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California Academy of Sciences, San Francisco. Received April 11, 1952.

GENERAL NOTES

A BEAKED WHALE, *MESOPLONDON* SP., FROM THE PRIBILOFS

During the summer of 1951, the writer had the rare opportunity to spend a month on St. Paul Island, one of the Fur Seal Rookery Islands of the Pribilof group in the Bering Sea, and to study parasites and diseases of the fur seals at the invitation of the U. S. Fish and Wildlife Service. This visit gave the opportunity to work on a stranded whale. Great was my surprise to find that it was a fairly complete specimen of *Mesoplodon*, one of the rare beaked whales.

On September 7, word reached me that Mr. Maussey, who tends the pumping system for the Island's water supply, had found a strange animal stranded on the beach near his station on Stony Point along the east side of the Island, and had saved from it a single tooth. Nikifer Mandrigan, native foreman on St. Paul Island, suggested that Mr. Maussey show the single tooth to me. It was a heavy flattened tooth, about $\frac{1}{2}$ inch thick, triangular in shape, $2\frac{3}{4}$ inches on a side, with only the top $\frac{1}{4}$ inch having been exposed in the jaw. It did not resemble any shark tooth that I had ever seen nor did it resemble anything with which I was familiar. We then hiked about a mile to the beach to see this strange animal. The beach party included Don Knudsen, photographer from Anchorage, and Frank Shaw, Assistant Director, Universal-International Pictures, from Hollywood, who were on St. Paul to take movies for a Rex Beach film, then under production.

Karl Kenyon, Clarence Jordan, and Ford Wilke, Fish and Wildlife Service Biologists, had left instructions posted in their laboratory as to what to do in their absence if a whale or big fish were found stranded on the Island. These instructions had been reviewed. Upon arrival at Stony Point we found the carcass just above high tide and in a good state of preservation. Photographs were taken and the animal was measured at 14 feet, 6 inches in length. The head of the animal was closest to the water and apparently submerged at high tide because it was quite free of flesh, though still attached to the body. The lower mandible was separated from the skull and only one-half of it remained; this had already been broken to obtain the single tooth brought in by Mr. Maussey. The skull and broken lower jaw were taken to the laboratory to be further cleaned and dried. The skull was not recognized by any of the Island residents who saw it. Still I was not aware that it was anything unusual. A few nights later a search in the limited scientific library on the Island revealed a copy of "Field Book of Giant Fishes" by Norman and Fraser, which indicated that our stranded animal was a specimen of *Mesoplodon*, one of the rarest of the whale genera. This demanded that a more complete specimen be preserved and that a strenuous effort be made to salvage the remainder of the skeleton. With two Aleut helpers we returned to the whale on September 12 to find it in a more decomposed state, but a brisk wind favored our fleshing operations. Some of the vertebrae were already freed from the carcass and washed clean; possibly

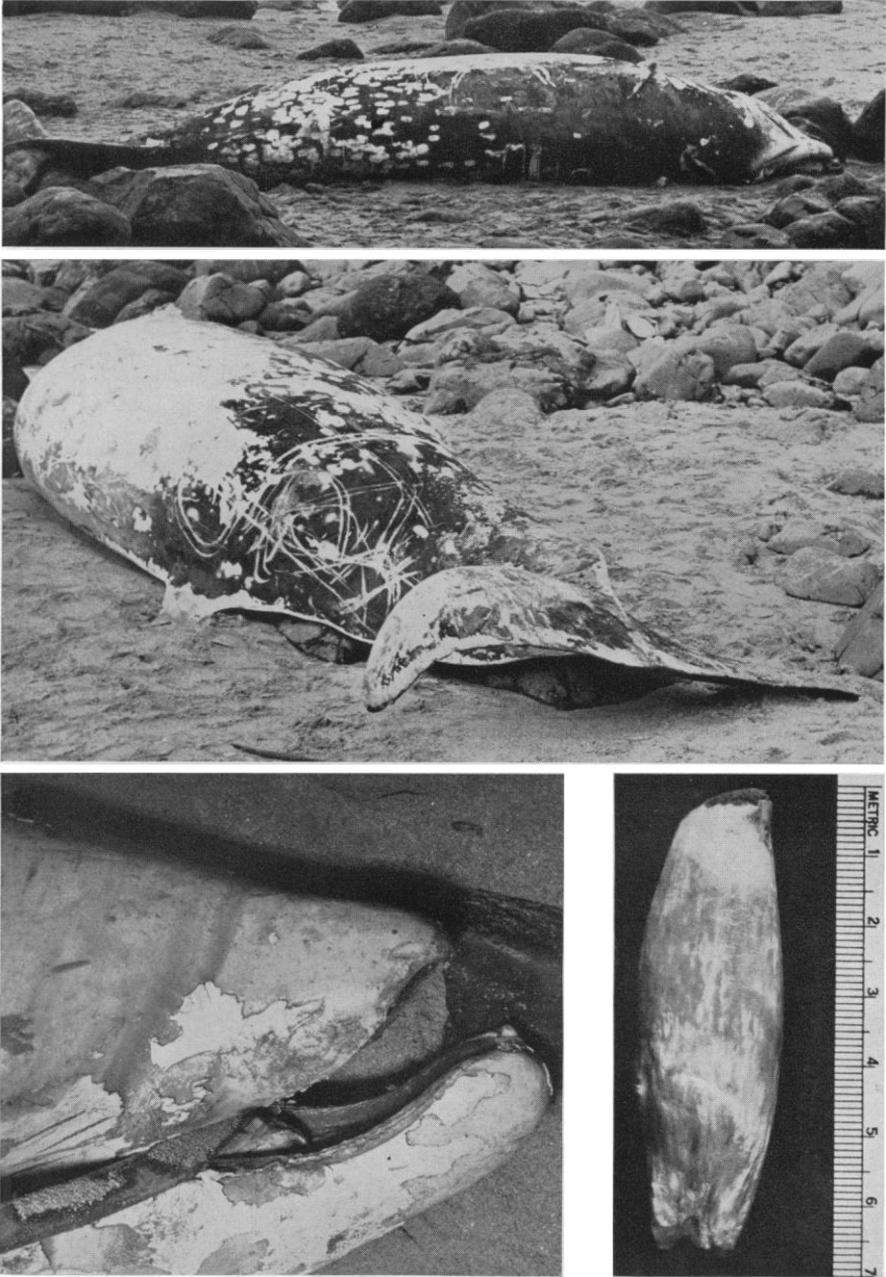


PLATE I

(TOP) Ventral view; note typical gular grooves. (CENTER) Flukes and dorsal surface; note shallow tail notch, double scars, and light gray color anterior to dorsal fin. (BOTTOM LEFT) Detail of jaws, showing teeth. Stick at angle of jaw to prop mouth open. (BOTTOM RIGHT) Tooth from left side, showing interior surface; anterior to the right.

several were missing. The other vertebrae were roughed out and, where possible, strung on wires in proper order, or numbered with tags. The pectoral bones on one side were saved. Several small bones thought to be from the pelvis were also found. Most of the bones were taken to the laboratory where they were further cleaned and dried. Some were so offensive that they were stored in one of the smoke houses previously used for curing seal meat for fox food. These are to be recovered next spring by the biologists.

The skull and part of the skeleton were brought to Seattle on the U. S. Coast and Geodetic Survey boat, the *Pathfinder*, where they were turned over to Dr. Victor B. Scheffer of the U. S. Fish and Wildlife Service.

The single tooth, the most important taxonomic character of the animal, has been borrowed from Mr. Knudsen, photographed, and cast in plaster at the National Museum. When the other skeletal parts left on St. Paul Island are received, a more thorough study will be made of this specimen. This appears to be an additional marine mammal record for the Pribilof Islands and adds skeletal material for the study of this rare genus of whales.—WILLIAM L. JELLISON, *Rocky Mountain Laboratory, Hamilton, Montana, Received May 6 1952*. [From the Federal Security Agency, Public Health Service, National Institutes of Health, National Microbiological Institute]

CUVIER'S BEAKED WHALE (*ZIPHIUS CAVIROSTRIS*) FROM OREGON

On February 21, 1952, an adult male Cuvier's beaked whale (*Ziphius cavirostris*) was cast up on the beach at Road's End, just north of Oceanlake, Lincoln County, Oregon. A photograph of the animal, lying on its right side, appeared in the *Oregonian* newspaper of February 23, 1952, taken by Les Fultz, of Oceanlake. The authors set out to investigate the animal (misidentified as a porpoise in the newspaper account) that afternoon.

TABLE 1.—Measurements of Oregon specimen of *Ziphius cavirostris*

Length, snout to base of tail (notch)	559	cm. (18 ft. 4 in.)
Maximum width of tail flukes	169	(5 ft. 2 in.)
Snout to tip of dorsal fin	380	
Dorsal fin to base of tail (notch)	178	
Snout to insertion of flipper	123	
Snout to corner of mouth	28.5	
Snout to center of eye	67.5	
Snout to slit of blowhole	63	
Projection of lower jaw beyond snout	1.8	
Axillary width of flipper	26	
Length of flipper	56	
Height of dorsal fin	23	
Maximum width of blowhole	19	
Dimensions of eye opening	5.2 x 2.8	
Tail notch to center of anus	170	
Anus to back of urogenital opening	39	
Anus to front of urogenital opening	63	
Length of penis exposed	32	

On arrival it was learned that the whale had been moved from its original position by the tide on the night of the twenty-first, and was now lying on its left side, not far from the original location. Much of the pigmented epidermis had been scraped off during the move, but enough remained to determine the original coloring over most of the animal without much difficulty. Decomposition was just beginning, a slight odor being noticeable at very close quarters. Death was apparently due to a large gash beginning just below the angle of

the jaw on the left side, curving up and around to end just below the front edge of the left flipper. This showed plainly in the newspaper photo, and the edges can be seen in the accompanying view of the ventral surface. Such a gash might be the result of contact with a ship's propeller. Both flippers were broken at their insertions, apparently during the moving on the night of the twenty-first, as the newspaper photo shows the left flipper, at least, undamaged.

The measurements in Table 1 were taken in centimeters, using a two meter steel tape; all measurements were made as nearly as possible in a straight line, and not along the curved body of the animal, and consequently a slight error may be noted in the larger dimensions.

The blowhole was in the shape of a crescent, the horns pointing forward. The measurement from the snout to the slit of the blowhole was made to the center of the crescent.

