NORTHWEST FAUNA

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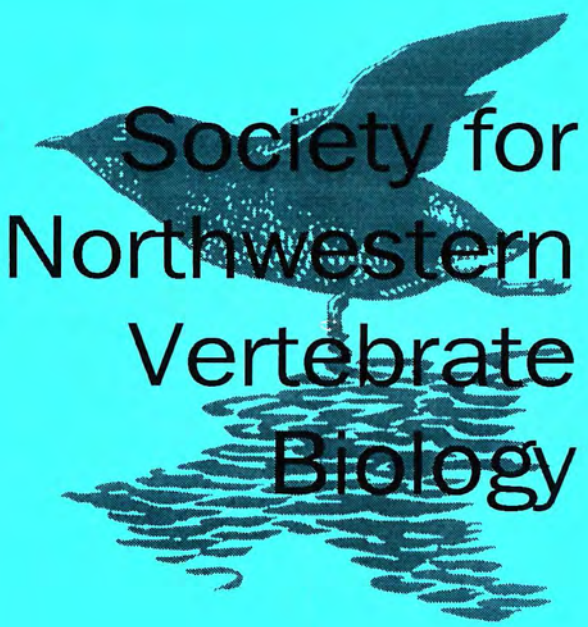
NUMBER TWO 1995

A significant previously unpublished monograph by Victor B. Scheffer:
MAMMALS OF THE OLYMPIC NATIONAL PARK AND VICINITY
(1949)



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PREFACE

In 1937, one year after receiving a Ph.D. in zoology from the University of Washington, Victor B. Scheffer joined the U.S. Bureau of Biological Survey as a junior biologist stationed in Olympia, Washington. In the early 1900s, under the guidance of pioneer mammalogist C. Hart Merriam, the Bureau had taken responsibility for exploring, describing, and mapping the distribution of wild mammal and bird faunas in North America. At the time Scheffer joined the Bureau, it was only three years from changing its name to the U.S. Fish and Wildlife Service. In the late 1930s, however, faunal surveys were still the primary activities of Bureau biologists, especially in the Pacific Northwest and Alaska. Scheffer participated in an expedition under the direction of Olaus J. Murie to survey wildlife in the Aleutian Islands, and devoted much of his time in the late 1930s and early 1940s to surveying and studying the mammals of Washington.

In 1936, Vernon Bailey, another biologist with the Survey, published *The Mammals and Life Zones of Oregon*. Scheffer's first supervisor, Hartley H. T. Jackson, was in favor of his conducting a similar survey of the mammals of Washington. However, Jackson's assistant, Leo K. Couch, thought that Scheffer ought to be documenting the status of furbearers, such as fisher and wolverine, that had become alarmingly scarce in Washington. Scheffer spent his first years with the Bureau working on both of these projects. The notes from his interviews with fur trappers and long-time residents in Washington conducted in the late 1930s were deposited in Manuscripts and University Archives at the University of Washington Libraries and are among the most valuable historical records available on the distribution and abundance of Washington furbearers in the early 1900s. He also worked on a more comprehensive mammal survey, spending many months collecting throughout Washington with Walter W. Dalquest, then an undergraduate student at the University of Washington. Scheffer and Dalquest described a number of new subspecies of mammals and published a seminal paper proposing that the Mima mounds of western Washington were created by the activities of pocket gophers. Scheffer's interests began turning strongly to marine mammals, however, which would eventually become the focus of his career as a zoologist. Dalquest finished the survey on his own, and eventually published the landmark text *Mammals of Washington* in 1948.

During this period in his career, Scheffer was particularly interested in the mammals of the Olympic Peninsula. He compiled museum records and published information, interviewed residents and biologists who had worked there, and conducted his own field studies of mammals on the Peninsula. The result was a manuscript completed in late 1946 entitled, *Mammals of the Olympic Peninsula*. In 1949, Victor H. Cahalane, then Chief of the Biology Branch of the National Park Service, approved publishing the manuscript as a Park Service publication, with the stipulation that the name be changed to *Mammals of the Olympic National Park and Vicinity*, and that certain portions of the text be changed to emphasize species occurring in the Park. In early 1950, Cahalane approved the revisions that Scheffer had made and sent the manuscipt to the Service's editor. Apparently, however, funds for printing could not be secured and the manuscript was never published.

Until this printing, only one complete copy of the manuscript has existed. Although copies of the text had been given to Olympic National Park, only the original typewritten manuscript, stored in a wooden box at the home of Dr. Murray Johnson, contained photographs. Scheffer's manuscript is now presented exactly as written after revisions were made in 1949. This is a work of significant historical interest. It not only contains invaluable information on Olympic Peninsula mammals in the early 1900s, but is a fascinating account of many of the people who settled the Peninsula and of the rapidly changing environment in which they lived.

The table immediately following this preface includes a list of nomenclatural changes since this manuscript was written. For current scientific names, we follow Wilson, D. E. and D. M. Reeder, eds., 1993, Mammal species of the world: a taxonomic and geographic reference, 2nd ed., Smithsonian Inst. Press, Washington, D.C. For current common names, we follow Jones, J. K., et al., 1992, Revised checklist of North America mammals north of Mexico, 1991, Occ. Pap. Mus. Tex. Tech. Univ. No. 146.

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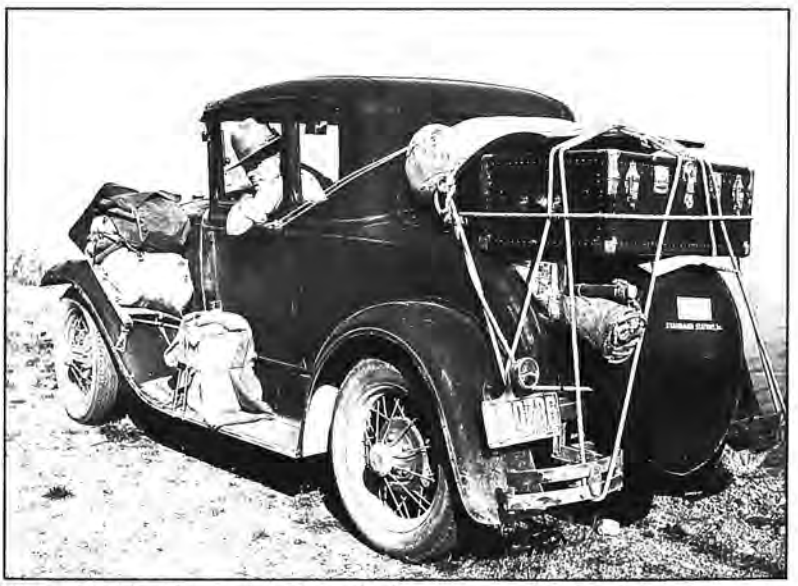

Victor B. Scheffer, Junior Biologist (temporary), leaving Lake Cushman on September 10, 1935 after a summer spent surveying lakes and streams on the Olympic National Forest.

Scientific Name, Scheffer, 1949	Common Name, Scheffer, 1949	Scientific Name, Wilson & Reeder, 1993	Common name, Jones, 1992
Sorex trowbridgii destructioni	Trowbridge Shrew	*Sorex trowbridgii trowbridgii*[1]	same
Sorex obscurus	dusky shrew	*Sorex monticolus*	same
Sorex palustris navigator	mountain water shrew	same	water shrew
Sorex bendirii albiventer	Bendire water shrew	same	marsh shrew
Scapanus townsendii	Townsend mole	*Scapanus townsendii olympicus*[2]	same
Myotis lucifugus alascensis	big myotis	same	little brown myotis
Myotis volans longicrus	hairy-winged myotis	same	long-legged myotis
Corynorhinus rafinesquii	long-eared bat	*Plecotus townsendii*	Townsend's big-eared bat
Eutamias amoenus	mountain chipmunk	*Tamias amoenus*	yellow-pine chipmunk
Eutamias townsendii	Townsend chipmunk	*Tamias townsendii*	same
Glaucomys sabrinus oregonensis	flying squirrel	same	northern flying squirrel
Thomomys talpoides	pocket gopher	*Thomomys mazama*	Mazama pocket gopher
Peromyscus maniculatus oreas	white-footed mouse	*Peromyscus oreas*	forest deer mouse[3]
Peromyscus maniculatus	white-footed mouse	same	deer mouse
Neotoma cinerea occidentalis	wood rat, or pack rat	same	bushy-tailed woodrat
Clethrionomys gapperi	Gapper red-backed mouse	same	southern red-backed vole
Clethrionomys californicus[4]	California red-backed mouse	*Clethrionomys gapperi*	southern red-backed vole
Microtus townsendii townsendii	Townsend meadow mouse	same	Townsend's vole
Microtus longicaudus macrurus	long-tailed meadow mouse	same	long-tailed vole
Microtus oregoni oregoni	creeping mouse	same	creeping vole
Zapus princeps trinotatus	jumping mouse	*Zapus trinotatus*	Pacific jumping mouse
Vulpes fulva	fox	*Vulpes vulpes*	red fox
Martes caurina	marten	*Martes americana*	American marten
Spilogale gracilis latifrons	spotted skunk, or civit cat	*Spilogale putorius olympica*	same
Callorhinus ursinus	fur seal	same	northern fur seal
Eumetopias jubata	Steller sea-lion	*Eumetopias jubatus*	northern sea-lion
Mirounga angustirostris	elephant seal	same	northern elephant seal

[1] *S. t. destructioni* may be invalid; based on Johnson, M.L. and S. Johnson. 1952. Check list of mammals of the Olympic Peninsula. *Murrelet* 33:32-37.

[2] based on Johnson, M.L. and T.L. Yates. 1980. A new Townsend's mole (Insectivora: Talpidae) from the state of Washington. Texas Tech. Univ. Occas. Pap. 63:1-6.

[3] based on Ingles, L.G. 1965. Mammals of the Pacific States. Stanford University Press, Stanford CA.

[4] from the Olympic Peninsula

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MAMMALS OF THE OLYMPIC NATIONAL PARK AND VICINITY

(1949)

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INTRODUCTION

This booklet is designed as a reference to information on the wild mammals of the Olympic Peninsula, Washington: their distribution, habits, and prominent features. It is planned especially for the use of the person who seeks his recreation in the snow-capped mountains and the evergreen forests of the Olympic National Park. Some of the facts presented here will be of interest to the professional naturalist or game manager only, while others, it is hoped, will be of interest to the general man-out-of-doors.

A companion booklet entitled *Birds of the Olympic Peninsula* has recently been published by Edwin A. Kitchin (see Literature Cited, p.119).

The Olympic Peninsula–northwest corner of the United States–is an important wildlife unit. It is the native home of a dozen or more kinds of birds and mammals found nowhere else in the world. In its magnificent stands of hemlock, fir, spruce, and cedar there may still be seen animals like the cougar, fisher, marten, and otter whose numbers, in other more civilized parts of the United States, have been sadly depleted. In its wilderness areas set aside for recreational use there roam splendid animals like the Roosevelt elk, black-tailed deer, and mountain goat.

The geographical boundaries which limit the present discussion are those of the Olympic Peninsula as a whole, rather than those of the National Park. By enlarging the scope of the booklet to include the semi-cultivated lowlands around the Park, we have aimed to give you an idea of the importance of Olympic mammals in the economy of the farmer, trapper, and hunter, as well as their interest to the National Park visitor. Within the park boundaries, of course, no hunting or trapping is permitted, and the taming and feeding of animals is discouraged. The National Park Service is attempting to preserve the areas under its jurisdiction, at the same time promoting their use and enjoyment by visitors.

As a political unit, the Olympia Peninsula includes about 5,000 square miles in the counties of Clallam, Jefferson, Mason, and Grays Harbor (the northern two-thirds). It contains the Olympic National Forest, established in 1897; the Olympic National Park, 1938; and Indian reservations under the Taholah Agency, as follows: Neah Bay (Makah Reservation), Quinaielt, and Skokomish. It includes five National Wildlife Refuges which are, in order of size: Dungeness Spit, Flattery Rocks, Quillayute Needles, Ediz Hook, and Copalis Rock. It also contains seven state parks and large amounts of land administered by the State Division of Forestry.

As a natural unit the peninsula includes the terrain whose waters drain into the Pacific Ocean, the Strait of Juan de Fuca, Hood Canal, the tip of Puget Sound, and the Chehalis River (Fig. 1).

The outstanding feature of the peninsula is the central mountain mass (Fig. 5). Sharply folded sandstones, slaty and igneous rocks have been cut by glaciers and numerous streams into rugged peaks and steep-walled valleys. Mount Olympus is the highest point, 7,923 feet above sea level. The Olympic Mountains are not, like the snowy cones of the Cascade Range, of volcanic origin.

Climatically, the peninsula is moist and cloudy in winter and dry in summer, always moderate in temperature. On the west side the annual rainfall may reach 160 inches while on the northeast corner, sheltered by the wall of mountains, it may drop below 10 inches! Timber line is 5,000 to 6,000 feet. Its position is fixed more by moisture, especially snowfall, than by temperature. Some 250 feet of snow may fall on the summit of Mount Olympus in the course of a year. The Olympic rivers are subject to great fluctuation and are a dreadful sight in time of flood. Thus, the Quinault River has dwindled to 285 second feet of water and risen to 37,000. On the 21st of January 1935, twelve inches of rain fell at Quinault Lake in 24 hours. Prostrate trees strewn about like jackstraws and now rotting on

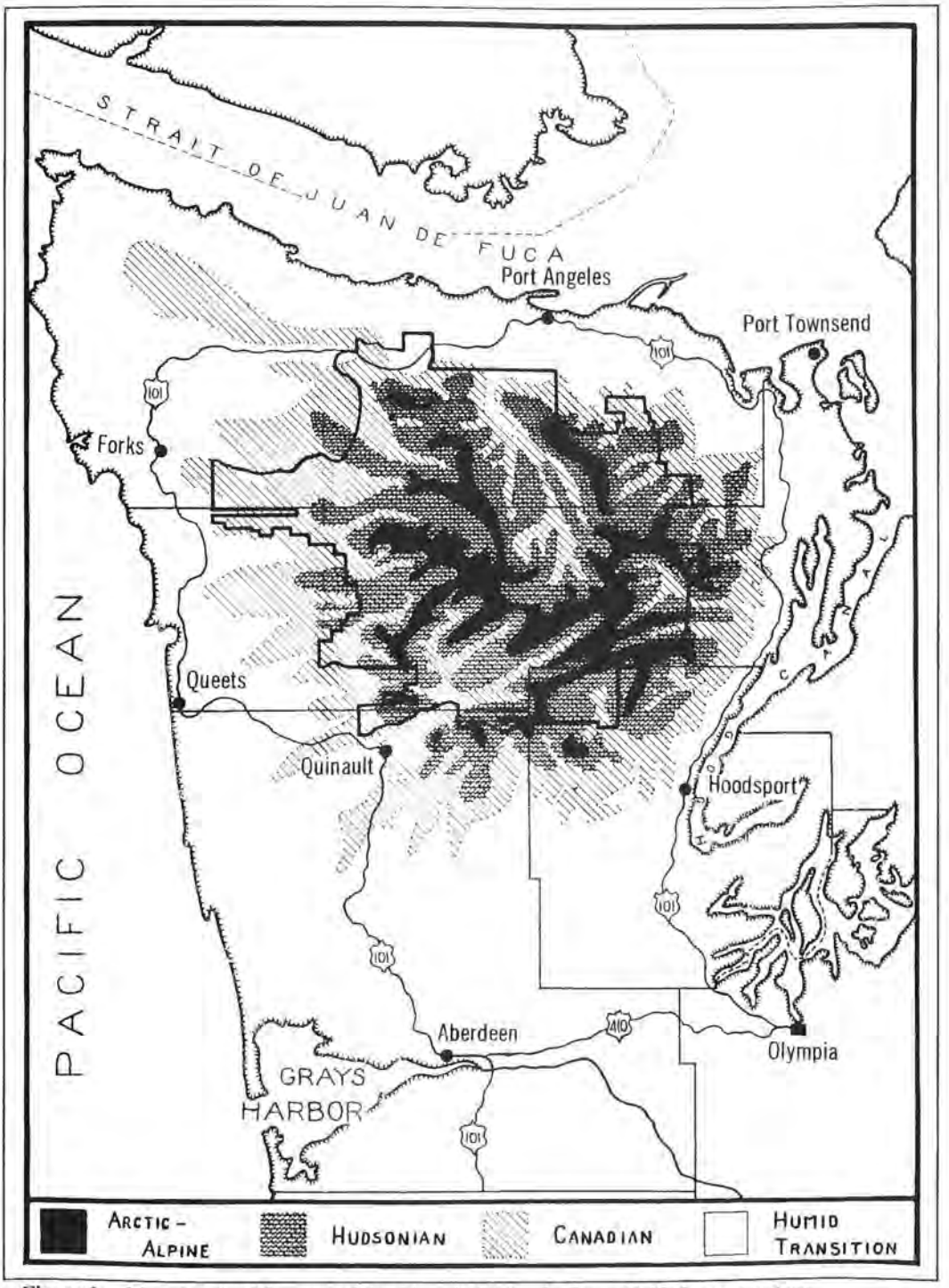

Figure 1. Map showing life-zones of the Olympic Peninsula (From G. N. Jones, courtesy University of Washington Press).

the forest floor are mementos of the historic "blowdown" of January 1921 when, at one time the wind reached a recorded velocity of 148 miles an hour.

The moist, oceanic climate along the west side of the peninsula is largely responsible for the great size of some of the forest trees. National Park Superintendent Preston P. Macy writes that "by actual measurement we have trees of three species which are recognized by the American Forestry Association as the largest known. On the North Fork Quinault is a western red cedar (*Thuja plicata*) 20 feet in diameter. On the Queets is a Douglas fir (*Pseudotsuga menziesii*) 17 feet 8 inches in diameter and on the East Fork Quinault is a western hemlock (*Tsuga heterophylla*) approximately 9 feet in diameter. We believe we have the record Alaska cedar (*Chamaecyparis nootkatensis*) and Sitka spruce (*Picea sitchensis*) but until accurate measurements are taken are making no claims"

LIFE-ZONES OF THE OLYMPIC PENINSULA

It is apparent to even the casual observer that the peninsula is made up of two kinds of terrain: a lowland apron and a central mountain mass. The biologist has named them the *Austral* and the *Boreal* regions and has further divided them into four *life-zones*. We might say that the character of a life-zone is determined primarily by temperature and, to a lesser extent, by rainfall (and snowfall), wind, slope of the terrain, and nature of the soil. The character of a life-zone is revealed by the kinds and relative numbers of plants growing within its confines. According to Jones (1936) the Olympic life-zones and the forests which identify them are as follows:

Austral Region

Transition Zone (fig. 2): from sea level to 1,500-2,000 feet

* Hemlock-Cedar Climax, or Douglas fir Subclimax, over most of the zone
* Spruce-Hemlock Climax occupying a narrow strip in the fog belt along the ocean

Boreal Region

Canadian Zone (fig. 3): mainly between 1,500 and 3,000 feet

* Western hemlock, Pacific silver fir, and western white pine

Hudsonian Zone (fig. 4): mainly between 2,500 and 5,500 feet

* Alaska cedar, subalpine and Pacific silver firs, and mountain hemlock

Arctic-alpine Zone (fig. 5): mainly between 5,000 and 7,923 feet

* Treeless

The visitor to the peninsula can thus identify the life-zone by the composition of its forest. He can also, if botanically trained, study the smaller elements in the vegetation: the mosses, ferns, grasses, forbs, and shrubs, and arrive at a similar conclusion. As an index to the life-zone, however, the nature of the forest is the simplest.

Since all animals are dependent, directly or indirectly, upon plants, the character of a life-zone is further revealed by the kinds of animals that inhabit it. Each mammal in the Olympic fauna has a preference for one, or a few, life-zones. It may change its preference with the seasons. Thus the elk and deer live mainly in the Hudsonian Zone in the summer and the Transition Zone in the winter. Or the animal may, like the fisher, pass rather freely from one zone to another at any time of the year. Generally speaking, the life-zone or

Figure 2. Transition Life-Zone; the Duckabush Valley at tidewater, Mt. Jupiter (5,690 feet) in the distance, December 13, 1945.

Figure 3. Canadian Life-Zone; forested slopes with Observation Point (6,450 feet) in the center and Strait of Juan de Fuca in the distance, October 8, 1936 (Photo by Pacific Aerial Surveys).

"home" of an animal is the place where it bears its young, regardless of where it may engage in mating and feeding.

With the exception of the Arctic-alpine, the mammalian life-zones of the Olympic Peninsula are poorly defined. Under the protective cover of evergreen timber, and everywhere supplied with an abundance of moisture, the mammals tend to ignore altitudinal limits. The species that claim all zones from sea level to timberline, in other words, the adaptable species, outnumber the ones that inhabit only the Transition, yet the Transition presents the greatest land area. Typical mammals of the Olympic life-zones are:

Transition – Townsend and coast moles, shrew-mole, Trowbridge shrew, Bendire water shrew, raccoon, mink, river otter, spotted and striped skunks, Townsend chipmunk (subspecies *townsendii*), pocket gopher (subspecies *couchi*), beaver, deer mouse (subspecies *austerus*), California red-backed mouse, muskrat, Townsend meadow mouse, and mountain-beaver.

Canadian and Hudsonian – Dusky shrew, mountain water shrew, Olympic marmot, mountain chipmunk, Townsend chipmunk (subspecies *cooperi*), pocket gopher (subspecies *melanops*), heather vole, and Gapper red-backed mouse.

All timbered zones – Shrews not listed above, black bear, marten, fisher, long-tailed weasel, ermine, coyote, cougar, bobcat, Douglas squirrel, flying squirrel, deer mouse (subspecies *oreas*), wood rat, long-tailed meadow mouse, Oregon meadow mouse, jumping mouse, snowshoe rabbit, Roosevelt elk, and black-tailed deer.

Arctic-alpine – Mountain goat.

COMPOSITION OF THE FAUNA

When the Vashon Ice Sheet, last of the lowland glaciers, rode down from the north some 20,000 years ago it ended its course just south of the Olympic Peninsula, near Tenino. The Olympic Mountains, with the exception of the west and southwest sides, stood out as a glacial island. Many of the plants and animals now found on the peninsula are descendants of ancient stocks. They exhibit characters which distinguish them from their relatives in the nearby Cascade Range.

Some species now living in the Cascades have been unable, in the time that has elapsed since the ice age, to cross the forested lowlands of the Puget Sound Trough and occupy suitable habitats in the Olympics. Cascade mammals which might logically be expected in the Olympics but which do not occur here include the grizzly bear (*Ursus arctos*), wolverine (*Gulo gulo*), red fox (*Vulpes fulva*), lynx (*Lynx canadensis*), water vole (*Microtus richardsoni*), northern bog lemming (*Synaptomys borealis*), Cascades golden-mantled ground squirrel (*Spermophilus saturatus*), porcupine (*Erethizon dorsatum*), pika (*Ochotona princeps*), mountain goat (*Oreamnos americanus*), and bighorn sheep (*Ovis canadensis*). I should add, however, that the red fox and porcupine are on the threshold of the peninsula and are expected to enter soon, while the goat has already been introduced through the agency of man.

The roster of wild mammal life on the peninsula includes 70 kinds (species and subspecies) of which 57 are natives occupying their primitive homes. The other 13 include: native mammals exterminated by man, foreign mammals introduced by man, and mammals straying occasionally within the boundaries of the peninsula.

Figure 4. Hudsonian Life-Zone; Hurricane Ridge (5,500 feet), June 29, 1938.

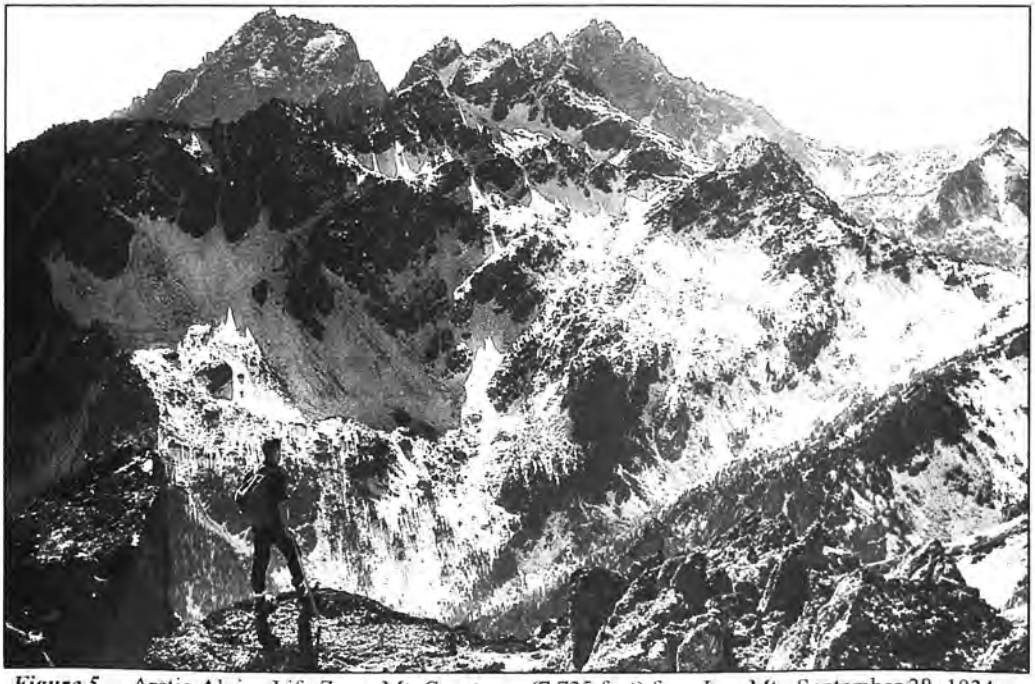

Figure 5. Arctic-Alpine Life-Zone; Mt. Constance (7,735 feet) from Iron Mt., September 28, 1934.

ECONOMIC IMPORTANCE OF OLYMPIC MAMMALS

In relation to man's welfare, no mammal is either wholly beneficial or wholly injurious. Thus, no thinking person will maintain that, at all times and places, the coyote is a "bad" animal and the beaver is a "good" one. The economic status of a wild species is complex and fluid, not to be described hastily or categorically. As a matter of convenience in managing wildlife, however, it is common practice to classify each important species in accordance with its usual economic position. Each of the five agencies concerned with wildlife on the peninsula–the State Game Department, the Forest Service, the Fish and Wildlife Service, the National Park Service, and the Indian Service has its respective point of view with regard to the economic classification of the Olympic mammals. I shall dwell here only on the classification employed by the Game Department. According to state law, the mammals of the peninsula are grouped as "game, fur-bearing, and predatory." This classification does not apply within the Olympic National Park, a wildlife sanctuary.

GAME ANIMALS

Four big-game species are represented here. (1) The black-tailed deer is the most abundant, and about 500-600 individuals are taken annually by hunters. (2) The Roosevelt elk is a difficult animal to hunt and to handle, mainly because of its large size and the rough terrain where it lives. Over 500 elk are taken annually. (3) The black bear is a poor game species, in the opinion of most Olympic hunters. During the fall its meat is apt to be fishy and unpalatable. The hunting season is open the year around, with minor exceptions, and there is no bag limit. About 100-200 bears are taken annually. (4) The mountain goat is an introduced species. Slightly over 100 goats live in the National Park, where they may be hunted only with a camera. Those that stray down into the National Forest are protected against hunting by the State Game Department.

Of the three small-game species, the snowshoe rabbit is rarely hunted. (The eastern cottontail has been planted in Pierce and Clark counties of western Washington and will doubtless spread to the southern Olympics). The Olympic marmot lives in and adjacent to the mountains of the National Park, and is protected by the Park Service and the State Game Department. The raccoon, classified for many years in Washington as a fur-bearing animal, was reclassified on June 6, 1949 as a game species.

FUR-BEARING ANIMALS

The fur-bearing animals include the marten, fisher, mink, river otter, beaver, and muskrat. The fisher has wisely been protected by the State Game Department for about 25 years. The beaver is an animal of dual personality: a furbearer and, at times, an injurious rodent. With the exception of a few taken by Indians on reservations, beavers are trapped only by agents of the Game Department, and 40 per cent of the net profits are given to the landowner. Records of the Game Department indicate that about 7,000 furbearers were taken annually by private trappers from the peninsula in the years 1945 to 1949. The annual value of the take is about $30,000.

PREDATORY ANIMALS

Most of the Olympic animals legally classified as predatory are fur-bearing as well, from the commercial point of view; that is, bobcat, cougar, coyote, wolf, spotted skunk, striped skunk, long-tailed weasel, ermine, and mole. Predators of no commercial value are the red squirrel and house rat.

Figure 6. Seashore habitat; foraging territory of raccoon, skunk, and bear; Shi-Shi Beach south of Cape Flattery, November 19, 1945.

Figure 7. Freshwater habitat; foraging territory of mink and otter; Skokomish River below The Staircase, Olympic National Park, August 25, 1947.

A state bounty system has been applied for many years to control the numbers of bobcats, cougars, coyotes, and wolves outside of the National Park.[1] Biennial reports of the Game Commission indicate that bounties were paid on Olympic animals during the 13-year period 1936-1948, as follows:

	Total number	Average number per year	Fewest and most in any year
Bobcat	4,362	336	147-594
Coyote	1,439	110	21-264
Cougar	514	40	8-98

These figures represent animals taken by private citizens only, not those killed by State and Federal employees. Thus, the total take of bobcats, coyotes, and cougars on the peninsula probably exceeds 500 a year. About 250 spotted skunks, 300 striped skunks, and 100 weasels (of 2 species) are taken annually.

OTHER ANIMALS

In addition to the mammals that are legally classed as game, fur-bearing, and predatory, there are others not legally defined by the State Game Department which are, nevertheless, of economic importance on the peninsula. These include the injurious rodents and shrews and the seashore mammals.

Discussion of the damage done by individual species of mice, squirrels, moles, and shrews is given under "Species Accounts" (see Contents).

The seashore mammals have only slight importance to residents of the Olympics. At the time of writing, the harbor seal is a liability in fishing ports and a tourist attraction elsewhere. The elephant seal is extremely rare. The Jagged Island sea-lion herd is of more importance as a recreational asset than as a destroyer of fish. The fur seal was, until recently, a source of cash income as well as food to the Quilieute and Makah Indians. A bounty of five dollars is now (1951) being paid by the State Department of Fisheries on the harbor seal and sea-lion. The bounty has little effect on the numbers of Olympic sea-lions since these animals are concentrated along a stretch of seacoast which is protected as a National Wildlife Refuge. Outside of the refuge, the harbor seals, elephant seals, and sea-lions of Washington are given no protection by State or Federal law.

HISTORICAL RESUMÉ OF MAMMAL STUDIES ON THE OLYMPIC PENINSULA

Most of the information below was obtained from a paper by Frank S. Hall (1932) and from extensive manuscript reports of the Section of Biological Surveys, Fish and Wildlife Service. Reference is omitted to a number of short-term studies of the Roosevelt elk, accounts of which may be found in Schwartz (1943).

1855-1857: George Suckley and George Gibbs, naturalists with the famous "railway survey" of the U. S. Government, touched briefly at Port Townsend, New Dungeness, and other points on the Strait of Juan de Fuca (Suckley and Gibbs, 1860).

[1] Effective July 1, 1949, the bounty on coyotes was removed. This step was taken by the State Game Department in response to a growing conviction that a bounty system is less efficient than a system of control by professional hunters.

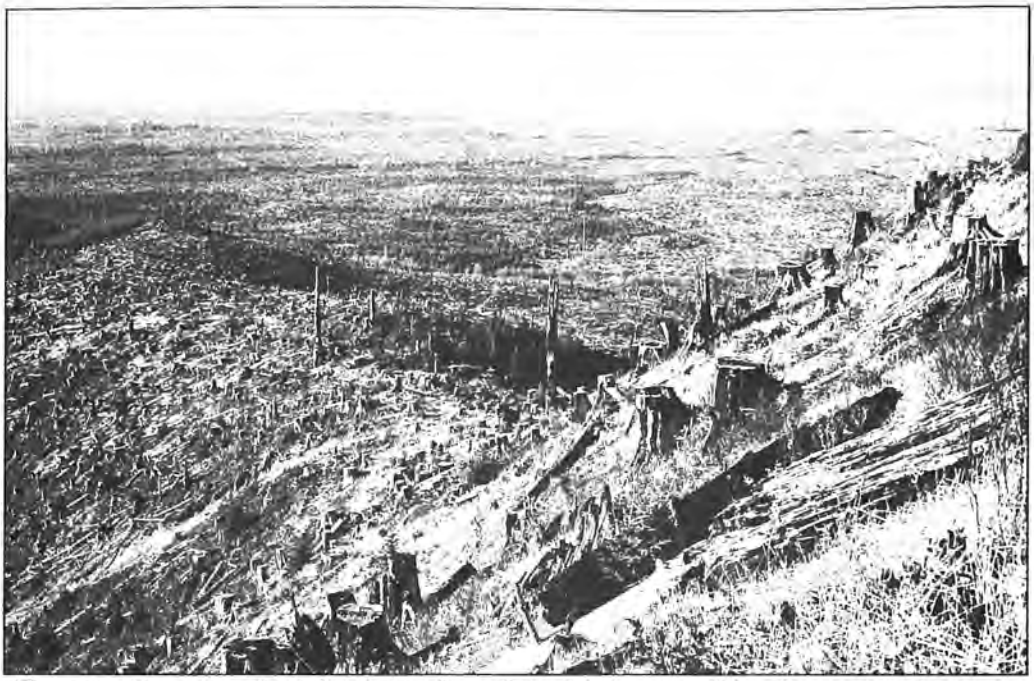

Figure 8. Burned-over land; foraging territory of mountain-beaver, rabbit, bobcat, coyote, deer, and elk; looking NW from Burnt Hill Lookout, near Humptulips, December 17, 1938. Stumps in foreground are those of charred snags felled by Forest Service employees to reduce fire hazard.

1886: L. Clark Toney, who seems to have been a physician, collected the type specimen of *Martes caurina caurina* near Grays Harbor and sent it to the National Museum.

1889: T. S. Palmer, of the Division of Ornithology and Mammalogy (precursor of the Division of Biological Survey), U. S. Department of Agriculture, spent part of the summer at Grays Harbor. Here he collected the types of *Clethrionomys californicus occidentalis*.

1894: Clark P. Streator, Division of Ornithology and Mammalogy, worked at Cushman Lake from June 21 to July 11, where he collected the type specimens of *Sorex bendirii albiventer*, *Clethrionomys gapperi nivarius*, and *Microtus longicaudus macrurus*.

1896: Thomas Hayes, presumably a hunter, collected the type of *Felis concolor olympus* at Cushman Lake.

1897: A party of naturalists from the Division of Biological Survey (precursor of the Bureau of Biological Survey) collected mammals at Neah Bay, Lapush, Taholah, Quinault Lake, Grays Harbor, and various places in the Olympic Mountains. Included in the party were C. Hart Merriam, R. T. Young, Edward A. Preble, and Vernon Bailey. It is probable that Albert K. Fisher, Walter K. Fisher, and J. Alden Loring were also members of the party. During the survey, the type specimens of *Marmota olympus*, *Eutamias amoenus caurinus*, *Thomomys talpoides melanops*, *Mustela erminea olympica*, and *Cervus canadensis roosevelti* were collected.

1898: A party from the Field Museum (now Chicago Museum of Natural History) including D. G. Elliot and Carl E. Akeley, spent July to October in the mountains south of Port Angeles (Elliot, 1899). They collected over 500 mammals, including the types of *Sorex obscurus setosus* and *Ursus americanus altifrontalis*. Eight additional species or subspecies described as new by Elliot are now considered invalid (Sanborn, 1947, p.284).

1905-1909: Albert B. Reagan, of the U. S. Indian Service, was in charge of the Quilicute and Hoh natives for five years. During this period, and later, he published a large number of short, semi-popular articles dealing with the geology, botany, zoology, and ethnology of the western Olympics.

