964. Each location was a latrine or sign post frequented by otter. Latrines were located within 5 m of water. Two of the latrines were near locations where logs protruded from the water to shore. Near all latrines were places used by otter to roll, where grass was absent and only sand was present. These "rolling places" were free of scats.

Otter scats are easily recognized (Greer 1955) and are characterized by a strong odor. Scats were black and covered with mucous when fresh except those containing only crab (*Cancer* sp.) shells. Contents usually consisted of fish bones and scales, feathers, crab shell fragments, and a few insect remains. Collected scats were placed in envelopes. All latrines were visited every two weeks, although not all latrines always contained scats.

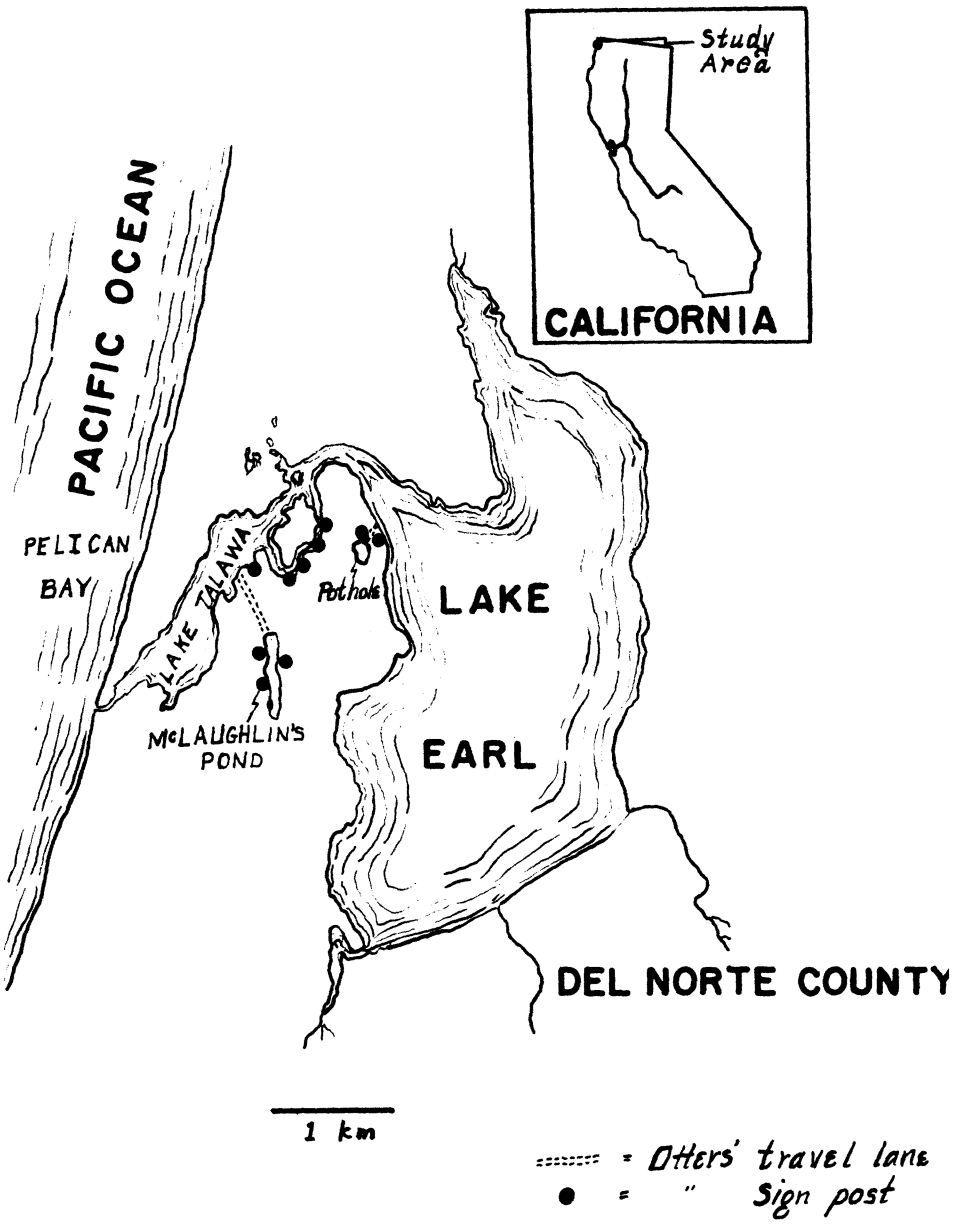

FIGURE 1. Study area in Del Norte County, California, including sites (sign posts) where otter scats were collected. (Map was adapted from Johnson and Yocom 1966.)

Scats were analyzed in a dry state. They were broken apart with tweezers, dissected with needles, and examined with naked eye supplemented with a binocular microscope whenever necessary. The entire scat was examined. Food items were identified by use of reference collections obtained in the area. Occurrence of all items was recorded on analysis cards and identified with a sample number. Each item was then immersed in 5 cc of water in a 10 cc graduated cylinder to record displacement volume per sample. Samples were agitated in the cylinder until all air bubbles surfaced. Items with a volume of less than 0.2 cc were recorded as a trace.

RESULTS

Table 1 shows the importance of the starry flounder (*Platichthys stellatus*) as a summer food for these river otters. Flounders occurred in 70 percent of the scats and constituted over 56 percent of the total volume of all scats examined. Crabs (*Cancer* sp.) were next in importance with 51 percent occurrence and over 37 percent of volume. Birds occurred in only 6 percent of the scats and made up less than 5 percent of the volume of scat material. The feathers of birds found in scats were "pin feathers," indicating that the birds eaten were young birds or adults going through postnuptial molt. Larvae of dragon flies (*Diastidae* sp.) occurred in 9 percent of scats analyzed, but made up less than 2 percent of the volume. Other items occurred only in trace amounts.