Over the ventral surface and lower half of the sides the predominant color was very dark gray, approaching black. Numerous roundish or oval white scars were concentrated in the perineal region, and long, double scars occurred along the sides. These latter were possibly due to fights with other whales, apparently being caused by the paired teeth at the end of the lower jaw of this species. The head was dirty white, grading into a light gray along the back nearly to the dorsal fin, which was blackish like the undersurface and flukes. In areas where the epidermis had been rubbed off, especially along the flanks, subsurface blood from decomposing tissues gave a rosy hue to the otherwise pure white dermis.

The lower jaw contained at the end the two teeth typical of *Ziphius*. The right tooth was broken flush with the gum. The left tooth, unbroken, was removed for aid in identification, and was apparently attached to the surface of the jaw rather than in a definite socket, being held in place largely by the gum tissue surrounding it for most of its length. The greatest dimensions of this tooth were: length, 65.5 mm.; width, 21.0 mm.; thickness, 17.3 mm. It shows signs of wear.

This report constitutes the third record for *Ziphius cavirostris* from the Pacific coast of the United States, two others having been found within recent years in California (Hubbs, Jour. Mamm., 27: 242-255, 1946, and Orr, *ibid.*, 29: 420-421, 1948). A fourth specimen from Baja California (Hubbs, Jour. Mamm., 32: 365-366, 1951), two from Vancouver Island, B. C. (Cowan, Murrelet, 21: 9, 1940 and Jour. Mamm., 26: 93-94, 1945), and one from Kiska Harbor, Alaska (True, U.S.N.M. Bul., 73, 1910), comprise the remaining records for the coast of western North America.—A. I. ROEST, R. M. STORM, AND P. C. DUMAS, *Department of Zoology, Oregon State College, Corvallis, Ore. Received March 24, 1952.*

MARINE MAMMALS IN MICHIGAN PLEISTOCENE BEACHES

A number of bones of marine mammals have been found in the Pleistocene lake beaches of Michigan. Most of these have come from the lower peninsula, from beaches ranging in age from Arkona to Nipissing. Obscure mention has been made of several of the finds in literature, but they are not generally known to mammalogists.

Uncertainty of the true origin of the bones has led to an understandable reticence to give them serious consideration. It is well known that whale bones are commonly carried to inland localities by curio collecting human beings. This was possibly as true of the Indians in pre-Columbian times as it is of whites today. Most inland records of whale remains can be assigned without hesitation to this agency. However, some of the Michigan finds are unique. They were not picked up on the surface or located in marine sediments, *but were found buried, some at considerable depths, in Pleistocene lake beaches.* The question raised is: Did these marine mammals reach the Michigan beaches naturally or by human transport? I shall be the first to concede that very considerable obstacles stand in the way of imagining a Pleistocene marine fauna in the Great Lakes, but I do not want to argue that point here. The purpose in writing this note is to put the facts on record, with the hope that they may hasten a conclusive answer to the question that is here raised.

Winchell (First Biennial Rept. Geol. Surv. Michigan, 1861: 133) is apparently the first to have made mention of Michigan whales, but his reference is vague and may have related to a surface find: “. . . a large vertebra was discovered in the western part of the tate which was recognized at the time as the caudal vertebra of a whale, by Prof. Sager,

then State Zoologist." According to E. C. Case, former Director, Museum of Paleontology, University of Michigan, this specimen was subsequently lost, and has been never relocated.

Hinsdale (Univ. Mus., Univ. Michigan, Mich. Handbook Series, 1: Pl. 37, Fig. 2, 1925) figured a walrus (*Odobenus*) baculum with cultural objects from Standish, Michigan. Correct data for this specimen indicates that it was discovered in Otsego County by Ezra Smith, who wrote: "I found the bone when hauling gravel out of a pit 7 miles NW of Gaylord, Michigan in 1914. Other pieces of bone were mixed with the gravel but they did not attract particular attention." This specimen, bearing no. 490, is preserved in the Museum of Anthropology and Archeology of the University of Michigan.

In 1930, Hussey (Sci. [N.S.], 72 [1871]: xiv) reported briefly on three sets of whale bones which had come into the possession of the University of Michigan Museum of Paleontology. I have recently examined these specimens. They are well preserved and show no evidence of human mutilation:

No. 14101, a single rib of a fin whale, *Balaenoptera*, was found during excavation of a cellar on the property of William Hummell on Genessee Road, 10 miles NE of Mt. Morris (near Thedford Center, just south of the county line), Genessee County. It was standing vertically in loose sand of a beach of Arkona age.

No. 14102 consists of a lumbar vertebra and two ribs of a sperm whale, *Physeter*, taken from a swamp in the NE corner of Lewaunee County in 1928. Beach deposits of this area are of Whittlesey age, but since this specimen was not accompanied by detailed notes, its age may be questioned.

No. 11008, a single rib, is probably of a bowhead whale, *Balaena*. It was discovered in 1928 during excavation at the SW corner of the schoolhouse at Oscoda, Iosco County. The rib was five feet below the surface in sands of the Nipissing beach. Identity of this bone is not certain, for it was not compared directly with *Balaena*. However, it closely resembles *Eubalaena*, with which it was compared, and agrees with descriptions and figures of *Balaena* in literature.

Another find, not previously reported, is the anterior portion of a walrus skull, which is preserved in the Old Fort Mackinac Museum. R. C. Hussey of the Department of Geology, University of Michigan, was told that the skull had been found many years ago in a beach deposit (Algonquin or Nipissing) on Mackinac Island. The original data was lost in a fire. The tusks are missing, but have probably been removed since the discovery of the skull, for their alveoli are well preserved. Of interest in this specimen is a series of short parallel grooves on the antero-lateral face of the rostrum. They may be the result of human carving, but there is no way to determine whether they came onto the bone before or subsequent to its recent discovery.

Other references which have a bearing on this problem are a paper by Cameron (Ann. Rept. Nat. Mus. Canada, 1949-1950, Bul. 123: 116-119, 1951) recording a *Balaena* from a Pleistocene deposit on the south shore of the Gulf of St. Lawrence, and a paper by Sternberg (*ibid.*: 259-261, 1951) recording *Delphinapterus*, *Phocoena*, and *Phoca groenlandica* from the Pleistocene of the Ottawa Valley of Ontario. Closer scrutiny of Michigan's Pleistocene beaches for vertebrate fossils may prove fruitful.—CHARLES O. HANDLEY, JR., U. S. National Museum, Washington, D. C. Received May 15, 1952.

NOTES ON PINNIPEDIA

The following notes are based on numerous journeys in northern Labrador since 1926. During many of them seals were important as food. I learned to identify them from the Eskimos, whose methods seem as reliable, if not as orthodox as those of the scientist. Except where noted, the conclusions about seal behavior are not in conflict with the opinions of Eskimos, and they are keen observers, at least in matters of natural history that are as vital to them as the habits of seals.

Taxonomy.—Doutt (Annals Carnegie Mus., Art. 4: 80, 1942) has suggested there are grounds for questioning the separation of the genera *Erignathus* and *Phoca*. This implies that the classification of the pinnipeds is not beyond question, and prompts the following observations.

When the ringed seal, *Phoca hispida*, comes to the surface to breathe, the body is sufficiently horizontal so that the head and back rise above the surface, making two separate lumps on the water. In this respect it resembles the bearded seal, *Erignathus barbatus*, and the walrus, *Odobenus rosmarus*. The harp seal, *Phoca groenlandica*, rises in a quite different manner, with the body much more nearly vertical. It often suggests a partly full, floating bottle, and is readily identified because of this, even at a considerable distance.

Such different behavior suggests a physiological distinction, but even if it has some other cause, there is at least one observable physiological difference. The outer layer of the ringed seal's intestines can be separated from the lining quite easily. This is also true of the bearded seal. The outer layer is regularly removed from the intestines of this species, and eaten raw as a delicacy by the Eskimos. An effort to peel it from the intestines of a partly grown, possibly two-year old, harp seal was unsuccessful.

These observations suggest that there may be a closer relationship between the ringed seal and the bearded seal than between the former and the harp seal.

Behavior.—Dunbar (Fisheries Res. Bd. Canada, Bul. 85: 10, 1949) comments that information on food habits of the harbor seal, *Phoca vitulina*, in the north is scarce. As far north as Okhakh Bay (Lat. 57° 30' N.) there is at least indirect evidence that they follow the sea trout, *Salvelinus alpinus*, up the rivers in the summer. About five miles up from the mouth of Umiakovik Brook, at the head of Okhakh Bay, August 7, 1932, when sea trout were running up the brook, I saw four seals at one time. During the day I could catch sea trout in a gill net, but there would be nothing but holes in it in the morning, indicating that the seals were robbing the net at night. August 12, I killed a harbor seal less than two miles below the outlet of Umiakovik Lake, roughly 15 miles above the mouth of the brook. It seems safe to conclude that the other seals seen in the brook were the same species. I did not examine the stomach contents to corroborate my conclusions about their diet. In the late summer of other years I have seen seals, presumably this species, in Tessersoakh Lake (Lat. 56° 38' N., Long. 62° 50' W.), Khingughutik Brook (Lat. 56° 51' N., Long. 62° 34' W.), and the lake at the head of Webb Brook, (Lat. 56° 58' N., Long. 62° 01' W.), though this last brook is scarcely large enough for canoe navigation.

Occasionally during the summer in this region a seal may be seen basking on a boulder projecting above the surface of the water in the tide wash. The only specimen I have ever killed under these circumstances was a harbor seal.

Dunbar (*loc. cit.*) raises a question as to whether the ringed seal frequents bay heads because of the ice there, or because of feeding conditions. At the end of September, 1950, ringed seals were frequently to be seen around the head of Tessiuyakh Bay (Lat. 57° 16' N.). On one occasion several surfaced repeatedly in a very small area, and numerous hovering gulls indicated they were feeding there. Since no ice had formed as yet around the head of the bay, where only a small brook enters, feeding conditions appear to have been the controlling factor in this case. Later, when the first ice developed there, two seals were seen basking on the small area while two others stuck their heads up through holes in it. It seemed rather crowded for seals as solitary as the ringed seal appears to be, but it would be difficult to say whether the formation of ice had caused an increase in the density of population at the head of the bay.

Two ringed seals and a partly grown harp seal were killed in the upper part of the bay during October and November. All had empty stomachs though there were numerous occasions when screaming gulls hovering and diving over seals indicated that the latter were getting food in the bay. Vibe (Meddelelser om Grønland, 150: 71, 1950) reports that all ringed seals killed by him while they were sleeping on the ice in the spring had empty stomachs. This raises an interesting question as to what ringed seals do after eating.