1916: Olaus J. Murie spent the winter of 1916-1917 in the Elwha Valley investigating reports of damage to elk, deer, and livestock by timber wolves. He was employed by the Bureau of Biological Survey (precursor, in part, of the Fish and Wildlife Service) some of the time. A few of the mammals that he collected are still in his possession and others are in the Carnegie Museum, Pittsburgh.

1916: Theo. H. Scheffer, Biological Survey, visited the Port Angeles region in 1916, to undertake studies of the mountain-beaver. In the ensuing 30 years he visited the peninsula on many occasions. His work was principally with the injurious animals including, on the peninsula, the snowshoe rabbit, meadow mouse, deer mouse, pocket gopher, mole, and mountain-beaver.

1917-1921: George G. Cantwell, of the Biological Survey, acted as custodian of the Federal bird refuges along the Olympic seacoast and, in his spare time, collected birds and mammals at various places around the lowlands of the peninsula. In 1921 he joined the Biological Survey expedition into the Olympic Mountains.

1919: Frederick M. Gaige, of the University of Michigan-Walker Expedition, collected 131 small mammals in the vicinity of Lake Cushman (Dice, 1932).

1920: E. B. Webster, publisher of the Port Angeles *Leader* and the *Evening News* from about 1900 to 1936, was well acquainted with the local game and furbearing animals. His book "King of the Olympics" (1920) was a popular account of the mammals of the peninsula, with special reference to elk.

1920-1935 (Approximate): Leo K. Couch, Biological Survey, carried on predatory animal and rodent control in Washington and frequently visited the peninsula. In 1922 he collected the type of *Thomomys talpoides couchi* and later obtained the fine series of cougar skins and skulls which served to reinstate the subspecies *Felis concolor olympus*.

1921: From June to September, members of a Biological Survey party investigated the bird and mammal fauna of the Olympics. Walter P. Taylor and George G. Cantwell were the principals, assisted at various times by other naturalists, most of whom were from colleges in the state of Washington: William T. Shaw, Harold St. John, H. S. Brode, J. B. Flett, J. W. Hungate, W. G. Cassels, William L. Finley, J. M. Edson, and Stanton Warburton Jr. While the findings of the expedition were not published, they were carefully filed in the National Museum, where we studied them in 1946.

1930-1931: Arthur and Ruth Svihla, then of Washington State College, collected small mammals in Clallam County in August 1930 and in June and July 1931. They subsequently made other collections and life-history studies of Olympic mammals (see "Literature Cited," p.119).

1931: During the summer of 1931, the Cleveland Museum of Natural History was represented by Benjamin P. Bole, Jr., and Frank C. Hibben in active field work on the Olympic Peninsula. These men visited the Quinault and Queets Divide, Hoh River, Forks, Neah Bay, Ozette Lake, Soleduck Hot Springs, Deer Lake, and Lake Crescent. They collected over 600 mammal specimens, mostly rodents (F. S. Hall, 1932, pp. 85-86).

1935-1938: John E. Schwartz, U. S. Forest Service, pursued biological studies on the Olympic Forest. He was especially concerned with an overpopulation of elk and its effect on the forest vegetation (Schwartz, 1943).

1935-1949: Victor B. Scheffer, Fish and Wildlife Service, studied Olympic mammals, especially the furbearers and seashore species, in a program covering a larger geographical area. About 6 months were spent in field work on the peninsula. At times he

was accompanied by Walter W. Dalquest, then of the University of Washington. The two collected the type of *Sorex trowbridgii destructioni* in 1941.

1947: Gunnar O. Fagerlund was appointed as the first Olympic National Park Naturalist on June 11. Since 1940, or thereabouts, a collection of natural history material from the park has been maintained at headquarters in Port Angeles. At present (1949) it includes mainly birds and plants, with a few dozen specimens of mammals. The mammals were prepared by Marion P. Harthill, Edwin A. Kitchin, H. C. Parker, and, recently, by Fagerlund.

1949: Murray L. Johnson was appointed in August as a National Park Service Collaborator to conduct an inventory of the mammals of the Olympic Park and to organize and strengthen the museum collection of mammals in park headquarters. He is depositing representative specimens in the Puget Sound Museum of Natural History (College of Puget Sound, Tacoma, Washington).

Miscellaneous studies of mammals: The Washington State Department of Game has contributed materially to knowledge of the mammals of the peninsula by recording the numbers and kinds of game, fur-bearing, and predatory mammals taken each year. State biologists have made life history studies of Olympic elk and deer. The present department was established on December 8, 1932, replacing a county system.

The wildlife reports of the Olympic National Forest, compiled yearly since 1922, and the Olympic National Park, compiled yearly since 1939, are based on the observations of field employees and serve to indicate trends in mammal populations.

Herbert B. Crisler and his wife Lois have taken a series of colored motion pictures, the finest of their kind, of Olympic birds, mammals, and flowers. They have concentrated their attention on the Olympic National Park since 1941 and are at present (1949) working out of the old Grant Humes cabin on the Elwha River.

CHECKLIST OF MAMMALS

The genera are arranged according to Simpson (1945), with two exceptions. *Marmota* has been placed ahead of *Tamiasciurus* and the familiar name *Lynx*, rather than Simpson's *Felis*, has been used for the bobcat.

The specific and subspecific names are those given by Dalquest (1948), with four exceptions. The name *olympus* rather than *oregonensis* is applied to the cougar. The subspecific name *americanus* for the mountain goat is not used in view of the fact that goats of three subspecies, from three different sources, have been planted on nearly the same site in the Olympic National Park and are presumably interbreeding. The subspecific name *nereis* for the Washington sea otter, now exterminated, is not used in view of the uncertain taxonomic position of that animal. Pending a revision of the northern fur seals, the subspecific name *cynocephalus* for the Alaska-breeding animals is not used.

Please note the following abbreviations: EXT - exterminated by man, INT - introduced by man, STR - straggler.

Mammals of the Olympic National Park (with 1949 boundaries) are identified by an asterisk (*).

The names now applied to certain Olympic mammals will probably need to be changed when their distribution and variation are more fully understood. Relatively few Olympic specimens are available for study as yet in museum collections. From the fact that certain species, like the Olympic marmot and Olympic cougar, are markedly different from their near relatives outside the peninsula, we suspect that smaller and as yet unrecognized differences exist among the lesser known mammals, –the shrews, mice, squirrels, rabbits, and others. Which of the Olympic mammals will eventually be found worthy of new and distinctive subspecific names is for future naturalists to decide. One arrives at the same conclusion by reflecting on the geographical position of the Peninsula. The Olympic Mountains stood out as a glacial island during the last ice age, and the Peninsula is still an isolated point at the edge of a continent. Its long-continued isolation has been favorable to the rapid speciation or radiation of its fauna.

CLASS MAMMALIA

Order Insectivora

Family Soricidae

Sorex cinereus streatori Merriam*	cinereous shrew
Sorex trowbridgii trowbridgii Baird*	Trowbridge shrew
Sorex trowbridgii destructioni Scheffer and Dalquest	Trowbridge shrew
Sorex vagrans vagrans Baird*	wandering shrew
Sorex obscurus setosus Elliot*	dusky shrew
Sorex palustris navigator (Baird)*	mountain water shrew
Sorex bendirii albiventer Merriam*	Bendire water shrew

Family Talpidae

Neurotrichus gibsii gibsii (Baird)	shrew-mole
Neurotrichus gibsii minor Dalquest and Burgner*	shrew-mole
Scapanus townsendii (Bachman)*	Townsend mole
Scapanus orarius orarius True*	coast mole

Order Chiroptera

Family Vespertilionidae	
Myotis lucifugus alascensis Miller*	big myotis
Myotis yumanensis saturatus Miller*	Yuma myotis
Myotis keenii keenii (Merriam)*	Keen myotis
Myotis evotis pacificus Dalquest (STR)	long-eared myotis
Myotis thysanodes Miller*	fringe-tailed myotis
Myotis volans longicrus (True)*	hairy-winged myotis
Myotis californicus caurinus Miller*	California myotis
Lasionycteris noctivagans (Le Conte) (STR)	silver-haired bat
Eptesicus fuscus bernardinus Rhoads (STR)	big brown bat
Lasiurus cinereus cinereus (Beauvois) (STR)	hoary bat
Corynorhinus rafinesquii townsendii (Cooper)*	long-eared bat

Order Lagomorpha

Family Leporidae	
Lepus americanus washingtonii Baird*	snowshoe rabbit

Order Rodentia

Family Aplodontidae	
Aplodontia rufa rufa (Rafinesque)*	mountain-beaver
Family Sciuridae	
Marmota olympus (Merriam)*	Olympic marmot
Tamiasciurus douglasii douglasii (Bachman)*	Douglas squirrel
Eutamias amoenus caurinus Merriam*	mountain chipmunk
Eutamias townsendii townsendii (Bachman)*	Townsend chipmunk
Eutamias townsendii cooperi (Baird)*	Townsend chipmunk
Glaucomys sabrinus oregonensis (Baehman)*	flying squirrel
Family Geomyidae	
Thomomys talpoides couchi Goldman	pocket gopher
Thomomys talpoides melanops Merriam*	pocket gopher
Family Castoridae	
Castor canadensis leucodonta Gray*	beaver
Family Cricetidae	
Peromyscus maniculatus oreas Bangs*	white-footed mouse
Peromyscus maniculatus austerus (Baird)*	white-footed mouse
Neotoma cinerea occidentalis Baird*	wood rat, or pack rat
Clethrionomys gapperi nivarius (Bailey)*	Gapper red-backed mouse
Clethrionomys californicus occidentalis (Merriam)	California red-backed mouse
Ondatra zibethicus osoyoosensis (Lord)*	muskrat
Phenacomys intermedius oramontis Rhoads*	heather vole
Microtus townsendii townsendii (Bachman)*	Townsend meadow mouse
Microtus longicaudus macrurus Merriam*	long-tailed meadow mouse
Microtus oregoni oregoni (Bachman)*	creeping mouse, or Oregon meadow mouse

Family Zapodidae	
Zapus princeps trinotatus Rhoads*	jumping mouse
Family Erethizontidae	
Erethizon dorsatum nigrescens Allen (STR)	porcupine
Order Carnivora	
Family Canidae	
Canis latrans lestes Merriam*	coyote
Canis lupus fuscus Richardson (EXT)*	wolf
Vulpes fulva (Desmarest) (STR)	fox
Family Ursidae	
Ursus americanus altifrontalis Elliot*	black bear
Family Procyonidae	
Procyon lotor psora Gray*	raccoon
Family Mustelidae	
Mustela frenata altifrontalis Hall*	long-tailed weasel
Mustela erminea olympica Hall*	ermine
Mustela vison energumenos (Bangs)*	mink
Martes caurina caurina (Merriam)*	marten
Martes pennanti (Erxleben)*	fisher
Mephitis mephitis spissigrada Bangs*	striped skunk
Spilogale gracilis latifrons Merriam*	spotted skunk, or civet cat
Lutra canadensis pacifica Rhoads*	river otter
Enhydra lutris (Linnaeus) (EXT)	sea otter
Family Felidae	
Lynx rufus fasciatus Rafinesque*	bobcat
Felis concolor olympus Merriam*	cougar, or mountain lion
Family Otariidae	
Callorhinus ursinus (L.) (STR)	fur seal
Zalophus californianus (Lesson) (STR)	California sea-lion
Eumetopias jubata (Schreber)	Steller sea-lion
Family Phocidae	
Phoca vitulina richardii (Gray)	harbor seal, or hair seal
Mirounga angustirostris (Gill) (STR)	elephant seal
Order Artiodactyla	
Family Cervidae	
Cervus canadensis roosevelti Merriam*	elk, or wapiti
Odocoileus hemionus hemionus (Rafinesque) (INT)*	mule deer
Odocoileus hemionus columbianus (Richardson)*	black-tailed deer
Family Bovidae	
Oreamnos americanus (Blainville) (INT)*	mountain goat

SPECIES ACCOUNTS

It is customary for natural history writers to endow wild animals with *popular names*, although few popular names can be said to be entirely satisfactory. Thus, a name applied to one local mammal, for example "gopher", may be applied to a quite different animal in another part of the county, and confusion results. Again, many a small, insignificant mammal like the shrew-mole scarcely deserves a popular name because it is not "popular", that is, it is virtually unknown to the public. To satisfy the conventions we have arbitrarily applied to each Olympic mammal an appropriate name.

On the other hand, the *scientific name* which is applied to a mammal is governed by international rules of nomenclature and is applied after careful study of the mammal and its relation to other species, living and extinct. Even here, though, the personal opinion of the scientist may enter into the choice of a name.

For the benefit of you who are unacquainted with mammals, a clue to the identification of each Olympic species is given. The well-known game and fur-bearing animals are described by photographs, the lesser known species by keys or synopses.

Unless otherwise stated, measurements were obtained by the author from his own specimens, now housed in the Biological Surveys collection, U.S. National Museum. Where Taylor, Cantwell, Bailey, Palmer, or Preble is given as the authority for a set of measurements, the specimen is also housed in this collection.

Measurements are usually given in millimeters and weights in grams. Certain equivalents are: 25.4 millimeters (mm.) = 1 inch; 453.6 grams (g) = 1 pound; 1 liter (L) = 1,000 cubic centimeters (cc.) = 1.056 liquid quarts. Where the original data were in English measurements these are given, followed by their metric equivalents.

In describing the occurrence of a species we have given a brief sketch of its distribution and abundance, based upon published records and upon specimens in the Biological Surveys collection. We have not attempted to plot the distribution of specimens collected by all of the naturalists who have worked on the peninsula. For the commoner species we have given the occurrence in general terms, while for the rarer ones we have included specific locality records.

KEY TO OLYMPIC SHREWS

On the Olympic Peninsula there are seven kinds of shrews (six species, one of which is represented by two subspecies). In general appearance each is mouse-like but is distinguished from a mouse by having: teeth fine and sharp; front two pairs of incisors (chisel teeth) lacking; nose pointed and foxy; eyes scarcely larger than a pinhead; ears inconspicuous; body size usually smaller than that of any Olympic mouse. As distinguished from the shrew-mole, *Neurotrichus*, the tail of the shrew is not constricted at its base, the tail hairs lie flat, not erect, and the fore feet are small, not heavy and spade-like. The color of the fur in most shrews varies with the age of the individual, with the season of the year, and to a certain extent with the environment, thus throwing the burden of identification upon other characters, mainly upon size and shape of body and skull.

A1. Total length more than 140 mm. (5.5 in.); hind foot fringed with short, stiff hairs as an adaptation for travel on mud and water; color never distinctly brown.....B
A2. Total length less than 135 mm. (5.3 in.); hind foot naked; color sometimes distinctly brown.....C

B1. Total length 145-152 mm. (5.7-5.9 in.); hind foot distinctly haired..... *Sorex palustris navigator*, p.30.
B2. Total length 150-169 mm. (5.9-6.6 in.); hind foot moderately haired..... *Sorex bendirii albiventer*, p.30.

C1. Color of belly scarcely, if any, paler than back (both gray); tail sharply bicolor (dark above, nearly white beneath), darkening near tip; total length 110-130 mm. (4.3-5.1 in.); tail about as long as rest of body..... *Sorex trowbridgii*, p.28.
C2. Color brown or brown and gray; belly paler than back; tail not sharply bicolor.....D

D1. Total length more than 120 mm. (4.7 in.); tail about as long as rest of body.....*Sorex obscurus setosus* p.29.
D2. Total length less than 120 mm. (4.7 in.); tail about two-thirds as long as rest of body.....E

E1. Third unicuspid tooth smaller than fourth..... *Sorex vagrans vagrans*, p.29.
E2. Third unicuspid tooth not smaller than fourth; rostrum narrower than in *obscurus* or *vagrans*..... *Sorex cinereus streatori*, p.28.

CINEREOUS SHREW
Sorex cinereus streatori Merriam 1892

Identification.– Key, p.27.

Measurements.–Adult male collected at Neah Bay by E. A. Preble on May 14, 1897, and another collected at Quinault River (headwaters of North Fork) by Cantwell on August 10, 1921: length 110, 110; tail 49, 48; hind foot 13, 13. Adult female collected at Cedarville, Grays Harbor County, by Cantwell on November 18, 1918: 102, 47, 11.

Occurrence.–Probably from sea level to timberline around the peninsula; rare. This race occupies the coastal rain forests from Alaska southward to about the Chehalis River. Locality records include: Neah Bay, Quinault River (head of North Fork, 4,000 feet), Skokomish River, and Cedarville.

"A male was trapped in a pile of shakes lying in a small clearing surrounded by conifer forest on the banks of the Skokomish River at an elevation of 1,100 or 1,200 feet" (Dice, 1932, p.47).

TROWBRIDGE SHREW
Sorex trowbridgii trowbridgii Baird 1857

Identification.–Key, p.27.

Measurements.–Two adults, sex-unknown and female, from Elwha, 425 feet, collected by W. P. Taylor on July 22 and 23, 1921: length 122, 114; tail 54, 52; hind foot 14, 13.

Occurrence.–Common in forested lowlands around the peninsula. Jackson stated that this species "displays a marked preference for the drier woods... apparently more plentiful in log-strewn forests than in marshes and habitats favorable to certain other shrews" (1928, pp.4, 95). Cantwell reported that no specimens were taken in the high hills (MS, 1921).

General.–With regard to pelage, Jackson found that "two males from Neah Bay, Wash., have the molt barely started May 14 and 23." One collected at Lake Quinault on September 27 had the fall molt well advanced under the old fur (*op. cit.*, pp. 92-93).

Walter W. Dalquest trapped a female with 4 embryos near Shelton on April 23, 1937.

TROWBRIDGE SHREW
Sorex trowbridgii destructioni Scheffer and Dalquest 1942

Identification.–Key, p.27. Scheffer and Dalquest (1942) found that six characters of the body and skull of this island race were significantly larger than the corresponding characters of the mainland race, *S. t. trowbridgii*.

Measurements.–Thirty adults from Destruction Island, April 22-24, 1941; length 122.5 (117-127), tail 56.7 (53-60), hind foot 14.3 (13.5-15), weight in grams 7.5 (7-9).

Occurrence.–Found only on Destruction Island, a rainswept, brush-covered islet about 35 acres in area jutting from the ocean southwest of the mouth of the Hoh River. This shrew, and a shrew-mole, are the only mammals native to the island. In April, 1941, we set out approximately 100 mouse traps here, baited with a peanut butter and oatmeal mixture.

At the end of 48 hours we had obtained 30 shrews. Most of them were taken in runways in deep, rank grass at the border of salmonberry thickets.

Breeding habits.–A female weighing 9 grams, trapped on April 22, held 3 large fetuses, 14, 15, and 16 mm. in crown-rump length. A 7-gram female taken on the same day was nursing.

Food habits.–We have no information on the food of *S. t. destructioni*. Slugs, snails, insects and millipedes, and one salamander (*Plethodon vehiculum*), occur on the island.

WANDERING SHREW
Sorex vagrans vagrans Baird 1857

Identification.–Key, p.27.

Measurements. –Average of four adult males from Aberdeen: length 103.8 (102-105), tail 42.5 (42-44), hind foot 12 (12-12), according to Jackson (1928, p.104).

Occurrence.–Widespread in the lowland around the peninsula, usually in damp meadows, ranging to an elevation of at least 5,200 feet. *S. vagrans* is the smallest shrew on the peninsula and shares with the dusky shrew the distinction of being the commonest. Naturalists have found the wandering shrew on all sides of the peninsula, from the ocean beaches to elevations as high as Cat Creek, 4,500 feet, and "Olympic Mountains," 5,200 feet.

Remarks.–Jackson (*op. cit.*, p.103) has presented rather extensive data on the pelage molt of the wandering shrew in the Olympics.

DUSKY SHREW
Sorex obscurus setosus Elliot 1899

Identification.–Key, p.27.

Measurements.–Average of three adult males from Lake Quinault: length 125.3 (124-126), tail 59.7 (59-60), hind foot 13.7 (13-14) according to Jackson (1928, p.136). A female from Lapush, April 22, 1941: 125, 56, 14, weight in grams 9.

Occurrence.–Widespread and common over the peninsula, from the ocean to timberline, principally in mountain meadows. Specimens were taken by Taylor and Cantwell at elevations as high as 6,000 feet (Mount Angeles, July 8, 1921, "by log in dry place in alpine fir woods").

Cantwell stated: "This large brown shrew we found fairly common... both at low and high altitudes, but most abundant in the high meadows near timber line... in the swamps, along stream banks, and through the forest about old rotten logs... in fresh runways of moles and *Phenacomys* and in old workings of pocket gophers and mountain beavers. On two occasions I found dead shrews lying on the ground, showing bruises where they had been killed by some predatory animal or bird" (MS, 1921).

Of specimens collected by Gaige near Lake Cushman "one was taken in a wet thicket in the valley bottom; one in a root cellar; one at the edge of a pile of logs and brush in a cultivated field beside the river; and two along a brushy ditch running through a meadow" (Dice, 1932, p.47).

Near Lapush we took two dusky shrews beside the small reservoir that supplies the village, and a third along a rivulet in deep woods.

Breeding habits.– A 9-gram female from Lapush, April 22, 1945, held 6 fetuses 13 mm. in crown-rump length, estimated to be three-quarters grown.

MOUNTAIN WATER SHREW
Sorex palustris navigator Baird 1857

Identification.– Key, p.27.

Measurements.–Two males from Canyon Creek, 3 miles S of Soleduck River, 3,550 feet, taken by Taylor on August 21, 1921: length 139, 147; tail 72, 78; hind foot 19.5, 20.5. Two females taken by Taylor from the Hoh River 2 miles SE of Olympus Ranger Station, 2,100 feet, on September 1, 1921, and from Cat Creek, 4,500 feet, an September 6, 1921: 159, 150; 71, 77; 19, 20.

Occurrence.–Along cold, rushing streams in the mountains. Only a few specimens have been taken on the peninsula, these at elevations over 2,000 feet in the valleys of the Soleduck, Elwha, Hoh, and Quinault. Taylor and Cantwell took a specimen at 4,500 feet, on Cat Creek, September 6, 1921. Although it probably occurs there, the mountain water shrew has not been reported from the eastern slope of the Olympics. It was not taken by Gaige in the course of his trapping operations at Lake Cushman in 1919.

The Svihlas observed a mountain water shrew "swimming in an ice-fed pool at Sol Duc Park" (1933, p. 38).

"Walter P. Taylor in his field report for Cat Creek .....states that on the evening of September 5, 1921, he saw a *Sorex palustris navigator*, which he at first mistook for a frog, in a shallow 'running' creek. He noticed that it was walking rather jerkily through the water, at first in water not so deep but that it could touch the rocks beneath, but soon in water that must have been beyond its depth. It did not sink, but remained half exposed, 'walking' rapidly along on top of the water. The animal had a dry, fluffy appearance" (Jackson, 1928, p.9).

BENDIRE WATER SHREW
Sorex bendirii albiventer Merriam 1895

Identification.–Key, p.27. "A specimen of *S. b. albiventer* collected during the winter of 1890 at Shelton, Wash., shows an approach toward *S. b. bendirii* in color and has a skull slightly smaller than typical *albiventer*; and three skins from the same locality in April, 1918, show a slight tendency toward the subspecies *bendirii* in color. A single specimen from Duckabush, Wash., collected January 24, 1919, is as dark ventrally as most specimens of *S. b. bendirii* and is referred to *albiventer* purely on geographical grounds" (Jackson, 1928, p.199).

Measurements.–Average of 4 adult males from Neah Bay: length 166.3 (160-169), tail 72.3 (71-73), hind foot 19.8 (19-20) according to Jackson (*op. cit.*, p.199). An adult female from the Hoh River (575 feet) April 19, 1938: 150, 69, 19, weight in grams 16.0.

Occurrence.–Widespread over the peninsula in wet, shady places from sea level to the mountains, nowhere abundant. Taylor and Cantwell took specimens up to 3,500 feet, on Canyon Creek, August 20 and 24, 1921. This large, handsome shrew represents a race confined to the Olympics but intergrading with the race *bendirii* of the Puget Sound trough. Locality records include: Canyon Creek (3 Miles S of Soleduck River, 3,550 feet),

Duckabush, Hoh River (575 feet), Lake Cushman, Lapush, Neah Bay, Olympic Hot Springs, Potlatch, Lake Quinault, Shelton, and Soleduck Hot Springs (1,750 feet).

Breeding habits.–On the Hoh River, April 19, 1938, we trapped a female that had evidently just given birth; her uterus was enlarged and empty.

SHREW-MOLE
Neurotrichus gibbsii gibbsii (Baird) 1857

Identification.–Distinguished from shrews by having a bristle-haired tail constricted at its base, front feet heavy and spade-like; distinguished from other moles by much smaller size; larger than the race *minor* of the Olympic mainland (p.32).

Measurements.–Eight adults of both sexes from Destruction Island, Jefferson County, collected by Walter W. Dalquest and Victor B. Scheffer, April 22-24, 1941: length 118.4 (112-127), tail 39.1 (37-43), hind foot 16.6 (16-17), weight in grams 13.2 (11.0-14.5).

Occurrence.–This race of shrew-mole is found on Destruction Island and in the Cascade Range but is absent from the intervening Puget Sound trough. Destruction Island lies southwest of the mouth of the Hoh River and is separated from the mainland by 3.4 miles of open water.

Remarks.–During a visit to the island in April 1941 we set out approximately 100 mouse traps baited with a peanut butter and oatmeal mixture. At the end of 48 hours we had captured 8 shrew-moles, in addition to 2 taken by the lightkeeper's dog. The shrew-moles were taken in soft earth almost free from grass, in the dense shade of salmonberry bushes. Our specimens appeared to be in non-breeding condition. The lightkeeper later sent us a three-quarters grown shrew-mole caught by a cat on April 30, thus indicating that the breeding season may begin in April.

SHREW-MOLE
Neurotrichus gibbsii minor Dalquest and Burgner 1941

Identification.–See under *Neurotrichus g. gibbsii*.

Measurements.–Adult male collected at Neah Bay by R. T. Young on May 28, 1897, and adult female collected at Elwha River (mouth of Boulder Creek, 560 feet) by Cantwell on July 182 1921: length 119, 112; tail 38, 41; hind foot 16, 15.

Occurrence.–Lowlands around the peninsula in well shaded places, burrowing in damp humus and moving about under cover of fallen leaves, moss, and decaying branches; rarely seen but, in places, fairly numerous. Locality records include: Neah Bay, Elwha (mouth of Boulder Creek 560 feet), Grays Harbor County, and Lake Cushman.

General habits.–Dalquest and Orcutt (1942) have described in detail the habits of the shrew-mole in western Washington under natural conditions and in captivity. The shrew-mole is blind but is able to move swiftly through forest litter in its unceasing search for earthworms and insects. In captivity, one shrew-mole ate 1.4 times its own weight in 12 hours! The breeding season is said to extend from March to September, and 3 or 4 young are born in a litter.

Shrew-moles are seldom taken by naturalists, although a person who has learned where to find them and how to trap them can generally obtain specimens. They are of no

economic importance. One was found in the stomach of a raccoon trapped on Woodward's Bay, Thurston County, December 30, 1937.

TOWNSEND MOLE
Scapanus townsendii (Bachman) 1839

Identification.–Fig. 9. The Townsend mole and the coast mole (p.34) are similar in color and shape and are often found in the same meadow. The Townsend mole, however, is decidedly larger, and is distinguished by: total length greater than 200 mm.; skull length greater than 40 mm., and distinct sublachrymal-maxillary ridge on the skull.

Measurements.–A male from Lapush, April 25, 1941: length 206, tail 39, hind foot 27, weight in grams 114. A female from Forks collected by Ivan A. Peterson on September 2, 1937: 204, 48, 28.

Occurrence.–Common on the lowlands around the peninsula; upper limit of the range unknown; abundant in river valleys and pasture lands; penetrating the fringe of the forest and the sands of the ocean beach. Locality records include: Soleduck trail (below the hot springs), Elwha River (lower), Boulder Creek (mouth, 500 feet), Forks, Lapush, Lake Cushman, and Shelton.

Shaw mentioned "a maze of shallow surface tunnels of a colony of moles (*Scapanus*)" at Idaho Shelter, elevation about 4,500 feet, Hurricane Ridge (1944, p.265). These may have been the diggings of the Townsend mole or the coast mole; both species are known to range above 5,000 feet on Mount Rainier, in the Cascades.

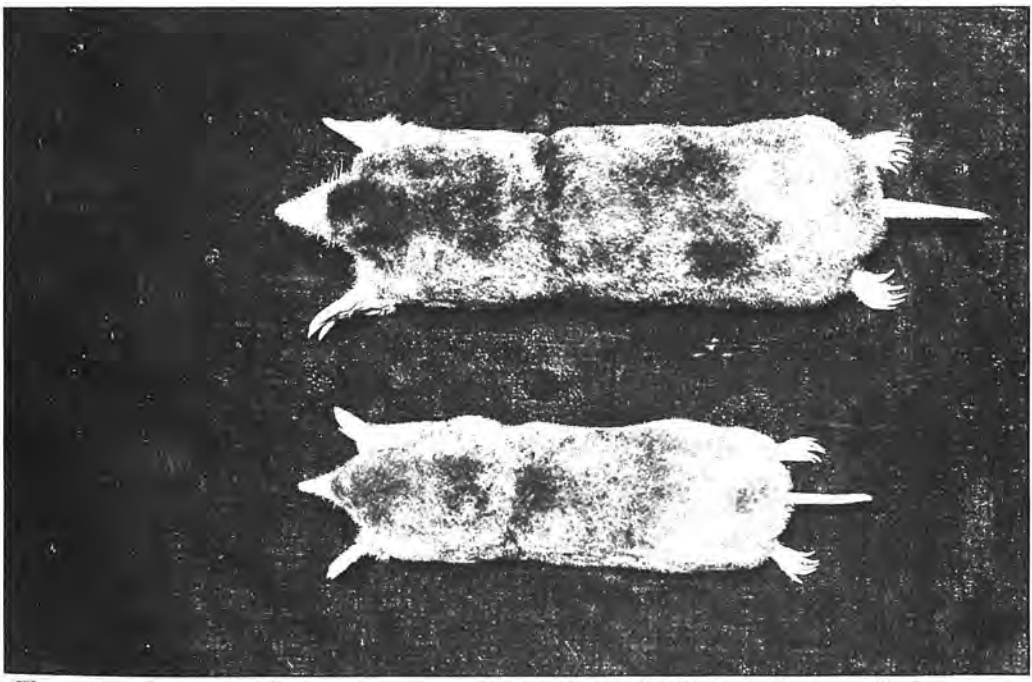

Figure 9. Townsend mole, *Scapanus townsendii* (above), length 8 inches and coast mole, *Scapanus o. orarius* (below), length 6.5 inches; freshly trapped specimens from Puyallup, Pierce County, May 1914 (Photo by T. H. Scheffer).

Moles are increasing on the peninsula as a result of the clearing of forested lands. Their increase is due less to immigration than to the rapid breeding of native stocks.

The mole is completely subterranean, and is probably the only Olympic mammal that can endure the effects of a prolonged forest fire. During the floods that periodically inundate certain pasture lands of the peninsula, moles gather on the higher knolls and throw up mounds of earth in profusion.

Except for an occasional one brought in to a farmhouse by a cat or dog, moles are seldom seen. In the public mind they are confused with animals of similar habits, the pocket gophers (see *Thomomys*, p.56).

Breeding habits.–According to T. H. Scheffer, the Townsend mole in the Puget Sound country usually has three young which are born in the latter half of March, in underground nests of grass and rootlets. They "spend the month of April in the nests. By the last of May they are so well grown that the ordinary observer would not be apt to distinguish them from the parent moles... By the time they leave the home nest and take to the runways for themselves they have already attained something like the proportions of adults" (1927, pp.6-7). The young are born blind and naked, in a single litter per year.

Food habits.–The food habits of the Townsend mole have been studied at a number of places along the humid west coast, although not on the Olympic Peninsula. There is general agreement that the mole has a ravenous appetite and at times may eat more than its own weight in a day. Its principal food is the earthworm, followed by various insects, centipedes, slugs, and the underground portions of plants. While its teeth are structurally those of a flesh-eater, the mole has been shown to consume plant roots, bulbs, and germinating seeds. Where garden plants are neatly arranged in rows and are readily accessible, the plants may be attacked by moles. In some cases of damage, however, it is found that the culprits are not moles but field mice and deer mice following in mole runways.

Economic status.–On waste lands, moles are beneficial in draining, aerating, and stirring the soil. On pasture lands they do no appreciable harm provided their mounds are leveled with a drag before they become sodded over. On city lawns and in gardens they are definitely a nuisance, but may be controlled by the use of traps. Poison baits and repellants have been used but are not, to the best of our knowledge, as effective as traps.

While the pelt of the mole is of mediocre quality and small size, it has a limited sale as a fur for trimming garments. Fur dealers will occasionally pay the farm boy 5 or 10 cents for a mole skin purchased along with skins of more desirable species. According to T. H. Scheffer (1927, p.13), the Townsend mole in western Washington molts in April and again in October-November, the molt at the latter season being more pronounced. At all seasons, however, the fur is marketable.

COAST MOLE
Scapanus orarius orarius True 1896

Identification.–Fig. 9. See under *Scapanus townsendii*, p.32.

Measurements.–Two females in the collection of the Olympic National Park, one taken at Port Angeles on November 26, 1935, and the other taken at Lake Crescent (Storm King Inn, elevation 600 feet) on July 23, 1940: length 153, 165; tail 30, 39; hind foot 20, 21.

Occurrence.–While few actual specimens of the coast mole have been taken here, the species quite certainly occurs up to timberline all around the peninsula. Locality records include: Neah Bay, Port Angeles, Port Townsend, Quillayute Prairie, Ozette Lake, Lapush, Chehalis [Grays Harbor] County, Elwha (425 feet), Tumwater Creek (head, 800 feet), and Duckabush. Cantwell wrote that "about 10% of the moles about Sequim are of this smaller species, and a single specimen was taken at Westport" (MS, 1921).

Habits.–The breeding and feeding habits of the coast mole are similar to those of the Townsend mole. Moore (1933, p.38) reported the contents of 8 stomachs of the coast mole as consisting of 70% earthworms, 29% insects and centipedes, and 1% vegetable matter.

KEY TO OLYMPIC BATS

Seven species of bats have been collected on the Olympic Peninsula and 4 others in the immediate vicinity. The little brown bats, or mouse-eared bats (genus *Myotis*), appear to be the only common ones although other kinds, now known from only one or two specimens, may actually occur in greater numbers than we realize.

Bats are difficult to identify and it is often necessary to clean the skull of a specimen before its identity can be established. Whenever a bat is captured it should, if possible, be sent to the nearest naturalist, high-school science teacher, or museum. Bats may be preserved alive in a cool place or dead in a refrigerator or a solution of 70% alcohol.

A1. Tail membrane furred above.....B
A2. Tail membrane naked above, or with scattered short hairs.....C
B1. Total length about 100 mm. (3.9 in.); hind foot about 10 mm. (0.3 in.); teeth 36; color dark chocolate brown to black, frosted above.....*Lasionycteris noctivagans*, p.40.
B2. Total length about 140 mm. (5.5 in.); hind foot about 16 mm. (0.6 in.); teeth 32; color silvery gray and brown.....*Lasiurus cinereus cinereus*, p.40.
C1. Ear long, about 35 mm. (1.3 in.) from notch, at least half the length of forearm; conspicuous rounded mass rising to a height of about 2.5 mm. (0.1 in.) on each side of snout between nostril and eye; teeth 36; color dull grayish brown.....*Corynorhinus rafinesquii townsendii*, p.40.
C2. Ear less than 35 mm. (1.3 in.) from notch, much less than half the length of forearm.....D
D1. Size large, total length over 105 mm. (4.1 in.); hind foot 11 mm. (0.4 in.) or more; ear short, barely reaching to nostril when laid forward; teeth 32; color uniform brown.....*Eptesicus fuscus bernardinus*, p.40.
D2. Size small, total length less than 100 mm. (3.9 in.); hind foot 12 mm. (0.4 in.) or less; ear extending to nostril or beyond when laid forward; teeth 38; color variegated brown (*Myotis*).....E
E1. Under-side of wing furred to level of elbow; ear short and rounded, barely reaching to nostril when laid forward; hind foot 7-9 mm. (0.27-0.35 in.); keel on outer edge of calcar; color dark reddish brown above, smoky below..... *Myotis volans longicrus*, p.38.
E2. Under side of wing not furred to level of elbow.....F
F1. Hind foot small, 5.4-8.0 mm. (0.21-0.31 in.); ear extending 1-3 mm. (0.04-0.11 in.) beyond nostrils when laid forward; calcar distinctly keeled, bases of hairs slaty, contrasting with brownish tips..... *Myotis californicus caurinus*, p.39.
F2. Hind foot large, 7.0-10.4 mm. (0.27-0.40 in.); calcar not distinctly keeled.....G
G1. Ear when laid forward extending noticeably (3-5 mm. or 0.11-0.19 in.) beyond tip of snout.....H
G2. Ear when laid forward barely reaching tip of snout.....I

H1. Free (posterior) edge of tail membrane with inconspicuous, scattered, stiff hairs; ears black..... *Myotis keenii keenii* p.37[1].