TABLE 1. River otter summer food habits based on 100 scats.

Food items	Percent of occurrence	Total volume in cc	Percent of total volume
Starry flounder (*Platichthys stellatus*)	70	228.9	56.1
Crab (*Cancer* sp.)	51	152.0	37.6
Avian species	6	18.5	4.6
Dragon fly (*Diastidae* sp.)	9	5.1	1.3
Ostracods	12	trace	trace
Snail	4	trace	trace

CONCLUSION

Obviously the most important indicator of foods consumed by river otter in this study is the percent of occurrence of food items found in the 100 scats analyzed. Total volume and percent of total volume for each item in table 1 are distorted from the actual volume of the foods eaten by river otter since only hard parts pass out in the scats. Since crab and starry flounder occurred in over 50 percent in each case, they must have been foods most often eaten by the river otter passing the scats. The periodic blasting of the sand spit separating Lake Talawa from the Pacific Ocean accompanied by high tides and stormy seas permits a constant supply of starry flounders and crabs to enter Lake Talawa for these river otter to feed on with the least effort.

Local ranchers feel river otters do not deserve full protection because of their supposed predation on ducklings during the summer period. Our observations did not substantiate that river otter eat ducklings.

LITERATURE CITED

ERLINGE, S. 1968. Food studies on captive otters *Lutra lutra* L. Oikos 19:259-270.

GREER, K. R. 1955. Yearly food habits of the river otter in the Thompson Lake region, northwestern Montana, as indicated by scat analyses. Am. Midl. Nat. 54:299-313.

GRINNELL, J., J. S. DIXON, AND J. M. LINSDALE. 1937. Fur-bearing mammals of California, Vol. I. Univ. of California Press, Berkeley.

HAMILTON, W. J., JR. 1961. Late fall, winter and early spring foods of 141 otters from New York. New York Fish and Game Journal 8:106-109.

JOHNSON, S. R., AND C. F. YOCOM. 1966. Breeding waterfowl in the Lake Earl-Lake Talawa area, Del Norte County, California. Murrelet 47:1-5.