Immediately after Tessiuyakh Bay froze over at the beginning of December, snow and mild weather caused the ice to founder so badly that even foxes had occasional trouble negotiating the slush. Soon after the ice became secure enough for travel, I found a dead, ringed seal frozen into it. There was a trench indicating it had traveled some distance over the slush. Possibly it had lost the hole by which it had come up onto the ice. It seems very unlikely that the hole could have frozen over while the slush was still so soft that the seal

made a trench in it. At the end of the trench there was a large circular area of churned up, blood-stained, frozen slush in which the carcass lay, with most of the skin and meat gnawed from the undamaged skull, and several holes in the skin where ravens had been pecking. There was very little hair on the hide except in the depressions around the front flippers. A fox track approached along the trench, and there were many frozen tracks in the churned up area. Possibly the fox had killed the seal. Eskimos with whom I discussed the question thought it was unlikely that a fox could kill a healthy ringed seal, claiming that this seal is a match for a sled dog. If the seal had been wounded and crawled up on the ice to die, it is likely that there would have been some sign of blood along the trench. The hairless condition of the skin may have indicated disease, which had weakened the animal, or possibly it had resulted from chafing during progress along the trench.

In the region from Nain (Lat. 56° 33' N.) to Hebron (Lat. 58° 12' N.) ringed seals start basking on the land-fast ice among the outer islands as early as the beginning of May. Yet in the spring of 1951 none were seen in Tessiuyakh Bay until June 3, when the ice was getting rotten in the bay. On June 12, 15 were counted in a 4.5 square mile area of the upper bay, and they continued there as long as there was any dry ice to crawl out on. Apparently they moved into the bay, when the ice began to rot, until an abnormally high population density had developed. There was no lack of ice outside the bay to account for their moving in. None were noted during several days spent around the bay after open water at the beginning of July, suggesting that the population density had dropped sharply, but no special watch for seals was being kept at that time.

Eskimo Names.—Dunbar (*loc. cit.*) points out that the Canadian Eskimo name for the harp seal is *kyolik* while the Greenland name is *atak*, with the comment that he knows of no explanation for the marked difference. In Labrador *qairolik*, in addition to being the name of the birch, *Betula papyrifera*, is the general name for the harp seal. A big, old harp is called *aktog*, which is not far from the Greenland name given by Dunbar. I have never heard the word applied to any other animal than the harp seal, though Bourquin (GRAMMATIK DER ESKIMO-SPRACHE: 368, 1891) indicates that it also applies to large individuals of some other species.

The other Eskimo names given by Dunbar are close enough to the forms used in Labrador so that they are readily recognizable.—E. P. WHEELER, 2ND., 320 University Avenue, Ithaca, N. Y. Received June 2, 1952.

OTTERS DIVING TO A DEPTH OF SIXTY FEET

Mrs. Gorman Fox of Sitka, Alaska, wrote us a letter on January 31, 1952, describing the capture by her husband of an otter, *Lutra canadensis*, in a crab pot set in Fish Bay in early April, 1949. At a later, unspecified, date Mr. Fox took two otters in Deep Bay at the same time and in the same pot. "He figures the depth of the pots at about 10 fathoms,—just beyond the drop off. He figures the depth by buoy lines. The tunnel-eyes on the pots are 3½ x 8 inches so the otters must have really wanted to get in. We bait with clams, and there were no crabs in the pots. . . . The otters do a lot of feeding around our cannery and they go down and bring up bullheads [fish, Cottidae]. The water is 7 fathoms."

This recalls a statement by Leslie C. Cox (*Field*, 1947, v. 190, p. 638) "... an off-shore fisherman, Eli Collins by name, on three different occasions caught otters in his lobster pots [on the English coast]. On each occasion when he hauled his pots he found the otter drowned, having apparently got in after the bait."—VICTOR B. SCHEFFER, U. S. Fish and Wildlife Service, Seattle, Washington. Received May 13, 1952.

THE EGG-OPENING TECHNIQUE OF A SPOTTED SKUNK

Spotted skunks (*Spilogale*) frequently have been accused of eating chicken eggs. However, the smaller subspecies of *Spilogale*, which occur in the southern portions of the range, apparently cannot open their mouths sufficiently wide to obtain a firm enough grasp to open a medium or large hen's egg. The following observation may indicate the manner in which these small animals open large eggs.

A captive adult female spotted skunk (*Spilogale putorius ambarvalis*) from Hendry

County, Florida, was given a large hen's egg, for the first time to the best of the writer's knowledge. The egg was straddled, held against the lower abdomen, and kept from rolling to either side by pressure from the forelegs. Attempts were made for nearly five minutes to open the egg by biting, and then a new technique was abruptly attempted. The egg was pushed backwards by the forelegs, and given a quick kick to the rear by one hind leg as the egg passed beneath the hind end of the animal. At the time of this observation, the skunk was housed in a bathtub, and there was a maximum distance of three feet of clear space to the farthest side of the tub. The propelled egg traveled this distance surprisingly rapidly. The skunk did not seem to "aim" the egg, but propelled it in whatever direction happened to be behind her when she had gotten into the proper position to kick the egg. On the fifth kick the egg struck the wall with sufficient force to crack it, and the skunk proceeded to open a small hole and lap out the contents. Later she devoured some of the shell as well. The skunk has been given eggs several times since, and she has repeated the procedure—first attempting to bite the egg open, and then kicking it backwards until it breaks.

A somewhat similar method was employed by young *Mephitis* according to Doris C. King (Readers' Digest, 1944, 44 (266): 85). The action was described as being similar to a football center passing the ball between his legs, which is the first impression one gets in the case of *Spilogale* until the action is carefully observed.—RICHARD G. VAN GELDER, *Museum of Natural History, University of Illinois, Urbana, Illinois. Received November 19, 1952.*

UNUSUAL CONCENTRATION OF HOARY BATS

On May 25, 1951, while collecting bats at a pond in the San Gabriel Mountains of Southern California, I observed a rather unusual concentration of hoary bats (*Lasiurus cinereus cinereus*). The pond was in San Antonio Canyon at about 2800 feet elevation, and was bordered by alders and surrounded by steep, dry, chaparral-clothed slopes.

Throughout early May I had been collecting bats at certain ponds in San Antonio Canyon by using Borell's method of stretching wires just above the surface of the water where bats come to drink (Jour. Mamm., 18: 478-480, 1937). Hoary bats were taken quite regularly, but generally only two or three were caught during an evening's collecting, which usually extended from sundown to about 11:00 P.M. On May 25, the first hoary bat dipped down to drink at 8:21 P.M. and was captured. From this time until about 10:30 P.M., when I stopped collecting, these bats came in large numbers. During this time, twenty-two hoary bats were collected and probably an equal number were observed. All but two of the captured bats were released, whereupon most of them lit in the nearby alders to rest and dry their wet fur. Several times during the evening two or more hoary bats were coursing over the pond at the same time. This same evening the other common species of bats—*Pipistrellus hesperus merriami*, *Myotis californicus californicus*, *Myotis evotis evotis*, and *Eptesicus fuscus bernardinus*—were taken in usual numbers.

May 25 was the first really hot day of spring. The hot weather may have started the northward migration of the hoary bats, with attending concentrations of this species at certain elevational belts. Though the weather remained warm, collecting for several nights following May 25 produced only four hoary bats, and none were noted or collected on May 26. All the hoary bats examined during the collecting in May were males, indicating a segregation of sexes at this time of the year.—TERRY A. VAUGHAN, *Department of Zoology, Claremont Graduate School, Claremont, California. Received March 28, 1952.*

OCCURRENCE OF PORCUPINE QUILLS IN CARNIVOROUS MAMMALS

A collection of about 500 mammals was made during the trapping seasons of 1947, 1948, and 1949, in the vicinity of Fort Nelson, British Columbia. This region is typical of the extensive wilderness which borders the isothermic line marking the zone of permafrost. It is a densely timbered region at the northern edge of the Great Boreal Forest (Hare, Geographical Review, October: 615, 1950) with interspersed areas of taiga and tundra. The region of about 20,000 square miles from which the collections were made produces a variety of fur animal species that is probably not exceeded anywhere on the North American

Continent. This variety and abundance of fur supports a lucrative fur trade. Since the war, the Fort Nelson trade has attained a volume valued at one-quarter million dollars a year. Data presented here are taken from records obtained during a fur resource survey sponsored by the Arctic Institute of North America.

Detailed examination of 414 of the specimens was possible, and the remains of porcupines were found in some of them (Table 1). During the survey of about 2500 miles of trap line, from which these specimens were collected, no use of porcupine for bait was known. Therefore, it seems likely that the occurrence of porcupine remains in these predatory mammals was the result of direct attack upon the prey. There are possibilities, however, of accidents in which porcupine quills might otherwise have entered the bodies of these predators.

During the fall of 1947, populations of *Clethrionomys* and *Peromyscus* were low. In the following autumn, 1948, these species made marked advances into habitats which had not been occupied by them during the previous fall. Mice were much more numerous as indicated by trapping, and the natives of the region called it a "mouse year." A greater avail-

TABLE 1.—Frequency of porcupine remains in a collection of mammals

	1947-48		1948-49	
	No. collected*	No. containing porcupine remains	No. collected*	No. containing porcupine remains
Marten	127	1 (0.7%)	123	1 (0.8%)
Mink	10	0	18	1 (5.5%)
Lynx	13	2 (15.3%)	5	0
Fisher	11	2 (18.1%)	6	3 (50.0%)
Wolverine	7	0	8	0
Ermine	31	0	36	1 (2.7%)
Fox (colored)	10	3 (30.0%)	2	1 (50.0%)
Otter	1	0	0	0
Wolf	4	0	0	0
Bear, black	1	0	0	0
Bear, grizzly	1	0	0	0
Total	216	8 (3.7%)	198	7 (3.4%)

* FROM THE FUR RESOURCE OF A WILDERNESS REGION (Quick, unpublished report) Arctic Institute of North America, Office of Naval Research, Wildlife Management Institute, and National Wildlife Federation.

ability of mice in 1948 did not appear to alter, significantly, the total incidence of porcupine remains in the specimens.