H2. Free edge of tail membrane with a noticeable fringe of stiff hairs, ears brownish..... *Myotis thysanodes*, p.38.

I1. Forearm 34-36 mm. (1.3-1.4 in.); greatest length of skull 12.4-14.0 mm. (0.4-0.5 in.); forehead rising abruptly; hairs of back dull..... *Myotis yumanensis saturatus*, p.37.

I2. Forearm 35.5-40.2 mm. (1.3-1.5 in.) ; greatest length of skull 14.0-15.8 mm. (0.5-0.6 in.); hairs of back with glossy, bronzy tips..... *Myotis lucifugus alascensis*, p.37.

[1] *Myotis evotis pacificus* Dalquest 1943, a species not yet reported from the Olympics but probably present, is similar to *keenii* but has longer ears, extending 5-7 mm. beyond the tip of the snout.

BIG MYOTIS
Myotis lucifugus alascensis Miller 1897

Identification.–Key, p.35.

Measurements.–A male collected near the Soleduck River, 4,000 feet, by Vernon Bailey on August 28, 1897: length 86, tail 40, hind foot 10, expanse 245.

Occurrence.–To our knowledge, Bailey's specimen is the only one from the Olympics.

YUMA MYOTIS
Myotis yumanensis saturatus Miller 1897

Identification.–Key, p.35.

Measurements.–Two males from Quinault Lake, 180 feet collected by Cantwell on September 24, 1921: length 80, 76; tail 38, 31; hind foot 9, 9. A female from Lake Cushman collected by C. P. Streator on June 30, 1894: 85, 34, 10.

Occurrence.–Neah Bay, Lake Quinault, Lake Cushman. "Fifteen were taken at Lake Cushman; some in rooms of a house at night; some in barns, and some under the shakes covering the roof of a barn. A single embryo was found in each of three females taken June 23rd" (Dice, 1932, p.47).

Elliot (1899, p.276) reported that "at our Boulder Lake camp, three or four bats were seen at dusk diving about in the air, and Mr. Akeley succeeded one evening in shooting two, only one of which he secured... . On the Elwah River, near a place called the Devil's Elbow, was a colony of bats inhabiting a large hole or small cave in the rock. Unfortunately we did not secure any of them."

Along the coast this bat is perhaps seen more often than any other species.

KEEN MYOTIS
Myotis keenii keenii (Merriam) 1895

Identification.–Key, p.35.

Measurements.–A male from Soleduck Hot Springs, 1,760 feet, collected by Cantwell on August 30, 1921: length 85, tail 44, hind foot 8.

Occurrence.–Soleduck Hot Springs and Lake Cushman. "A female was taken on the night of July 24th as it was flying about in a bedroom at Lake Cushman" (Dice, 1932, p.47). According to Dalquest (MS) *Myotis keenii* has been collected, in Washington, only on the Olympic Peninsula (1948, p. 151).

LONG-EARED MYOTIS
Myotis evotis pacificus Dalquest 1943

Identification.–Key, p.35.

Measurements.–None available from the Olympic Peninsula. According to Dalquest (1948, p.153) five specimens from the type locality in Clark County, southwestern Washington, average: length 85, tail 41, hind foot 7.4, ear 19.4 tragus 10; weight in grams, 5.5.

Occurrence.–Dalquest (*op. cit.*) includes all of western Washington in the range of *pacificus*. Naturalists should watch for this bat on the Olympic Peninsula.

FRINGE-TAILED MYOTIS
Myotis thysanodes Miller 1897

Identification.–Key, p.35.

Measurements.–A female from North Fork Guard Station (12 miles NE of Quinault P.O., about 500 feet) collected by John Morgenroth and prepared by H. C. Parker, July 4, 1940: length 75, tail 35, hind foot 6, ear 15, forearm 36, tragus 10.

Occurrence.–This specimen, from the Olympic Park museum, has been examined by Seth Benson and Walter W. Dalquest, who are reluctant to link it at the present time with any known race of *M. thysanodes*.

HAIRY-WINGED MYOTIS
Myotis volans longicrus (True) 1886

Identification.–Key, p.35.

Measurements.–A female from Mount Angeles, 6,000 feet, collected by Cantwell on July 6, 1921: length 93, tail 46, hind foot 9. A male from Port Townsend: length 90.6, tail 42.8, hind foot 8, ear 13, humerus 40 (Bailey, 1936, p.375).

Occurrence.–Mount Angeles, Lake Cushman, and Port Townsend. "One was secured July 29th from an old barn at Lake Cushman" (Dice, 1932, p.47).

With regard to the specimen listed under "*Measurements*," Cantwell stated: "A bat noted at 8:30 p.m. flying about clicking its jaws among the alpine firs on the top of the ridge. The bat flew rather low, usually some 10 to 15 feet up, and sallied in and out of the tree clumps, sometimes working within a clump for some moments" (MS, 1921).

CALIFORNIA MYOTIS
Myotis californicus caurinus Miller 1897

Identification.–Key, p.35; Fig. 10.

Measurements.–An adult (sex?) from the Soleduck River 3 miles E of Lapush, April 25, 1941: length 80, tail 41, hind foot 8, tragus 6, ear from base 14, weight in grams 4.0. Two males from Hoodsport collected by Cantwell on January 17 and 20, 1919: 75, 72; 30, 30; 7, 6.

Occurrence.–Lapush (3 miles E), Hoodsport, and Lake Cushman. "Three were taken in July at Lake Cushman, all being found in a big barn" (Dice, 1932, p.48). This bat is widely distributed in the lowlands of Washington.

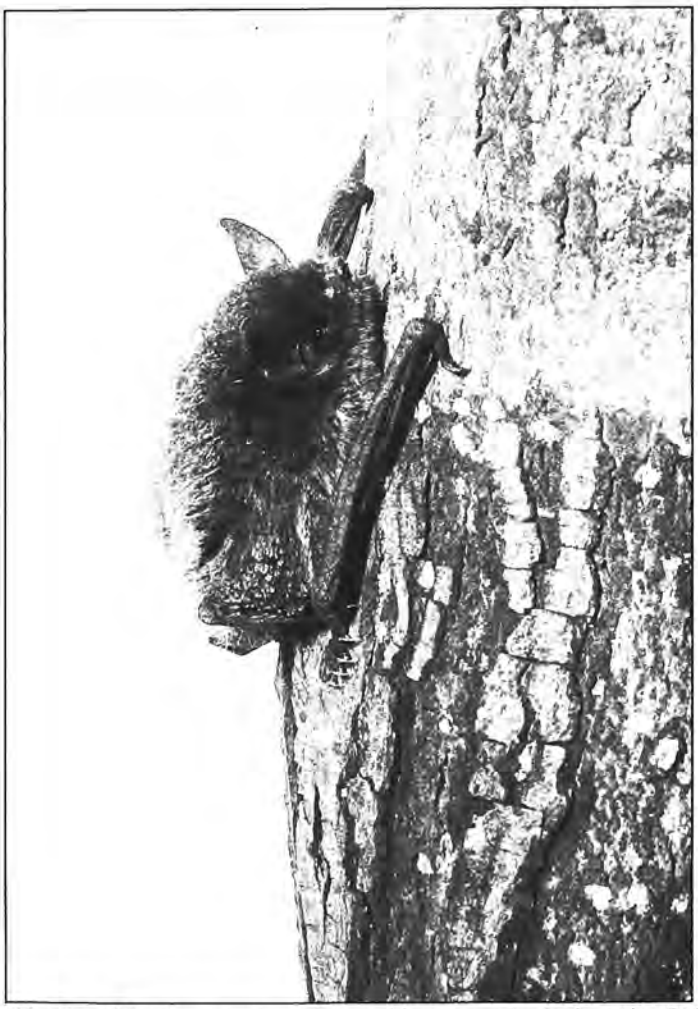

Figure 10. Bat *(Myotis californicus caurinus)* from a chimney crevice in the attic of Lincoln Ranger Station, Lake Cushman, Olympic National Park, October 3, 1949.

SILVER-HAIRED BAT
Lasionycteris noctivagans (Le Conte) 1831

Identification.–Key, p.35.

Measurements.–None from the Olympic Peninsula. According to Dalquest (1948, p.159) five males from San Juan County average: length 96.2, tail 46.4, hind foot 8.5, ear 16; tragus 7.2; weight in grams 8.2.

Occurrence.–Dalquest (*op. cit.*) indicates that the silver-haired bat is apt to be found anywhere in the forested areas of Washington, from about the middle of May to the middle of September. Naturalists should look for it on the Olympic Peninsula.

BIG BROWN BAT
Eptesicus fuscus bernardinus Rhoads 1901

Identification.–Key, p.35.

Measurements.–Collected in the Old Capitol, Olympia, by Leo K. Couch, December 4-20, 1928: two males; length 107, 104; tail 43, 35; hind foot 11, 13; two females: 115, 112; 37, 49; 13, 13.

Occurrence.–The big brown bat has not been taken on the peninsula proper. Engels (1936) examined 22 specimens from Olympia, Washington, and 3 from Victoria, B.C.

HOARY BAT
Lasiurus cinereus cinereus (Beauvois) 1796

Identification.–Key, p.35.

Measurements.–None available from the peninsula proper. An adult (sex?) from Tokeland, Pacific County, collected by M. E. Kindred, September 7, 1935, and a male from Puyallup, Pierce County, collected by Ford Dicks, September 27, 1933: length 136, 126; tail 59, 54; hind foot –, 9; forearm 54, –; wing spread –, 330.

Occurrence.–A specimen was taken at Westport, August 23, 1935, close to the peninsula proper (Brown, 1935). Since hoary bats are known to migrate, they probably occur along the Olympic coast in the fall, headed south. A Makah native of Neah Bay recognized a specimen of the hoary bat shown him by Gunther (1936, p.114).

LONG-EARED BAT
Corynorhinus rafinesquii townsendii (Cooper) 1837

Identification.–Key, p.35.

Measurements.–Two males from Lake Cushman collected by F. M. Gaige on July 14 and August 2, 1919: length 98, 107; tail 41, 46; hind foot 9, 10.5; ear –, 36 (E. J. Hooper, MS). A female from Olympia collected by Leo K. Couch on August 12, 1924: 112, 46, 9.

Occurrence.–"Two males were secured July 14th and August 2nd, in the attic of a house at Lake Cushman" (Dice, 1932, p.48).

SNOWSHOE RABBIT
Lepus americanus washingtonii Baird 1855

Identification.–Fig. 11.

Measurements.–A male from Deer Park, 5,300 feet, April 22, 1938: length 408, tail 40, hind foot 125, weight in pounds 2-1/4. Two females from the lowland of Clallam County, February 17 and 18, 1946: 423, 446; 22, 30; 118, 116; ear from notch 76, –; weight in pounds 2-1/3, 3.

Occurrence.–From sea level to timberline (6,000 feet), fluctuating greatly in numbers from year to year. Rabbits are most abundant in open country dotted with brush, that is, in second-growth forests and in dwarf alpine forests near timberline.

Floyd Thornton told us that rabbits were common around Forks in 1924, scarce in 1930-31, and fairly common in 1938. We found them common in spruce plantings on the Soleduck Burn in 1938. W. B. Augustine described them as common in the Olympic Park in 1944, but not as abundant as of several years previous (MS). A population cycle of about 6 years is suggested by these notes.

Rangers estimated that there were 10,000 rabbits on the Olympic Forest in 1918-1919, 2,000 in 1938, and 8,700 in 1940-1941. Such figures are of course approximate and serve mainly to indicate that rabbits are not scarce.

Snowshoe rabbits are active throughout the winter. On November 19, 1945, we examined the crushed body of an adult female on the highway near Sekiu. On December 6, 1938, we took one in a mink trap on the Soleduck River near Forks. After snowplows had cleared a path to Deer Park we observed, on April 22, 1938, many fresh scats of rabbits on bare spots of ground under alpine firs. On April 10, 1941, we drove along western Olympic roads for perhaps 100 miles and saw no rabbits, while on June 4-5 of the same year, on the same roads, we counted 3 dead and 3 live ones.

Breeding habits.–Couch collected a female snowshoe rabbit with 2 embryos, on the Soleduck River, May 14, 1925 (1932, p.25).

On the road between Forks and Neah Bay, June 4-5, 1941, we saw three dead rabbits, of which one was one-third grown, one was subadult, and one was adult.

Cantwell noted that a female taken at Ozette Lake on June 15, 1921, was nursing (MS).

Taylor took a young rabbit, length 264 mm., at Lake Sutherland, 500 feet, on June 28, 1921 (MS).

Dice found that near Olympia the snowshoe rabbit has at least two litters of young a year. "A female taken July 26 (1922)... contained four very small embryos, and her mammae were filled with milk; another taken the same day contained three small embryos; while a third taken July 29 contained five embryos. Of this last set of embryos three were large and covered with hair, being nearly ready for birth; one was medium in size; and the other was very small and undeveloped. A juvenile hare, weighing 553 grams [1.22 pounds] was taken July 28" (1926, p.7).

Taylor took "a female with 4 large embryos 60 mm. long, just about ready to be born", at the head of the Dosewallips River, 4,500 feet, on July 30, 1921.

Food habits.–Travelers on the Olympic loop highway in early morning often see rabbits feeding beside the road on clover, grasses, and weeds.

The fondness of rabbits for the tender tips or "leaders" of young evergreens creates an important, and as yet unsolved, problem to foresters who are attempting to replant the extensive burned and logged areas of the peninsula. According to Moore:

Figure 11. Snowshoe rabbit, *Lepus americanus washingtonii*, resting on ground after removal from snare; female, weight 2-1/4 pounds; 3 miles W of Sequim, February 17, 1946.

"In the Douglas fir region, rabbits retard to a greater extent than any other animal the growth of young trees by cropping... . [In January 1932] it was estimated that up to 95 percent of the planted Douglas fir seedlings were being cut off and eaten by the Washington varying hare, or snowshoe rabbit... . Some of the planted trees were larger than a lead pencil in diameter and up to 18 inches high. On test areas 38 per cent of the trees were cropped by this rabbit within a month and 94.4 per cent within a year, and of the injured trees, 35 per cent were heavily, and usually fatally cropped. Attack appeared to be heaviest immediately following planting and continued into early summer. When the tree survived, its bushy growth seemed to be more attractive to the rabbits and the pruning was continued from year to year... .

"Primarily the brush rabbit [cottontail] and varying hare are browsers. Succulents, such as clovers, apparently are not eaten, although a red huckleberry bush or a young Douglas fir growing near them may be trimmed severely... .

"Although natural conifer reproduction may be cropped only lightly or to a moderate degree by rabbits, planted stock is attacked immediately after planting, even in areas that have a light sprinkling of naturally seeded trees. As the individual rabbit ranges over only a few acres, it would appear that the attacks are caused by the introduction of something new in the region. With one exception, these croppings were found at elevations under 2,000 feet" (1940, pp.18-21).

On the Olympic Peninsula, rabbit damage has been especially severe on Douglas fir on the Soleduck and Snow Creek burns.

Mortality.–We give on page 81 two observations of rabbits pursued by weasels. The heavy predation upon rabbits by the bobcat, cougar, and coyote will be discussed under those species. The bobcat, especially, takes a high toll of rabbits on the peninsula.

We collected small, lead-gray ticks, *Ixodes spinipalgis* (identified by R. A. Cooley and Glen M. Kohls) from a rabbit killed near Sekiu on November 19, 1945, and from

another killed at Sequim on February 17, 1946. Cantwell wrote that of two adults (male and female) taken at Westport in February, 1921, one had 14 ticks and the other had 6 (MS).

General.–The race *washingtonii* is almost, but not quite, alone among the snowshoe rabbits of North America in retaining its brown coat in winter. It shows little variation in western Washington and, according to Nelson, "an immature specimen taken at 3,500 feet altitude on the west slope of Mount Rainier is indistinguishable from one of the same age from the coast of Neah Bay" (1909, p.106).

MOUNTAIN-BEAVER
Aplodontia rufa rufa (Rafinesque) 1817

Identification.–Fig. 12.

Measurements.–An adult male from Forks, November 18, 1938: length 350, tail 37, hind foot 55, weight in grams 1,382, (pounds, 3.04).

Occurrence.–Mountain-beavers are widely distributed on the peninsula from sea level nearly to timberline, except in deep forest. They appear to be absent from the northwest tip of the peninsula and from the lower Hoh Valley. Taylor recorded specimens from elevations up to 4,500 feet, near the head of the Soleduck River (1918, p.461).

Cantwell found them in 1921 "all along the trail south of Clallam to where it crossed the Hoko River, but all signs of the animal ceased on the west bank of the stream... . It is not to be found at Royal or Ozette Lake, and old settlers say it has never been known there" (MS). We were told in 1944 by a Makah that the mountain-beaver had not yet crossed the Hoko into the Neah Bay country. Surely a stream of the size of the Hoko is no barrier to the water-loving mountain-beaver. The reason for its absence to the westward is a mystery.

Mountain-beavers "may be found in almost any wooded situation where the soil will permit fairly easy burrowing (Fig. 13). They are more numerous, though, on the slopes of the ridges and foothills and along the sides of the many gulches, large and small, that cut through the bench lands. Here amid tree trunks and dense tangled undergrowth they find shelter and concealment. In these situations food is abundant almost anywhere the year around, and water, if needed, may be reached by short excursions. Though not aquatic in any sense, the mountain beaver is usually found not far from running water. The animal continues to make use of its burrows even when they are partly flooded, and will pad along in shallow streams when it could apparently just as well as follow the shore... .

"The deep forest does not harbor nearly so many mountain-beavers on a given area as do old burns and cut-over lands, where more food is afforded by second-growth trees and herbaceous vegetation and where more retreats are made available by the debris of the former forest. If there has really been a considerable increase in the numbers of the animal in recent years, as older settlers claim, it has been due to these more favoring food and shelter conditions, as well as to the destruction of its natural enemies by man" (T. H. Scheffer, 1929, p.3).

Breeding habits.–T. H. Scheffer made the following notes on the breeding condition of female mountain-beavers trapped at Port Angeles in 1916 (MS):

March 1-3:	6 specimens, none pregnant.
April 3-7:	13 specimens, of which 6 were pregnant; number of fetuses 3, 3, 3, 2, 2, 2; diameter of fetuses 16-55 mm.
April 23-29:	23 specimens, of which 12 were recently delivered and the others were yearlings, not pregnant.

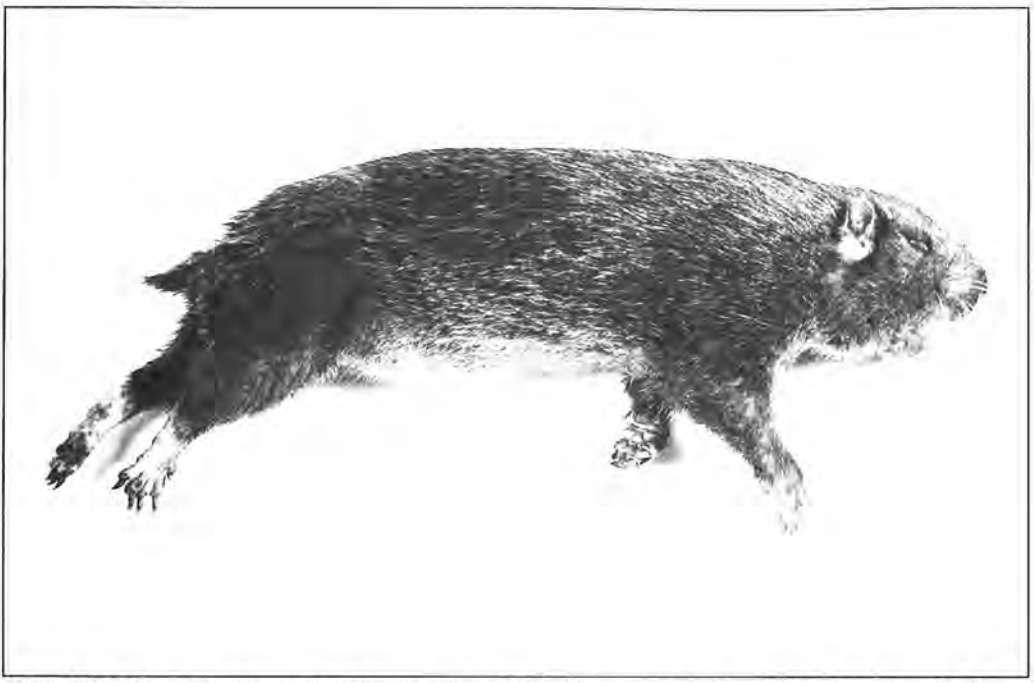

Figure 12. Mountain-beaver, *Aplodontia rufa rufa*, freshly trapped male weighing 2-1/3 pounds, from Puyallup, Pierce County, March 2, 1939.

Figure 13. Mountain-beaver tunnels in hillside near Port Angeles; April, 1916 (Photo by T. H. Scheffer).

From these and other data Scheffer concluded that mating takes place between the 10th and 20th of March, that the period of gestation is about a month, and that the young are born between the 15th and the 20th of April.

Writing at a later date (1929, pp.14-15) Scheffer stated "In 16 records of pregnancy or litters of young, there were 7 cases of twins and 9 of triplets." No other number of young was noted at any time. It seems remarkable that an increase of only 2 or 3 young a year is sufficient to maintain the mountain-beaver as a species in view of the fact that it is so feebly protected from its enemies. The blind and scantily-haired young are born in a nest of dried stems and leaves in a dry burrow sheltered by a log or tree trunk. There are 6 mammae.

Food habits.–Mountain-beavers eat a wide variety of plants. "Herbaceous plants are eaten, stem, leaves, and all; while woody plant structures are discarded after the bark has been peeled off for food. Rejected material consisting of these peeled sticks, together with spoiled food supplies and other refuse, may commonly be noted about the openings from mountain-beaver burrows. The refuse affords evidence that the animals habitually cut and store away more food than they can eat before it spoils... .

"When winter snows lie deep in the lower Cascades and the Olympics, the mountain beavers resort to feeding on the bark of saplings and even of large trees, both beneath the snow covering and above the crust. This will explain the condition of tree trunks that, at the base, appear bare and tooth scarred when the snows have melted away. It will also account for the girdling of second-growth evergreens at a height, sometimes, of 3 feet or more from the ground. Tall, slender saplings that have been weighted down to earth by wet snow, when freed of this incubus, appear as bare poles... .

"The season when herbaceous food is abundant is also the time when the mountain-beaver feeds largely on the cuttings of deciduous trees and shrubs, showing thus that it prefers this class of food. At this season an examination of the green food supplies cached at burrow entrances reveals little or no evergreen material. On the other hand, winter supplies consist almost wholly of evergreens: salal (*Gaultheria shallon*), Oregon grape (*Berberis nervosa*), ferns, cedar, fir, and hemlock. The neglect of deciduous trees and shrubs when not in foliage would seem to indicate a preference for the leaves rather than the bark... .

"Very commonly little piles of mixed herbs and grasses cut by mountain beavers may be noted in summer lying in exposed places to dry and cure in the sun. This circumstance has given rise to a belief that the little animal is 'making hay' to store in its underground 'mows' for future consumption. As there is little really dry material to be had at any season of the year in the mountain beaver's environment, it is more probable that the 'hay' is to be used for bedding" (T. H. Scheffer, 19291 pp.7-9).

Economic status.–The mountain-beaver is an important food of the bobcat and coyote on the peninsula and thus serves, in a great measure, to turn the attention of these carnivores from small-game and furbearers of value. *Aplodontia* remains were found in 7 out of 18 bobcat stomachs collected by the writer between November 15 and January 15, 1939 (analyses by C. C. Sperry). No *Aplodontia* remains were found in 7 bobcat stomachs collected by John E. Schwartz in January and February, 1936 (analyses by C. S. Williams). Remains of one *Aplodontia* (May 22) were found in 22 bobcat scats collected by Schwartz in, January, February, April, May, and November, 1936-1938 (analyses by C. C. Sperry).

Sperry has reported that, in more than 8,000 coyote stomachs from the United States, only 11 contained *Aplodontia*. All 11 were taken in the State of Washington and of these, only one contained other food. "Furthermore, 7 of the 10 coyotes that had fed exclusively on mountain-beavers were among the 14 taken in Grays Harbor and Mason Counties, and 1 of these, trapped in June, had eaten 3" (1921, p.26).

It is generally known that the mountain-beaver, in certain situations, delays reforestation through its attacks upon young trees. Injury is most pronounced when attempts

are made by the forester to plant seedlings on cut-over lands that have grown up partially into brush and have developed a high population of mountain-beavers.

Couch reported that "mountain beavers... have increased in certain forest localities to a point where they are a serious factor in tree growth. On the Sol Duc Burn, in the Olympic National Forest, these animals climb the young trees, trim the branches and cut off the terminal shoots. These small trees were planted a few years ago. The Burn is more than five thousand acres in extent, and is in a section where surrounding forests run heavy to spruce, fir, and hemlock. In other sections of the Olympic Peninsula there is photographic evidence that saplings have been stripped of branches to a height of fourteen feet. During the winter months the mountain beavers girdle trees as large as a foot in diameter" (1925, p.39).

In the opinion of A. W. Moore "the animal's actual status in relation to the forest is questionable. Its pruning of forest plantations brings disfavor of the planter. In dense forests, however, its browsing maintains openings in which deer food flourishes... and fawn tracks are numerous. Mountain-beaver and rabbit croppings are almost identical in appearance, but the beaver climbs, delimbs, and tops small saplings. Both animals have been trapped in mountain-beaver runways" (1940, p. 23).

Poisons and repellants applied to seedlings have thus far been unsatisfactory. The suggestion has been made that artificial reforestation should be attempted as soon as possible after logging operations have ceased, or after a fire, while the rodent populations are still low.

Many of the farms of the Olympic Peninsula are still surrounded by the wilderness from which they were carved. Here mountain-beavers, leaving their forest retreats at night, cause damage to truck crops, orchard trees, and ornamental shrubs. Unless the surrounding reservoir of animals is large, it is relatively easy to control the mountain-beavers by placing box traps in their runways at the boundaries of the farm.

General.–Preston P. Macy described an albino mountain-beaver which was brought to the Olympic Park headquarters in the summer of 1939. It was killed by a dog owned by J. Kiehl, of Port Angeles, on August 17, and was said to be "pure white with gray eyes; length was 8 inches from tip of nose to end of tail" (MS). Mr. Kiehl had never seen an albino mountain-beaver before.

Cantwell trapped 13 mountain-beavers at Shelton, April 14-20, 1918, and found that 12 of them were so "mangy" as to be unfit for preservation as specimens (MS). This pelage condition, whatever it may be, is widespread in western Washington mountain-beavers.

OLYMPIC MARMOT
Marmota olympus (Merriam) 1898

Identification.–Fig. 14.

Measurements.–"Adult male [3 specimens]: Total length 720-750 (average, 740); tail vertebrae 210-237 (219); hind foot 100-110 (106). Adult female [2 specimens]: 670-690 (680); 180-192 (186); 91-100 (95.5)" (according to A. H. Howell, 1915, p.70).

"..... Some specimens weighing as much as twenty-five pounds" (Elliot, 1899, pp.248-249). Probably a guess, and exaggerated.

Occurrence.–"Upper slopes of the Olympic Mountains... above timberline (from about 4,000 feet altitude to near summits of peaks)" (Howell, *op. cit.*, p.69). Specific locality records include: Happy Lake, Mount Ellinor, Mount Steele, head of Soleduck River, Mount Angeles (head of Little River, 5,000 feet), Cat Creek (4,500 feet), Elwha Basin (2,750 feet), and Quinault River (N. Fork, 4,000 feet). Marmots have been reported from other places, some near sea level, in recent years (see below). Forest rangers estimated that there were 2,000 marmots on the Olympic Forest in 1918.

Forest Supervisor H. L. Plumb wrote in 1933 "we would recommend that the season be closed on whistlers, or marmots... .These animals have little food or fur value. Their bodies are seldom recovered when shot, as they usually fall or dive into their burrows from which they can not be retrieved... .These animals add much to the enjoyment of hikers and campers. In places such as Marmot Pass, they have been all but exterminated" (MS).

The State Game Department has for a number years, at least since 1937, offered protection to the "whistling marmots" (*M. caligata* and *M. olympus*) as distinguished from the yellow bellied marmot (*M. flaviventris*) of eastern Washington. Since the range of the Olympic marmot lies almost wholly within the National Park, the species is further protected by the no-hunting policy of the Park Service.

According to Park Service records, a marmot was seen in 1941 near Sequim Bay at an elevation of about 100 feet and a distance of only one-quarter of a mile from salt water. In early May, 1942, three different marmots described as "poor bedraggled specimens" were seen by Harry S. Brooks around Lake Crescent (579 feet), and Brooks remembered seeing a marmot years before on the Fischer ranch, Hoh River [300-400 feet]. In 1943, Marion P. Harthill saw one on Lake Mills near the mouth of Boulder Creek [610 feet].

General habits.–In a charming booklet published for his friends, E. A. Kitchin has presented certain observations of the marmot in the northern Olympics (1942). He finds that the animal appears fitfully on the snowfields in May but is not active for another month. "In the spring when the animals first come out, many are in a very dirty and bedraggled condition. This might almost be expected as in many of their holes the receding snow melts and the water runs down their tunnel. They make it livable by dragging out the old grass bedding and gathering fresh dead grass from the meadows to make it a drier den. Females with young look the worse... . As summer advances and new pelage grows, the marmots become cleaner; in fact some of the old males look strikingly handsome, the yellow almost turning to gold in the strong afternoon sun. In August comes a sudden change. In little more than a week a heavy dark gray, almost black, mantle appears over the back and sides. The rump and tail are a bright clean yellowish tan, the hair on the tail straight, not curly... . In early June the old males are distinguished by their larger size. Females with young were scarce, perhaps in about the same ratio as the old males. I doubt whether one in six was either an old male or a breeding female... . From observations of numerous families the number of little ones ran from two to five. The young could be seen at play near the entrance hole from July on, when they appeared about half grown.

Figure 14. Marmot in Glacier Meadow, Olympic National Park, September 6, 1940 (Photo by Floyd L. Dickinson).

"Marmots have regular registering posts something after the manner of dogs or wolves. Across the meadow below us is a scattered line of old telephone poles long since out of use. Marmots visit these posts regularly and after carefully circling a post, smelling for information as it were, will also register by biting lightly with their long front chisel-like teeth... .

"The marmot's vegetable diet consists of all kinds of small plants and flowers that spring up after the receding snow. The marmots, like the rabbits, seem to prefer the tender shoots of plants just showing above the ground. There were two plants that seemed more than attractive and on which they fed as long as the flower lasted [*Claytonia diffusa* and *Polygonum bistortoides*]... .

"I did not learn much regarding the marmot's predatory foes. During the whole season in the high country, I did not find any sign of an animal having been killed... . One day, however, while our friend White Spot was in the meadow feeding, an eagle swooped down and lit about ten feet away. Big and strong it looked, with its strong talons held straight as broomsticks and body held at right angles. No doubt it could have made short work of White Spot, but the marmot quickly and fearlessly faced his foe and with mouth wide open defied him with a snarl. After moments of tenseness, the bird took to the air... ."

[In August, a horde of small grasshoppers appeared in the alpine meadows and speedily consumed every living plant except the trees. Marmots, rabbits, and deer moved to lower elevations where food was available. Only three marmots remained in the vicinity of Mr. Kitchin's cabin].

"All through September we waited and watched for the marmot's return. The weather was warm and bright. We made trips up and down the ridges and into the higher valleys, but our records consisted of two marmots seen, outside of White Spot, who had remained faithful to us and had not left our meadows... . Toward the end White Spot gave up eating entirely. He left his summer den and moved into another nearer us. Here he

would spend an hour in the morning lying in the sun, taking no food of any kind. On September twenty-sixth, he made his last appearance; after that he never came out, asleep for the winter... ."

As regards the appearance and disappearance of the marmot, we note that Vernon Bailey saw a big one on the upper Elwha as early as April 31, 1918, while W. P. Taylor saw several and collected one as late as September 5, 1921, on Cat Creek, 4,500 feet (MS). Lois Crisler, living at Hurricane Lookout, 6,000 feet, stated (1946) that the marmots "dehibernated" on the morning of May 8.

Cantwell found that the animals which he "collected in July and through August into the first week in September were all in a very similar stage of moult. The old, long hair is quite yellowish, while the new short hair beneath is quite black with a tinge of rich rufous in spots along the lower legs. Apparently the animal is in full new fur only during the winter and early spring–a period when they are in hibernation and out of sight of pursuing naturalists" (MS, 1921).

KEY TO OLYMPIC SQUIRRELS AND CHIPMUNKS

A1. Back distinctly marked with 9 stripes (chipmunks).....B
A2. Back not striped (squirrels).....D

B1. Size larger; total length over 335 mm. (13.1 in.); length of skull 37 mm. (1.4 in.) or over (Townsend chipmunks).....C
B2. Size smaller; total length under 325 mm. (12.7 in.); length of skull under 37 mm. (1.4 in.).....*Eutamias amoenus caurinus*, p.52.

C1. Middle pair of light stripes tawny or light olive; range on lowlands.....*Eutanias t. townsendii*, p.53.
C2. Middle pair of light stripes distinctly whitish; range in mountains.....*Eutamias t. cooperi*, p.54.

D1. With wide fold of skin on each side of body between fore and hind limbs; general color grayish.....*Glaucomys sabrinus oregonensis*, p.55.
D 2. Without lateral skin fold; general color brownish or reddish.....*Tamiasciurus d. douglasii*, p.50.

DOUGLAS SQUIRREL
Tamiasciurus douglasii douglasii (Bachman) 1838

Identification.–Fig. 15; key, p.49.

Measurements.–A male from Copalis, April 2, 1940 and another from Elk Creek, Forks, December 9, 1945: length 300, 319; tail 117, 116; hind foot 49, 46; ear from base 25, –; ear from notch –, 29; weight in grams 196, –. Two females from Duckabush collected by Cantwell on January 27, 1919: 308, 320; 120, 125; 48, 50.

Occurrence.–Common in forests from salt water nearly to timberline. Taylor took specimens from as high as Mount Angeles, head of Little River, 5,000 feet, July 5, 1921. Gaige found them "common in the conifer forest near Lake Cushman up to an elevation of about 2,500 feet, above which... rare" (Dice, 1932, p.48).

Douglas squirrels are often active in midwinter, especially on sunny days. On November 17, 1938, near Forks, we collected two squirrels. On December 16, 1938, on the upper Calawah River we saw or heard at least four. Several of them were cutting spruce cones and letting them drop to the ground. The weather had remained below freezing for three days.