KNUDSEN, G. J., AND J. B. HALE. 1968. Food habits of otters in the Great Lakes region. J. Wildl. Manage. 32:89-93.

LAGLER, K. F., AND B. T. OSTENSON. 1942. Early spring food of the otter in Michigan. J. Wildl. Manage. 6:244-254.

MOREJOHN, G. V. 1969. Evidence of river otter feeding on freshwater mussels and range extension. Calif. Fish Game 55:83-85.

RYDER, R. A. 1955. Fish predation by the otter in Michigan. J. Wildl. Manage. 19:497-498.

SHELDON, W. G., AND W. G. TOLL. 1964. Feeding habits of the river otter in a reservoir in central Massachusetts. J. Mammal. 45:449-455.

TOWELL, D. S. 1974. Winter food habits of river otters in western Oregon. J. Wildl. Manage. 38:107-111.
WILSON, K. A. 1954. The role of mink and otter as muskrat predators in northeastern North Carolina. J. Wildl. Manage. 18:199-207.

R. MODAFFERI, *Alaska Department of Fish and Game, Anchorage, Alaska 99500,* and CHARLES F. YOCOM, *Department of Wildlife Management, Humboldt State University, Arcata, California 95521.* Accepted 2 July 1979.

Notes on the births and deaths of harbor seal pups at Double Point, California.— Numerous studies have been conducted on the mother-pup interactions of harbor seals (*Phoca vitulina*), but little information exists on the reactions of females toward their dead pups. Trudeau (1976) recorded responses in two harbor seals (*P. v. concolor*) toward their dead offspring, yet both of these sightings were short in duration. I report here responses in similar situations by females (*P. v. richardi*) at Double Point, Marin County, California.

On 15 April 1977 at 14:15, I observed a pregnant harbor seal with distinctive markings at this haul out. A red sac, presumably the embryonic membrane, ballooned from her vulva. A Western Gull (*Larus occidentalis*) instantly landed and began to pull at the sac. Within 15 seconds the pup's tail was exposed. The female then rolled onto her side; at 14:16:30, the pup was expelled and simultaneously the umbilical cord was broken.

The pup exhibited the lanugo pelage, usually shed *in utero* in this subspecies (Shaughnessy and Fay 1977, Stutz 1966), and the red membrane still clung to its sides. Its first activity was to swing its head back and forth in an uncoordinated manner. The female turned immediately after parturition and began nosing the pup's side. Both were on the tidal interface being gently washed by waves. The gull attempted to remove the sac clinging to the pup's side; however, the female threatened the gull away with a head thrust. At 14:18 a wave backwash drew the pup from the beach and the female quickly followed it. At 14:20 she continued to initiate naso-naso contact with the pup. Obviously the latter was unresponsive; it repeatedly swung its head and lacked motor coordination. At 14:21, with the female actively following, the pup drifted out to where the water was a meter deep and there floated motionless on its back, apparently drowned. The mother attempted to lift the pup's head out of the water several times, but by this time the pup lacked buoyancy. She then submerged and pushed the body to the surface, but it again sank. At 14:25, she moved 3 m away from where the pup was last seen and arched her body so that her head and tail were out of the water. I have noted other females in this posture a short time after giving birth, and it may be associated with expelling the afterbirth. Part of the afterbirth extruded from her vulva. At 14:32 she dove and surfaced and appeared to be searching, but no pup was observed.

The female was not seen again until 15:04, when she was 15 m offshore in the posture noted earlier. She again disappeared and not until 15:27 did she appear, this time carrying her dead pup by its nape in her mouth. Allen (1880) described this mode of conveyance by females with live pups, and I too once saw a mother retrieve her pup in this manner after the herd had stampeded from the beach. The female with the dead pup beached, released the pup and moved a meter up the beach. She turned, saw the pup drawn into the water by a wave and retrieved it. Because she remained on the tidal interface, she and the dead pup were continually dislodged by wave action. The pup would be washed away by a wave and the female would either retrieve it or block it from being drawn further. During this time she repeatedly attempted to solicit responses from the pup, nosing its side and muzzle, and, at