The marten collections reported in Table 1 represent about 16 per cent of the known total kill in the region for the two trapping seasons indicated. The low incidence of porcupine remains in this species is probably indicative of the frequency with which it attacks porcupines. Fisher specimens represent nearly 50 per cent of the total known kill, and though this collection is numerically small, the high frequency of porcupine remains portrays the relationship between the two species. Fox and lynx collections represent about 20 per cent of the known catch. The occurrence of porcupine remains in these specimens is relatively as great as in the fisher specimens.

Retention of quills in the bodies of the predators would influence an interpretation of the data in the table. Because so few of the specimens contained porcupine remains (15 out of 414) notes on the individual cases can be presented here.

Martes americana actiosa (Osgood). Marten.—MALE: This specimen, a medium sized male, had two porcupine hairs in the stomach. A feather, probably ruffed grouse, was found, which might have been part of a trap bait. FEMALE: Stomach empty except for the half-

inch barbed end of a porcupine quill impaled in the lining; a piece of porcupine quill $\frac{3}{4}$ inch long had pierced the junction of the liver lobes. The rectum of this specimen contained a small amount of spruce-squirrel hair.

Martes pennanti columbiana Goldman. Fisher.—MALE: A porcupine quill was found stuck into the lining of the stomach, from the inside; stomach also contained a few small feathers, three claws (presumably of the fisher itself), and some wood chips and plant debris swallowed while fighting the trap. FEMALE: A half-inch length of porcupine quill was found embedded in the flesh over the eye of this specimen. A porcupine hair was found in the intestine; alimentary tract otherwise empty. FEMALE: Three porcupine hairs found in intestine; a $\frac{3}{8}$ -inch length of quill lay in the duodenum. The barbs appeared, under microscope, to be softened and frayed. FEMALE: Part of quill in liver; no apparent trauma; stomach empty; rectum contained foot, tail, and mass of hair of *Clethrionomys*. FEMALE: Fragments of five porcupine quills in mesenteric fat adjacent to duodenum; one quill extruded from duodenum with shaft frayed; one quill fragment pierced stomach wall. One of the quills was entire, but only 20 mm. long; others all broken and frayed on proximal ends. Lengths varied from 4 to 15 mm. A small amount of porcupine hair was found in rectum.

Mustela vison energumenos (Bangs). Mink.—FEMALE: Intestine contained a dozen porcupine hairs and a few feathers of a small bird.

Mustela erminea richardsoni Bonaparte. Ermine.—MALE: Stomach contained one porcupine hair; also two feet, tail and mass of hair of *Sorex*.

Vulpes fulva abietorum Merriam. Fox.—MALE: Stomach contained one porcupine quill, mouse tail, rabbit toe, and egg shell (bait). FEMALE: Stomach with one quill impaled in lining; two quills free-floating in abdominal cavity. These two specimens from same trap line were both caught in late winter; (obtained February 25) both in fair to poor condition (no fat).

MALE: A cross fox, snared. Found with about a dozen quills embedded in nose and lips; stomach empty. FEMALE: A $\frac{3}{4}$ -inch length of quill embedded in stomach lining. A $\frac{1}{4}$ -inch length of quill lying in mesentery next to duodenum; it appeared frayed and blunted when examined under microscope.

Lynx canadensis canadensis Kerr. Lynx.—FEMALE: Stomach empty except for two porcupine hairs; probably trapped in early winter; fat. FEMALE: Stomach contained six quills and hair of porcupine. Trapped February 3, 1948. Found alive in trap and examined on trap line by collector immediately after it was killed.

Discussion.—Since these investigations were made, I have examined two specimens of mink in Maine, each of which had a porcupine quill lodged dorsal to the palatine bone. These were found by William R. Nicholson (Maine Cooperative Wildlife Research Unit, unpublished graduate problem) and F. C. Dean in an examination of mink taken during November, 1950 and 1951. In January, 1951, I found signs in the snow where a fox had fought and killed a porcupine. The porcupine had been roughly skinned up to the base of the skull which was left attached to the larger portion of the hide.

Mouse populations in Maine during the fall of 1950, were very low in comparison with the Fort Nelson region sampled by similar methods. It might be inferred that a scarcity of these species of prey would lead to more frequent attack upon larger prey species. Porcupine populations at present in Maine are much higher than they were in the Fort Nelson region in 1947 through 1949. Thus, the incidence of porcupine remains in the 414 specimens from British Columbia would be expected to be infrequent while similar occurrences might now be more frequent in Maine.

Evidence indicating that fox and lynx attack porcupines does not seem at all unusual, but the occurrence of porcupine remains in mink, weasel, and marten, does seem unusual to the writer. It also seems odd that some evidence of attacks on porcupines was not found in wolf and wolverine specimens. Wolf populations were considered to be low in the Fort Nelson region during the period of study, and thus only a small number of specimens was available. Wolverine populations were believed to be at a level which according to past

records has not fluctuated. I believe that a larger sample of these species would have shown some evidence of predation on porcupine. It is noteworthy, however, that an examination of over 3000 wolf stomachs showed no evidence of porcupine remains (Young and Goldman, *THE WOLVES OF NORTH AMERICA*, 1944). Murie (*THE WOLVES OF MT. MCKINLEY*, 1944) found remains of porcupines in wolf scats and in a specimen which had been shot. Seton (*LIVES OF GAME ANIMALS*, 1937) records a report by Walter Fry from California that wolverine in "making a losing fight" will resort to killing porcupines for food. He further states that the sharp quills will cause painful death in seven to ten days.

The porcupine quills found in the specimens reported here were examined under a compound microscope. All except one short quill were found to be frayed at the base. It appeared that either digestive or abrasive action, or both, had begun a reduction of the quills. Several quills found "free-floating" in the abdomen appeared to have lost effective penetrability. Microscopic examination revealed that the barb scales were either worn away or very soft. Body fluids might have a tendency to soften the quills. The fact that quills were found piercing stomach linings and other organs indicates that some time is required to reduce the quill to relative harmlessness. Variations in the lengths of the quills found show that such a process is possible. Some quills, it was noted, were reduced to lengths of about four millimeters. Those found in the organs of the abdominal cavity probably were ingested with hide and flesh.

The trails of fisher and fox indicate that they attack porcupines with the same method used by experienced domestic dogs. This has been reported by Murie also. These encounters usually result in a face full of quills for the attacker. In this way there is the possibility of quills entering the thoracic cavity and piercing the heart. No quills were found in the thoracic cavities of the 414 specimens examined. Quills in the nose and lips make foraging difficult and might lead to starvation. Cattlemen sometimes must remove porcupine quills from the faces of cattle so that they can feed. Repeated pursuit of porcupines by cattle and dogs suggests that the piercing by porcupine quills is probably not painful. I was recently struck by the tail of a large porcupine, and approximately 50 quills were embedded in my forearm. There was scarcely any sensation other than a tingling of the flesh. However, the extraction of the quills was somewhat more painful and caused minor bleeding.

In summary, it appears from the foregoing observations and the literature that all species of predatory animals which range with porcupines may sooner or later attack them. Probably some individual predators attack porcupines repeatedly, experiencing little or no pain. Larger predators, particularly fishers which are capable climbers, are probably habitual porcupine killers. The smaller carnivores are likely to attack them only when there is a scarcity of other prey. Apparently there is no propensity for one sex or the other to attack porcupines. It will be noted above that both sexes of marten, fisher, and fox specimens contained quills. While the Fort Nelson mink mentioned was a female, one of the Maine mink was a male. Considering the small size of the ermine it was sufficiently astonishing that this species would attack porcupines at all. The ingestion of carrion is a possibility.

These observations indicate that porcupine quills are in some manner dissolved and absorbed in the body cavities of animals which swallow them, or are passed in scats. Quills impaled in flesh seem to drift about or come to rest against bone. In fisher, quills have been known to work out of the body and to fall from the pelt while it is being graded. The evidence shows that ingested or injected quills are not necessarily lethal to mammals which prey upon porcupines.—HORACE F. QUICK, *University of Maine, Orono, Maine. Received April 12, 1952.*

SOME PORCUPINE RECORDS FOR THE COLORADO RIVER, NEVADA

The absence of records of porcupines from along the Colorado River in Clark County, Nevada prompts the author to report the following porcupine occurrences. The nearest records in Nevada are those reported by Hall (*MAMMALS OF NEVADA*, 1946: 585) for the Charleston Mountains over 50 airline miles away, and by Burt (*Trans. San Diego Soc. Nat. Hist.*, 7: 422-423, 1934) for the Charleston and the Sheep mountains.

Steve A. Fenton, Nevada Game Warden, and Howard L. Cantrell, Federal Game Management Agent, killed a porcupine on January 31, 1950, at the lower end of Cottonwood Island, an alluvial flood plain of the river, which was being inundated by the formation of Lake Mohave behind Davis Dam. Unfortunately, this specimen was not saved.

On June 1, 1950, Mr. Fenton presented the National Park Service at Boulder City with a live porcupine. On June 3, the porcupine gave birth to one young while being held in a burlap sack. After being confined for two weeks, the mother and young were released in a wash on the shore of Lake Mead above Hoover Dam. Mr. Fenton had captured this animal along the shore of Lake Mohave in the vicinity of Cottonwood Island.

Mr. Al Jones of the Nevada Fish and Game Commission reported that he saw a dead porcupine that lay along the road, about one mile above Emery's Landing at the mouth of El Dorado Canyon, for a week or so in the spring of 1951. It had apparently been killed by a car while crossing the road.

The writer in the company of Gordon W. Gullion and Glen Christensen, both of the Nevada Fish and Game Commission, observed a porcupine on January 25, 1952, in a cottonwood about two and a half miles north-east of the California-Nevada boundary at the tip of the state. On January 31, 1952, the writer was again in the area and collected a porcupine about one-half a mile north of the original observation location. It may have been the one seen previously as no other porcupines were seen on this latter date. The animal was up about 50 feet in one of the main limbs of the tree. Upon examination it proved to be a female which contained one embryo, 135 mm. in length. This specimen has been given to the Museum of Vertebrate Zoology at Berkeley, California and is now number 115605 of the university collection. Dr. Seth B. Benson identified the porcupine specimen as the common race *Erethizon epixanthum couesi*.

Both the El Dorado and the Newberry Mountains of Nevada which parallel the Colorado River to the west contain juniper-pinyon pine association. Although there are no known reports of porcupine from these ranges, it is very likely that porcupines are a regular inhabitant of these mountains and wander to the river quite frequently. An old-time Indian resident, who has lived over 35 years on the Fort Mohave Indian Reservation (near specimen record location), indicates that the porcupine is a regular visitor to the cottonwood groves of that area.