Breeding habits.–A male taken at Copalis on April 2, 1940, had swollen testes 9 x 17 mm. In the western Olympics from April 28 to May 8, 1918, Vernon Bailey observed that the squirrels were quiet, and he concluded that the young were not yet out of the nests

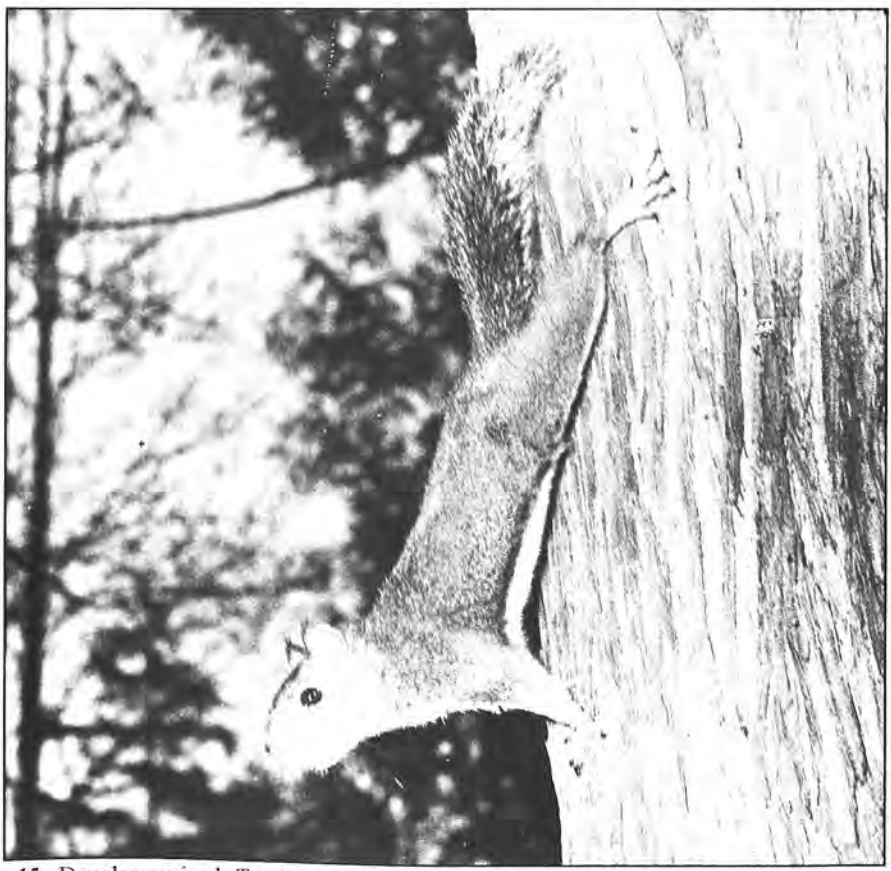

Figure 15. Douglas squirrel, *Tamiasciurus d. douglasii*, from Mt. Rainier; tamed by Ellsworth Lumley; photographed in Seattle on March 3, 1946.

(MS). A female taken by Cantwell at Cedarville, Grays Harbor County, on November 16, 1918, had 6 embryos 1/2 inch long. In a male taken at Elk Creek, Forks, on December 9, 1945, the testes were descended and large, 10 x 23 mm. These meager notes throw little light on the breeding habits of the Douglas squirrel. Some naturalist living in good "squirrel country" should collect a series of specimens in all months of the year.

Food habits.–"Squirrels play a spectacular, though relatively insignificant role in conifer reforestation through their habit of dropping cones from which they later extract the seeds. Disdaining to wait for individual seeds to fall to the ground, squirrels harvest the cones as they near ripeness by nipping and twisting them loose from the tips of branches. At times cones may nearly cover the ground under a tree in which a family of squirrels is working. The squirrels may eat the seeds from some of the cones while still in the tree, or they may pick up cones from the ground and carry them to vantage spots on nearby logs to extract and consume the seeds, but they cache by far the greater number of cones in some cavity" (Moore, 1940, p.11).

According to a story in the *Seattle Times* (December 29, 1946) Mrs. Cliff Rice has capitalized on the industry of the Douglas squirrel to build a unique and profitable business for herself. As manager of the Reed Seed Company, located ten miles north of Satsop, she buys cones of the spruce and the Douglas and balsam firs from collectors who rob the food caches of squirrels. In 1946 she was paying from $1.50 to $7.00 a sack, depending on the species and quality of the cones. The business grossed about $35,000 in that year. The average cache is said to contain about eight sacks of cones, with some holding as many as fifteen, and is located in a hollow tree or in a hole around the roots of a tree. Mrs. Reed is quoted as saying that "at higher elevations the caches are largest and sometimes will be completely restored by one squirrel in two weeks."

General.–The Douglas squirrel is legally classed as a predator in the state of Washington, while the gray squirrel, *Sciurus g. griseus*, is regarded as a game species. Neither classification applies to squirrels in the National Park, of course. The gray squirrel has not been reported from the peninsula although it occurs in the oak groves south of here. Jack Musgrove, resident of Grays Harbor County for more than 50 years, told of seeing gray squirrels near Oakville, 15 miles south of Elma, on both sides of the Chehalis River. The agricultural agents of Mason and Grays Harbor counties said in 1945 that gray squirrels had not, to the best of their knowledge, invaded the peninsula proper.

MOUNTAIN CHIPMUNK
Eutamias amoenus caurinus Merriam 1898

Identification.–Key p.49.

Measurements.–Type specimen, adult male from timberline near head of Soleduck River, August 27, 1897: length 210, tail 85, hind foot 34 (Merriam, 1898, p.353). Female from 3 miles S of Canyon Creek, collected by W. P. Taylor on August 20, 1921: 215, 97, 34. A nursing female from Hurricane Ridge, 6,450 feet, July 12, 1942, weighed 64 grams (Shaw, 1944, p.282).

Occurrence.–On alpine meadows and among low, scattered trees and rock piles in the mountains. Taylor's specimen taken at elevation 3,550 feet was probably near the lower limit of the range and Shaw's specimen taken at 6,450 near the upper. *Eutamias caurinus* is a resident of the Hudsonian, and sunnier parts of the Canadian, life-zones on Mount Rainier and the Olympic Mountains. It is found nowhere else.

While Elliot (1899, p.248) stated that "it could not be called abundant anywhere" he nevertheless collected 50 specimens at one place, Happy Lake, 3,600 feet. Cantwell, in 1921, "seldom saw more than a pair during a day's hunting and none were noted any distance in the heavier timber" (MS).

A. H. Howell listed the following Olympic localities where *caurinus* had been obtained: Canyon Creek, Clallam County (3,550 feet); Dosewallips River near its head; Mount Angeles (6,000 feet); Mount Carrie, Clallam County (6,000 feet); Boulder Lake; Happy Lake; head of Soleduck River (1929, p.77).

Lois Crisler noted (1946) that "one morning in March the chipmunks dehibernated. They raced around the lookout and shoved each other off the branches of the low alpine scrub" [Hurricane Ridge, 6,000 feet].

We saw several mountain chipmunks running over the snow at Deer Park, 5,300 feet, on April 22, 1938.

Breeding habits.–William T. Shaw (1944) found the nest of a mountain chipmunk at an elevation of 6,450 feet on Hurricane Ridge, July 12, 1942. The site was an open, gently sloping meadow covered with grasses and flowers and surrounded by alpine firs. From an open entrance a tunnel led slightly more then 4 feet to a nest cavity just beneath the sod. The cavity was roundish, 7 x 7-1/2 inches, and snugly filled with nest material. The bedding consisted of recently gathered dry, dead vegetation, largely the sedge *Carex spectabilis*. "Here and there in the nest were scattered a few contour feathers of the sooty grouse (*Dendragapus*) from which had been nipped the tiny plume-like aftershafts, which, when thus liberated, were soft and downy. Furthermore, as if to make the coarser contour feathers still more soft and pliant they had been nipped into two or three shorter pieces. This casual grouse feather donation added to the material makeup of the nest seemed not especially to be employed in the lining, but was scattered throughout. The texture of the nest was of a nature to produce warmth and dryness, for Obstruction Point might, at any moment, be fogblown. Its lining was thick and soft and made of finely shredded sedge blades. As one worked toward the exterior the material became coarser and on the upper side was arched over by a roof-like wall, a good inch and a half in thickness, of rather coarse unshredded blades, continuing down over the sides. As with other small mammals of like habit, the saucer or the nest cavity was matted with a dust mulch, a precaution used against dampness. The bedding itself weighed 124 grams" (p.275).

Seven young, judged to be 16-18 days old, were found in the nest. Although their eyes were still closed the little animals were well formed and patterned like the adult. Their mean weight was 10.6 grams.

TOWNSEND CHIPMUNK
Eutamias townsendii townsendii (Bachman) 1839

Identification.–Key p.49. This subspecies intermingles and interbreeds with the paler race *cooperi* of the higher forested slopes and some specimens can as well be assigned to one subspecies as the other. Members of the subspecies *townsendii* live in the Transition and lower Canadian life-zones, and of the subspecies *cooperi* in the Canadian.

Measurements.–A male from Quillayute Prairie, April 10, 1941, and a female from Copalis, April 3, 1940: length 251, 265; tail 112, 120; hind foot 37, 37; ear from base 22, 23; weight in grams 65, 76.

Occurrence.–Common on the lowlands; especially on logged or burned-over lands strewn with logs, stumps, brush, and young conifers. Altitudinal range from sea level to 4,000 feet (Mount Ellinor).

A. H. Howell (1929, pp.109-110) listed 21 Olympic locality records for the Townsend chipmunk. While there are other scattered records, these of Howell serve to outline the distribution of the race on the peninsula, as follows: Aberdeen, Blyn, Boulder Creek, Boulder Lake, Canyon Creek (Clallam), Elwha River at Boulder Creek (560 feet), Elwha River at Hays River (2,000 feet), Elwha Post Office, Forks, Happy Lake [3,600 feet], Lake Cushman, Lapush, Mount Ellinor (4,000 feet), Neah Bay, Ozette Lake, Port Townsend, Potlatch, Quinault Lake, Shelton, Soleduck Hot Springs, and Taholah.

Chipmunks are rarely seen in winter. On November 16 we saw one on the road near Ozette Lake; on December 4 we saw one by a tourist cabin 4 miles south of Forks; on April 9-10 we drove several hundred miles on western Olympic roads and saw only one chipmunk, an individual sitting on a fence post at Quillayute Prairie; in early June of the same year we passed over these roads and saw a number of chipmunks running about.

Breeding habits.–A female collected at Copalis an April 3 had a small uterus without evidence of pregnancy.

George G. Cantwell took three chipmunks described as "the first of the season" at Shelton on April 15, 1918. Two contained 6 embryos about one-half inch long; the third contained 4 embryos (MS).

Vernon Bailey found the chipmunks quiet and saw no young up to the time he left the peninsula on May 8, 1918 (MS).

Cantwell found chipmunks "common at Lake Quinault Sept. 25 to 29, where a series in fine winter pelage were collected" (MS, 1918).

On his visit to the northern Olympics in 1898, Elliot was not aware of the presence of two races of Townsend chipmunks there, although he "noticed a decided difference in the call of the individuals that dwelt at different altitudes. Those of the valleys and lower hills uttered a querulous chirp, while those near and at timber line called attention to themselves by a short, sharp, hoarse bark. I never heard on the top of the mountains the querulous chirp uttered everywhere by the species at lower levels. Excepting this call, there was nothing in either their habits or appearance that was different between individuals from separate localities" (1899, pp.247-248). Elliot failed to notice that *cooperi* is paler than *townsendii*.

Moore stated (1940, p.11) that the Townsend chipmunk "is to be found over the entire Douglas fir region in numbers that vary greatly from year to year. Normally, these rodents prefer the more open parts of the forest. Their diet closely resembles that of the white-footed mouse. Like true squirrels, they climb some of the smaller seed-producing trees, from which they cut and drop the cones, but as they hibernate in this region, usually from November to March, their demands upon seed on the ground are reduced. Townsend

chipmunks have been kept in outdoor captivity by the writer for 11 years and have remained active at all times." [The life span of no individual exceeded five years].

TOWNSEND CHIPMUNK
Eutamias townsendii cooperi (Baird) 1855

Identification.–Key, p.49. "On the north slope of the Olympics this race descends to very low altitudes, specimens from 4 miles southwest of Port Angeles at an altitude of 800 feet [Frazier Creek], being much nearer to *cooperi* than to *townsendii*" (A. H. Howell, 1929, p. 111).

Measurements.–An adult male and 3 adult females from the Elwha Basin, 2,760 feet, collected by Cantwell on August 5, 1921: length 248, 248, 248, 245; tail 118, 115, 115, 110; hind foot 37, 36, 37, 37. A nursing female from Hurricane Ridge, July 14, 1942, weighed 73 grams (Shaw, 1944, p.282).

Occurrence.–In mountain forests. Howell listed 8 Olympic locality records for *cooperi*, as follows: Canyon Creek (Clallam); Dosewallips River (4,500 feet), Elwha River (2,750 feet), Hoh River (5,000 feet), Mount Angeles (6,000 feet), Port Angeles (4 miles SW, 800 feet), North Fork Quinault River (4,000 feet), and Seven Lakes Basin.

The Svihlas gave additional locality records: Port Crescent [Strait of Juan de Fuca] and Olympic Hot Springs (1933, p.40).

The two high-country chipmunks, *E. townsendii cooperi* and *E. amoenus caurinus* share the major portions of their respective ranges, although *cooperi* is fonder of timber and *caurinus* of meadow and talus. We saw several Townsend chipmunks at timberline in Deer Park, April 22, 1938, when the ground was still covered with winter snow.

Breeding habits.–William T. Shaw has described a nest of a *cooperi* chipmunk which he found at Idaho Shelter, Hurricane Ridge, July 14, 1942 (*op. cit.*). The nest was underground on a cool, damp, slope partly shaded by tall firs, at an elevation of about 4,500 feet. Inside the single entrance, which was open, a simple, unbranched tunnel led to an enlargement or "turning point" and continued to a nest cavity among tree roots. "It was odd to find no provision for escape from its home in case of invasion." As nearly as we can judge from the illustrations which accompany Dr. Shaw's description, the total length of the tunnel was about 4 feet, the nest cavity was about 7 inches in diameter, and its roof was 6-8 inches below the surface of the ground.

"In regard to the materials in the brood nest of the Cooper chipmunk, first appearances after excavating were deceiving. A sectional view showed the nest to be lined with the broad blades of the same species of sedge (*Carex spectabilis*) as noted above [in nest of mountain chipmunk]; not shredded especially, but nipped into short pieces varying from a quarter of an inch to an inch in length. To this were added a few pieces of paper picked up probably from a near-by camp, making a warm spring bed.

"On the outside was a thin, thatch-like veneer of *Carex*... its broad blades guarding well against possible moisture. Between these two layers, forming a heavy compact felting, extended the firm body of the nest made entirely of *Usnea*, the gray 'moss' so abundant in damp forests of the Pacific Coast. This brood nest had comparatively little dust mulch in the floor of the nest cavity, but the *Usnea* was firmly matted down in the saucer. The nest weighed 98 grams" (*op. cit.*, p.276).

In the nest were 3 chipmunks judged by Dr. Shaw to be 2 or 3 days old. Their "querulous, protesting voices" were heard at the outer entrance of the den. They were

toothless, blind, hairless except for a faint suggestion of vibrissae, flesh-colored without sign of striping, and had small but well-developed claws. Their mean weight was 4.8 grams.

FLYING SQUIRREL
Glaucomys sabrinus oregonensis (Bachman) 1839

Identification.–Key, p.49.

Measurements.–Adult male collected 8 miles W of Forks, near sea level, December 8, 1945; and adult female collected by W. P. Taylor 2 miles SW of Mount Angeles at 6,000 feet, July 6, 1921: length 322, 323; tail 139, 146; hind foot 42, 40; ear from notch –, 26.

Occurrence.–Flying squirrels have been taken on all sides of the peninsula and from sea level to 6,000 feet (see above). They inhabit the dense evergreen forests and are probably more abundant at elevations above 3,000 feet. Because of their nocturnal habits they are seldom seen, although trappers testify that they are so common on the mountain ridges as to be a nuisance in traps set for marten. They are active at all seasons.

General habits.–Flying squirrels forage at night among dead snags and in evergreen foliage. They may be collected by placing a rat trap baited with a prune at the base of a long, leaning snag whose upper end is lodged against a conifer. A "cubby" set placed on a leaning pole or hacked out of a large, rotten stub is also attractive. For some reason flying squirrels are fond of old barns and hay lofts. Thus, we surprised one at night in a stable in a mountain meadow, where it was gnawing on a leather saddle. The squirrel continued to gnaw without alarm in spite of the fact that we turned a flashlight directly into its face and approached within a distance of six feet.

E. B. Cameron found a flying squirrel nest about 3 miles west of Carlsborg on February 1, 1946. He noticed a dead fir snag leaning over a ravine, and at the end, a hole like the entrance to a woodpeckers nest. He fired a rifle shot into the snag and 6 squirrels in succession appeared in the doorway. The gregarious habit illustrated here prevails among flying squirrels in general.

In the lore of the Makah at Neah Bay "the flying squirrel is never hunted but only taken when found by chance. Anyone who finds one is lucky. The skin of the flying squirrel is tied to the rope of the whaling harpoon to make the whale turn toward land. The skin is also kept with fishing tackle for salmon" (Gunther, 1936, p.116).

POCKET GOPHER
Thomomys talpoides couchi Goldman 1939

Identification.–About the size of a small rat; dull brown in color; with a pair of fur-lined cheek pouches, each large enough to accommodate the end of a man's finger; fore feet with long claws for digging; rarely seen above ground; living only on prairies near Shelton; apparently not approaching the range of *T. t. melanops* (p.57).

Measurements.–Thirteen males from 4 miles N of Shelton, average: length 196, tail 55, hind foot 27, weight in grams 87. Nine females from the same place: 189, 56, 26, 81 (Dalquest and Scheffer, 1944, pp.33-34).

Occurrence.–Isolated prairies at the southeastern base of the Olympic Mountains; collected from Scotts Prairie (airport, 4 miles north of Shelton) and Lost Lake Prairie (15 miles NNE of Satsop). In 1940 we noted gopher activity on a prairie beside the highway one mile south of Scotts Prairie, and also on a hill, elevation about 500 feet, two miles north of Shelton on the base of Kitsap Peninsula. The total population of *couchi* gophers is small because of the limited area of the habitat. The steady encroachment of the forest upon the small prairies around Shelton may result in the extermination of the gophers within the present century. On Lost Lake Prairie there are now probably less than a hundred gophers.

Although we have made diligent search and inquiry over a period of many years, we have found no evidence of gophers on the lowland prairies of the peninsula elsewhere than at the southeast corner. We assume that, following the Vashon Ice Age, forests arose and blocked the path of gophers before these animals had a chance to invade the gravelly prairies on the south, west, and north sides of the peninsula. A single pioneer offshoot of the southern Puget Sound tribe was able to reach the alpine meadows before the forests closed in below, with the result that *melanops* is now established in the mountains of Clallam County.

During two nights in December, 1940 and January, 1941, we took 27 gophers in approximately 100 traps on Scotts Prairie. While this is a rather poor catch it shows that gophers are active in winter time.

Gophers of the subspecies *couchi* live in thin, black, silt-gravel so dry in midsummer that it allows to wither and die any seedling trees that may have sprouted during the winter.

Breeding habits.–In 7 pregnant females trapped at Shelton on May 14, 1922, Couch found an average of 4.1 embryos (1932, p.25).

Food habits.–In the cheek pouches of a gopher trapped on Scotts Prairie on December 8 we noted cut stems and leaves of cats-ear (*Hypochaeris radicata*) and found several wilted rosettes of the same plant whose roots had been cut underground. In food caches of Puget Sound gophers related to *couchi* and living under similar conditions, we have found roots or bulbs of the following plants: cats-ear, bracken fern (*Pteridium aquilinum*), quack-grass (*Agropyron repens*), yampa or squawroot (*Carum gairdneri*), and camas (*Quamasia sp.*).

The visitor to the Olympic Peninsula, approaching from the south, may see climax examples of the mound-building activities of gophers. Along the highway near Tenino, Grand Mound, and Mima there are mounds up to 7 feet high, perhaps the largest structures created by any mammal in the world.

POCKET GOPHER
Thomomys talpoides melanops Merriam 1899

Identification.–See *couchi*, p.56.

Measurements.–Cantwell took 2 males and 2 females at the head of Cat Creek, 4,500 feet, August 28-September 3, 1921: Males; length 205, 216; tail 72, 70; hind foot 26, 29. Females; 210, 192; 74, 65; 29, 28.

Occurrence.–This gopher has been reported only from the alpine meadows of Clallam County, as follows: Soleduck River (timberline at head of), Cat Creek (head, 4,500 feet), Happy Lake Ridge (4,000 and 5,500 feet), and Bogachiel River (Canyon Creek Divide at head of). The Svihlas "saw many winter tunnels as well as fresh workings of this gopher above timberline at Boulder Lake and High Divide" (1933, p.40).

Taylor and Shaw believe that *melanops* may intergrade with the subspecies of the nearby lowlands in favorable territory on or near the southeast slopes of the Olympics (1929, p. 20). Colonies of gophers should be looked for in the mountains in the northeast corner of Mason County, in an attempt to fill in the present gap of 50 miles between *couchi* on the Shelton airport and *melanops* on Cat Creek. Taylor and Cantwell reported that they found no gophers at the heads of the Elwha, Quinault, or Dosewallips rivers.

General habits.–The average visitor to the Olympic Mountains would be ignorant of the presence of gophers were it not for the hillocks and ridges of earth which the animals leave on the surface of the ground. In tunneling through the ground in search of plant roots, and in excavating for nest chambers, gophers dispose of waste earth by piling up hillocks 1-2 feet in diameter and about 4 inches high. During the winter months, they make long tunnels in the snow at the surface of the ground and subsequently pack these tunnels with waste earth. (The waste snow, we presume, is compressed against the sides and roof of the excavated snow tunnel). With the arrival of summer, the earthen, rope-like casts are plainly evident. In regions of little or no snowfall, as in the Puget Sound trough, gopher casts are rarely seen. Taylor observed fresh gopher work underneath the snow on Happy Lake Ridge, 5,500 feet, July 12, 1921.

Nothing is known of the food habits or breeding of *melanops*.

BEAVER
Castor canadensis leucodonta Gray 1869

Identification.–Fig. 16. Another subspecies, *idoneus*, may extend as far north as the Chehalis River and thus touch the Olympic Peninsula, although borderline specimens to prove or disprove this point are not available.

Measurements.–Cooper collected a very large, fat female beaver on the Chehalis River which measured "head and body, 3 feet long. Tail, one foot long, 4-5/8 inches wide [millimeters: 914, 304, 116]" (1860, p.83).

We obtained a subadult male caught accidentally in an otter trap on the Dickey River, December 8, 1945: length 926; tail (naked under surface) 114 x 250; hind foot 175, ear from notch 34; weight in pounds 29-1/4.

Occurrence.–Before the coming of the white man it is likely that beavers occurred on the lowlands entirely around the peninsula. It is also likely that they were thinly scattered, since the conditions under which they must have been living could not have been especially favorable. A dense cover of evergreen timber lay over most of the peninsula, and the larger streams along which the beavers lived and traveled were subject to great fluctuation in size. Wolves and cougars were ever ready to wipe out local colonies of beavers, and forest fires to destroy their food supply. Thus, it is likely that beavers were absent from extensive areas for years at a time, only to return when conditions became favorable.

Our records of beavers on the peninsula reflect the spotty nature of their distribution. Beaver bones were found in Quillayute middens by Reagan (1917, p.16). The Makah at Neah Bay had no information on beaver (Gunther, 1936), yet E. A. Preble and R. T. Young reported beavers at Suez, 10 miles southwest of Neah Bay, and at Lake Ozette (MS, 1897). The National Museum has 12 specimens collected at old Lake Cushman in 1895. Elliot saw no beavers on the north side of the peninsula during his visit in 1898. Trappers at Sequim and Port Angeles told W. P. Taylor in 1919 that there were no beavers here. Cantwell wrote in 1921 of Ozette Lake: "Beavers were once plentiful... but of late only an occasional animal travels through" (MS).

In its biennial report for 1921-22, the State Department of Fisheries and Game announced that "sometime in the near future it is our intention to stock the more remote areas of the Olympic Peninsula with these animals. It is believed that they will succeed well in that section."

In 1935, we visited Lake Ozette, reported to be ideal beaver country, and found sign of only one animal around its shore. Well-founded rumor attributed the loss of the Lake Ozette beavers to poaching.

In the Olympic Forest wildlife report for 1936, John E. Schwartz wrote that "beaver are appearing on the Calawah drainages and there is now a fair sized colony on the North Fork... . Ranger Fulton, of the Quinault District, likewise reports beaver increases on the Queets, Humptulips, and Wynooche Rivers."

On July 29, 1937, State Game Protector Fred Rice planted 2 beavers in Moose Lake and 4 on the stream which drains it, about 1/4 mile below the outlet. Moose Lake is on the Hurricane Ridge trail at about 3,200 feet. The sex and source of the stock are not recorded. "Those planted in the lake have built a house... and are apparently settled down and established permanently. Beaver are increasing rather rapidly in parts of the Quinault District and on the logged-off lands just south of the forest boundary in this locality. In other districts less is known of their status although it is likely that with the protection they are now receiving they are slowly recovering" (Olympic Forest wildlife report for 1937).

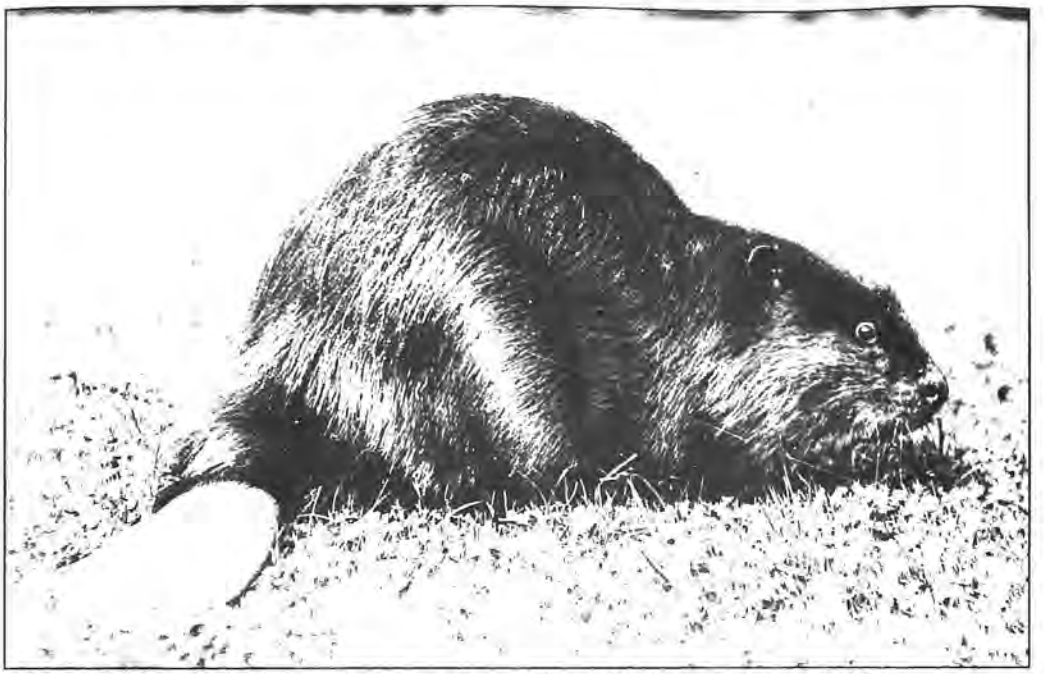

Figure 16. Beaver, *Castor canadensis leucodonta*, Silvana, Washington. August 15, 1921 (Photo by Leo K. Couch.)

Figure 17. Beaver dam and pond on Humptulips Burn, Grays Harbor County, December 10, 1945.

Forest Service estimates of the number of beavers on the Olympic Forest were: in 1925, 2,000; in 1932, 95; in 1948, 690.

Beavers are now increasing at a rapid rate on the southwest corner of the peninsula, for example, on the Humptulips Burn, where countless small streams thread between rolling hills that have lost their native timber and are growing up to willow, poplar, maple, and brush (Fig. 17).

General.–Some years ago we commented on the beaver situation in the Olympics, especially on the prospects for introducing beavers into new localities and the advantages to be expected therefrom (1935, pp.24-25).

Leo K. Couch has noted that "the west fork of the Satsop River becomes roily and rises and falls rapidly after every heavy rainfall. The east fork, which flows through several miles of beaver dams, has carried sediment in one year only since under observation and even in storm periods shows no tendency to flood" (1942, p.2).

At Lake Ozette on November 16, 1936, we saw a muddy path about 2 feet wide where beavers had travelled between a drainage ditch and a vegetable garden owned by Charles Keller. The beavers had pulled up carrots from an area 20 feet in diameter, and were said to have damaged beets as well.

Joseph S. Dixon and Preston Macy photographed a cottonwood tree over 6 feet in diameter at which beavers were vigorously gnawing on the nights of September 15 and 16, 1943. It was located on the Queets River about one-quarter of a mile above Spruce Bottom. This is perhaps a record for size of tree attacked by beavers (Dixon, MS).

Members of native tribes on the peninsula are allowed to trap beavers on their respective Indian Reservations. In the ten-year period 1936-1945 the following numbers of beavers were taken: Quinaielt 1,507 (24-316 a year), Makah 8 (0-5 a year), and Quilieute 1 (in 1941).

In the opinion of many white trappers on the peninsula who are watching with glistening eyes the increase of beavers, the State Game Department should declare an open trapping season. To this we are firmly opposed, and we base our opinion on first-hand observations over a period of 10 years of beaver management in Oregon and Washington. The beaver is not an ordinary furbearer whose numbers can be regulated wisely by the farm boy trapper; it is an active agent in soil and water conservation and, at times, a destructive agent on forested and cultivated lands. The beaver should be managed by persons who are in a position to judge (first) where beavers should be thinned out and where new stocks should be planted, (second) how the landowner should be compensated for damage done on his place by beavers, and (third) how beaver pelts should be removed, cured, and sold so as to provide the greatest revenue to the community. The present system wherein beavers are trapped only by salaried employees of the Game Department under the supervision of biologists is a satisfactory one.

While he was descending the Chehalis River, J. G. Cooper obtained a beaver. "About sunrise, one of the Indians saw it swimming close to the bank, with only its nose above water. He shot it, and on getting it into the canoe it proved to be a very large one, extremely fat. We soon after landed, skinned, and cooked it, the Indians considering it a great delicacy, but, though hungry, I thought it barely eatable. A fishy flavor pervaded every part of it, and it was very tough" (1860, p.82).

Specimens of the cosmopolitan little beaver beetle, *Platypsyllus castoris* Ritsema (identified by Melville H. Hatch) were taken from the fur of a beaver on the Dickey River, December 8, 1945.

KEY TO NATIVE OLYMPIC MICE

(To distinguish mice from shrews and shrew-moles, see p.27)

A1. Hind feet specialized for jumping, about 3 times length of fore feet; cheek-teeth 4 on each side in each jaw; sides of body yellowish, belly pure white; back marked with distinct dark band; tail about 150 mm. (5.9 in.) in length, much longer than body; color of tail gray above and white beneath.....*Zapus princeps trinotatus*, p.71.

A2. Hind legs not specialized for jumping; cheek-teeth 3 on each side in each jaw.....B

B1. Ears large and flaring, length from notch 17-20 mm. (0.6-0.7 in.); tail nearly as long, or longer than body; feet white; underparts, including tail, light gray, sharply contrasting with grayish brown of back and upper surface of tail (deer mice).....C

B2. Ears not conspicuous, nearly concealed by pelage; tail much shorter than body; feet grayish or brown, never white; color of upperparts blending gradually with underparts.....D

C1. Tail longer than body, or 100 mm. (3.9 in.) or more in length.....*Peromyscus maniculatus oreas*, p.62.

C2. Tail equal to, or shorter than body; or less than 100 mm. (3.9 in.) in length.....*Peromyscus maniculatus austerus*, p.62.

D1. Back from forehead to tail washed with reddish (red-backed mice).....E

D2. Back not reddish.....F

E1. Reddish back-strip well defined, dull, light chestnut in color; tail distinctly darker above than below; usual habitat, mountain forests.....*Clethrionomys gapperi vinarius*, p.64.

E2. Reddish back-stripe dark and subdued, at times nearly lost in general brown color of upperparts; tail about as dark beneath as below; usual habitat, lowland forests.....*Clethrionomys californicus occidentalis*, p.64.

F1. Total length less than 170 mm. (6.6 in.).....G

F2. Total length more than 170 mm.....H

G1. Adult molars (cheek-teeth) with 2-pronged roots; usual habitat, mountain meadows.....*Phenacomys intermedius oramontis*, p. 67.

G2. Adult molars without roots; usual habitat, lowland meadows.....*Microtus oregoni oregoni*, p.70.

H1. Tail less than one-half as long as body; color of upperparts grayish; tail scarcely any lighter below than above; hip glands (dark spots) conspicuous in adult males.....*Microtus townsendii townsendii*, p.68.

H2. Tail more than one-half as long as body; color of upperparts brownish gray, upperparts gray; tail distinctly bicolor; hip glands not conspicuous.....*Microtus longicaudus macrurus*, p.68.

DEER MOUSE, WHITE-FOOTED MOUSE
Peromyscus maniculatus oreas Bangs 1898

Identification.–Key, p.61.

Measurements.–Five adults from 3 miles E of Lapush, April 9, 1941: length 196 (192-200), tail 108 (103-113), hind foot 23.4 (23-24), weight in grams 19.0 (16-21).

Osgood (1909, p.52) mentioned an individual from Quinault with an extremely long tail, 131 mm. and also listed average and extreme measurements of 12 *oreas* mice from Neah Bay. The averages were: 201, 111, and 22.8.

Occurrence.–Abundant on the peninsula from sea level to timberline, except in a lowland belt along the northeast and east sides. Occupying similar habitats on the peninsula are deer mice of two subspecies, *oreas* and *austerus*, as well as mice showing intermediate characters. Whether these intermediates are hybrids or intergrades is not known. A lengthy discussion of the problem of distribution and variation of *oreas* and *austerus* was given by Osgood (*op. cit.*). Generally speaking, *oreas* mice are more abundant in the higher and more westerly parts of the peninsula and *austerus* mice more abundant along the Puget Sound side. On the peninsula as a whole, *oreas* mice are predominant.

Deer mice are common in fairly open country among logs, brush, and deciduous trees; less common in dense forest. They are easily trapped about buildings, lumber piles, and driftwood at the upper margin of the ocean beach. It would perhaps be simpler to state where these mice do not occur than where they do!

T. H. Scheffer found a sparse population of deer mice on the Humptulips Burn two and one-half years after a disastrous fire had consumed 3,500 acres of timber (MS). He captured 7 "pioneers" in 225 trap-nights in the center of the burn, April, 27-30, 1931.

Breeding habits.–In 1931, Arthur Svihla captured a number of deer mice on the lower Elwha and studied them in captivity (1933). Two females which were pregnant when trapped gave birth on June 28 and July 20, respectively. A female bred in captivity on the same day that she had given birth produced a second litter on August 2, thirty-five days later. The first litter was suckled until the second was born. Six litters born in captivity contained the following numbers of young: 2, 4, 4, 5, 7, 7, (average 4.8). The eyes opened at an age of 16-17 days. Instances were observed where male and female adults killed the newborn young.

On April 9 at Lapush we trapped a female not visibly pregnant; on April 11 at Port Angeles a female carrying 2 fetuses 11 mm. in crown-rump length. On April 27-30 at Humptulips, T. H. Scheffer trapped 2 females not visibly pregnant (MS, 1931). On June 19 at Forks, Taylor took a female with five 7 mm. embryos (MS, 1921). On June 27 at Lake Cushman, Gaige found a nest with 5 young (Dice, 1932, p.48).

DEER MOUSE, WHITE-FOOTED MOUSE
Peromyscus maniculatus austerus (Baird) 1855

Identification.–Key, p.61; see also *oreas*.

Measurements.–Six specimens from Port Angeles and the Elwha Forest Camp, collected by M. P. Harthill: length 163 (158-170), tail 82 (79-85), hind foot 20.8 (20-21.5).

Occurrence.–Common in a narrow belt of lowland along the east side of the peninsula and along the north side as far west as Port Angeles; reported from scattered points along the west coast and in the mountains.

Osgood stated that "typical *austerus* seems to be confined to the immediate vicinity of Puget Sound. Specimens from Lake Cushman and the Skokomish River... are larger than typical... . The series representing '*P. akeleyli*' (Elliot) also comes within this category." (1909, p.63).

WOOD RAT, PACK RAT
Neotoma cinerea occidentalis Baird 1855

Identification.–About the size of a domestic rat, but more "squirrely"; general color brownish gray, gray beneath; tail bushy, eyes and ears large and conspicuous; whiskers long; nocturnal.

Measurements.–A large male from the head of the Soleduck River, 4,000 feet, collected by Vernon Bailey on August 29, 1897: length 412, tail 180, hind foot 45. A female from Mount Angeles, 5,000 feet, collected by W. P. Taylor on July 5, 1921: 360, 155, 40.

Occurrence.–In or near conifer forests over the entire peninsula, from sea level to timberline, seldom abundant. Wood rats are generally found in deserted buildings, prospector's tunnels, or in natural rock crevices. Altitudinally they range from Ruby Beach, Neah Bay, Dungeness and Hoodsport to at least 5,500 feet above Happy Lake. They are seen most often on the north and west sides of the peninsula. Cooper found no evidence of wood rats on Puget Sound, although he inquired about them (1860, p.85). Dice reported them as rare around Lake Cushman (1932, p.48).

Elliot found that the wood rat "was in no place abundant, single families occupying certain localities, and when these were captured there was no use trapping for them any longer in that vicinity. The supply appeared to have become exhausted" (1899, p.254). We have noted the same solitary or antisocial trait in the wood rat of eastern Washington.

W. P. Taylor found wood rats abundant among the rocks of the ridge north of Happy Lake, also in the rock slide at the head of a nearby draw, July 13, 1921. He noted several dust wallows along the ridge (MS).

Cantwell was told in 1921 that there were no wood rats on the ranches at Ozette Lake, although he obtained two specimens at Clallam, 15-20 miles northeast of here (MS).

Breeding habits.–Of 23 specimens taken by Elliot in late summer and fall, the majority were young or subadult. A male taken by us on the lower Hoh River on November 17, was judged to be half-grown.

General habits.–In 1860, Dr. Suckley stated "I obtained a very fine male specimen at New Dungeness, on the Straits of Juan de Fuca [January 21, 1857]. It was killed by Mr. Madison, a settler in that locality, who gave me the following account of their habits, which he has had many opportunities of observing: He says that when irritated or alarmed they have a habit of stamping with their hind feet like rabbits. When sitting at rest, or while feeding, they assume the peculiar sitting position of the squirrel, but differ in the manner of carrying the tail, not curling it like the latter animal, but carrying it straight and up. They make nests or beds of soft materials, which are frequently as large as a half bushel measure. The rat does not burrow into this, but lies in a depression on the top–the whole fabric resembling a bird's nest. In dwelling-houses his nest is composed of all sorts of material, embracing feathers, cotton, bits of calico, fragments of blanket, strips of cloth, shavings, and anything else that is light and soft. It is a great thief, magpie-like, stealing articles of which it can make no possible use. Mr. M. says that he has known one of these rats to carry to its magazine, in the course of a single night, two bushels of unshelled peas, from a point 100 yards distant" (1860, p.128).

GAPPER RED-BACKED MOUSE
Clethrionomys gapperi nivarius (Bailey) 1897

Identification.–Key, p.61.

Measurements.–Three adult females from the type locality, northwest slope of Mount Ellinor, 4,000 feet, collected by C. P. Streator on July 9, 1894, average: length 150, tail 50, hind foot 18.

Specimens collected by Elliot at Happy and Boulder lakes were somewhat smaller, the largest of 22 specimens being: 137, 40, 16 (1899, p.256).

Occurrence.–The Olympic Mountains "in dry heavy forest about logs and old brush piles, seldom straying far out into the meadows" (Cantwell, MS, 1921). There are numerous records for this upland race of the red-backed mouse. Specimens have been taken at elevations as low as 425 feet (Elwha P.O., July 22, 1921, W. P. Taylor). The Svihlas reported one taken at the mouth of the Sekiu River (1933, p.40). The upper limit of the range seems to be about 6,000 feet (Hurricane Ridge, July 8, 1921, G. G. Cantwell). At low elevations the range of *gapperi* overlaps that of *californicus*.

Bailey stated that "the specimens from the type locality were caught on July 9, at the edge of an alpine lake, at about 4,000 feet altitude. At that date Mr. Streator reports about one-third of the lake covered with ice and snow from the previous winter, while deep snow drifts lay on most of the neighboring slopes. Ice formed over the water almost every night during his stay, from July 8 to 11... . At this altitude the timber is smaller and more scattered and the undergrowth less dense than lower down" (1897, p.136).

Breeding habits.–Arthur Svihla gave an account (1931) of the breeding of the red-backed mouse in captivity. The gestation period of one female, bred immediately after she had given birth, was 18 days. "Evidently... more than one litter of young are produced by one female in a single year, for, during the short period that I had them under observation (from September to January) one of the *C. g. nivarius* females produced two litters. The breeding period of this species of *Clethrionomys* must therefore extend into the fall, for several of the females captured in September were gravid and later gave birth to young. The number of young in three litters of mice born in captivity were three, three, and four, respectively." The eyes of the young opened in 14 days.

W. P. Taylor collected a female *nivarius* with five 15 mm. embryos, 3 miles south of Canyon Creek, 3,500 feet, August 25, 1921.

CALIFORNIA RED-BACKED MOUSE
Clethrionomys californicus occidentalis (Merriam) 1890

Identification.–Key, p.61.

Measurements.–Adult male (type) from Aberdeen, collected by T. S. Palmer on August 16, 1889: length 145, tail 45, hind foot 18. Average of 3 adults from the type locality: 146, 47, 18.3 (Bailey, 1897, p.135).

Adult female from Forks, December 9, 1945: 149, 48, 19, ear from notch 15, weight in grams 16.4.

Occurrence.–"This species is peculiar to the low, moist coast and sound region–the 'Webfoot' country–where its dark color blends with the shadows of dense vegetation" (Bailey, *op. cit.*). Red-backed mice are trapped along rotten spruce logs and among spreading tree roots in the jungles of the Olympics; occasionally on logged-off lands under

cover of brush. They prefer a slightly damper habitat than the deer mice with which they are occasionally trapped.

Locality records include: Aberdeen, Copalis, Forks, and Lake Dawn (Port Angeles).

Breeding habits.–A female taken by W. P. Taylor at Forks on June 20, 1921, had "two pectoral and two inguinal mammae strongly functioning; doubtless nursing" (MS). A female from Forks, December 9, 1945, had 6 uterine swellings about 1 mm. in diameter and black in color, presumably placental scars.

MUSKRAT
Ondatra zibethicus osoyoosensis (Lord) 1863

Identification.–Fig. 18. (The subspecies *occipitalis* may extend as far north as the Chehalis River and thus touch the Olympic Peninsula, according to Walter W. Dalquest, 1948, pp.362-363).

Measurements.–Five males from Lake Pleasant, Clallam County, November 18, 1938: length 554 (535-578), tail 244 (240-252), hind foot 80 (74-84), weight in grams 987 (868-1,153), weight in pounds 2.17 (1.91-2.54). The largest male we have examined was taken at Sequim on December 6, 1945: length 590, tail 253, hind foot 79, ear from notch 26, weight in grams 1,191 (pounds, 2.6). A female from Lake Pleasant, November 18, 1938: 577, 256, 80, weight in grams 1,175 (pounds 2.5).

Occurrence.–Common in the lowlands around the peninsula with the exception of the northwest corner and Hood Canal, where only scattered groups occur. Within the Olympic Park, muskrats are found in Lake Dawn, Heart O' the Hills.

The peculiar distribution of muskrats on the peninsula is similar to that in many parts of the United States where, although food and shelter are adequate, no muskrats are found. For example, on Vancouver Island there were no muskrats until a few were introduced in 1923 (Storer, 1938, p.169), yet it seems reasonable that the animals would have established themselves here by natural means in the centuries that have elapsed since the last ice age.

Charles W. Keller, long-time resident of Lake Ozette, told us in 1938 that there had never been muskrats here, and his father said that there were none on Hood Canal when he settled here in 1888, although they appeared a few years afterward. Harvey Keller claimed to have trapped the first muskrat on Pysht River about 1930. Floyd Thornton said in 1938 that muskrats appeared in recent years on the northwest corner of the peninsula and were still scarce, except at Lake Pleasant. The muskrat was not listed by Olson (1936) from Quinault, by Reagan (1917) from Lapush, by Gunther (1936) from Neah Bay, by Elliot (1899) from the Port Angeles region, or by the Svihlas (1933) from Clallam County. Cooper (1860, p.87) stated that "The muskrat appears to be rather scarce in the western portions of the Territory, where I never saw any signs of their existence. I have been told, however, by credible persons that they were sometimes found, though scarce." Suckley and Gibbs (1860, p.87) collected muskrats at Steilacoom and reported them from the Cowlitz River. In 1889, T. S. Palmer examined a skull and talked with "mushrat" trappers at Aberdeen (MS). In 1911, the only Olympic muskrats available to Hollister were from Aberdeen, "Chehalis County," and Lake Cushman (p.26). It is certain that if muskrats were present in Lake Cushman they were also in southern Hood Canal.

Figure 18. Muskrat, Lake Washington, Seattle, November 4, 1939.

Thus, we believe that, by the middle of the last century, muskrats were established on the southern end of the peninsula, including the Chehalis drainage and southern Hood Canal, and have now nearly, but not quite, reached the northwest corner of the peninsula. Forest rangers are of the opinion that muskrats have increased six-fold in the past 25 years (Table 3). In the Olympic Park in 1942 a few signs were noted on the North Fork of the Quinault River at low elevations but muskrats were considered to be "decidedly uncommon."

According to trappers' reports (Table 4) about 4,000 muskrats were taken annually from the Olympic counties in 1945-1949. On the basis of number of muskrats per trapper per year, productivity of the counties may be arrayed as follows: Grays Harbor 23, Mason 15, Clallam 8, and Jefferson 2. These figures reflect the preponderance of muskrats on the southern end of the peninsula, with the exception of those on the fertile lowlands of eastern Clallam County.

Breeding habits.–Of 17 females trapped on the peninsula between December 11 and 29, 1937, only one showed sign of breeding activity. This one, taken at Sequim on the 11th, had given birth at a recent date, for one horn of the uterus had 3 placental scars and the other had at least 2, while the body of the uterus was enlarged and bloodshot.

Of 6 males trapped between December 11 and January 2, only one showed sign of breeding activity. This one, taken on the 12th at Sequim, had testes 7 x 10 x 14 mm., in descended position. By comparison with measurements made of muskrats in other parts of Washington in spring months, we suspect that the testes of this animal were only one-third their potential size. Whether the animal was in waxing or waning breeding condition was not decided.

Mortality.–William Townsend, a trapper living at Elma, wrote us on December 7, 1937: "I have noticed the muskrats are dying off this year and that some of the ones I have skinned have yellow spots on their liver, and some have large abcesses [scars from fighting] on their back and around their ears." E. B. Cameron, a trapper living at Sequim, wrote us on December 14, 1937: "I have not found any diseased rats yet although I have seen quite a few

with spotted livers and some with tape worms." A small male muskrat from Polson Creek, Grays Harbor County, January 2, 1938, had what appeared to be tapeworm cysts on the walls of the body cavity.

General habits.–Little information is available on the behavior of muskrats on the peninsula. Game protector Charles Haley says that he once watched a muskrat capture a mallard duck. Jack Handron says that the flesh of a muskrat makes an attractive bait for other muskrats.

HEATHER VOLE
Phenacomys intermedius oramontis Rhoads 1895

Identification.–Key, p.61.

Measurements.–Two pregnant females from the Soleduck River (near head, 4,500 feet) collected by Vernon Bailey on August 26, 1897: length 148, 140; tail 42, 39; hind foot 19.5, 19.

An adult male from Deer Park, 5,300 feet, April 22, 1938: 145, 34, 19, weight in grams 29.1.

Occurrence.–"An animal of the high altitudes only, and of quite local distribution. We first found them on the high dry ridge at the head of Little River, near the west slope of Mount Angeles, where for several miles along the top of Hurricane Ridge a rather extensive colony had once lived... . We found in trapping this locality that the greater part of these burrows were deserted... . Many small round grass nests were noted under the heather of the hillsides that were no doubt the winter refuge of the *Phenacomys* under the snow. None of these grass nests were occupied... the animals seemed to be living during the summer beneath old logs lying near the edge of the timber... . Beneath clumps of the tall 'Basket Grass' (*Xerophyllum tenax*) seemed to be the favorite spots to find them" (Cantwell, MS, 1921).

Locality records include: Boulder Lake, Cat Creek (4,500 feet), Dosewallips, Happy Lake (including *Microtus pumilus*, Elliot, which is a young *Phenacomys*), Deer Park, Canyon Creek, Cushman Lake, Soleduck Hot Springs (3 miles above), Soleduck River (near head, 4,500 feet). The Svihlas reported that "nests and runways of the heather vole were observed above timberline at Low Divide in 1930" (1933, p.40).

Breeding habits.–The females collected on August 26 by Bailey (see "Measurements") contained, respectively, 5 and 4 embryos. Cantwell noted that a female taken at the head of Cat Creek, 4,500 feet, on August 30, 1921, was in nursing condition. He also reported that females taken at Cat Creek, 4,500 feet, contained five embryos 30 mm. in length [presumably not the first litter of the year] (MS).

Dice reported that "two young were taken July 16 and 18, in a grassy marsh just above Lake Cushman [elevation 300-400 feet]. They were trapped in runways, which appeared to be like those made by *Microtus pennsylvanicus*" (1932, p.48).

TOWNSEND MEADOW MOUSE
Microtus townsendii townsendii (Bachman) 1839

Identification.–Fig. 19; key, p.61.

Measurements.–A very large male from Forks (1 mile W) February 18, 1946: length 256, tail 78, hind foot 30, ear from notch 19, weight in grams 91. An adult female from Grayland (south of the peninsula proper), April 4, 1940: 189, 52, 25, ear from base 18, weight in grams 62.5.

Occurrence.–On grassy or marshy lowlands around the peninsula, at times abundant. Locality records include: Grayland, Westport, Sekiu River mouth, Forks, Lake Cushman, and Sequim.

Breeding habits.–The female listed under "*Measurements*" had an enlarged uterus with 5 whitish spots and her mammae were enlarged. She had either just given birth or was in early pregnancy. "A nest containing 7 small young was found July 18th at Lake Cushman and another nest containing 6 young was found August 9th" (Dice, 1932, p.49).

General habits.–Figure 20 shows a typical runway of the Townsend meadow mouse through swampy grass about 200 yards from the ocean. Dice found this mouse "abundant in cultivated fields of oats, vetch, etc., above Lake Cushman... said sometimes to cause considerable injury to crops" (*op. cit.*, p.49).

Suckley reported that "Townsend's meadow mouse, also called the salt-marsh rat, is found on the tide prairies and salt meadows bordering Puget Sound. It is very common on the salt meadows along the Straits of Fuca, where, at New Dungeness, I obtained a specimen. On the potato fields on the rich 'bottom lands' in the neighborhood of these marshes they are quite destructive to that vegetable. The marshes are very much 'cut up' by narrow little trails and paths which they travel upon. These are about 2 inches wide and well beaten, looking much like buffalo trails in miniature. These mice are very numerous at Dungeness, so much so that Mr. Madison informs me that he had killed several hundred in a day while ploughing" (1860, p.129).

From a Townsend meadow mouse trapped at Forks on February 18, 1946, we collected two large ticks, *Ixodes angustus* (identified by Dr. Glen Kohls).

LONG-TAILED MEADOW MOUSE
Microtus longicaudus macrurus Merriam 1898

Identification.–Key, p.61.

Measurements.–A nursing female from Ruby Beach, Jefferson County, June 29, 1938: length 216, tail 85, hind foot 25. An adult male (the type) from Lake Cushman, June 26, 1894, measured by C. P. Streator: 220, 88, 24 (Merriam, 1898, p.353).

Occurrence.–Widespread, from sea level to alpine meadows. "We found this meadow mouse rather evenly distributed throughout the district but more numerous in high altitudes at the heads of the streams, occupying a position about midway between the *Phenacomys* of the summits and *[Microtus] oregoni* of the bottom lands. They inhabit both the wet meadow lands and the dryer thickets along the streams, and occasionally we found them in traps well inside the forest edges" (Cantwell, MS, 1921).

Taylor and Cantwell collected specimens at elevations as high as 5,000 feet (Little River) while others have collected specimens along the seacoast.

Gaige obtained two specimens in a rather unusual habitat, a heavy coniferous forest (Dice, 1932, p.49).

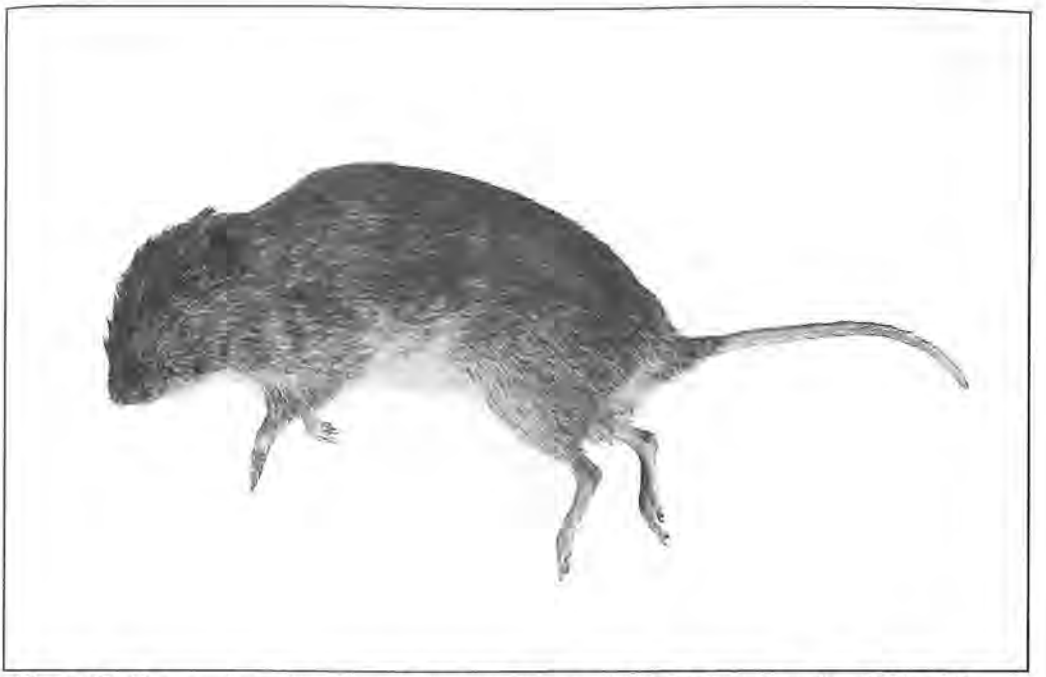

Figure 19. Townsend meadow mouse, *Microtus t. townsendii*, freshly trapped male weighing 3.2 ounces, from 1 mile W of Forks, February 18, 1946.

Figure 20. Townsend meadow mouse, runway through grass near ocean beach, Grayland, April 3, 1940.

Breeding habits.–Taylor collected two pregnant females in 1921, as follows: August 20, 3 miles south of Canyon Creek, 3,550 feet, six 10 mm. embryos; September 4, Cat Creek, 4,500 feet, six 12 mm. embryos (MS).

CREEPING MOUSE, OREGON MEADOW MOUSE
Microtus oregoni oregoni (Bachman) 1839

Identification.–Key, p.61.

Measurements.–A male and a pregnant female collected on Glacier Creek, Hoh River, 4,000 feet, by W. P. Taylor on August 31, 1921: length 143, 147; tail 43, 40; hind foot 17, 18.

Occurrence.–Common over the peninsula from sea level to timberline; usually in grassy, but not marshy, situations, and among logs and brush in sparse forests. Locality records include: Aberdeen, Point Grenville, Lake Quinault and 30 miles south, Lapush, Suez, Quillayute Prairie, Neah Bay, Lake Cushman, Sekiu River mouth, Happy Lake, Boulder Lake, Elwha River (Johnson's Ranch and 12 miles south of Port Angeles), Cat Creek, and Soleduck River near head.

Bailey stated that "all of the specimens examined from the low country south of Puget Sound are clearly referable to *oregoni*, and those from timberline in the Olympics do not vary sufficiently for even subspecific recognition" (1900, p.71).

As compared with the larger meadow mouse, *M. townsendii*, with which it is occasionally trapped, the Oregon meadow mouse prefers a drier habitat and is more inclined to dig beneath the surface of loose ground litter or in the ground itself. Arthur Svihla trapped Oregon meadow mice along the Elwha River in small, open, grassy meadows: "Here their labyrinthine runways resembled the runways of the eastern meadow mice very closely except that they were not as numerous nor as conspicuous. The majority of the specimens were collected in these grassy meadows, although some were taken in live traps set in the surrounding dense forests. Meadow mice are not averse to making use of the underground runways of other mammals, for several were captured in snap traps set in the tunnels of the Townsend mole (*Scapanus townsendii*). One morning while running the trap line, a mouse was seen half way out of a mole hole but scurried down when approached" (1932, p.94).

Breeding habits.–Cantwell took an adult and a young in the same trap at the same time, Shelton, mid-April, 1918 (MS).

A female from 10 miles south of Lake Quinault, 500-600 feet, April 30, 1931, had 3 advanced fetuses (T. H. Scheffer, MS).

On Quillayute Prairie, 200-300 feet, May 8, 1930, T. H. Scheffer trapped 8 pregnant Oregon meadow mice and found two nests of young under haystacks. The fetuses were evenly distributed from early to advanced size and numbered 2-4 (average 3). Six young in a nest were small and hairless; 3 young in a nest had their eyes open (MS).

Taylor took a meadow mouse at Lake Sutherland, 500 feet, June 28, 1921, with 2 embryos 13 mm. long (MS).

Bailey took one 2 miles below Soleduck Hot Springs, August 25, 1897, with 4 embryos (MS).

Taylor took one on Glacier Creek, Hoh Valley, 4,000 feet, August 31, 1921, with 4 embryos 25 mm. long, "near full term" (MS).

Cantwell took one at the head of Cat Creek, 4,500 feet, September 3, 1921, with 5 embryos 30 mm. long (MS).

Svihla took live meadow mice from the Elwha Valley and held them in captivity. "Two of the females were pregnant when captured and gave birth to their young a few days later. On July 10 a litter of three and on July 18 a litter of five was born." The 8 newborn young weighed each, 1.5 to 2.1 grams; average 1.64. After 10-11 days the eyes opened and the young came out of the nest (*op. cit.*).

Food habits.–In March, 1929, a paper-pulp manufacturer planted seedlings of Sitka spruce on 325 acres of Quillayute Prairie, – a natural expanse of silt-gravel covered with grasses and bracken fern and surrounded by evergreen forest. During the cold weather of January-February, 1930, considerable damage was done to the seedlings by rodents. T. H. Scheffer visited the scene on May 6-9, 1930, and found that the rodents responsible were, in order of importance, the Oregon meadow mouse, snowshoe rabbit, and mountain-beaver. His notes state that mice "were numerous over almost all parts of the plantings, under the shelter of dried brake ferns, tangled dead grasses, and other herbage. Green grass was coming on in abundant supply for food. The brake ferns had not yet put up their new shoots for this season. Mouse trails under the cover, openings of burrows, and fresh green cuttings were much in evidence... . Ragged cutting on the main stem of the spruce seedling and the severing of small side buds or twigs, sometimes under shelter of the ground cover, were indications of mouse work" (MS). In this situation the investigator found that rodents did not bother the little spruce trees after the spring crop of native green plants appeared.

It is reasonable to assume that damage by meadow mice was important here because the trees were planted in the midst of a natural mouse habitat. Elsewhere on the peninsula where trees have been planted, especially on cut-over lands and burns, damage by mice is less than that by rabbits and mountain-beavers.

JUMPING MOUSE
Zapus princeps trinotatus Rhoads 1895

Identification.–Key, p.61.

Measurements.–Average of 4 adults from Neah Bay: length 248, tail 153, hind foot 33.5. Average of ten specimens from Lake Cushman: 239.5, 144.5, 32.5 (Preble, 1899, p.27).

Occurrence.–Common in damp, grassy meadows from sea level to timberline over the entire peninsula. Taylor took 6 specimens at an elevation of 5,000 feet, at the head of the South Fork of Little River, July 9, 1921.

"This large kangaroo mouse was quite plentiful in certain localities, especially in clearings on the banks of the Elwha River, where grass seed had been sown by the owners of a few ranches, some of which, however, had been deserted... . They were very difficult to catch in traps, and the greater number... were taken in butterfly nets. One of the men would go carefully through the grass holding the net before him, and when one of the little animals would disclose his presence by leaping forward the net holder would throw the net at him, frequently following it himself with his whole length on the ground. In this way as many as seven were taken in one afternoon" (Elliot, 1899, pp.260-261).

Cantwell found that "the jumping mouse was by far the most abundant animal in the Olympics. We caught them at all our camps, both in the low bottoms and in the highest meadows, often at the rate of six to ten each day. They were found most abundantly in the tall grass beneath thickets of willows and alders in the high meadows" (MS). Specimens taken in July were said to be lean, while those taken in September were fat.

Gaige reported the jumping mouse "abundant" at Lake Cushman, occurring in deciduous forest, but especially common in marshes, and in open, grassy or sphagnum bogs. It was common among the alders and willows in the high, open grassy parks on Mt. Steele (Dice, 1932, p.49).

Breeding habits.–Taylor and Cantwell in 1921 found embryos in *Zapus* as follows:

June 23, Forks [300 feet].....8, length 18 mm.
July 9, Little River, 5,000 feet.....7, length 3 mm.
August 3, Elwha Basin, 2,750 feet.....6, length 20 mm.
August 4, Elwha Basin, 2,750 feet.....6, length 15 mm.
August 4, Elwha Basin, 2,750 feet.....6, length 20 mm.
August 25, Canyon Creek, 3,550 feet.....7, length 5 mm.

Taylor noted "one scared from a surface nest in meadow near Lake Mary [head of North Fork of Quinault River, about 4,000 feet, July 12]. The nest was the usual flimsy spherical structure, made all of dry grass stems. It was three inches in diameter. The occupant of the nest ran out, taking short jumps 12 inches in length, and running, too" (MS).

General habits.–The Svihlas took 7 jumping mice within a half hour in the same live trap baited with a fresh fish head, near timberline at Boulder Lake along tall meadow grass and low blueberry bushes. They found that live specimens removed to the laboratory were nervous and high-strung. "On several occasions these rodents were seen to make a drumming noise by rapidly vibrating their tails against some resonant body such as the bottom of a tin can trap or shreds of papers used for nesting purposes. They also make a squeaking noise when fighting... .

"During September and October the mice gained perceptibly in weight until they were extremely fat. As their weight increased, they became more and more listless and drowsy, often spending days curled up in their characteristic hibernating position, bent over so that the head is between the hind legs and the long tail curled completely over the head and body. When taken in the hand or into a warm room they uncurled and began to move about slowly. When the temperature rose in the room, they became active and even ate solid food; but when the temperature dropped again they went back into hibernation. We think that this food remained undigested and caused their deaths, for during the winter they all died" (1933A).

PORCUPINE
Erethizon dorsatum nigrescens Allen 1903

C. Okerstrom, agricultural agent for Mason County, says that porcupines have been seen on rare occasions in the vicinity of Shelton.

Jack Musgrove, a resident of Grays Harbor County for over 50 years, recalls that a porcupine was killed by an automobile at Oakville about 1930. Taylor and Shaw state that the porcupine is "reported" from the Olympic Mountains (1929, p.27).

The porcupine is not native to the peninsula, although it will become established here if man so changes the composition of the forest as to attract it. Porcupines prefer the bark of the pine to that of other conifers, and there is relatively little pine on the peninsula at the present time.

COYOTE
Canis latrans lestes Merriam 1897

Identification.–Fig. 21. Like a collie dog, but with shorter hair; grayish brown becoming blackish along midline of back and whitish on underparts; tail with black, or often black-and-white, tip. In an occasional specimen it is necessary to examine the skull carefully to distinguish it from that of a wolf or dog. W. E. Howard has recently suggested that skulls, even in the flesh, of coyote and dog can be separated by the following criterion: "If the molar tooth-row is 3.1 or more times that of the palatal width, the specimen is a coyote; but if it is less than 2.7 times it is a dog" (1949, p.171). See also *Canis lupus*, p.76.

Measurements.–An adult male from the Soleduck River 5 miles N of Forks, February 13, 1946: length 1,247, tail 358, hind foot 207, ear from notch 122, weight in pounds 27-1/4 (in kilograms, 12.36).

Occurrence.–"Coyotes inhabit the lower, logged-off lands on the south, east, and north sides of the Olympic Peninsula. They seem to be entirely absent from the heavily timbered valleys of the west-side drainages, and it is only on the more open northeast portions of the range that they are found at higher levels. Here they occur at elevations of 6,000 to 7,000 feet. Little is known of the present trend of the coyote population, but the local consensus is that the animals are slowly increasing, although not yet considered abundant" (Schwartz 1943, p.55).

There is a general belief that the coyote was not found on the west and north sides of the peninsula prior to the coming of the white man. Chronological notes on the increase and spread of coyotes are as follows:

1898 – In reporting on his visit to the northern valleys Elliot (1899) did not mention either the coyote or the wolf.

1910 – In what he called "a preliminary report upon the game in the Olympic National Forest," supervisor R. E. Benedict listed 14 species of mammals of economic importance. Although he estimated a population of 115 wolves, he made no mention of the coyote (MS). Reagan, however, stated in 1909 (p.197) that two coyotes "were killed by one of the forest rangers last year. They evidently were strays."

1912-1913 – A. B. Cameron, who settled in eastern Clallam County in 1899, says that he first heard of coyotes after the opening of the Hood Canal road in 1912 or 1913.

1919 – A questionnaire sent by the Biological Survey to residents of the peninsula revealed that a few coyotes had been killed at Port Angeles, Chimacum, and Quilcene; while more had been killed on the logged-off lands on the south side of the peninsula. Ranger J. Fulton, of, Quilcene, stated that "coyotes were never seen or heard of in this part of the country before 1915; a number have been seen and two or three killed since then."

1920 – "Until the last two or three years the Coyote has not been a resident of the northern Olympic peninsula... ." (Webster, 1920, p.213).

1921 – "L. Elliot told Oscar Peterson that a coyote was killed at Dungeness a short while ago. The nearest place from which coyotes have been reported previously in the Olympic Peninsula is Chimacum... on the northeast and Grays Harbor on the south" (Taylor, MS).

At Ozette Lake in June, 1921, Cantwell learned that "while coyotes are not as yet known in the district, an occasional wolf in past years occurred about Ozette Lake" (MS).

1923 – A male coyote was killed on May 25, 4 miles SE of Joyce, Clallam County, and the skull preserved by the Biological Survey.

1926 – "Coyotes are increasing rather rapidly and continue to spread into the west end of the Olympic Peninsula around the north side. A few years back they were unknown

Figure 21. Coyote, *Canis latrans lestes*, freshly trapped male weighing 27-1/4 pounds, from 5 miles N of Forks. February 18, 1946.

in this country but worked in from the southeast corner, probably six or seven years ago" (R. L. Fromme, Forest Service wildlife report, January 14).

1929 – "Invading western Washington as lumbering and clearing proceed... eastern part of Olympic Peninsula... and the Grays Harbor country" (Taylor and Shaw, 1929, p.13).

1930 – "Stock ranchers in and about Sequim report that the coyote originally rarely, if ever, seen are steadily increasing in numbers" (H. L. Plumb, Forest Service wildlife report, November 29).

"The small, dark-colored, rough-furred animal said to be found here would suggest a native coast prairie form that has merely increased in abundance since man had destroyed the timber, made an open country of heavy forest and brought abundance of choice food, mutton, poultry, and fruit with him. But they are here and to stay" (Vernon Bailey, MS)

1934 – Trapper Floyd Thornton says that coyotes are not native to the fern prairies about Forks. He trapped his first one here in 1934. [The west link of the Olympic loop highway was completed in 1930]. By 1937 they were common around Forks, Sappho, and Beaver.

1938 – Charles W. Keller, long-time resident of Lake Ozette, says that there were no coyotes here in 1938 although they occurred then around Clallam Bay on the Strait of Juan de Fuca.

Bounties were paid by the State Department of Game over a recent 10-year period on 1,355 Olympic coyotes (Table 5). The bounty was discontinued effective July 1, 1949.

One Federal agent trapping near agricultural lands in Grays Harbor and Mason counties (rarely Clallam and Jefferson) over the 8-year period 1937-1944 took a total of 761 coyotes (from 23 to 80 a year).

One private trapper took 26 coyotes, most of them within 5 miles of Forks, in the spring of 1945.

Breeding habits.–A summary of the breeding habits of the coyote in Washington has been given by Hamlett (1938, pp.7, 11). His data were obtained from coyotes from both sides of the Cascade Range. "The coyote breeds during February, there being about a month's difference in time between the earliest and latest breeding. The litters are whelped during April, there being about a month's 'spread'. There is no record of the production of a second litter... ." The period of gestation is about 63 days and the average number of young is slightly over 6. We found that the testes of an adult male killed on February 18 (see under *Measurements*) were moderately large and weighed, together, 22 grams.

Food habits.–"In addition to a diet of small mammals, birds, berries, and other items, coyotes will prey on deer and elk fawns whenever possible. Because of their food habits and the fact that coyotes are newcomers to the Olympic fauna... it seems that efforts should be made to keep their numbers low or even eliminate them entirely from the peninsula" (Schwartz, 1943, p.56).

In an important study conducted by Sperry, "coyote stomachs were collected in 17 Western States in all months of the year over a 5-year period (1931-1935), and the contents of 8,339 that contained food were analyzed in the laboratory. The major food items were found to be rabbits (33 per cent [by volume]) carrion (25 per cent), rodents (18 per cent), and domestic livestock--chiefly sheep and goats (13.5 per cent). Other foods included deer (3.5 per cent), birds (3 per cent), and vegetable matter (2 per cent)... . The coyotes' consumption of rabbits, rodents, carrion, insects, vegetable matter (in most cases), and miscellaneous mammals, which aggregated 80 per cent of the diet, may be construed as not inimical to human interests or may even be considered beneficial; whereas their consumption of domestic livestock, poultry, deer, and wild birds, totalling 20 per cent of the food, is indicative of loss and reveals the serious economic importance of the coyote" (1941, p.11).

Assuming, for lack of more specific information, that about 3.5 per cent of the diet of the coyote in the Olympic National Park is deer and 3 per cent is birds, we conclude that the coyote is a rather harmless species here. Within the Park, the deer population is influenced more by competition with elk for food than by predation. Bird life in the Park is abundant.

Mortality.–From the fact that coyotes have ready access to spawning salmon along the Olympic streams, some persons believe that the disease known as "salmon poisoning" is a deterrent to the increase of coyotes here. Proof is lacking, although the organism responsible for carrying the disease has been found in wild coyotes in western Washington and, further, coyotes have been killed experimentally by feeding them with fish known to be carrying the disease (Donham and Simms, 1927).

WOLF
Canis lupus fuscus Richardson 1839

Identification.–Figs 22 and 23. See also *Canis latrans*, p.73.

Measurements.–No measurements in the flesh of the subspecies *fuscus* from anywhere in its range are available. Grant Humes, on the Elwha River 22 miles S of Port Angeles, January 4, 1920, trapped an adult male which weighed 86 pounds. Webster (1920, p.89) told of "a big fellow, six feet in length" which was evidently the same individual.