The kind assistance of the above mentioned persons in making their observations available to me is sincerely appreciated.—WARREN M. PULICH, 539 Avenue L, Boulder City Nevada. Received May 13, 1952.

LARGE WISCONSIN BEAVER

Having heard of the capture of two exceptionally large beaver (*Castor canadensis*) in southwestern Wisconsin, I went to Prairie du Chien on March 12, 1952, to check the weights. The two beaver were purchased by Z. D. Brown, of the Alaska-Canadian Fur Trading Post, from whom most of the data were obtained. The total lengths of the beaver were not taken, but fortunately the tails and feet were preserved.

No. 1. This beaver, a female, was trapped by Tom Brown, of De Soto, the last week in February. It weighed 78.5 pounds three days after capture. Z. D. Brown estimated that the original weight was 80 pounds since in his experience a large beaver will lose about one-half pound in 24 hours. My measurements of the scaly portion of the tail were: length, $12\frac{3}{4}$ in.; breadth, $7\frac{5}{8}$ in.

No. 2. This specimen, a male, was taken from the trap by Lee Faust on the morning of March 9 at the junction of Knapp's Creek and the Wisconsin River. At 2.00 P.M. of this day, it weighed 80.5 pounds, and at 7.00 P.M., 80 pounds. The scaly portion of the tail measured $13\frac{1}{2}$ in. in length and $7\frac{7}{8}$ in. in breadth.

The weights of the above beaver were confirmed (*in litt.*) by Stanley A. Apel, Conservation Warden, Prairie du Chien. He stated that he checked the weight of the male the evening of capture on two different scales and obtained the figure of 80.5 pounds. This is one-half pound higher than the weight obtained by Mr. Brown for the same time of day.

No. 3. The Madison *Wisconsin State Journal* of March 23 carried a photograph of a beaver caught at Livingston, Grant County, by Wesley Hannan. It weighed 87 pounds when free of dirt and water. Oliver J. Valley, Conservation Warden, Platteville, informed me that he did not check the weight, but he understood that it was weighed in the presence of witnesses.

It is difficult to account for the number of large beaver in southwestern Wisconsin. Except for the past four years, there has been no legal trapping of beaver in the area for many years. This may have permitted an unusual number of beaver to live to attain exceptional weight.—A. W. SCHORGER, *Department of Wildlife Management, University of Wisconsin, Madison, Wisconsin. Received May 12, 1952.*

EFFECTS OF A SUMMER FLASH FLOOD UPON A BEAVER POPULATION

An unprecedented flash flood on the Cache la Poudre River, Larimer County, Colorado, in August, 1951, later provided an unusual opportunity to study the effects of extreme high water on the resident beaver population. Field work leading to this evaluation was carried on during the fall and winter of 1951-52, and it involved observations of the occurrence and distribution of beavers along the river after its emergence from the sandstone hogbacks which flank the foothills of the Continental Divide.

The portion of the river studied extends from the town of Bellvue to a point about 2.5 miles west of Windsor, Colorado, a distance of 19 miles. Here, the Cache la Poudre flows southeasterly through the uppermost agricultural land along its course. Elevations vary from approximately 5,100 feet from point of emergence to about 4,750 feet at Windsor. On the nearly level plain, the river tends to meander to some extent. The bottom lands are wooded over most of the distance encompassed by the survey, the principal tree species being cottonwood (*Populus sargentii*) and willow (*Salix* spp.).

Driftwood and other debris piled several feet above the normal high-water line on the up-stream side of trees attested to the volume and velocity of the flood waters. Mr. W. G. Wilkinson, State Water Board administrator for the Cache la Poudre watershed, furnished information on the flow, as follows: average peak flow of spring high water, over a period of 40 years, 3,500 cubic feet per second, with 5,800 cu. ft./sec. the maximum flow. At the height of the flood on August 4, a flow of approximately 10,000 cu. ft./sec. was estimated at the town of Bellvue. This flow was so great that an accurate recording with existing gauging equipment could not be made. Duration of flood stage at Bellvue, at the mouth of the canyon, was 12 hours. As the water spread out and the velocity decreased downstream, flood-stage duration at Fort Collins, for example, was proportionately longer. The total runoff during the 12- or 15-hour flood stage was estimated at 7,500 acre-feet.

Convincing evidence of the effect of this flood on the resident beaver population was obtained. Before the flood there were recorded seven dams, two lodges, and nine fresh-cutting areas. After the flood (as of March 1, 1952) there were recorded no dams, no lodges, and only four fresh-cutting areas.

Verification of the number of established colonies prior to the flood was obtained by personal inspection, and by interviewing landowners along the course of the river and faculty members and students at Colorado A & M College, who were familiar with the area involved in the survey.

A follow-up inspection during the month of April, 1952, revealed that the beavers remaining in two of the four areas of fresh cuttings were beginning to construct dams. Five beavers were removed from one of these colonies by state trapper, Sigfrid Palm, in late March, 1952, upon complaint from the landowner. Colorado law provides that only trappers employed by the state may take beavers; therefore, these removals are known to have been the only animals so affected during the past year. The trapper in question stated that two or more complaints per year from landowners along this portion of the river were not uncommon in previous years. On this basis, it seems probable that a minimum of 10 beavers was removed annually from the 19-mile stretch under consideration.

The results of this survey indicate that beavers, even though aquatic mammals, are not

immune to extreme disturbance of the aquatic medium, and that a sudden, excessive volume of water can adversely affect a well-situated beaver population.—WILLIAM H. RUTHERFORD, *Colorado Cooperative Wildlife Research Unit, Colorado A & M College, Fort Collins, Colorado. Received May 23, 1952.*

CANNIBALISM IN *PEROMYSCUS*

During the summer of 1949, while working at a camp in Green Lake County, Wisconsin, I had an opportunity to observe a case of cannibalism in *Peromyscus*.

An immature female *Peromyscus leucopus* and an adult female *Peromyscus maniculatus* had been placed together in a cage. They were fed fresh greens daily, along with small amounts of oatmeal and a small pan of water.

On the morning of the third day of their captivity, the young *P. leucopus* was found completely skinned out in one corner of the cage, with only the left hind leg and a small piece of the skull left uneaten. As no other specimens had access to the cage, it was evident that the larger mouse had devoured the smaller.—KERRY B. STERLING, *Spring Arbor Junior College, Spring Arbor, Michigan. Received December 17, 1951.*

AN UNUSUAL CONCENTRATION OF ALBINO MUSKRATS

Albinism in the muskrat, *Ondatra zibethica zibethica*, appears to be relatively uncommon. Arthur Cook, of the New York State Conservation Department, has told me that one fur-buyer, Joseph Buff of Syracuse, has received only two albino specimens in over 600,000 muskrat skins purchased over a fifty-three year period. These figures probably exaggerate the rarity of albinos, for many muskrat trappers, who catch an albino, retain it for their own use, so that it does not enter the fur trade. A more realistic estimate of the occurrence of albinism is that of Dozier (*Jour. Mamm.*, 29: 393–405) who found one albino muskrat in a total catch of 83,804 muskrats taken on the Blackwater Refuge in Maryland from 1938 to 1944. This specimen represented the subspecies *O. z. macrodon*.

Dozier (*loc. cit.*) has summarized other occurrences of albinism in the various subspecies of *Ondatra zibethica*. Three of these instances refer to the nominate subspecies, one case involving eight specimens, another five.

The marshes around Forest Lake, (locally known as Parker's Pond), at Cato, Cayuga County, New York, annually produce large numbers of muskrats. About 1925, local trappers began to take albino muskrats with surprising frequency in this area. The catch continued to include these white individuals for several years, and trappers who were active at that time estimate the total take of albinos at 20 to 25 individuals. Glenn Wright of Cato, who caught several of them, has told me that they were true pink-eyed albinos. In recent years none have been taken in that area, although two were trapped within the past year in the same river system about ten miles to the east. So far as I have been able to determine, none of the specimens taken in the period 1925–27 is still in existence, although several were mounted by taxidermists.

In addition to those previously mentioned, I am indebted to my brother, Francis Benton of Ira, E. Wilson of Bethel, V. Follett of Cato, and Glen Blakeman of Little Utica, N. Y for their assistance in securing the above information.—ALLEN H. BENTON, *Department of Biology, New York State College for Teachers, Albany, New York. Received April 10, 1952.*

ABNORMAL COLORATION IN THE PINE MOUSE (*PITYMYS PINETORUM*)

The normal pelages and pelage sequence in *Pitymys pinetorum* are perplexing problems to systematic mammalogists. In addition, obviously aberrant pelages are sometimes found. Two such have been reported by Owen and Shackelford (*Jour. Mamm.*, 23: 306, 1942), another by Hatt (*Jour. Mamm.*, 11: 323, 1930), and two are in the collections of the U. S. National Museum.

One of the National Museum specimens (USNM 293679) was collected at Blacksburg, Montgomery County, Virginia, on August 24, 1936. Its coloration is dilute throughout. The

basal portions of the hairs are Pale Neutral Gray (capitalized color terms from Ridgway, 1912, COLOR STANDARDS AND COLOR NOMENCLATURE) rather than Slate Color as is seen in normal individuals, and the hair tips on the dorsum are Light Vinaceous-Cinnamon rather than brown. The belly is nearly white. There is no black in the pelage. Nothing unusual about eye color was noted at the time of capture.

The other National Museum specimen (USNM 293682) was collected at Hurricane, Wise County, Virginia, on December 31, 1941. Its hairs are darker basally than normal and the tips of the dorsal hairs are such a dark, rich shade of brown that the mass effect is nearly black. Distinction in color between base and tip of hair is apparent only upon close inspection. The belly, feet, and tail are correspondingly dark.

Numerous other normal-colored individuals have been collected at each of these localities.—CHARLES O. HANDLEY, JR., *U. S. National Museum, Washington, D. C. Received May 6, 1952.*

RESPONSE OF *MICROTUS* TO VEGETATIVE COVER

It has long been observed that meadow voles, *Microtus pennsylvanicus*, seem to be more abundant in the heavier cover of an area. It is common experience that runways are more abundant there than in the lighter cover and that more mice are taken in traps located

TABLE 1.—*Number of bait placements and acceptances on each quadrant of a quarter-acre plot*

QUADRANT	NO. OF PLACEMENTS EACH DATE	NO. ACCEPTED OCT. 14	NO. ACCEPTED NOV. 8
1	25	3	3
2	25	12	7
3	25	16	13
4	25	15	15
Totals	100	46	38

in the heavier cover. In the course of experiments on the foraging habits of *Microtus* (Eadie, Cornell Univ. Exp. Sta. Bul. 856, 1950), an opportunity occurred to measure quantitatively this response to cover, in a limited experiment.