Occurrence.–The last wolf on the peninsula was quite certainly killed before 1930. According to Young and Goldman, the range of the wolf once included all of the forested regions of Washington (1944, pp.10, 455). The animal was known to the aborigines of Neah Bay (Gunther, 1936, p.115). Chronological notes on the occurrence of the Olympic wolf are as follows:

1889 – T. S. Palmer, visiting at Aberdeen, reported that "an animal was described to me as being common in the woods near the Quiniaelt Reservation and the wilder portions of north western Washington; it was locally known as the Timber Wolf and was said to be larger than a Coyote and of a gray or dark color" (MS).

1894 – "In 1894 they were reported as common in the Olympic Mountains" (Bailey, 1907, p.15).

Figure 22. Wolf, *Canis lupus fuscus*, mounted pelt of a male from 10 miles above the mouth of Cameron Creek, Clallam County, mid-November, 1919.

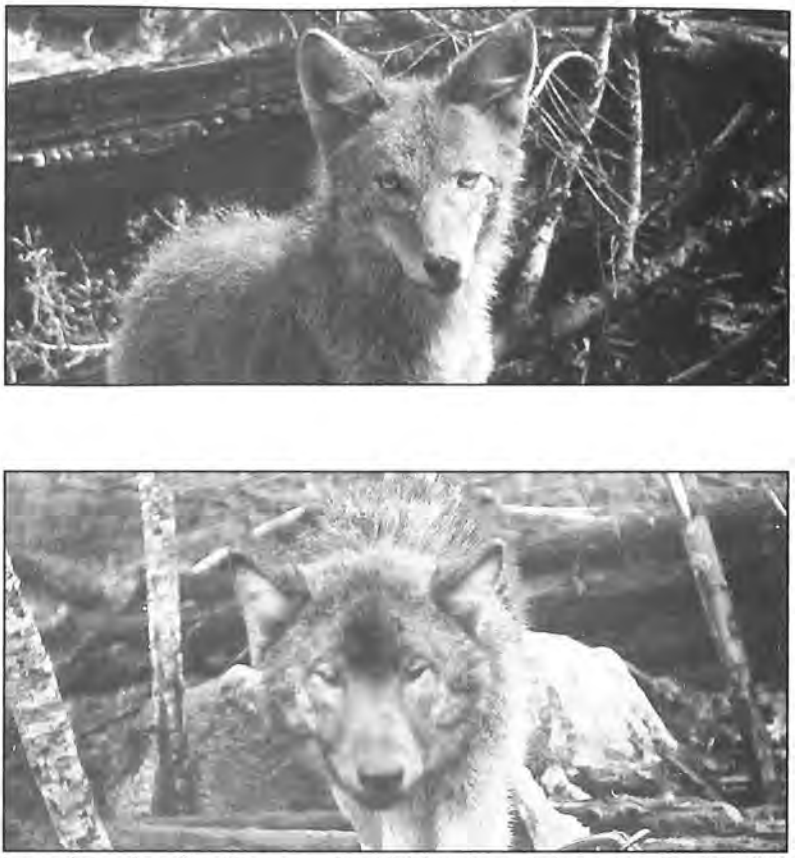

Fig. 23. Comparison of profile of coyote and wolf: (above) coyote in trap 5 miles SE of McKenna, Thurston County, April 10, 1924, (below) wolf in trap at Grant Humes Ranch, Elwha Valley, January 4, 1920; male weighing 86 pounds (Photo from G. R. Bach and Beth Webster).

1897 – The National Museum has a skin-with-skull collected from the Hoh River "at the base of the Olympic Mountains", October 8, 1897.

1909 – Reagan reported that "these animals are now practically extinct; the settlers killed them by wholesale with poison to keep them from making raids on their sheep ranches" (1909, p.197).

1910 – Supervisor R. E. Benedict placed the total population on the Olympic Forest at 115.

1917 – "We counted 42 timber wolves in Lost Creek bottom when we were there 2 years ago. They seemed to be following the elk" (J. W. Brown, of Sequim, MS, 1919).

1918 – Vernon Bailey stated that "very large and very dark colored wolves are said to be found throughout the central portion of the Olympic Mts. where the deer and the elk are most numerous" (MS). Chris Morgenroth, who was apparently Bailey's informant, estimated the population of wolves at 50, in pairs or scattered families. Not over 8 or 10 pairs were being taken yearly. Cantwell, reporting from Shelton in 1918, stated that no wolves had been taken here for many years (MS).

1919 – We examined a wolf skin mounted as a rug. A. B. Cameron says that he trapped the animal in mid-November, 1919, in snow on Cameron Creek about 10 miles above its mouth. Six wolves were travelling with an elk band here and Cameron succeeded in catching one in a bear trap. It was an old male "6 feet long." As he carried the wolf downhill on his back, Cameron estimated its weight at 100 pounds. In 1945 the skin

measured 1,800 mm. from snout to tip of tail flesh, with terminal hairs about 90 mm. long. The color was gray washed with buffy, blackish down the back.

To a questionnaire sent by the Biological Survey in 1919, various old-timers replied that there were 40-60 wolves on the Olympic Peninsula.

1920 – Grant Humes trapped a wolf on the Elwha and sent the skull to the National Museum, the last positive record of an Olympic wolf (see under *Measurements*).

1925-1937 – The annual wildlife reports of the Olympic Forest Supervisor reflect the opinions of rangers that a few wolves were still to be found on the forest (Table 3).

1937 – Ranger John E. Schwartz added this note to his wildlife report: "Six wolves are reported from the Quilcene District. Since this is an extremely doubtful record I wrote to Ranger [Monty] Mapes for further details. He replied that from the years 1928 to 1932 inclusive, there appeared to be several wolves in that locality. In 1929 he personally saw one in the Snow Creek country and in 1930 a trail crew also saw one. Afterward, reports came in over a period of several years of seeing tracks and hearing wolves howl. Mr. Mapes farther states that this past summer he saw tracks on the Greywolf River which he believed to be wolf tracks."

General.–Young and Goldman state that *fuscus* is perhaps the most distinctively colored geographic race of any of the gray wolves. The pelage is dark cinnamon or cinnamon buff in general tone, with the back profusely overlaid with black (1944, pp.405-406).

A story has been widely circulated that Chris Morgenroth was treed by a pair of wolves on the upper Elwha trail many years ago (Webster, 1920, pp.85-87). By climbing a tree, by pelting the animals with stones, and by flourishing a club, Morgenroth finally succeeded in discouraging or frightening the wolves away.

The *Pacific Northwest Sportsman* reported an incident in Grays Harbor County in March, 1946:

"What he believed to be a timber wolf attacked Jack Sousie, recently returned veteran, when Sousie was inspecting second growth timber near his home three miles northeast of Elma. Sousie reported that the animal, twice the size of a coyote and gray, leaped at him twice. Both times he hit it away with a heavy limb. After the second attack the animal fled into the woods with two others which didn't join the attack." It is possible, of course, that these were wild dogs.

FOX
Vulpes fulva (Desmarest) 1820

While it has not yet been reported from the peninsula, the red fox appears to be spreading in western Washington and may be expected to invade the southern Olympics in the near future.

Cantwell reported in 1918 that "a stuffed red fox is on exhibition at Oakville that was killed 10 years ago at Elma, Grays Harbor county, by Mr. E. R. Wray, and is the only instance coming to my notice of a red fox having been taken on the west side of the mountains. The animal is small and pale in color" (MS). Oscar J. Hart, a Fish and Wildlife Service predator hunter stationed at Olympia for many years writes that he trapped a red fox at the "Nelson sheep ranch near Tenino, Thurston County, on October 6, 1945."

The State Game biologists report "a few in Thurston County" and also state that "during the past three years, in the lower regions of the state, more than 1,000 of these animals have been destroyed" (Biennial Report, Washington State Department of Game,

1949, p.67). Three foxes were reported taken by licensed trappers of Mason County in the winter of 1948-1949. These may not have been taken on the peninsula. It is very likely that the foxes of the Puget Sound lowlands are descendants of ranch-raised animals rather than migrants from the Cascade Range.

BLACK BEAR
Ursus americanus altifrontalis Elliot 1903

Identification.–Figs. 24 and 25.

Measurements.–For an animal as common in the Olympics as the black bear, it is surprising that so few individuals have been measured in the flesh. A female from 2 miles W of Lake Cushman, 3,300 feet, shot by C. P. Streator on July 2, 1894: length 1,320 (51.9 inches), tail 98, hind foot 230.

A fat old male from Montesano shot by Louis Skinner on November 15, 1945, was weighed ("cut up") by Skinner on a Chatillon steelyard at 500 pounds. H. F. Aubuchon took certain measurements on the body before it was skinned (inches): "from nose tip to end of hind foot 38, around neck 38, around chest 48, around waist 44, hind foot 6 by 9, across front paw 6" (MS). The tanned pelt measures, from snout to tip of tail flesh, 1,696 mm.

In a bobcat trap on the Soleduck River, December 1, 1938, Floyd Thornton took a bear cub weighing 35 pounds. Thornton considered the cub rather small for this time of year.

Occurrence.–The Olympic Peninsula is excellent bear country. In summer, bears may be encountered almost anywhere from sea level to the alpine meadows, and in winter they are found at lower elevations along streams and saltwater beaches. It is generally believed that the young bears and some of the adults go into hibernation by the first of January, while other adults remain active all winter. Few bears are seen in the months of December, January, and February.

Park Service reports state that 6 bears were seen at Soleduck Park feeding on huckleberries in late August, 1942, and in the following year were common in the high Soleduck country, Bogachiel Lookout, and Hoh Lake.

An early (1910) estimate by rangers placed 1,280 bears on the Olympic Forest and a later (1939), 900 bears. The population is thought to have fluctuated but little in the intervening years (Table 3).

The bear has long been classified as a game animal in Washington. In 1946, the State Game Department declared a year-around open season on bear in western Washington, with no bag limit. However, it is unlawful to hunt bear during an elk season in a county open to elk hunting. About 50-100 bears are killed on the peninsula each year.

A federal agent for predator control, operating near farm lands in Grays Harbor and Mason counties, took 16 "nuisance" bears in three years (1937-1939).

Residents of Quillayute Prairie say that bears are "common here, and we picked up the skulls of two that had been killed in an orchard about 1940."

According to the *Pacific Northwest Sportsman* (December 27, 1946) a bear climbed a 9-foot fence to kill 14 sheep at the A. E. Loertscher farm near Shelton, and another killed 12 sheep at the Mel Saeger farm.

Breeding habits.–Josh Allen says that in December he killed a female bear in hibernation carrying a fetus the size of a man's thumb.

Phil McCully found two newborn female bear cubs near McCleary in February (James, 1949). They were under a stump surrounded by fresh snow and were cold and stiff.

Figure 24. Black bear crossing the Hoh River, October 29, 1940 (Photo by Floyd L. Dickinson).

Figure 25. Black bear; *Ursus americanus altifrontalis*; Silt River Basin, Eel Glacier district, August, 1936 (Photo by C. Olympic Jones).

"Their mousey bodies were covered with a short black fuzz. Slits showed where their ears should come. The cubs... were so small each could sit in a teacup without upsetting it." One cub died shortly but the other, fed warm milk with a pipette every three hours for the first week, survived. Her eyes opened in the third week. At one-month, her "ears and claws were becoming her main attractions. The claws were hardening even in the first week. The hair was one-quarter inch long." (Under ordinary circumstances it is both inhuman and illegal to pick up bear cubs, deer fawns, and other big game animals in the woods. In the present case, Mr. McCully was given permission by the State Game Department to care for an animal which was presumably an orphan).

Food habits.—According to the State Game Department, "western Washington bear are of poorer quality since their meat is sometimes tainted from feeding upon salmon. Thus very few are killed by hunters in spite of the fact that seasons and bag limits are very liberal. This limited hunting has allowed for substantial increases of western Washington bear and has resulted in serious bear damage problems. Increased kills will be necessary to relieve these damaged sections" (Biennial Report, 1943, p.8).

Harvey Smith, farmer at Lapush since 1877, says that bears occasionally break the limbs of his apple trees in getting the fruit, and he has seen the animals sitting upright in his oat field raking in the heads of grain with their paws. In the early spring the bears eat skunk cabbage roots and green shoots of the salmonberry.

John E. Schwartz stated that the Olympic bear "has been condemned by local residents as a most destructive predator of elk fawns. In fact, so much adverse sentiment has been aroused that many people have advocated drastic reduction and, in some cases, elimination of the bear from the Olympic fauna. Although it is conceded that bears do prey on deer and elk fawns, it seems that the habit is developed in certain individual animals and not among bears as a group. Observations made during the summer months of 1936, 1937, and 1938 would seem to uphold such a theory. During those periods, all bear scats found were examined for evidence of elk and deer, and out of more than 100 samples, only 8 per cent contained sufficient evidence to indicate that fawns had been part of the diet.

"Even such evidence, however, does not necessarily indicate that all the fawns eaten by bears were killed by them. That bears are natural scavengers is demonstrated by their tendency to clean up the carcasses of deer and elk which have died during the winter and spring months. Bear droppings during the spring season contain ample evidence of such a tendency, and it is likely, therefore, that some of the remains of fawns found in the examinations during the summer were from newlyborn calves that had died of causes other than predation" (1943, p.56).

Travelling down the Bogachiel River below Forks, December 14, 1938, we saw bear tracks constantly along both banks of the stream for a distance of 6 miles. The weather had remained below freezing for several days. About 20 feet from the river bank we saw a half-eaten salmon surrounded by bear tracks. Large chunks had been bitten out of the back and the head; the fish had not been skinned. Similar conditions were noted along the Calawah River 2 days later. Of 3 salmon bodies which we saw, one was one-third eaten, one was half eaten, one was scarcely touched. One of the salmon was on a forest trail, one on a sandbar, and one on the river beach. During the months of September to December it is likely that bears on the western streams find more spawned-out salmon than they can eat.

On December 14, 1938, on the Bogachiel, we saw a deposit of bear scats filled with brown, shredded bark.

The "bear problem" in our national parks is an old and familiar one. Victor H. Cahalane, Chief of the Biology Branch of the National Park Service, has made the following analysis:

"Until the late 1920's bears in the national parks were seldom seen except at the few points where garbage dumps provided the lure of food. These glimpses of the animals were so popular with tourists that feeding at designated platforms was made a feature in several parks. Bears increased in numbers and, as a result of the growing familiarity between animals and humans, the highlight of the average tourist's visit to a national park was to feed a bear by the roadside. Thus developed the hold-up bear who, no longer being satisfied with gifts, went after food concealed in cars, tents, and cabins, or even seized it from the hands of reluctant donors. The hundreds of cases of resulting human injuries and of property damage, causing fear of more serious future consequences, have forced the National Park Service to make a careful study of the situation.

"The primary consideration throughout most of a bear's waking moments is food. The supply determines the animal's whereabouts, his daily schedule and many of his habits. Carefully accumulated statistics on bear problem cases in Yellowstone National Park during the past seven years clearly demonstrate that bear trouble is human trouble. Feeding an animal along the roadside induces him to abandon the natural mode of living to take up instead a life of racketeering. Constant close association with people causes the bear to lose the fear that is the basis of respect. It is a logical consequence that he will attack people and tear open locked automobiles and cabins to satisfy his new appetites.

"The National Park Service is now taking various steps to remedy this situation. The most important is the new Service-wide regulation forbidding all feeding of park bears by tourists. This has been tested in Sequoia National Park for several years with the result that there has been a minimum of bear damage. The Service is furnishing, as rapidly as possible, bear-proof food containers and garbage receptacles in all the camp grounds. Individual bears that become too dangerous and persist in vandalism are trapped and deported from areas frequented by people. If such animals return, they are regretfully shot. Electrically charged wire fences are used to repel bears from sources of food where the public will not be endangered. These are inexpensive and entirely satisfactory in frightening away the bears, but unfortunately this method is not safe for general application.

"The success of these steps depends finally and almost entirely upon the concerted action of the visiting public. When the public observes the Service regulation: *Feeding of Bears is Prohibited* the normal relationship between bears and humans will be restored. Then bears will be bears and not racketeers" (1938A, p.32).

General.–The brown phase of pelage has not been reported from Olympic bears. Cowan stated that "on Vancouver Island, Queen Charlotte Islands, and most, if not all, of the coastal islands, including also the narrow strip of territory on the mainland of British Columbia immediately adjoining the coast, the brown phase is unknown" (1938, p.204).

Certain individuals, probably the older ones, are distinctly gray about the face and shoulders. A pelt which we examined and photographed had a small white spot on the breast and another on the throat.

Oscar Peterson tells of finding two hibernating dens on the first ridge north of Forks Prairie, one in a hollow balsam stub with much brush piled in front of the entrance; the other beneath a large uprooted Douglas fir, the entrance also protected by brush. Each den was dry and had a small entrance (Taylor, MS, 1921).

"John Heulsdonk and Pete Brandenbury once shot a bear in a tree den. They could not pull the bear out, so John crawled in the hole behind the bear to help push him out. Pete pulled and John pushed, and presently they found that they were unable to budge the bear! And John could not get out! Pete had to walk six miles to get an ax to enlarge the hole enough to get out the bear and man."

RACCOON
Procyon lotor psora Gray 1842

Identification.–Fig. 26.

Measurements.–An adult male from Forks, December 7, 1945, and an adult male from 6 miles WNW of Forks, February 18, 1946: length 888, 913; tail 320, 315; hind foot 130, 133; ear from notch 69, 64; weight in pounds 16-3/4, 16. A female from Forks, November 17, 1938: 7971 296, 120, weight in pounds 9.

During the trapping season of 1938-1939, Floyd Thornton obtained the weights of eight raccoons taken by him in western Clallam and Jefferson counties, as follows (pounds):

	Male	Female
December 18	15	–
December 21	7	8
December 24	8	–
January 5	20	8
January 14	16	10

The males weighing 7 and 8 pounds were probably less than a year old.

Occurrence.–Fairly common on lowland streams, lakes, and saltwater beaches around the peninsula. Raccoons are known to range, in other parts of Washington, to an elevation of about 3,000 feet.

Each Olympic trapper took, on an average, 2-3 raccoons a year in the period 1945-1949. Nearly 800 raccoons were taken annually from the four counties (Table 4). The animals are easily trapped or hunted with dogs and their numbers are kept at a minimum around towns and seaside resorts.

John Fletcher says that coons were formerly abundant at Ruby Beach but are now rare. Jack Ward says that they are rarely seen at the Indian village of Lapush but are common farther up the Quillayute River. Charles W. Keller says that there are a few at Lake Ozette. Floyd Thornton told us in 1938 that he had trapped the upper Calawah River for 10 years and found no increase in the numbers of raccoons. Rube Harps says that raccoons have never been abundant in the Lake Cushman-Skokomish region.

Breeding habits.–Floyd Thornton believes that the raccoon has 3-5 young, and he once tracked an adult with 4 young in the snow of Thurston County.

Food habits.–A. L. Nelson of the Fish and Wildlife Service has examined the stomachs and (or) intestines of 15 raccoons trapped in scattered places on the peninsula between December 11, 1937 and January 10, 1938. In only two cases were there sufficient remains to justify tabulation by volume:

No.377 Male.	Fish bones and flesh, probably Salmonidae.....	100%
No.378 Female.	Fish remains, possibly *Oncorhynchus sp.* [salmon].....	98%
	22 larvae of Rhyacophilidae [caddis-flies].....	2%

Figure 26. Raccoon feeding along Olympic seacoast, near Yellow Banks, June 1, 1949 (Photo by Neil Mortiboy).

In the 15 specimens, food items were recorded the following number of times, according to our compilations:

Insects (ants, beetles, caddis-flies, caterpillars, fly maggots, grasshoppers) 14; spiders 6; fish (4 probably Salmonidae) 6; crayfish (*Astacus*) 5; plant seeds (rose, salmonberry, thornapple) 5; molluscs (snails, etc.) 4; feathers (of perching birds) 2; amphibian (bones of frog, toad, or salamander) 1; shrew-mole (*Neurotrichus gibbsii*) 1.

Although raccoons are generally associated with water and obtain most of their food from the shores of lakes and streams, they do not, like the muskrat, mink, and otter, instinctively seek the protection of water when they are caught in a trap. The trapped raccoon is generally found tangled in the brush or resting in a tree.

LONG-TAILED WEASEL
Mustela frenata altifrontalis Hall 1936

Identification.–See *Mustela erminea*, p.86.

Measurements.–A male picked up on the Highway between McCleary and Elma, July 3, 1942: length 446, tail 165, hind foot 46, ear from notch 26. A male from Humes Ranch, Elwha River, collected by Cantwell on August 13, 1921: 450, 185, 52. A female (the type) from the mouth of Boulder Creek, 560 feet, collected by Taylor on July 16, 1921: 365, 142, 44.

Occurrence.–According to E. R. Hall (1936, p.94) the range of *Mustela altifrontalis* includes the coastal regions of Oregon, Washington, and southern British Columbia. Hall examined specimens from the following Olympic sources: Happy Lake; Elwha River at elevation 560 feet, and Lake Cushman. The maximum altitude record seems to be Hurricane Ridge, 5,750 feet. We have obtained skulls of this weasel from trappers in the lowlands of all four counties of the peninsula.

Records of the State Game Department indicate that slightly under 100 weasels (including ermines) are taken annually from the peninsula (Table 4). The total would be greater if trappers were to report all weasels actually caught, including those discarded as not worth the trouble of skinning. Table 4 suggests that more weasels per trapper are taken in Mason county than in the other three counties.

Breeding habits.–A male from Grays Harbor County, July 3, 1942, had swollen testes, 8 x 9 x 44 mm., and was probably in or nearing mating condition.

Food habits.–C. T. Albrecht mentioned an encounter between a weasel and a rabbit on the road between Forks and Lapush, July 27, 1922:

"We noticed two objects coming toward us in the road; one large, the other small. Before we reached them, they darted into the bushes at the side of the road. I could see that it was a rabbit pursued by a weazel and it was evident that both were almost overcome with fatigue. We stopped the car, got out the gun and waited. Within a few seconds the rabbit dashed out of the brush still pursued by the weazel, and headed in the opposite direction where they again disappeared in the undergrowth. Shortly they reappeared in the road, this time coming straight toward us, and when about fifty feet from the machine the weazel caught the rabbit by the hind leg and threw him, much as a dog would bring down his quarry. He commenced working toward the head and the vulnerable jugular vein, but the rabbit freed himself and came on, apparently unaware of our presence. When only six feet away from us, the weazel caught him and threw him the second time in the same manner, again working toward the head. I climbed out of the machine and, to save the rabbit, I hit the weazel with my hat. He then finally let go and disappeared in the bushes. The rabbit lay perfectly still for a moment, but soon revived and hopped away. I made a squeaking noise and the weazel stuck his head out, still intent on the chase, whereupon the 'game-getter' spoke and the weazel was bagged" (1922, p.5).

A similar encounter between a weasel and a rabbit was reported by Dice (1932, p.48).

In the Olympic Park museum there is a specimen of a male long-tailed weasel, length 17 inches [432 mm.] collected on Hurricane Ridge by E. A. Kitchin on August 15, 1942. Kitchin writes: "I shot the weasel from the lookout station... 5,750 feet. Noticed the chipmunks were very excited all morning and was sure something was after them. One climbed a little tree and the weasel after him. I shot and he fell under the tree" (MS, 1945).

The type specimen was taken at the base of an alder at the border of a flat, in a rat trap baited with a part of a mammal body, a prune, and a peanut (Taylor, MS, 1921).

On the prairies of Thurston County, adjoining the peninsula on the southeast, Theo. H. Scheffer reported six observations of long-tailed weasels in burrows of the pocket gopher, *Thomomys talpoides*. Weasels were trapped in burrows on May 4 and December 20. On May 4 a weasel was seen emerging from a burrow with a limp gopher in its mouth (MS).

Mortality.–In the skulls of three long-tailed weasels, a male and two females, from Mason County, December 7-11, 1937, we note deformities and holes caused by the peculiar nematode worm, *Skrjabingylus nasicola* (identified by E. C. Dougherty).

ERMINE
Mustela erminea olympica Hall 1945

Identification.–Fig. 27. The ermine is distinguished from the long-tailed weasel by the length of its tail, which is less, instead of more, than 47 per cent of the length of the head and body. This distinction holds good for adults of either sex. The Olympic ermine grades into the race *streatori* of western Washington and Oregon. See also *Mustela frenata*, p.85.

Measurements.–Twelve males of adult proportions show average and extreme measurements as follows: Total length, 243 (205-269); length of tail, 65 (60-74); length of hind foot, 31 (29-32). Corresponding measurements of six females are: 196 (188-208), 52 (45-60), 23.4 (22.7-24.0)... .On the basis of available data the female of *olympica* is smaller than that of any other race of the species and hence is the smallest adult weasel of the species *erminea* in either the Old World or America" (E. R. Hall, 1945, p.81).

We have a male slightly larger than any listed by Hall, from Forks, December 19, 1945 (Fig. 27): 273, 75, 33, ear from notch 21, weight in grams 69.

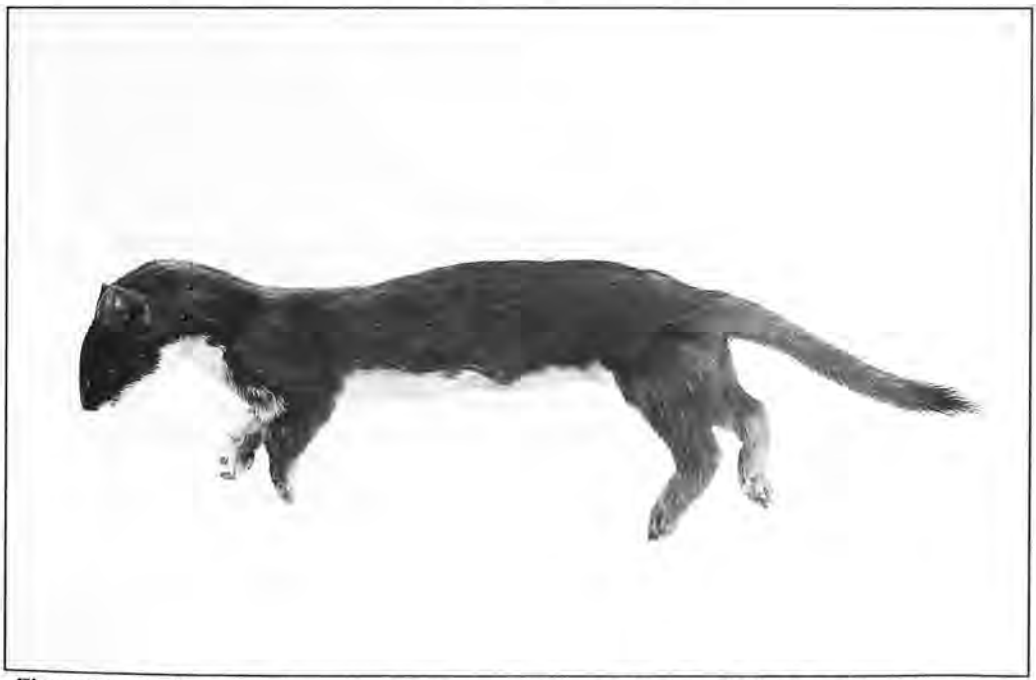

Figure 27. Ermine, *Mustela erminea olympica,* freshly trapped male weighing 2.4 ounces, from Forks, December 19, 1945.

Occurrence.–The range of *olympica* includes only the peninsula and the adjacent territory as far south as Olympia and Tokeland. Twenty specimens from the region between Clallam Bay and Olympia, but none from the west side of the peninsula, were available to Hall. The ermine occurs on the west, however, as evidenced by our specimen from Forks. Also, John Fletcher says that there are two kinds of weasels at Ruby Beach and Charles Keller says that he once caught an extremely short weasel at Lake Ozette. Hall reported an altitudinal range for the ermine from sea level to 4,500 feet, near the head of the Soleduck River.

General.–The coat of the Olympic ermine does not turn white in winter, although it differs slightly from the summer coat. On July 20, 1935, at Neah Bay, Kit Spier collected a small ermine with a curious white band of fur circling the body just ahead of the shoulders, in addition to the usual white underparts.

The Svihlas reported a least weasel, *Mustela rixosa*, from south of Port Angeles (1932, p.24) but later told us that their specimen was a small ermine.

MINK
Mustela vison energumenos (Bangs) 1896

Identification.–Fig. 28.

Measurements.–Six males from near Forks, November 15-December 4, 1938: length 579 (487-668); tail 190 (145-225); hind foot 65 (55-77); weight in grams 1,053 (612-1,667); weight in pounds 2.31 (1.34-3.67). Of these measurements, all of the minima pertain to one specimen and all of the maxima to another. Three females from near Forks, November 17-December 4, 1938: length 474 (465-482); tail 157 (153-160); hind foot 52 (50-55); weight in grams 529 (412-593); weight in pounds 1.17 (0.91-1.31). A female, for which only the weight is recorded, from Forks, December 6, 1938, weighed 693 grams (1.53 pounds). It will be seen that the male is about twice as heavy as the female.

Occurrence.–Entirely around the peninsula, from salt water to an unknown elevation, probably timberline. Elvin Olson caught a large male one winter on a ridge at an elevation of 4,000 feet, on the East Fork of the Quinault.

Between 1945 and 1949, on an average, 1,385 minks were taken annually by Olympic trappers. Over twice as many came from the sloughs and meandering streams of Grays Harbor County as from any one of the other three counties (Table 4).

Owing to the fact that the mink is an active and wide-ranging animal, individuals are often taken in the forest at some distance from the water, leading to a belief among certain trappers that there are two kinds, the "timber mink" and the "stream mink". Individuals trapped on logs and trails in the forest are nearly always adult males. Floyd Thornton has observed that along his trap lines on the Hoh River, more minks are taken downstream in November and more upstream in December and January. If, as indicated, a migration exists, it may be related to the movements of salmon upon which the minks feed.

Breeding habits.–We have not found embryos in females trapped as late as January 15. From November 1 to November 18, 1938, Thornton trapped 17 males and 21 females in western Clallam and Jefferson counties. He recalls, however, that in former years when the season extended into February, about 4 out of 5 minks trapped in late season were males. In 1945 Thornton told us that, by grouping his mink sets with long stretches between groups, he was able to take more males than females. The mink is believed by local observers to have 5 or 6 young in a litter. Both sexes have anal scent-glands which secrete a pungent liquid with a sickening odor like coal gas.

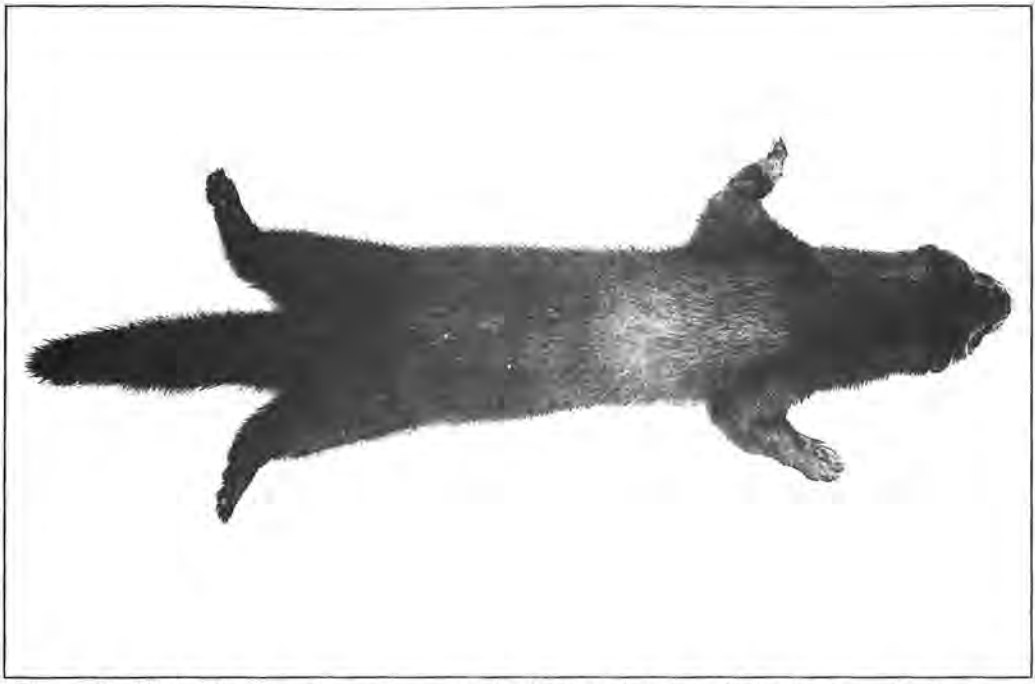

Figure 28. Mink, *Mustela vison energumenos,* freshly trapped male weighing 2-3/8 pounds, from Dickey River 8 miles W of Forks, December 8, 1945.

Food habits.–The mink glides along the edge of a stream, ducking under logs and pausing at tangles of driftwood to nose out, perchance, the lodged carcass of a duck or spawned-out salmon. It searches for crayfish in fresh water and for crabs, clams, and other shellfish along the ocean beach, not hesitating to enter the salt water.

In the stomach of an adult male mink trapped near Forks on November 19, 1945, we found the well crushed remains of a deer mouse. The Svihlas fed a small clam to a captive mink at the mouth of the Sekiu River (1931). Boone Cameron says that on the sloughs around Dungeness minks feed on crabs and "swamp mice" [*Microtus*]. Small birds are included in their diet.

Mink scats are about the diameter of a lead pencil and up to 2 inches long, dark colored, generally deposited on logs. Floyd Thornton has observed that mink scats on the western slope of the peninsula are characterized by crayfish remains during the spring and summer and by salmon bones during the fall and winter. Feathers, and claws of mice and mountain-beavers, are occasionally seen.

One winter Thornton watched a mink attack a mountain-beaver twice its size which had been caught in a trap. The mink seized the rodent by the back of the neck and easily killed it.

In the stomachs of a male and a female trapped near Forks, December 7 and 9, 1945, we found, respectively, 12 and 20 cc. of well-chewed fish remains. These were of a small fish, probably a cottid or bullhead, with white flesh, smooth gray skin and spiny fins.

F. M. Gaige shot a mink on the Skokomish River as it was running along the bank carrying a 30-inch garter snake [*Thamnophis*] in its mouth. The snake was held just back of its head (Dice, 1932, p.48).

Mortality.–The skulls of 3 minks in our collection have deformed sinuses as a result of the activities of the nematode parasite, *Skrjabingylus nasicola* (identified by E. C. Dougherty).

MARTEN
Martes caurina caurina (Merriam) 1890

Identification.–Cat-like; total length about 2 feet; weight about 1-1/2 to 2-1/2 pounds; fur rich brown with orange patch on breast; tail bushy; ears rounded (see also *Martes pennanti*, p.90)

Measurements.–None available from the Olympics.

Occurrence.–The marten is a wide-ranging animal and may be encountered on the peninsula in conifer forests from salt water to timberline. The type specimen was collected from the coast. In the Cascade Range it is known to occur up to an elevation of 10,000 feet. According to Olympic Park wildlife reports, marten tracks have been seen in the snow at Low Divide and Enchanted Valley, Deer Lake, Hurricane Ridge, and Greywolf River. The species was known to the Makah natives at Neah Bay (Gunther, 1936, p.114) and Cooper reported a specimen from Cape Flattery (1860, p.92). While the marten is often thought of as a denizen of the mountains, we are inclined to believe that, on the Olympic Peninsula, martens ignore altitudinal limits and travel through the dense evergreen forests wherever flying squirrels, red squirrels, chipmunks, mice, and other food species are to be found. A pioneer of Sequim, A. B. Cameron, believes that there are relatively few martens on the northeast corner of the peninsula.

Trapping records of the Olympic marten are shown in Table 4. The earliest (1918) estimates by rangers placed 1,500 martens on the Olympic Forest and the latest (1948) 2,575.

Breeding habits.–Charles Lewis, farmer and fur breeder at Spruce, told us that three females which he trapped alive on the Hoh watershed mated in July and gave birth to 2, 2, and 3 young, respectively. Another female received the male in August and was sold shortly afterward.