A quarter-acre quadrat was marked out in a four-acre, uncut timothy hay plot, and five lines of bait placements were established across it with 20 feet between lines. Two oat grains were placed at each bait spot, which were five feet apart in the lines. Runways were avoided in making these placements, which were left overnight and checked for acceptance the following morning. The *Microtus* population was of moderate density on the area during the study, and no other small mammals were taken on the area in subsequent trapping.

The acceptance of the bait placements was plotted, and it was observed that one segment of the quadrat seemed to be avoided by the mice, since a low acceptance rate was recorded for it in contrast to the general pattern of acceptance in the remainder of the quadrat. The experiment was repeated three weeks later on the same quadrat with essentially similar results (Table 1).

The low rate of acceptance on one segment of the plot was significant each time when compared to the rate of acceptance for the quadrat as a whole (corrected $\chi^2 = 10.2$ and 6.1). Inspection of the quadrat indicated a somewhat lighter vegetative cover on the area of low acceptance and, although this seemed ample for fair *Microtus* habitat, a quantitative measurement was made of the difference in the amount of cover on the areas of high and low acceptance.

A circular, wire hoop, 12 inches in diameter, was dropped at random on three different spots in each of the areas. The vegetation within the hoop at each spot was removed down to the bare ground. These separate samples were air-dried in the laboratory and weighed, with the results shown in Table 2.

The difference in the amount of vegetative cover as indicated by these samples was highly significant. The area of high acceptance had almost twice as much vegetative cover as the area of low acceptance.

TABLE 2.—Weights of air-dried vegetative samples from areas of low and high bait acceptance

SAMPLE NO.	FROM LOW ACCEPTANCE AREA	FROM HIGH ACCEPTANCE AREA
1	28.5 grams	72.5 grams
2	38.3 grams	56.5 grams
3	40.5 grams	64.4 grams
Mean	35.8 grams	64.5 grams
	-d = 28.7 grams	s = 7.2 grams

This limited experiment seems to hint at a rather direct response of *Microtus* to measurable differences in the amount of vegetative cover within its local habitat. This response has a practical application in *Microtus* control in orchards, since it supports the value of the practice of making repeated mowings and removing surface vegetation from the sod orchard floor to make the area less habitable for mice. It also supports to some extent the practice of creating vegetation-free areas surrounding tree bases.—W. ROBERT EADIE, Department of Conservation, Cornell University, Ithaca, N. Y. Received May 5, 1952.

A NEW SOUTH DAKOTA LOCALITY FOR THE KANGAROO RAT, *DIPODOMYS*

The present eastern limit of distribution of the kangaroo rat, *Dipodomys*, in South Dakota, Nebraska, and Kansas, appears to be fifty to one hundred miles west of the Missouri River (Setzer, Univ. Kans. Publ. Mus. Nat. Hist., 1: 535, 1949). That its range extended farther east in sub-recent times is indicated by the discovery of a pair of auditory bullae, not differing in size or detail from those of *Dipodomys ordi luteolus* Goldman, in an Indian village site on the west bank of the Missouri River, 6.3 river miles northwest of Pierre, South Dakota. The age of this site, the Dodd Site, is not definitely known, but according to F. H. H. Roberts, Jr., Bureau of American Ethnology, it was probably occupied in very late pre-contact times. The specimen (USNM 293799) was collected during the Missouri River Basin Surveys of the Bureau of American Ethnology by Donald J. Lehmer. The site was in the line of the approach channel to the Oahe Dam, and has been destroyed by construction work.—CHARLES O. HANDLEY, JR., U. S. National Museum, Washington, D. C. Received May 6, 1952.

A CHANGE IN THE DEFINITION OF THE GENERIC CHARACTERS OF THE GENUS *DIPODOMYS* GRAY

Coues (Proc. Acad. Nat. Sci. Phila., part 2: 272-327, 1875) under the heading of, "Generic Characters of *Dipodomys*," made the following statement on page 306: "Molars ($\frac{1}{4}$ - $\frac{1}{4}$) simple, rootless." On page 316 under the heading of, "Dental Characters of *Dipodomys*," he makes the following ambiguous statement: "The dentition of *Dipodomys* is simple. Of the four molar teeth above and below, the anterior one is a premolar, being preceded by a deciduous tooth, which, however, is long persistent. This one is rooted and with a more complicated crown than the rest; the molars proper are rootless and perennial."

It is not known whether his reference to "This one" refers to the deciduous fourth premolar or to the permanent fourth premolar. His following reference to "molars proper" may indicate that he may have considered the expression "This one" to refer to the permanent fourth premolar.

Regardless of how Coues intended his statement, he has been quoted by later workers as having said that cheek teeth are evergrowing or of persistent growth, and this character has been considered as one of the diagnostic characters of the genus *Dipodomys*.

In the few adult and old adult Recent specimens of *Dipodomys ordi* that I have dissected, I have found roots present on both P_4 and P^4 in all specimens. On P_4 the anterior and posterior roots are fused and are T-shaped in old adults and V-shaped in young adults. The roots on P^4 are fused and form a knob-like base.

In an adult specimen of *Dipodomys merriami*, the bases of the premolars were closed and each possessed a well-developed single root. No old adult specimen of *Dipodomys deserti* was available, but an adult specimen had the base of P_4 closed and there was the beginning of root development. The base of P^4 was nearly closed. Many other specimens, and other species, should be examined and close attention given to the bases of the first and second molars in extremely old adult specimens.

The generic character "evergrowing cheek teeth" should be changed to "the fourth premolar rooted or generally rooted in adult specimens and rooted in old adult specimens." As far as known, the first to third molars are "evergrowing."

I am most grateful to Dr. W. H. Burt, and to Dr. Emmet T. Hooper, of the Museum of Zoology, for generously allowing the dissection of Recent skulls and jaws of *Dipodomys* in the collection under their care.—CLAUDE W. HIBBARD, *Museum of Paleontology, University of Michigan, Ann Arbor, Michigan. Received April 4, 1952.*

SUPERNUMERARY MOLARS IN THE JUMPING MOUSE (*ZAPUS PRINCEPS*)

Teeth in addition to those normal for a species may develop at any place in the tooth row. Such teeth vary in size and shape but usually have little functional importance. In mammals most deviations from the normal number of teeth result from the presence or absence of teeth which are in the process of being lost. More rarely, deviations result in additions to the basic placental formula.

The supernumerary teeth here recorded are in an adult female of the mountain jumping mouse, *Zapus princeps princeps* Allen (U. S. Biological Survey Collection, No. 264388), which was taken on July 15, 1931, at Gothic, Gunnison County, Colorado. The dentition is fully erupted and shows moderate wear. The usual four cheek teeth (PM^4 , M^1 , M^2 , and M^3) of the maxillary row and the three (M_{11} , M_2 , and M_3) of the mandibular row are present and normal. At the posterior end of each maxillary row is an extra molar. There are no supernumerary teeth in the mandibular series.

The additional teeth are only slightly smaller than the adjacent molars, and the crowns of the additional teeth are at the same occlusal level. The supernumerary teeth were functional since they are approximately as worn as are the other cheek teeth. The left tooth is slightly larger than the right. The greatest diameter of the crown of the left tooth, measured transversely to the axis of the tooth row, is 0.8 mm. and the anteroposterior diameter is 0.7 mm., as compared with a transverse diameter of 0.6 mm. and an anteroposterior diameter of 0.7 mm. for the right tooth. On each side of the upper jaw, the molar immediately preceding the supernumerary tooth measures 1.0 mm. transversely and 0.8 mm. anteroposteriorly. In occlusal view, the crown of each supernumerary tooth is shaped like three quarters of a circle and is truncate on the anterior side.

Johnson (Jour. Mamm., 33: 70, 1952), in reporting a similar case for an Asiatic rodent, speculated as to the possible significance, in rodents, of an added tooth at the posterior end of the molariform series. He suggested two explanations: first, "that the three cheek teeth of the normal tooth row in murid rodents [in *Zapus* the last three teeth] are true molars," in which case the added tooth must be a fourth molar; or, more probably, "that the anterior tooth in the series is homologous with the fourth deciduous premolar of other mammals and that the remaining two teeth correspond to the first and second molars." In the event the latter speculation is correct, an additional tooth must be a third molar; "An occasional vestige of the lost third molar might be expected to appear at the posterior end of the tooth row" (Johnson, *loc. cit.*).

Another explanation which seems more plausible to me is that the supernumerary teeth might have resulted from bifurcation of the enamel organs. If such were the case, the equality of the two parts would depend upon when and where the split occurred.—

PHILIP H. KRUTZSCH, *Museum of Natural History, University of Kansas, Lawrence, Kansas.*
Received May 19, 1952.

ABERRANT *CITELLUS BEECHEYI* SPECIMENS FROM ORANGE COUNTY, CALIFORNIA

A study of ectoparasites found on *Citellus beecheyi beecheyi* (Richardson) is being conducted in Orange County, California by the School of Tropical and Preventive Medicine. An occasional golden ground squirrel was seen while trapping for rodents five miles northwest of San Juan Capistrano. Fifty squirrels were captured from a ten-acre pasture area; 47 were typical *C. beecheyi beecheyi* and three, or six percent, were golden aberrants. The golden aberrant forms and the typical dark squirrels used the same burrow systems.

The squirrels were trapped by No. 1½ size steel traps. One specimen, while in the trap, was partially eaten by a hawk; a second (female) was shot and a study-skin made; and the third (female) has been reared for seven months, November through May. The former squirrel was captured on November 4, and the latter two on November 6, 1951.

The golden specimens mentioned above are identified from the typical population principally by color differences. The aberrant forms are characterized by the following color pattern: Top of head, dorsal neck, back, and rump are golden brown with inconspicuous light golden mottling variations. Shoulder strips are golden; abdomen and underparts are light golden.

Measurements of the aberrants and typical forms are as follows: The aberrant squirrel captured and skinned November 6, 1951, measured 379-162-53-24; the squirrel reared in the laboratory was anesthetized and measured in the laboratory during March. Measurements obtained then were 363-152-50-26. Nine dark females were trapped during March from the same area as the golden squirrels. Their measurements were 423-170-54-26, 410-157-52-24, and 384-136-50-18, maximum, mean and minimum respectively.