Food habits.–Lewis believes that the martens in the Hoh Valley feed at low elevations in November on huckleberries (*Vaccinium*) and that they move upward in January. Martens held in captivity were tamed in "3-4 hours" and subsequently ate mush, milk, fruit, and honey. In the stomachs of wild-trapped martens, Lewis has observed feathers and remains of rabbits, mice, squirrels, and many spotted skunks. On one occasion, when a marten and a spotted skunk were held in captivity in adjoining pens, the marten forced its way through the partition and "in spite of a gas attack" killed the skunk and ate one of its legs!

Josh Allen, game warden, once watched a marten in the Olympics moving on a light crust of snow, picking up seeds of "fir" one by one.

"Howard Walton saw one chasing a snowshoe rabbit at Low Divide" (Olympic Park wildlife report for 1943).

General habits.–Ben York, who trapped on the Duckabush River in the Olympics and later established a 133-mile trapline on the Cascade Range, says that his favorite set for marten is a pole 6 inches in diameter leaning against a tree with a canopy of fir boughs placed overhead as a protection from snow. At the upper end of the pole, which is chopped in the form of a small platform, a naked steel trap is laid. A bait, sometimes with an added lure of herring oil, is nailed to the tree 18 inches above the trap.

York is of the opinion that the martens do not move about in groups or bands but, with the coming of cold weather and crusty snow, most of them leave their individual dens at about the same time and start in search of food.

FISHER
Martes pennanti (Erxleben) 1777

Identification.–Fig. 29. Cat-like; total length about 3 feet; weight about 5-10 pounds; fur dark brown to blackish; tail bushy; ears rounded (see also *Martes caurina*, p.89).

Measurements.–A mounted specimen, probably a male, taken at an elevation of 5,000 feet on Mount Ellinor, January 1912, by Rube Harps, was measured in 1938: length 40 inches, tail 14 inches (Scheffer, 1938, p.10).

Occurrence.–At one time the fisher occupied the same range in the Olympics as the marten, namely, the evergreen forests from sea level to timberline. It is now restricted to the central wilderness, or, if it occurs in the lowlands, is very rare. In 1909 Lester Fairbrother trapped a fisher at the water reservoir of the town of Cosmopolis. Henry Markishtum and Fred Irving say that fishers used to be trapped by Makah natives in the low hills around Neah Bay, a fact corroborated by Washburn, the storekeeper who handled the furs. According to Charles Keller, his brother trapped two fishers at Clallam Bay in 1926 and George Fargo took one on Crooked Creek between Lake Ozette and Dickey Lake in 1925.

Cantwell wrote in April 1920 that "two trappers working the Queets River west of Clearwater this winter have caught 37 fisher, that sold for $75 each. Three were taken last year, and one this year, on the narrow spit below Copalis" (MS).

Elvin and Ignor Olson say that in 1921, the last year that they trapped for marten and fisher, they took 20 fishers on the East Fork of the Quinault between elevations of 1,500 and 5,000 feet. These men recall that fishers were taken at lower elevations also.

Ted Anderson saw fisher tracks in a blowdown on the Queets River in the winter of 1937-1938. Rube Harps said in 1938 that there were fishers at Big Log on the North Fork of the Skokomish. The National Park Service (1943, p.33) reported that "one fisher was seen along Barnes Creek [Lake Crescent] in 1940."

Forest rangers have estimated the numbers of fishers on the peninsula in various years since 1918 at from 100 to 800, but readily admit the difficulty of estimating this species. While a few fishers may still exist along the coast of Washington south of the Olympics, it is safe to say that the species will make its last stand in western Washington in

Figure 29. Fisher, *Martes pennanti;* poorly mounted specimen from Mt. Ellinor, January 1912.

Olympic National Park.

Food habits.–The Olson brothers recall finding mountain-beaver and squirrel remains in fisher stomachs. Fisher scats along the trail in summer contained huckleberries (*Vaccinium*) and salal berries (*Gaultheria shallon*).

Josh Allen, game warden, says that he trapped fishers in the Olympics, using bear meat, while that fish meat was unsatisfactory. He believes that fishers eat mountain-beavers and rabbits.

Rube Harps caught one fisher to about five martens on the North Fork of the Skokomish. He believes that fishers feed on mountain-beavers, rabbits, squirrels, and grouse.

Leroy Smith told of sitting at the border of a forest opening in the Olympics one spring when a rabbit suddenly appeared, followed a zigzag course across the clearing, and entered the brush on the opposite side. Hot on its trail was a fisher with nose to the ground following the scent, although its prey was in plain sight. A loud squeal issued from the brush and when Smith investigated, both animals were gone.

General habits.–The Olson brothers used No. 1-1/2 steel traps for both marten and fisher, set in "cubbies" and baited with fish or other meat. The fisher was said to be slightly more suspicious than the marten. One old 3-legged fisher (presumably injured in a trap) robbed baits from the trapline before it was eventually caught. Dogs were able to tree fishers on several occasions, and the Olsons observed that the fisher, unlike the house cat which it somewhat resembles, is very agile in trees and can run head-first down a trunk. Elliot (1899, pp.266-267) found the fisher exceedingly quick in all its movements. One moved with such rapidity over the ground and over the trees that he was unable to get a shot at it.

The Makah natives say that the fisher is occasionally attacked by the bobcat (Gunther, 1936, p.115).

STRIPED SKUNK
Mephitis mephitis spissigrada Bangs 1898

Identification.–Fig. 30.

Measurements.–Three males from Neah Bay collected May 17-31, 1897, by E. A. Preble: length 620, 630, 640; tail 260, 230, 200; hind foot 85, 83, 85. Three females: Cedarville, Grays Harbor County, by G. G. Cantwell on November 16, 1918: 610, 250, 75; Neah Bay, by E. A. Preble on May 22, 1897: 645, 245, 80; Lake Cushman, by C. P. Streator an July 31, 1894: 670, 270, 76.

A young male, presumably in its first year, from Sequim, December 7, 1945: length 591, tail 200, hind foot 66, ear from notch 27, weight in pounds 3-3/4 (in grams, 1,701).

Occurrence.–Common in the lowlands around the peninsula. "Grant Humes says that skunks are scarce on the Elwha River, occurring at elevations up to 900 feet. William Everett saw one about 1916 near the 2,000 foot level, Olympic Hot Springs, the only one he has seen this high" (Taylor, MS, 1921).

"As many as sixty have been counted at one time, congregated on the beach at low tide hunting for soft shell clams, and various crustacea revealed by the receded waters" (Elliot, 1899, p.270).

About 250 striped skunks were taken annually from the peninsula in the four trapping seasons ending 1945-1949 (Table 4). Skunks are more numerous on the farms of Clallam and Mason counties than on forested lands.

Figure 30. Striped skunk near its den, Staircase Resort, Skokomish River, Olympic National Park, October 2, 1949.

Boone Cameron trapped 14 skunks under buildings of the Anjouli farm, near Sequim, in the first week or ten days of November 1945.

Breeding habits.–E. A. Preble took a female with 4 embryos at Neah Bay, May 22, 1897.

SPOTTED SKUNK, CIVET CAT
Spilogale gracilis latifrons Merriam 1890

Identification.–Fig. 31.

Measurements.–A fat male from the Bogachiel River, December 14, 1938: length 432, tail 142, hind foot 49, ear from base 28, weight in grams 741 (in pounds, 1.63). A male from the South Fork of the Hoh River collected by I. A. Peterson, July 16, 1937: length 500, tail 130, hind foot 47. A female from Frazier Creek, 4 miles SW of Port Angeles, 800 feet, taken by W. P. Taylor on July 4, 1921, and another from Lincoln Ranger Station, upper end of Lake Cushman, 800 feet, collected by E. A. Kitchin on December 17, 1943: 365, 356; 110, 102; 43, 44.

Occurrence.–Common in the lowlands around the entire peninsula. John Tolen, Forest Service employee, says that civet cats occur at least as high as Elkhorn Ranger Station, 1,850 feet, on the Elwha River (Taylor, MS, 1921). State Game Department records (Table 4) show that over 200 spotted skunks are trapped annually in the four counties. Many others are discarded by annoyed trappers who find these little pests in mink and muskrat sets.

Trappers disagree as to which skunk, spotted or striped, is more common along the ocean, but it is safe to say that both species are plentiful there. We accompanied a trapper

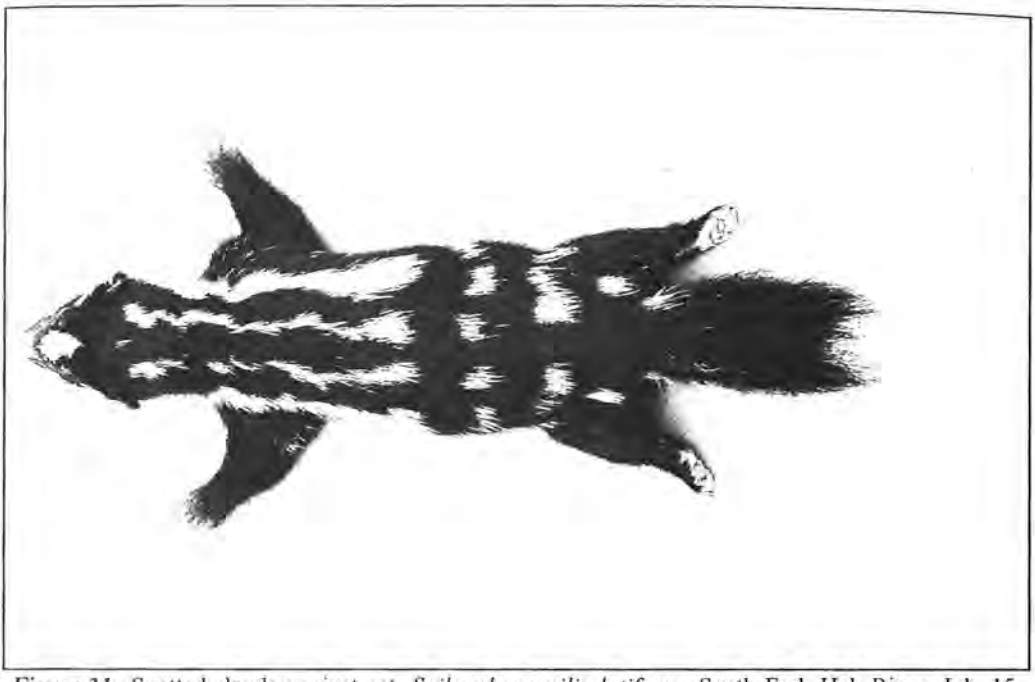

Figure 31. Spotted skunk or civet cat, *Spilogale gracilis latifrons*, South Fork Hoh River, July 15, 1937 (U. S. Forest Service photo by John E. Schwartz).

along the Hoh and Bogachiel rivers on November 17 and December 14, 1938, and watched him remove seven spotted skunks from drowning sets prepared for mink. Spotted skunks are more active on warm nights, although they are abroad to a certain extent even in freezing weather.

J. B. Flett (1928) reported that 26 spotted skunks were trapped in one year at the Mountaineer's Lodge, Kitsap Peninsula.

The Svihlas reported that "five little spotted skunks were trapped in mountain beaver runways and holes at the mouth of the Sekiu River. Along the Elwha River, 12 miles south of Port Angeles, a spotted skunk and a mountain-beaver were taken in the same runway" (1933, p.39).

In his fourth biennial report (1940) the State Game Director observed that "the extremely low quotation marked up for this fur-bearer has reacted in bringing about a heavy rate of increase, especially in Clallam County. In many districts the rate of growth has attained a point where this animal is becoming a pest." The market value of a spotted skunk at that time was 20-25 cents.

It is common opinion that skunks are increasing in numbers on the peninsula. As the Olympic forests are cleared and farms are created, more food in the form of insects and rodents is made available for skunks.

Mortality.–Floyd Thornton, of Forks, tells of finding the nearly-eaten carcass of a spotted skunk in a trap, surrounded by tracks of other spotted skunks. On another occasion a hawk ate the meat and left the skin of a spotted skunk in a trap.

Josh Allen says that a horned owl ate about half the body of a trapped spotted skunk and on the next day the owl itself was caught in the re-set trap.

(For an account of an attack by a marten upon a skunk, see page 89).

In all skulls of spotted skunks, totalling 8, which we have obtained from the peninsula, there is evidence of damage by the sinus worm, *Skrjabingylus chitwoodorum* (identified by E. C. Dougherty.)

General.–The scent glands of a male spotted skunk were examined on December 14, 1938. An egg-shaped sac 20 x 22 mm. lay in the flesh on either side of the anus, communicating with it directly, and was filled with a thin, watery, clear, slightly yellowish fluid. According to trappers, the anal secretion of the spotted skunk disappears more quickly from hands and clothing than that of the striped skunk. We have not bothered to make the test.

RIVER OTTER
Lutra canadensis pacifica Rhoads 1898

Identification.–Fig. 32.

Measurements.–An old male from the Dickey River 8 miles W of Forks, December 8, 1945, the largest of 16 males examined in this region: length 1,220, tail 475[1] (from center of anus 428), hind foot 142, ear from notch 29, weight in pounds 23-1/4. Another male, slightly shorter, from the same locality on the same date, was the heaviest specimen examined: 26 pounds.

An old female from the Calawah River, Clallam County, December 6, 1938; the largest of 4 females examined in this region: length 1,062, tail 430, hind foot 120, ear from notch 23, weight in pounds 14-3/4. She was poor in fat, although the heaviest of 3 females weighed.

Three small males believed to be in their first year, from Forks, December 13, November 30, and November 29, 1938: length 970, 1,000, 1,030; tail 405, 415, 405; hind foot not measured; weight in pounds 11, 9, 11.

Occurrence.–The Olympic Peninsula probably has more "otter country" than any region of similar size in the United States. Otters are most abundant on the large rivers that receive the heavy rainfall of the west slope, but they may be encountered anywhere on the peninsula between the mountains and saltwater. How high they venture into the mountains is not known, Otters have held their ground in spite of the fact that they are vulnerable to trappers working along the Olympic loop highway. Fortunately for the breeding stock, however, there are many places virtually inaccessible to man where some otters may retreat during the trapping season, November to January. Nearly 200 otters were taken annually from the four Olympic counties in 1945-1949 (Table 4). These comprised one-third of the take of otters from the entire state of Washington. In the winter of 1943-1944, a single trapper working out of Forks took 48 otters!

Breeding habits.–Trappers believe that mating takes place in midwinter. We found that the testes of adult males were definitely swollen by December 15.

Trapper Floyd Thornton, of Forks, told us that he has seen otters in August and September, usually in threes (1 adult and 2 young). On isolated, undisturbed lakes he has seen two adults with the young. In December, 1937, he caught an old female on the Hoh and during the next week he caught 2 young within a mile of the spot. Trapper Jack Petit, of

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[1] The tail of an otter is difficult to measure. Our values were obtained by bending the tail at right angles, marking the center of curvature with a pin, and allowing the tail to assume its normal position.

Figure 32. Otter, *Lutra canadensis pacifica*, befriended by C. A. Bushnell on the Wishkah River; male in its third year, December 1-2, 1945.

Ilwaco, Pacific County, saw an adult and 5 small otters in September, and the next day he saw an adult with 8 small ones.

There is some evidence that males are more active than females in the early part of the trapping season. In the winter of 1938-1939, Thornton took 8 males and 1 female between November 1 and December 15, and 5 males and 5 females between December 20 and January 13.

The female otter has 4 abdominal mammae. The male has 4 rudimentary mammae arranged on the corners of a rectangle, with an opening in the center of the rectangle through which the bony penis is protruded. Each sex has a pair of anal glands. On an adult female examined December 6, each gland was cylindrical, 15 x 40 mm., and led through a duct, 10 mm. long, to the anus. Each gland contained 5-10 ml. of a yellow liquid with a not unpleasant odor faintly resembling coal gas. Some trappers dissolve the anal secretion in alcohol and use it as a lure.

Food habits.–From his observations, Charles Keller, of Lake Ozette, believes that crayfish (*Astacus*) and squawfish (*Ptychocheilus*) in summer, and salmon in winter, are the principal foods of the otter. Along the lake shore, near otter tracks, he has found duck carcasses with only the feet, head, feathers, and breastbone left.

Floyd Thornton has noted in winter otter scats containing feathers. Several times when he has accidentally caught ducks in steel traps he has found that otters visited the traps and ate all but the feet of the ducks. On one occasion, a seagull was trapped in this way and subsequently torn to pieces by an otter. Before he started using drowning sets, Thornton found perhaps a dozen trapped minks that had been bitten through the back of the neck and killed by otters. Thornton tells of shooting an otter on the Bogachiel River while it was in the act of eating a rabbit. The rabbit, which had been caught in a mink trap, was almost consumed. The otter held its ground and growled in a threatening manner as Thornton approached. There is an unverified report that an otter killed two geese on the Earl Hundley farm, Grays Harbor.

On the Bogachiel River in December we found two places where otters had left scats on partly submerged drift logs. In one case the scats contained crayfish and fish bones, in another case fish bones only. A fresh scat on a sandbar on the Calawah River in December contained crayfish. At three places on Salmon Creek, Grays Harbor County, in January, we saw otter scats, all containing crayfish. Several others seen later contained salmon bones. Salmon eggs are said to pass intact through the food tract of the otter, although we have not verified this statement.

Thornton says that in eating salmon, an otter generally leaves the skin, head, tail, and backbone on a rock or drift log near water. We saw a fish skinned in this manner on the Bogachiel River, December 14. The bear, another fish-eater in the same locality, generally carries the fish back from the stream side and eats any or all parts of the body without discrimination.

General habits.–The familiar slide or playground of the otter is rarely seen in the western Olympics because of the great fluctuation of stream levels. Joseph S. Dixon reported one on the Hoh River in September, 1943, and also stated that a family of otters lived in a log jam just above the Bogachiel Ranger Station during the summer of 1943 (MS). Log jams created by the tremendous winter floods afford ideal protection for otters.

An experienced trapper at Forks says that he is able to take many more males than females, by grouping 3 or 4 traps at intervals of 1 to 2 miles, thus capitalizing on the tendency of the male to wander. This method is said to spare the female breeding stock.

We once watched a 15-pound female otter held by a few hind toes in a trap, in shallow water and along a stream bank. It dived and twisted rapidly, more like a fish or a snake than a mammal. Every 5-15 seconds it uttered a quiet, throaty growl like a dog with a bone, alternating with a forcibly exhaled f....f! like a boxer clearing his nostrils. Several teaspoonfuls of creamy anal gland secretion were left on the ground as the otter twisted about.

On another occasion we had the pleasure of seeing an otter which had been tamed by C. A. Bushnell, caretaker of the Aberdeen City Reservoir on the Wishkah River (Fig. 32). The animal was a male and had been picked up as a kit on May 29, 1943, at the edge of the reservoir. At that time its eyes were fully open and it was wandering about; probably 4-6 weeks old. When I saw it two and one-half years later it was spending its nights in a woodshed and playing along the banks of the reservoir during the day. Mr. Bushnell writes that "in watching our pet otter I have found that he catches and eats, grasshoppers, crawfish, periwinkles [caddis-fly larvae], small catfish, and occasional trout... . My wife, each day, makes about 1-1/2 quarts of bread pudding... . He likes this pudding and will eat this much every day."

In order to photograph the otter I coaxed it with a pound of salmon, fed bit by bit. The last few scraps were taken reluctantly, which is not surprising in view of the fact that the otter had just eaten a dish of bread pudding before my arrival!

SEA OTTER
Enhydra lutris (Linnaeus) 1758

Identification.–Fig. 33.

Measurements.–No measurements of Olympic sea otters have been preserved, although a photograph of seven pelts against a barn door at Oyhut, in the late 1800's suggests that some individuals attained a length of six feet (Fig. 33). It is a sad corollary to the extermination of the Olympic sea otter that the only photographs available are those of dead animals or their pelts. In color, the pelts were said to vary from rich brown to black, becoming silvery about the face and underparts in old individuals. The Alaska sea otter is three or four times as heavy as the land otter and may attain a weight of 80 pounds.

Occurrence.–The last sea otter on the Washington coast was killed about 1911 and it is quite certain that the species will not return (Scheffer, 1940).

A recent observation, however, suggests that an occasional sea otter may reach the Olympic seacoast. Preston P. Macy and Gunnar O. Fagerlund report that, on July 18, 1949, they saw several animals, like river otters but larger, at the mouth of Goodman Creek. "It was about 2:30 p.m. and the animals were in the water, mostly beneath the surface but appearing on the surface at intervals. We did not see them on any of the numerous rocks that stud the junction of the creek with the ocean. The water was rolling in smooth swells and the tide was coming in" (Fagerlund, letter of September 16, 1949).

Sea otters tend to retreat with the advance of civilization. The present-day colonies along the American shore are found only on rugged and uninhabited beaches in central California, western Alaska, and probably northern British Columbia. Along the Oregon-Washington coast where sea otters disappeared, the last important colony to vanish was on the Olympic Peninsula.

T. S. Palmer stated in 1889 that "the animals seem to be confined to a strip of beach... from Gray's Harbor to the Quinaelt Reservation... about 25 otters are killed in all, each year, and the shooting is done at nearly all seasons. No perceptible increase or decrease

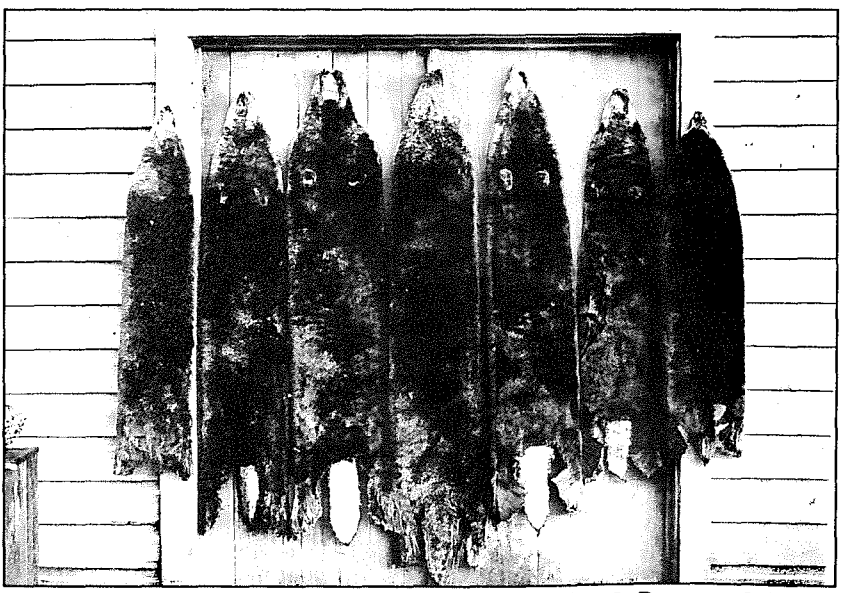


Figure 33. Sea otter, *Enhydra lutris*, pelts drying on warehouse of A. O. Damon at Oyhut, in the late 1800's (Photo by Damon's daughter, Clara L. Minard).

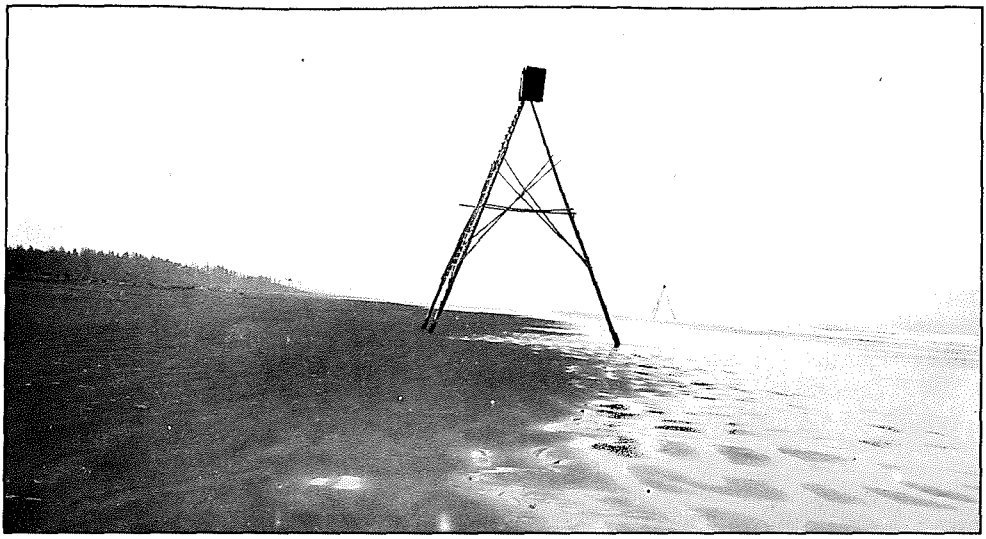


Figure 34 Derrick, 20-25 feet high, used by sea otter hunters at Copalis, September 13, 1897 (Photo by A. K. Fisher).

in their numbers has been observed in the last few years. Skins bring from $75 to $100 apiece" (MS).

Gilman (1896, p.138) stated that "off the beach from Gray's Harbor to Point Grenville is one of the few sea-otter ranges of the world. It still furnishes a few hides of that valuable fur to market each year."

Reagan (1909, p.199) reported that the sea otter was not common but was occasionally captured or found dead on the beach. "A starving aged squaw found one on the beach near here some four years ago [Lapush, 1904?] while looking for some barnacles to eat. She put it in her basket and brought it home, skinned and sold the pelt for more than $200; then gave a 'potlatch' with the money and starved to death herself the next summer."

Although the local Indians hunted the animals for centuries without depleting their numbers, white men succeeded in destroying them in the brief space of fifty years. The favorite hunting weapon was a .50 caliber Sharps "buffalo gun" handled by a man perched on top of a high wooden derrick or offshore rock (Fig. 34). The first derricks were said to have been erected near Copalis in 1863, and by 1900 as many as ten tripods could be seen from one point of view. The value of a sea otter pelt rose from $40-50 in 1863 to $600-750 in 1911. Lester Fairbrother says that, while he was trapping and hunting at Grays Harbor about 1914, crab fishermen shot three sea otters out of a small herd, later obtaining $500 for each of two pelts and $750 for the other. [The international treaty for the protection of fur seals and sea otters went into effect on December 15, 1911, so if these pelts were legally sold they must have been taken before 1911]. To the best of our knowledge, the last professional sea otter hunter on the coast, Charlie McIntyre, died in Aberdeen on April 24, 1933.

A little information on the biology of the sea otter has been obtained from Indians now living on the coast. The sea otters were almost constantly in the water, rarely crawling out on the rocks at Point Grenville. They were hunted from the surf line to about 8 miles offshore. They fed in shallow water on sea urchins, crabs, clams, and an occasional fish or sea bird. When not feeding they were generally sleeping at sea, or lazily rolling in the fronds of kelp. Apparently the single young was born at any time of the year–just where was not certain–and remained near its mother for many months.

BOBCAT
Lynx rufus fasciatus Rafinesque 1817

Identification.–Fig. 35.

Measurements.–A male from the Bogachiel River near Forks, December 14, 1938: length 890, tail 190, hind foot 167, ear from base 80, weight in pounds 24-1/4 (in kilograms 11.00). A small male from Elkhorn Ranger Station, Elwha River, collected by E. A. Kitchin on December 4, 1942: 25 inches [635 mm.], 4-1/2 inches [114 mm.], 6 inches [152 mm]. A rather lean female from Quillayute Prairie, February 18, 1946 (Fig. 35): 831, 140, 170, ear from notch 73, ear tufts 19, weight in pounds 15-1/2 (in kilograms 7.03).

Occurrence.–Fairly common in the forest and on cutover lands of the peninsula. In 1921, Taylor and Cantwell found bobcat sign up to the highest peaks. At the head of the Dosewallips River, 6,000 feet, on July 28, they found a den on the point of a rocky ridge. "It was under a rock, the hole 8" by 10". Cat feces were plentiful in the vicinity" (MS).

The bobcat population is influenced mainly by: (1) Changes in the native forest brought about by man. Thus, logging and burning destroy coniferous trees and allow the growth of deciduous brush favorable to the rabbits, mountain-beavers, and mice upon which the bobcat feeds. (2) The market value of bobcat pelts. (3) The intensity of hunting for bounty.

Bounty records in the biennial reports of the State Game Department indicate that a bounty was paid on nearly 3,000 Olympic bobcats over a recent 10-year period (Table 6). To the figures showing bobcats killed for bounty, there can be added a few, perhaps a dozen, killed each year by State Game wardens in the course of duty. Federal agents for predatory animal control operating near agricultural lands in Grays Harbor and Mason counties (rarely in Clallam and Jefferson) over the 8-year period 1937-1944 took 411 bobcats.

A single private trapper took 63 bobcats in the spring of 1945, most of them within 5 miles of Forks!

The estimates made by rangers of the bobcat population on the Olympic Forest were, in 1910, 2,050 and in 1948, 2,000. This suggests that, while the amount of suitable bobcat country has been increasing as a result of man's farming and logging activities, the hunting pressure has also been increasing at a similar rate, with the result that the bobcat population is stable.

Breeding habits.–Game warden Josh Allen believes that the bobcat has 2, seldom 3, young. According to Floyd Thornton, bobcats are most active in February and March. He believes that about two-thirds of the cats which he traps between November and March are males. The female listed under "*Measurements*" had a small uterus and was probably a nullipara in her second year.

Food habits.–The contents of 21 bobcat stomachs obtained on the peninsula and listed in Table 7, indicate the importance of rodents in the midwinter diet. Two of the stomachs are of special interest: one "crammed full (weight of contents 2 lbs., 2 oz., damp)", of rabbit and deer meat; another "plus full" with remains of 2 flying squirrels, 1 rabbit, and 2 deer mice.

John E. Schwartz listed the occurrence of food items in 6 stomachs and 99 scats of bobcats from the north and west drainages of the Olympics over a 3-year period (1943, p.55). The 6 stomachs are the same as those listed in our Table 7, Lot B. Rabbit and red squirrel were easily the most common items, followed by deer, wood rat, salmon, meadow mouse, flying squirrel, jumping mouse, deer mouse, mountain-beaver, winter wren, mole and grouse.

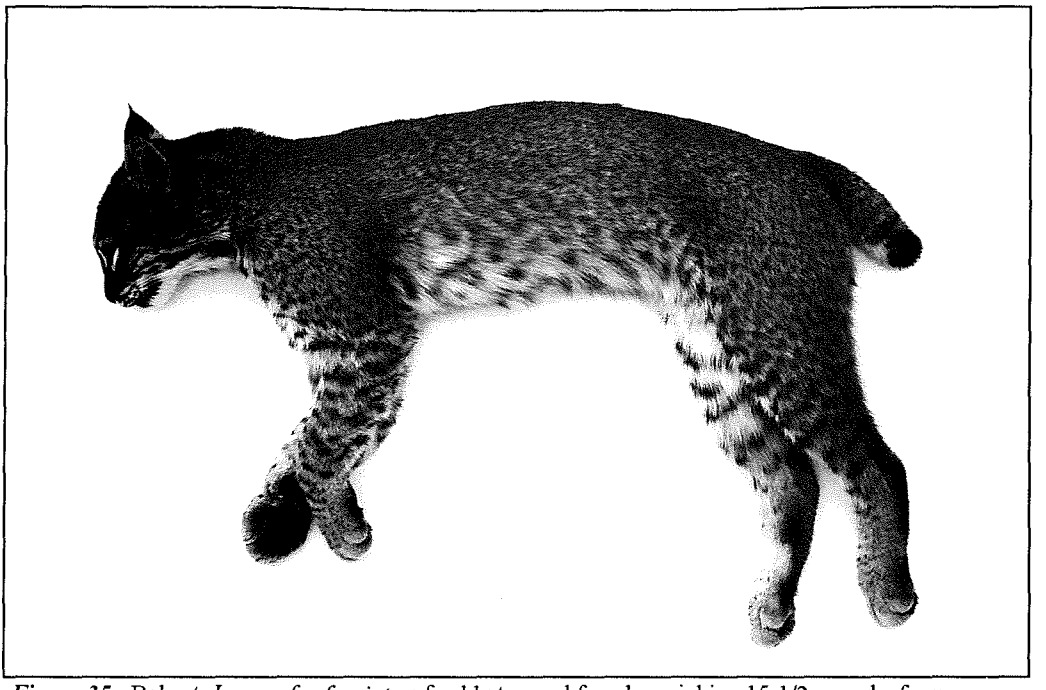


Figure 35. Bobcat, *Lynx rufus fasciatus*; freshly trapped female weighing 15-1/2 pounds, from Quillayute Prairie, February 18, 1946.

A female bobcat, said to be adult, was taken alive from a trap on the upper Bogachiel River in 1931 by Jim Reed. We photographed it in captivity in 1938. When it escaped in June, 1942 and was shot by its keeper, Leroy Smith, it must have attained an age of 12 years or more. Smith fed the bobcat about 2 pounds a day, using whatever meat was available, such as rabbit, mountain-beaver, beef liver, and trout and salmon heads. In eating a rabbit, the bobcat invariably started with the ears. It refused canned salmon and salted meats.

Economic status.–"Bobcats are found throughout the Olympic Peninsula, and in spite of the large numbers taken by predatory animal hunters in recent years, are still fairly numerous. Their destructiveness to big game is limited mainly to young fawns, although it has been determined that they occasionally attack and kill yearlings and even adult deer during the winter months. Probably most adults so killed are in a weakened condition" (Schwartz, *op. cit.*, p.54).

Certain well-furred bobcats are occasionally referred to by trappers, and commonly by fur dealers, as "lynx cats" or "link cats". The true lynx, *L. canadensis canadensis*, has not been taken in western Washington.

According to Gunther (1936, p.115) the bobcat was not hunted by the natives at Neah Bay.

Mortality.–Bobcats examined in the Olympics in 1937 and 1936 were found heavily parasitized with roundworms and tapeworms, probably a normal condition.

COUGAR, MOUNTAIN LION
Felis concolor olympus Merriam 1897

Identification.–Figs. 36 and 37.

Measurements.–Of the 23 specimens of *olympus* examined by Young and Goldman (1946) none was accompanied by measurements in the flesh. The "well made dry skin" of an adult female from Lake Cushman: length 2,095 (6.8 feet), tail 775, hind foot 260 (according to Merriam, 1901, p.590).

A. B. Cameron says that the largest cougar taken by him in eastern Clallam County measured 9 feet in length. Vernon Bailey learned that Grant Hume, on the Elwha in February 1918, took a female cougar weighing 140 pounds, "the largest of the many he has killed" (MS). A small cougar killed in February 1936 weighed 76 pounds, according to Schwartz (1943, p.54). A photograph labelled "175 Lb. Olympic Mt. Lion" was given to us by C. G. Jones, who said that the cat was killed by Emil Michael on the Elwha River in 1937. The weight was probably an estimate. A cougar, possibly of the subspecies *oregonensis*, was killed in Thurston County 20 miles SE of Vail in April 1946 by Al Lynn. The green hide, stretched for drying, was said to measure 9 feet 2 inches from tip of nose to tip of tail.

James Crowell, of Brinnon, told us that he took an old female, 8 feet, 6 inches in length, from the upper Quilcene River in the spring of 1948.

Occurrence.–In forested areas and mountain meadows remote from civilization; fairly common. Young and Goldman consider the range of *olympus* to extend as far south as Tenino.

State bounties were paid on 348 cougars killed in the Olympic counties over a recent 10-year period (Table 8).

Clallam and Jefferson counties, with extensive wilderness areas, have produced far more cougars than Grays Harbor and Mason counties, with large areas of cultivated land.

Rangers on the Olympic Forest estimated the cougar population at 155 in 1919 and 530 in 1948, with little fluctuation in intervening years.

In recent Olympic Park wildlife reports the statements appear: "Cougars are not as plentiful as had previously been believed by some observers. Three deer kills were reported on the Elwha River and cougar signs were seen in only three places during the year" (1939); "Emil Michael, old resident hunter, claims they are not increasing" (1942); "uncommon.... cougar signs are observed on all watersheds... none were actually seen this year" (1944).