Behavior is indeed subjective to measure, but the single golden squirrel under observation in the laboratory appears to be of a more retiring nature than darker squirrels. The latter whistle and chatter furiously if disturbed in their cages, but the golden animal remains quiet and "freezes" in a retiring position.

The study skin and skull were deposited with the U. S. National Museum. An attempt is being made to mate the remaining golden female to a typical dark male in the laboratory.

The authors are indebted to Dr. Kenneth Stager, Los Angeles County Museum, and Dr. D. H. Johnson, U. S. National Museum, for assistance in comparing study skins in the above museums.—RAYMOND E. RYCKMAN AND CHESTER C. LINDT, *Department of Entomology, School of Tropical and Preventive Medicine, Loma Linda, California.* Received April 4, 1952.

OBSERVATIONS ON BARRO COLORADO ISLAND MAMMALS

The following field observations on Barro Colorado Island mammals are intended as supplementary to those already recorded by Goldman (Smithsonian Misc. Colls., 69 (5): 1-309; 1920), Chapman (MY TROPICAL AIR CASTLE, 1933; LIFE IN AN AIR CASTLE, 1938), Enders (Bul. Mus. Comp. Zool., 78: 385-502, 1935), and Carpenter (Comp. Psych. Mono., 10 (2), 1934). They were made by the author in the dry season between December 16, 1951 and March 16, 1952.

Saccopteryx bilineata. White-lined bat.—Four individuals of this bat were daily observed as they occupied a roosting place under the eaves of a cabin. These bats hold their heads higher than the level of their wings while roosting. They are very active in the day time, and frequently change places even if it means moving out temporarily into the sunshine. On especially sultry days they would cling to the window screen, apparently to receive a greater circulation of air. One was captured with an insect net for measurements. When released it returned to its regular roosting spot. On each of three visits 47 of these bats were counted in the shaded cavities formed by the buttresses of the Van Tyne big tree (*Bombacopsis Fendleri*). There was always considerable shifting and fluttering over resting

individuals during these observations. At the laboratory clearing these bats regularly left their roost earlier and returned to it later than did other species of bats.

Artibeus watsoni. Watson's bat.—Chapman (1933) was the first to call attention to the "tents" made presumably by this bat, and definitely occupied by it, using the leaf of the palm, *Geonoma decurrens*. The author found as many as three individuals occupying one tent made from a leaf of this palm. However another palm, *Geonoma binervia*, seems to be utilized much more frequently. Six tents examined on February 5 between markers 7 and 8 on the Shannon Trail contained no bats.

Cebus capucinus. White-faced monkey.—A troop of these monkeys was observed to run on the ground across an open space to a star apple tree (*Chrysophyllum panamensis*) 50 meters from the forest edge. After a week of baiting, using the star apples, a few individuals were induced to come down near the forest floor for photographic purposes. Although the camera and flash were tripped with an electric control 50 feet long, the animals approached within five feet of the camera and showed very little concern when it clicked and the photo-flash lamp went off. On one occasion one individual actually lowered itself by its tail from a limb directly above the reflector and began shaking it with its hands. When star apples, almonds, peanuts, and ripe bananas were placed in the bait bucket only the star apples were eaten.

Coendou rothschildi. Porcupine.—At marker 4 on the Donato Trail a porcupine was discovered 10 feet above the ground in the cavity formed by the roots of a strangler fig. When an attempt to capture it failed, it climbed with surprising rapidity and crossed to a larger tree on a liana 30 feet above the ground. It was much faster and more agile than the northern porcupine (*Erethizon dorsatum*).

Dasyprocta punctata. Agouti.—When breadfruits from an introduced Bread Fruit Tree (*Artocarpus communis*) were dropped by a coati (*Nasua narica*), the agoutis would appear immediately even in bright sunlight to eat any of the breadfruits that were left. Sometimes they would approach within 4 feet of the feasting coatis without being molested. As the season advanced and the breadfruits became scarce the agoutis quit the area almost entirely.

Mazama sator. Brocket deer.—A buck and a doe were observed browsing under a large tree near marker 6 on the Barbour Trail. The cavities formed by the large buttresses were covered with deer feces, indicating they had been used as resting places by these deer. When lying down in one of these spaces, which is partitioned from the others by high buttresses, a deer could be approached by a predator only from the front. Two of these deer were approached and photographed within 50 feet without apparently being aware of the photographer's presence.

Tapirella bairdi. Baird's tapir.—Two three-year-old tapirs that were formerly young pets at the laboratory frequently came into the clearing, and many observations were made on their behavior at close range. Their favorite browsing grounds were along the banks of a small stream that separated the forest from the clearing along the north side of the latter. Their preferred foods were the herbs and grasses of the clearing and the soft leafy foliage that over-hung the stream. In season they spent considerable time under the breadfruit and star apple trees, eating their fallen ripe fruits. Occasionally they were seen eating the stalks of introduced sugar cane.

One of them would utter a high pitched whistle and bolt for the forest when approached by a white-tailed deer (*Odocoileus rothschildi*). On a few occasions the deer was seen to chase and strike the fleeing tapir with its front feet.

On two occasions one of these animals was observed to walk into the lake, submerge itself, then emerge on a shallow place 40 feet away. Only the snout, eyes, and ears were above water when the animal had its feet on the bottom. Defecation was here observed four times, and tapir feces floating in the water at other times indicated that these animals regularly used the place for that purpose. Tapir feces were also seen in the Wheeler Estero. Such feces were about one foot long and fully 3 inches in diameter. They were light green in color.

Enders (*loc. cit.*) mentions the belief, prevalent among the natives, that the tapir walks on the bottoms of streams, estros, etc. instead of swimming them. The author and another observer watched a tapir enter the lake, walk out until submerged, then continue across the bottom until it reached the place used for defecation already described. The animal went directly beneath both observers, and could be clearly seen as it stirred up the muddy bottom under about five feet of clear water. Whether the animal was walking or swimming along the bottom could not be determined. It did, however, go under the water for a distance of 40 feet when measured over the surface.

Both animals were always very heavily infested with large ticks (*Amblyoma cajennense*) around the margins of the ears and between the hind legs. The male animal was frequently seen to urinate as he walked along by shooting the urine directly backwards with a sudden squirt.

Bradypus griseus. Three-toed sloth.—Near marker 8 on the Fairchild Trail, two male sloths were observed to fall 30 feet to the ground from a palm tree. Although still obviously stunned, they held on to each other with their hind feet. Previous to the fall there had been considerable shrieking, which may have been caused by the sloths that were presumably fighting. After about 30 seconds, both animals released their grips on each other and slowly began to climb the lianas. Enders (*loc. cit.*) records one that was killed by falling five feet.

This species was occasionally seen after sundown, hanging from the leafless branches of some tree silhouetted against the sky. Almost always it would be hanging with two feet and scratching or combing its pelage with its other feet. A female with a young one clinging to her breast was observed feeding on January 4 in the swaying top of a cecropia tree (*Cecropia arachnoidea*) in a moderately high wind at mid-day.

Cabassos centralis. Central American armadillo.—This is the first record of this species on the island. Goldman (*loc. cit.*) writes that it is very rare throughout all Central America. The animal was sighted one evening about sundown as it was swimming about 50 meters off shore near the dock. It was pursued in a cayuco, and captured after it reached the shore and ran across a little clearing toward the woods. It was kept in a cage in the laboratory and was fed raw eggs and milk. Each day the animal was given its liberty in the clearing to hunt for its food. During this time it was closely followed and notes made on its behavior. Most of the time the armadillo searched for ground-dwelling termites and ants by burrowing through the litter and by digging holes, about a foot deep, to some dead root or stump that contained the insects. It apparently located these with the sense of smell by placing its nose close to the ground. The large sickle-like claw of this species is used to cut roots up to one-fourth inch in diameter as it digs after its prey. The insects are extracted from their tunnels by the long tongue in the same manner and with the same facility as that employed by the tamandua (*Tamandua tetradactyla*). On one occasion the animal entirely buried itself (about 18 inches) as it worked along an old root infested with termites. It would stop digging and become perfectly quiet when a person approached. Its eyesight is apparently very poor. This armadillo is very slow as compared with the nine-banded armadillo (*Dasypus novemcinctus*) also found on the island. A workman, familiar with both species, reported another individual swimming near the same place where the original one was captured. The captured animal died after one week, was preserved in formalin, and left at the laboratory.—LLOYD G. INGLES, *Fresno State College, Fresno, California. Received March 27, 1952.*

ECTOPARASITES FROM MAMMALS AND BIRDS ON A QUAIL PRESERVE

In the fall of 1950, large numbers of larval and nymphal rabbit ticks, *Haemaphysalis leporis-palustris*, were noted on quail from a game preserve in Kleberg County, Texas. Forty-three of 46 quail examined were infested; 17 of them had only 3 to 8 ticks each, 12 had from 13 to 30 ticks and 14 had from 65 to 123 ticks. This represented the first large-scale quail ectoparasite infestation seen by one of us (V.W.L.) in twenty years of continuous field work in Texas, although rare instances of heavily parasitized individual birds have been encountered. However, Bishopp and Trembley (*Jour. Parasit.*, 31: 1-54, 1946), location unspecified, report quail and meadow larks suffering such severe depre-

from the immature stages of this common tick that the birds, particularly young ones, were adversely affected or even killed.

This tick situation occasioned particular concern since prolonged drought conditions in south Texas had rendered the birds unusually susceptible to tick-induced anemia and tularemia or other bacterial diseases. The possibility of quail epizootics due to *Pasteurella tularensis* has been of interest to both game management and public health personnel since Green and Wade (Proc. Soc. Exp. Biol. and Med., 26: 626-627, 1929) reported natural infection in the quail. Parker (Publ. Health Repts., 44: 999-1000, 1929) demonstrated that quail are highly susceptible to tularemia. Parker *et al.* (Publ. Health Repts., 47: 479-487, 1932) indicated that they may be the source of human infections.

In an effort to determine the extent to which other animals were being parasitized and to aid in determining the feasibility of attempting control measures, an ectoparasite survey was made of the game preserve fauna during January and February, 1951. One possibility under consideration was that the tick population could be lowered by reducing the number of cottontails, *Sylvilagus auduboni* and jackrabbits, *Lepus californicus*, in the area.

The quail were taken in live traps, while the other birds and miscellaneous wild animals were shot, for the most part. A few of the carnivores were trapped. The domestic animals were examined for ectoparasites in the field. All *Haemaphysalis leporis-palustris* were retained alive, after removal from their hosts, for laboratory animal inoculation, since Parker and Spencer (Sixth Biennial Rept. Montana St. Bd. Ext.: 30-41, 1925) have shown that this tick is the principal vector of tularemia among rabbits.

The results of the survey are presented here. All of the ticks from birds were larvae or nymphs.

BIRDS

Collected Jan. 9-12, 1951.—Quail, *Colinus virginianus*, 8 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 48. MALLOPHAGA—*Colinicola numidiana*, 8; *Menacanthus* sp., 3; *Oxylipeurus clavatus*, 12; *Goniodes ortygis*, 18. DIPTERA—*Microlynychia pusilla*, 4. ACARINA—*Haemaphysalis leporis-palustris*, 187; *Amblyomma maculatum*, 4.

Western meadow lark, *Sturnella neglecta*, 3 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 3. MALLOPHAGA—*Brulelia picturata*, 2. ACARINA—*Haemaphysalis leporis-palustris*, 50.

Lark bunting, *Calamospiza melanocorys*, 3 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 1. MALLOPHAGA—*Philoapterus* sp., 2.

Eastern vesper sparrow, *Poocetes gramineus*, 3 examined: ACARINA—*Haemaphysalis leporis-palustris*, 12.

Shrike, *Lanius ludovicianus*, 1 examined: ACARINA—*Haemaphysalis leporis-palustris*, 3.

Mockingbird, *Minus polyglottus*, 1 examined: DIPTERA—*Microlynychia pusilla*, 1. SIPHONAPTERA—*Echidnophaga gallinacea*, 2. ACARINA—*Haemaphysalis leporis-palustris*, 16.

Roadrunner, *Geococcyx californianus*, 3 examined: DIPTERA—*Microlynychia pusilla*, 6. SIPHONAPTERA—*Echidnophaga gallinacea*, 5; *Pulex irritans*, 1. ACARINA—*Haemaphysalis leporis-palustris*, 110.

Collected Feb. 18, 1951.—Wild turkey, *Meleagris gallopavo*, 1 examined: MALLOPHAGA, not counted—*Oxylipeurus corpulentus*, *Oxylipeurus polytrapezius*, *Chelopistes meleagridis*, *Menacanthus* sp.

Collected Feb. 13, 1951.—Quail, *Colinus virginianus*, 12 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 9. DIPTERA—*Microlynychia pusilla*, 7. MALLOPHAGA—*Goniodes ortygis*, 262; *Oxylipeurus clavatus*, 127; *Colinicola numidiana*, 143; *Menacanthus* sp., 114. ACARINA—*Haemaphysalis leporis-palustris*, 183; *Amblyomma cajennense*, 4.

MAMMALS

Collected Jan. 9-12, 1951.—Jack rabbit, *Lepus californicus*, 5 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 60; *Hoplopyllus affinis*, 3; *Pulex irritans*, 1. ACARINA—*Haemaphysalis leporis-palustris*, 142 (adults and immature forms).

Cottontail rabbit, *Sylvilagus auduboni*, 2 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 31; *Hoplopsyllus affinis*, 3; *Pulex irritans*, 1. ACARINA—*Haemaphysalis leporis-palustris*, 7 (adults and immature forms).

Baird wood rat, *Neotoma micropus*, 7 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 94. ACARINA—*Bdellonyssus bacoti*, 24.

White-tailed deer, *Odocoileus virginianus*, 2 examined: SIPHONAPTERA—*Juxtapulex porcinus*, 16. MALLOPHAGA—*Tricholipeurus lipeuroides*, 9.

Javelina, *Tayassu angulatus*, 7 examined: SIPHONAPTERA—*Juxtapulex porcinus*, 22. ACARINA—*Amblyomma cajennense*, 7 (adults).

Coyote, *Canis latrans*, 1 examined: SIPHONAPTERA—*Pulex irritans*, 2; *Echidnophaga gallinacea*, 19.

Broad-striped skunk, *Mephitis mephitis*, 1 examined: SIPHONAPTERA—*Pulex irritans*, 4; *Echidnophaga gallinacea*, 2. MALLOPHAGA—*Neotrichodectes mephitidis*, 5. ACARINA—*Haemaphysalis leporis-palustris*, 1.

Nine-banded armadillo, *Dasypus novemcinctus*, 1 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 1.

Domestic goat, 12 examined: SIPHONAPTERA—*Echidnophaga gallinacea*, 8. ANOPLURA—*Linognathus africanus*, 12. MALLOPHAGA—*Bovicola caprae*, 2. ACARINA—*Haemaphysalis leporis-palustris*, 6 (adults and immature forms).

Cow, 6 examined: ANOPLURA—*Linognathus vituli*, 1.

It will be noted from these data that there were 23.4 immature *Haemaphysalis leporis-palustris* per quail on the birds taken in January and 15.3 immature ticks on those examined in February. Two other ground-frequenting birds, the western meadow lark and the road-runner, showed 16.7 and 11 ticks per birds, respectively. The fact that 16 larval and nymphal rabbit ticks were taken from a single mocking bird was of interest, although this host has been previously reported (Bishopp and Trembley, *loc. cit.*). The only other ticks taken from quail were four *Amblyomma cajennense* and four *A. maculatum*, all immature.

In the mammal study, 6 immature and adult *H. leporis-palustris* were taken from 12 goats and a single immature specimen from the broad-striped skunk, in addition to the usual host animals, jackrabbits and cottontails. The rabbit population was found to be unusually low. Only five jackrabbits and two cottontails were shot in several days hunting. The jackrabbits showed an infestation rate of 28.4 immature and adult *H. leporis-palustris* per animal, and there were 3.5 per animal on the cottontails.

The scarcity of rabbits refuted our original theory that the heavy tick infestations on the birds might be correlated with an unusual abundance of rabbits. A more likely explanation is that the type of range frequented was a predisposing factor in the number of ticks per bird. Grass was sparse in semi-prairie due to the drought, and both quail and rabbits were utilizing the few existing clumps of woody cover extensively. This provided an excellent opportunity for the exchange of ectoparasites. Quail from brushy range where the birds and rabbits were not forced into such close association were not so heavily infested with ticks.

Trapping and examination of the quail continued into the spring and early summer. The number of immature rabbit ticks on the birds dropped sharply after February, 1951, and no ticks were found by the early summer months. It was not believed that the ticks were the direct cause of the unusually high quail mortality during the winter of 1950-51, but they were unquestionably a contributing factor.

No evidence of tularemia was obtained in the quail, either in the birds trapped alive or picked up dead or in a dying condition in the field. The *Haemaphysalis leporis-palustris* ticks which were taken from the quail and inoculated into laboratory animals were also negative. These negative results were not surprising since the incidence of tularemia in Kleberg County in humans is extremely low. Jellison and Parker (1945) are of the opinion that in North America, cottontail rabbits, especially *Sylvilagus floridanus*, are the direct source of over 70 percent of our human cases of tularemia. The heaviest incidence of the disease occurs within the range of *S. floridanus*. The common cottontail in Kleberg County

is *S. auduboni*. This species appears to be of little importance in the epidemiology of tularemia in Texas, since few cases occur within its range in the western two-thirds of the state. During plague studies in west Texas in 1947-1949, 598 *S. auduboni* were examined for evidence of tularemia, with negative results. Similar results were obtained from the laboratory animal inoculation of 10,000 *Dermacentor parumapertis* and 300 *Haemaphysalis leporis-palustris* ticks from the cottontails.

Summary.—A severe infestation of bobwhite quail in a south Texas game preserve by larval and nymphal rabbit ticks, *Haemaphysalis leporis-palustris*, is reported. An ectoparasite survey of the game preserve fauna was made to determine the extent to which other animals were being parasitized. Immature rabbit ticks were taken from: western meadow lark, *Sturnella neglecta*; eastern vesper sparrow, *Pooecetes gramineus*; shrike, *Lanius ludovicianus*; mockingbird, *Mimus polyglottos*; roadrunner, *Geococcyx californianus*; jackrabbit, *Lepus californicus*; cottontail rabbit, *Sylvilagus auduboni*; the domestic goat; and skunk, *Mephitis mephitis*. Adult rabbit ticks were collected from domestic goat and the two species of rabbits previously listed. Other ectoparasites from game preserve animals are listed.—B. G. HIGHTOWER, V. W. LEHMAN AND R. B. EADS, *Bureau of Laboratories, State Dept. of Health, Austin, Texas, and King Ranch, Kingsville, Texas. Received May 8, 1952.*

REVIEWS

Miller, Malcolm E. *GUIDE TO THE DISSECTION OF THE DOG*. 3rd Ed. Edwards Brothers, Inc., Ann Arbor, Michigan. xi + 369 pp.; figs., 229. 1952. Price, \$5.75 (lithoprinted).

Although there are a number of good texts describing the anatomy of the dog, these do not fulfill the need of the beginning student for a dissection guide. With the publication of this work, we are provided with a book that is not only an excellent guide to the dissection of the dog, but is so detailed and so well illustrated that it might also serve as a textbook.

In the brief introduction one is provided with a discussion of the basis of nomenclature, definitions of the anatomical planes of the body, and definitions of positional and directional terms so necessary in descriptive anatomy. These definitions are very concise, but adequate.

The main body of the work is a combination of the regional and systematic approaches to dissection. The first two major sections are devoted to the skeletal system and the muscular system. The dissector is then led through a regional study of the blood vessels, nerves, and organs of the thorax, neck, and pectoral limb. A fourth section similarly treats the abdomen, pelvis, and pelvic limb. Then comes a regional study of the head (including muscles), a rather brief but thorough section on the central nervous system, and finally a section on the articulations. The whole is supported by frequent citations to a well-selected bibliography of anatomical works.

All the sections are illustrated by excellent drawings, which present the essential features of the subject in considerable detail. These are done, however, with an economy of lines which gives a very pleasing effect to the illustrations. The artists deserve much credit for their contribution to this guide.

The section on the skeletal system begins with a discussion of the general types, structure, and physical properties of bone. An interesting feature here is the directions for preparing skeletal material by hand as well as by use of the beetle, *Dermestes*.

The individual bones are described in considerable detail. The discussion of the cranial foramina alone would make this section important to many anatomists and mammalogists in general.

The dissection of the muscular system follows an apparently thoroughly workable plan. All muscles except those intrinsic to the head are treated in this section. The manner in which the dissection proceeds from region to region without loss of continuity is commend-