Breeding habits.–Leroy Smith, cougar hunter from Forks, says that the Olympic cougar usually has two kits. At birth these are as large as a house cat and well furred. On November 1, 1945, a traveler saw an adult cougar with kits on the Hoh road at Rock Creek. According to Young and Goldman (1946, p.114) the cougar may deliver as many as six young. Later in the same day, Smith and Charlie Lewis found a 100 pound deer killed and partly eaten here. They set dogs on the trail and treed an adult with one kit, both of which they shot. In the next few days hunters shot or trapped three more kits, all of them said to be larger than adult bobcats [over 25 pounds?].

Food habits.–The stomachs of six cougars from Clallam County "all of them filled with the remains of deer" were examined by Charles C. Sperry (MS, 1945). Three were taken in December, one in February, one on March 15, and one on April 15. Three of the cougars were adult males, two were adult females, and one was a young male.

John E. Schwartz investigated the food habits of the cougar with relation to the Olympic elk and reported as follows:

"Detailed analyses of 28 cougar scats collected from the Hoh, Queets, and Quinault Valleys indicated that slightly more than 30 per cent of the total number of identifiable food

Figure 36. Cougar, *Felis concolor olympus*, treed by dogs on Elwha River, February 1917 (Photo by O. J. Murie).

Figure 37. Olympic cougar, three kittens found under a fallen log near the upper Dungeness River, May 1947 (Photo by Lloyd Beebe).

items was composed of [deer and elk]. Most of this, or 23.5 per cent, was represented by deer and only 8.8 per cent by elk... . Abundant evidence indicates... that cougars can kill elk without extreme difficulty. For example, a yearling cougar had killed an adult elk in February 1936, and a few hours later was tracked down and shot. It was found to weigh only 76 pounds. The elk, which appeared to have been in a healthy condition, was judged to weigh around 600 pounds... ."

"Most of the food items, other than elk and deer, represented in the scats analyzed were of nongame animals." (1943, pp.53-54). In order of abundance, these were rabbit, Douglas squirrel, mountain-beaver, deer mouse, wood rat, meadow mouse, and flying squirrel.

Economic status.–Victor H. Cahalane has summarized in appropriate words the status of the cougar on the peninsula:

"The lion deserves a higher standing in wilderness areas and the Olympics constitute one of the finest of the few retreats in America where it can exist without conflict with human activities. It is not only of the greatest interest to visitors as well as professional biologists, but one of natural checks on the unnatural concentrations of elk and deer.... There is not a doubt that critics of the cougar are correct in stating that the big cat kills game animals. Although we do not know the rate of kill, claims that one lion kills as many as one hundred deer and elk per year are obviously too high. Otherwise the prey would have been exterminated long since. It is also folly to attempt to keep the cougars to the lowest possible numbers or to exterminate it with the object of increasing deer and elk that are already so numerous as to endanger the future food supply. On the other hand, hunting outside the park will probably prevent a large increase of lions. It seems evident that a park even 35 miles square in extent will not completely protect such a peripatetic species" 1938, p.22).

General habits.–"Forest Ranger Fisher of the Olympic National Forest, in western Washington, has a cougar captured when very young and raised on a bottle. Ranger Fisher writes his pet 'fairly wakes the dead with her piercing screams almost every day of her young life" (Barnes, 1928, pp.341-342).

Webster describes the voice of a large cougar trapped and placed on exhibit at Port Townsend. "Night after night, at about the same hour, would come the series of cries. At first low, as though the animal were trying out its voice; a throaty call, possibly it might be termed. Then louder and louder, a cry you instinctively felt might be clearly heard for miles; one that neither stone wall, nor heavy forest, nor mountain ridge might shut out" (1920, p.56).

Webster also tells of an attack by a cougar upon a man: "On June 24, when Glen Merchant was hurrying toward Forks, Washington, rather late in the afternoon., with a string of fish in one hand and a steel fish rod in the other, he met a very large cougar... . The mammoth cat came straight toward Mr. Merchant... . Thinking that the smell of the fish had attracted the cat he threw his string directly toward the animal, but to no purpose, for the cougar continued to come toward him and then slunk by with tail swishing back and forth. The intention of this move evidently was to get behind the man for a spring or a rush, but Merchant swung around to keep the animal in sight. Defeated in his plans the cougar came back toward Merchant and when close to him gave a quick side swipe with both its front paws, just like any cat, and caught its claws in the man's trousers sufficiently to rip in them a hole several inches long, but fortunately did not throw him down. With the animal so close, Merchant made good use of the only weapon he had with him; he quickly stepped to one side and with all the strength he had swung at the head of the cougar with the butt end of the steel fish rod. The blow somewhat stunned the animal and caused it to sneak off into the woods" (1924, p.12).

The cougar is habitually a shy animal, avoiding whenever possible the scent and sight of mankind. It so rarely attacks a human being that scientists have taken considerable pains to authenticate the few cases on record.

KEY TO OLYMPIC SEALS AND SEA-LIONS

Five species of pinnipeds, or flippered animals, may be seen by the visitor to waters along the Olympic seacoast. Only two of them, the harbor seal and Steller sea-lion, are resident throughout the year. The two major groups of pinnipeds – the so-called "eared" and "earless" seals, are easily distinguished. The individual species are not. This is especially true of young seals, and seals observed from a distance or seen partly submerged. If, however, the specimen in question is a stranded carcass, the skull serves as an unmistakable clue to the species.

A1. Ears conspicuous, at least 25 mm. (1 inch) in length; fore flippers long and oar-like; all flippers naked and leathery except at bases; testes scrotal; vibrissae (whiskers) smooth; upper incisors notched; lower cheek-teeth single pointed (Otariidae).....B

A2. Ears represented by a low wrinkle of skin; fore flippers short; all flippers covered with hair; testes internal; whiskers faintly nodulated (beaded); upper incisors not notched; lower cheek-teeth with 3 or 4 cusps (points) (Phocidae).....D

B1. Pelage with two distinct layers; an overhair colored in shades of brown and gray and a velvety underhair colored brown; weight of males up to 700 pounds, of females up to 125; occurring in deep water off the Olympic coast in winter and spring, rarely on land.....*Callorhinus ursinus*, p.105.

B2. Pelage coarse, with barely discernible underhair; color golden brown to blackish brown (sea-lions).....C

C1. Gap between 4th and 5th upper cheek-teeth at least 4 times as wide as gap between any other adjacent cheek-teeth; weight of males to over 2,000 pounds, of females up to 1,000 (?); pelage more brownish; voice a deep, leonine roar; resident most of the year on wave-beaten rocks along Olympic coast.....*Eumetopias jubata*, p. 108.

C2. No remarkable gap between 4th and 5th cheek-teeth; weight of males up to 1,000 pounds (?), of females up to 700 (?); pelage more blackish; old males with a distinctly bulging forehead; voice a hoarse "honk honk"; straying rarely into Olympic waters.....*Zalophus californianus*, p.108.

D1. Color light gray or tan with blackish spots; weight up to 250 pounds; resident throughout the year on or near the Olympic beaches.....*Phoca vitulina richardii*, p.111.

D2. Color slaty gray to light brown without spots; weight up to 6,000 pounds (?); straying rarely into Olympic waters..... *Mirounga angustirostris*, p.112.

FUR SEAL
Callorhinus ursinus (L.) 1758

Identification.–Fig. 39; key, p.104.

Measurements.–Stanton Warburton, Jr., and Leo K. Couch found the body of a seal on the beach, Grays Harbor County, January 19, 1933. We judge from its recorded length that it was a 1932-born young: length 711, tail 51, right hind flipper 254. Measurements of a fetus are given on below.

Occurrence.–The fur seals that enter Olympic waters breed in summer on the Pribilof Islands in the Bering Sea. In winter they are scattered on the open ocean from southern California to the Aleutian Islands. During the winter they are roughly dispersed according to sex and age classes, the females and young tending to appear in the more southerly waters. In the spring and early summer thousands of seals push their way northward past the Olympic Peninsula, feeding and resting as they move. For centuries during this season the Quilieute and Makah natives hunted the seals 10-25 miles from shore. (While seals might also be hunted in these waters in early winter, on their way south to Oregon and California feeding grounds, weather conditions are unfavorable.) Under terms of an international treaty signed in 1911, the Olympic natives were allowed to kill seals at sea provided they used primitive methods, did not enter into contract to sell their catch, and submitted all skins to a Government agent for inspection. The treaty was dissolved on October 23, 1941. Under renewed arrangements between the United States and Canada, the northwest coast natives continue to enjoy substantially the same sealing rights as they did between 1911 and 1941.

A record of the annual take since 1912 is given in Table 9. The table indicates not only the number of seals killed, but also reveals the frequency with which the hunters ventured forth at different months of the year, that is,

Month	Jan	Feb	Mar	Apr	May	June	July
Number of years when hunting was done in this month.	3	6	8	13	14	7	1

Seals occasionally enter the Strait of Juan de Fuca; in fact 4 were killed off Waadah Island in January, 1937. In the summer of 1945 the body of a fur seal floating in the channel between Bellingham and Blaine was recovered.

Foster Jackson found a dead fur seal tangled in his fish net 300 yards upstream from the mouth of the Quillayute River on January 15, 1947. To the best of our knowledge, this is the only record of a fur seal in fresh water.

Breeding habits.–Mating and bearing of the young are accomplished on the Pribilof Islands, mainly in July. After a gestation period of slightly less than a year the female gives birth to a single young, or "pup." The fetal pup is well developed in the mother's body at the time she is passing the Olympic coast, and there are several instances where pups removed by Caesarian section have been kept alive in native villages for days.

We recovered a male fetus from a seal taken 15 miles off Tatoosh Island, June 4, 1941: length 613, tail 30, ear from base 36, weight in pounds 9-1/2. This individual cried and moved actively. It was as large as a newborn pup taken on the Pribilof Islands on July 11.

The seals which winter off the Olympic coast are predominantly females. From native stories we learn that few "bulls" are seen here. Records of seals killed by natives over

Figure 38. Sealing canoe under construction at Quilieute village of Lapush, March 26, 1930 (Photo by T. H. Scheffer).

Figure 39. Fur seals on their breeding grounds, St. Paul Island, Alaska, July 7, 1946; a small family including the bull (left), six cows, and several newborn pups.

a 30 year period show that 59% were female and 41% males (Table 9).

Food habits.–Food items in the stomachs of 55 seals from the Olympic coast in spring and early summer have been studied. Nothing is known of the food habits of seals in these waters at other seasons of the year.

Schultz and Rafn (1936) examined 26 stomachs containing food, collected in March, April, and May. Food items in order of frequency were as follows:

Food item	Number of stomachs containing
Squid (*Gonatus fabricii* in most cases)	21
Herring (*Clupea pallasii*)	15
Small shrimps (total of 8 individuals)	1
Lamprey (*Entosphenus tridentatus*)	1

The greatest volume of food found in any stomach was 2 quarts. Parasitic roundworms were found in 3 out of 4 stomachs.

F. H. May reported (1937) on the food habits of seals in the waters of Washington and Alaska. We have reviewed his manuscript notes and have segregated the Olympic coast material. Between April 4 and May 27, 27 stomachs containing food were collected off Lapush. The percentage by volume of the various food items was:

Herring (*Clupea pallasii*)	37%
Unidentified animal tissue	29%
Clupeidae (*Clupea pallasii?*)	22%
Clupeidae?	11%
Squid and small crustacea	1%

The average number of individual herring per stomach was 10 (3-25). Analysis by volume, as carried out in this instance, gives a better picture of the food habits of the seal than does analysis by frequency, as carried out by Schultz and Rafn.

Kelshaw Bonham reported on the stomach contents of two female fur seals taken off Lapush on April 25, 1941 (MS). One stomach, 15 per cent full, contained 42 cc. solids, as follows: vertebrae and other bones of unidentified fishes less than 7 inches long and remains of about 14 small squids (*Loligo opalescens*) about 4-5 inches long. The other stomach, 50 per cent full, contained 330 cc. solids, as follows: remains of 8 shad (*Alosa sapidissima*) 10-12 inches long and unidentified fish flesh.

Economic importance.–The sale of fur seal skins was for many years an important source of income to the natives of Lapush and Neah Bay. The natives have found easier ways of earning money, however, and are no longer interested in sealing.

The methods employed by the natives in capturing seals have been described by many authors. We are told by the hunters themselves that they used to leave the village at dawn in a flotilla of from 2 to 10 dugout canoes, each carrying 3 men and worked by 2 pairs of oars or 2 sails (Fig. 38). When seals were sighted the canoes moved quietly toward them. Usually only 1 or 2, but occasionally up to 30 animals were encountered in a group. These were commonly found sleeping on their backs. When the bow man was 25 feet or less from a seal, he threw the harpoon. When one of a sleeping group was speared, several other seals might approach the canoe in curiosity and could be killed. When the seals were disturbed, their roars could be heard for a great distance. Hunting in flat, calm weather was difficult because the animals take alarm readily. The harpoon was 15-20 feet long and carried a loosely attached, bifurcated head, one prong being 18 inches longer than the other. Joe

Pullen says that on a half dozen occasions he has speared 2 seals with a single throw, and that his father once got 3! Pullen has taken up to 19 seals in a single day. The body of the seal was lifted into the canoe and carried back to the village where the pelt was removed and most of the flesh was eaten.

Vernon Bailey, writing of a visit to Neah Bay in the spring of 1918, said that "last year one of the best sealers got 126 during the season and killed as high as 16 in a day. They got $20 apiece for the skins" (MS). George G. Cantwell also writing of the Makah natives, said that in 1920 they took "153 skins divided among about a dozen hunters which were sold to a Seattle fur buyer for $32.00 each... .Walter Jackson drew $800 as his share of the spoils" (MS).

CALIFORNIA SEA-LION
Zalophus californianus (Lesson) 1828

Identification.–Key, p.104.

Occurrence.–This species has been reported from the Olympic seacoast by Newcombe, Greenwood, and Fraser (1918, pp.10-11). While stray individuals may venture north from their breeding grounds in Mexico and California, no actual specimens have been taken in Washington waters. We once saw and photographed Steller and California sea-lions together on the Oregon coast 197 miles south of the Columbia River, but have never seen *Zalophus* north of there. Stranded specimens of sea-lions on Olympic beaches should be carefully examined.

STELLER SEA-LION
Eumetopias jubata (Schreber) 1776

Identification.–Fig. 40; key, p.104.

Measurements.–An adult male shot on Jagged Island by C. T. Albrecht in August 1920: length 12 feet, 4 inches; neck circumference 7 feet 10 inches [millimeters, 3,759 and 2,387] (Albrecht, 1921). This specimen is exhibited in the Washington State Museum. Bull sea-lions weighed piecemeal by Karl W. Kenyon on St. Paul Island, Alaska, June 6, 1949, weighed 2,068 and 2,069 pounds, respectively, in addition to lost blood.

An adult male found dead on the beach between Taholah and Moclips by Kelshaw Bonham on June 6, 1942: length 3,060 mm. (10.00 feet), snout to tips of hind flippers 3,610 mm. (11.93 feet).

A pregnant female found dead on the beach at Seaview, Pacific County, April 5, 1940, had been dead 2-4 weeks: length 2,670 mm. (8.75 feet), tail about 150 mm. Her fetus was a female: length 850 mm., tail about 50 mm.

Occurrence.–Sea-lions are found on rocky, surf-beaten islets along the northwest side of the peninsula. Stragglers are occasionally seen in the Strait of Juan de Fuca and in Grays Harbor. The principal resorts are: Jagged Island, 7 miles NNW of Lapush (the most important); "Sea Lion Rocks" including Willoughby Rock, Split Rock, and Sea Lion Rock, 3-6 miles NNW of Cape Elizabeth; an unnamed rock 1-1/4 miles W of the mouth of Ozette River; and Tatoosh Island.

Figure 40. Steller sea-lions, a breeding colony in early summer near Oceanside, Oregon, in 1940 (Christian's Photo Service).

These resorts are used by sea-lions at certain times of the year and are nearly deserted at others. The seasonal movements of the animals are poorly understood. In attempting to follow the seasonal changes in the sea-lion population we have examined the accounts of naturalists who, at various times during the past 30 years, have worked along the Olympic seacoast. It appears that several hundred sea-lions are on hand in all months of the year except May and June, when only a few are present. In these two months the animals are presumably on their breeding grounds, locations unknown. We have arranged, by months, certain reports on Olympic sea-lions. Most of the reports are based on observations from aircraft.

January 18 – Robert S. Bach saw 250 on Jagged Island and 80 on Sea Lion Rocks (MS, 1938).

March 21 – Scheffer and Macy saw 150 on Jagged Island, 105 on Sea Lion Rocks, and 50 on an unnamed islet off the mouth of the Ozette River (1944, p.341).

April 14 – Karl W. Kenyon saw 50-75 on Jagged Island and about 40 on Split Rock.

May 19 – Kenyon and Scheffer saw 20-25 sea-lions, none of them definitely pups, on Jagged Island.

May 29 – Cantwell saw "not over a dozen" on Jagged Island (MS, 1915).

May 30 – E. Benn saw a lone bull on Jagged Island.

June 2 – R. W. Josephson saw 35-40 on Split Rock.

June 14 – Cantwell saw none on Sea Lion Rocks; an occasional one in open water (MS, 1916).

June 24 – Robert S. Bach saw 1 bull on Jagged Island (MS, 1938).

June 25 – Scheffer and James L. Wilding, in a special investigation by power boat saw only 3 on Jagged Island (MS, 1941).

July 24 – Cantwell saw "1,000 or more", on Jagged Island (MS, 1917).

August 2 – Cantwell saw "not over a dozen" on Sea Lion Rocks "in contrast to the hundreds that were found here at this time last year" (MS, 1915).

August 10 – Cantwell saw "2,000 or more" which had returned to Jagged Island "after an absence of three months" (MS, 1915).

August 10 – Cantwell saw 2,000-3,000 on Jagged Islands (MS, 1916).

August – C. J. Albrecht saw "not less than 300" on Jagged Island (1921).

September 6 – Cantwell saw 2,000 on Jagged Island and fewer on Sea Lion Rocks (MS, 1914).

September 17 – Oscar Kuntz saw 350 on Jagged Island (MS, 1941).

October to December – No observations.

Gunther was told by Makah natives that sea-lions used to be plentiful around Waadah Island, Neah Bay, where they killed lingcod during the spawning season (1936, p.115). Sea-lions no longer frequent this spot.

Breeding habits.–Natives who have hunted the sea-lion on the Olympic resorts seem not to know whether the animals give birth to their young here. From the fact that most of the sea-lions leave the Olympic coast in May and June, we conclude that few do.

On the other hand, the American Museum of Natural History has a display group of sea-lions collected by Albrecht and labelled as coming from Lapush, including 5 pups about 30-40 pounds in weight. These are certainly the size of newborn pups.

A March fetus has been mentioned under "*Measurements.*"

Food habits.–The food habits of sea-lions on the Olympic coast have not been studied. In adjacent British Columbia, provincial fishery agents killed 30,000 sea-lions during the period 1922-1943 in the belief (probably correct) that the animals were too numerous in commercial fishing waters. On the Olympic coast, sea-lions have recreational appeal and should not be molested. Fortunately, they spend a good part of the year on islands protected since 1907 by the Federal Government, namely, on the Copalis Rock, Flattery Rocks, and Quillayute Needles bird refuges.

From 1944 to 1948 the Washington State Department of Fisheries paid a bounty of $8 on sea-lions. In 1949 the bounty was wisely reduced to $3 and was restricted to individuals taken in the enclosed waters of the state. In letter of September 7, 1949, the Chief Inspector wrote us: "The reason we are not paying a bounty on sea lions from the coastal area is due to the fact that our aerial patrol reports a drastic decline in the populations of sea lion herds on Jagged Island and Split Rock. I have observed these herds from the air and from the water for the last fifteen years, and in about 1936 I estimated about 600 sea lions on Jagged Island; and I doubt if that herd today runs more than 100."

General habits.–Oscar Kuntz, National Park Service, visited Jagged Island on September 17, 1941, and found that "As we approached the island, the sea-lions just watched us. Many seemed to be asleep. When we were probably within 75 feet of the island, they began to roar and slide into the water. They set up a furious noise. The old bulls were two or three times as large as the females, and they seemed to occupy the highest positions on the rocks and were the last to slide off into the water. We travelled around the island three times, and each time the sea lions would make more noise and appeared to be getting angry. They would swim under the boat and come to the surface on the other side of us, roar and dive again. The odor on the lee side of the rocks was quite offensive" (MS).

HARBOR SEAL
Phoca vitulina richardii (Gray) 1864

(*Note*: The following account is based in part on a report by Scheffer and Slipp, 1944, on the harbor seal in Washington state).

Identification.–Fig. 41; key, p.104.

Measurements.–Of 74 seals of all ages collected at the mouth of the Nisqually River, the 20 largest males averaged 160 pounds and the 20 largest females averaged 129 pounds. The largest male and female taken in Washington measured, respectively: length 1,700 and 1,258 mm. (67 and 50.5 inches); weight 256 and 243 pounds.

A newborn male taken at Copalis on May 29, 1942: length 890 mm. (35 inches), weight 22-1/4 pounds.

A newborn male measured at Kalaloch by E. A. Kitchin, June 10, 1941: length 33-1/4 inches [845 mm.].

Occurrence.–Harbor seals are seen the year around in saltwater on the east, north, and west sides of the peninsula. The total population is perhaps one or two thousand. The seals haul out on numerous rocks awash at high tide, from Point Grenville to Cape Flattery and Waadah Island. Concentrations are seen on Destruction Island, Grays Harbor, Dungeness Spit, Quilcene Bay, and in Hood Canal at the mouth of every large river. There is scarcely a foot of shoreline around the peninsula that is not visited by a seal at some time of the year.

According to commercial fishermen, harbor seals rarely venture beyond 15 miles from land. They prefer shelving rocks, log rafts, and sandbars with an unrestricted view on all sides as a protection from enemies.

Breeding habits.–The harbor seal bears a single young–very rarely two. From all evidence the pup is born about June 1 in Grays Harbor and along the coast, and about July 1 in the eastern part of the Strait of Juan de Fuca and Hood Canal. At birth the pup weighs 22-30 pounds, is fully haired, and is alert and ready to swim. The adults probably mate in September. There is no "harem" organization such as is found among sea-lions and fur seals.

Figure 41. Harbor seal, *Phoca vitulina richardii*, 4-year-old male from the Nisqually River mouth, photographed in an aquarium at Tacoma, May 7, 1942.

Food habits.–Seals are known to eat a wide variety of foods, particularly shallow-water and brackish-water organisms. In Washington waters as a whole, seals eat principally flounders, herring, tomcod, hake, sculpins, crabs, shrimps, squids and pollack. Individual seals may learn to steal salmon from gillnets and thus affect the livelihood of commercial fishermen, especially the small scale operators.

Funds were appropriated by the legislature in 1944 to pay a bounty of $3 on seals and to hire seal hunters on a salary basis. According to Frank Telquist of the State Department of Fisheries, 377 seals were reported killed in Grays Harbor in 1944 and 51 in 1945. In the latter year, only bounty hunters were operating. Taking a number of factors into consideration, we think that about 500 seals are killed annually around the peninsula.

Most visitors to the peninsula, we believe, enjoy seeing a harbor seal at close range and for this reason we hope that a few seals will always be found here. A roadside aquarium at Hoodsport had an adult harbor seal and two young on display in an outdoor salt water pool during the summer of 1949, attracting considerable attention from tourists.

ELEPHANT SEAL
Mirounga angustirostris (Gill) 1866

Identification.–Key, p.104.

Occurrence.–An elephant seal occasionally appears in waters off the Olympic coast. The species is rare in all parts of its range and is known to breed only on a few islands on the coast of Baja California. On October 25, 1944, at Neah Bay, John Slipp and the writer interviewed an elderly Makah, Lance Kallappa, through interpreter Fred Irving. Kallappa stated that the elephant seal was familiar to him and to his father and grandfather who used to hunt fur seals 20 miles or more off the Strait of Juan de Fuca. Kallappa had never killed an elephant seal although he had seen the animal close at hand. It is called, he said, *lik kwa si* or *l'kwa sich*, which means one who draws in his neck or hunches his shoulders. It is lighter in color and larger than the Steller sea-lion. It raises its body nearly upright in the water at times. The smallest ones are as large as a harbor seal [100-250 pounds] and have a single bump or ridge on the snout. The number of ridges increases to about 4 as the animal grows larger. The flippers are hairy. The flesh is good to eat. The bones are somewhat like those of halibut [translated also as *porous* by the interpreter], lighter and with more holes than those of the sea-lion. The oil which is extracted from the elephant seal is clear [presumably more so than that of sea-lion and harbor seal].

Kallappa continued with the statement that only one elephant seal at a time is seen, never mother and young. [The only time that the Makah venture far out from land is in the spring, thus they have no information on the occurrence of seals in other seasons of the year]. The natives have always butchered elephant seals at sea; never brought them to land. Live or stranded ones are never, to Kallappa's knowledge, seen on the beach. John Markishtum and two other men who were fur sealing 2 or 3 years ago saw an elephant seal.

In this connection it is interesting to note that an elephant seal was killed at Kasaan, southeastern Alaska, on November 5, 1939 (Oliver T. Edwards, MS) and another was shot at the northern end of Vancouver Island in the fall of 1944 (Cowan and Carl, 1945). These are the only specimens known positively to have been killed north of California, although commercial fishermen and natives see them occasionally in coastal waters as far north as southeastern Alaska.

Several halibut fishermen have reported seeing, off the Washington coast, creatures which are evidently elephant seals (*Seattle Times*, April 15, 1947, p.3).

ELK, WAPITI
Cervus canadensis roosevelti Merriam 1897

Identification.–Figs. 42 and 43.

Measurements.–John E. Schwartz considers the following measurements typical of adult males and females (inches): length 98, 92; height at shoulder 60, 59; hind foot 28, 26.5; ear 8, 8; tail 4, 4. Antlers: spread 40.5, circumference 11, length 44.5, number of points 6 x 6 (1943, p.4). He states that "a mature bull in prime condition is usually thought to weigh between 700 and 1,000 pounds, whereas an average cow in good shape will weigh between 400 and 700 pounds."

Occurrence.–Elk are widely distributed on the peninsula but they tend to concentrate in certain valleys and to ignore others which seem, from our point of view, to be equally suitable for them. They winter in the forest, especially on the wetter slopes of the peninsula (west and south), rarely straying to salt water except along the middle of Hood Canal and the mouth of the Hoh. In summer, most of them move up into the alpine meadows.

The entire range of the subspecies *roosevelti*, namely, the coastal evergreen forests from southern British Columbia to northern California, has suffered little change in outline since the coming of the white man, although the killing of many local herds of elk has resulted in a spotty pattern of distribution at the present time. The largest band of elk, totalling 6,000-7,000 animals, is now found on the Olympic Peninsula, with the result that the popular name "Olympic elk" is often applied throughout the range. Where we use this term, we mean the Roosevelt elk of the Olympic Peninsula.

Because of the barrier effect of the desert strip which extends from the Horse Heaven Plateau to the Okanogan Valley it is unlikely that, in primitive times, *roosevelti* intergraded in Washington with the Rocky Mountain subspecies *nelsoni*. In the present century, however, county and state game officials have planted Rocky Mountain elk in western Washington and Olympic elk in eastern Washington with the result that interbreeding has undoubtedly taken place.

From detailed information presented by Schwartz (*op. cit.*) on the habits of the Olympic elk, the following notes are abstracted:

Breeding habits.–"Shedding of antlers occurs from February to April, and the new set is fully developed by late summer. Bugling starts about September 1 and lasts until the middle of November. Most actual breeding occurs between September 15 and October 15. Harems vary in size from 5 to 15 adult females." The single calf is born from approximately May 15 to June 15.

Food habits.–"The elk in this coastal environment are predominantly browsers during the winter months. During the spring, summer, and autumn, grazing and browsing are about equal, although there are some periods when grazing use does exceed browsing. Although over 100 different species of plants are eaten by elk, only about 25 form the main items of diet. Vine maple and huckleberry are the two principal species of browse found on the peninsula. These plants, along with salmonberry, furnish the bulk of the elk diet on the winter ranges and are the species which suffer most from overgrazing. Certain conifers, such as western hemlock, western red cedar, Douglas fir, and Sitka spruce, are much used as browse. Numerous other browse and herbaceous plants such as salal, Oregon grape, willow, sword fern, deer fern, wood sorrel, spring beauty, coolwort, and various sedges and grasses also form an important part of the elk diet at various seasons of the year."

Mortality.–"112 elk were found dead during the course of the study. Twenty-one deaths were attributed to malnutrition and disease, 10 were cougar kills, and 8 were

Figure 42. Roosevelt elk, band starting to stampede (Photo by Wm. Everett, courtesy Forest Service).

Figure 43. Roosevelt elk, a bull on the lower Hoh River, September 23, 1940 (Photo by Floyd L. Dickinson).

accidental. Heaviest losses occurred in 1937, when it was estimated that more than four hundred elk died of malnutrition and disease on the Hoh, Clearwater, Queets, and Quinault drainages. During that winter calf losses equalled those of all other age classes combined... . Cougar, bobcat, coyote, and bear are the principal predator species in the Olympics. Of these the cougar is the most destructive to elk and deer... ."

Olympic elk were first protected by state law in 1905. Twenty-eight years later the herds in certain valleys on the west side had outgrown their food supply, mainly because of the withdrawal of natural range land in the lower valleys for agricultural use. Overgrowth of the elk herd was accelerated by the killing of their natural enemies, wolves and cougars, by man. Amid lively controversy, a hunting season was proclaimed in 1933 on elk on certain crowded ranges. In the last eighteen years over 8,000 elk have been removed from lands outside the National Park.

MULE DEER
Odocoileus hemionus hemionus (Rafinesque) 1817

Occurrence.–The mule deer is native to the pine forests and the deserts of eastern Washington and is listed among Olympic mammals only because 7 individuals were transplanted on the peninsula a few years ago. The deer were picked up in the wild as fawns, were held for a time at the State Game Farm at South Tacoma, and were released near Idaho Lookout, Hurricane Ridge, on September 30, 1936.

In a recent letter from the game farm, R. D. Leslie states that "Mr. Charles Morrell who was superintendent here at the time, personally took these deer to Port Angeles in the fall of 1936. Some were from Okanogan County and some from Chelan County. There were two 2-year bucks, one 1-year buck; the balance [4] being does. Mr. Morrell said that they sawed the horns from the older bucks as a precaution from the hunters."

All of the transplanted deer remained quite tame. We photographed one of the bucks on Hurricane Ridge 22 months after its release, perhaps the same one that was later "removed to the game farm, at Tacoma to protect it from hunters" (Olympic National Park, wildlife report for 1939).

Since mule deer and black-tailed deer interbreed in places where their natural ranges adjoin, the results of introducing mule deer into the Olympics are insignificant. The mule deer should probably be dropped from future lists of Olympic mammals.

BLACK-TAILED DEER
Odocoileus hemionus columbianus (Richardson) 1829

Measurements.–A male and a female from the Olympic Mountains, December 2, 1904: length (inches) 66-1/4 and 63; tail 9 and 7-1/2; hind foot 19 and 18 (according to Seton, 1929, v.3, part 1, p.369).

The weights of certain deer from Thurston County (adjacent to the peninsula on the south) are given by Lauckhart (1940, p.9). The deer were killed between October 1 and 22, 1939, during a special season. Average weights of eviscerated animals, occasionally with liver and heart included: "Does, 93 pounds; fawn, 48 pounds; spikes, 102 pounds; two-points, 135 pounds; three-points, 157 pounds, and 4-points (only one taken), 216 pounds. These are considered average weights for western Washington Black-tailed Deer."

According to the *Pacific Northwest Sportsman* (October 25 and November 1, 1946), Roy Thomas, of Port Angeles, killed a 224 pound deer on Dry Creek. Robert Esterday brought a 4-point deer weighing 231 pounds into Raymond (south of the Peninsula) on the opening day of the hunt.

Occurrence.–Common almost everywhere on the peninsula, particularly on logged or burnt-over lands that have grown up to mixed evergreen and deciduous trees, salal, huckleberry, salmonberry, and other shrubs. Deer are seen singly or in groups of 2-5 along highways and riverside trails in winter and spring. In mid-summer many of them move up to the alpine meadows to browse, and in November, to mate, returning to the lowlands after the first fall of snow.

Over 8,000 deer are thought to inhabit the Olympic Forest at the present time (1949). State game protector Fred Rice told us in 1941 that he considered the Blyn Peninsula one of the best deer hunting grounds in the state. In 1940 he picked up more than 40 deer killed by automobiles in Clallam County.

According to A. B. Cameron, there is a well-used deer lick on Cameron Creek, eastern Clallam County, "a five minute walk up the trail from the three forks shelter" (MS, 1942).

Economic importance.–Certain data on the hunting of Olympic deer as given by Lauckhart (*op. cit.*) are abstracted in Table 11. The kill for the 1948 season was 2,771, distributed as follows: Clallam 622, Jefferson 260, Grays Harbor 1,205, and Mason 684.

Mortality.–While specific information on Olympic black-tailed deer is not available, certain suggestive figures on the mortality of all species of deer in all of Washington are available through the studies of Lauckhart (1940, p.26).

The bodies of 936 deer were examined by game protectors who recorded, in most instances, the cause of death. We present Lauckhart's data in slightly altered form in Table 12.

General.–Residents of Hoodsport say that white, and partly white deer have been seen for many years near the head of Lake Cushman. Oscar White shot a four-point 251 - pound white-and-tan deer in the Stevens Creek area above Humptulips on October 25, 1946 (*Pacific Northwest Sportsman*, November 22, 1946).

MOUNTAIN GOAT
Oreamnos americanus (Blainville) 1816

Identification.–Fig. 44.

Measurements.–None available from the Olympic Mountains.

Occurrence.–Goats from three sources outside of the state of Washington have been planted in the Olympics. The history of the plantings is poorly preserved and we have been obliged to rely on scattered notes in manuscript files of the Forest Service and Park Service, as well as on a few published references, in preparing the following account:

1925 – Four *Oreamnos americanus missoulae*. In the latter part of 1924, four adult goats were shipped from the Rocky Mountains near Banff to State Supervisor of Fish and Game, J. Warren Kinney. Banff is situated in Alberta near the British Columbia border, and whether the goats were captured by British Columbia or by Alberta game officials is not known. The provincial governments of British Columbia and Alberta have no records of the transfer. The Olympic Forest Supervisor wrote that "three nannys and a billy were liberated," while Ranger John E. Schwartz wrote that two pairs were liberated (Forest Service wildlife reports, 1930 and 1938).

Figure 44. Mountain goats, *Oreamnos americanus,* on Mt. Storm King above Lake Crescent, July 21, 1939 (Photo by Jack Walker).

Figure 45. Mountain goat habitat; vicinity of Mt. Bogachiel looking SW, October 8, 1936 (Photo by Pacific Aerial Surveys).

The goats were crated and forwarded to Port Angeles, arriving January 1, 1925. On the same day, game warden Jack Pike and forest ranger Chris Morgenroth released the goats on the shore of Lake Crescent at the foot of Mount Storm King (Webster, 1925). On January 6, 1925, the Clallam County Game Commission created the Storm King Game Refuge to protect the goats.

The fate of this first planting is uncertain. No goats were listed in the annual wildlife reports of the Forest Service in the ensuing years, 1925-1928, although in the annual report for 1929 the Supervisor stated that "while there have been rumors of people seeing them since, I have no authentic information that they survived."

1929-1930 – We are obliged to Mr. Van W. Welch of Port Angeles for information on the planting of goats in 1929 and 1930. Mr. Welch replaced Jack Pike as game warden of Clallam County in February 1926 and participated in the plantings. He has furnished certain notes from his diary (letters of February 20 and 26, 1948). Eight goats were captured in Alaska by the Alaska Game Commission and released in Clallam County, Washington, by the Clallam County Game Commission, as follows:

1929, April 7 – Two *Oreamnos americanus kennedyi* captured near Cordova and released on Mt. Storm King.

1929, April 21 – Two *Oreamnos a. columbiae* captured near Juneau and released on Mt. Storm King.

1930, February 14 – Two *Oreamnos a. columbiae* captured near Juneau and released on Mt. Storm King.

1930, February 21 – Two *Oreamnos a. columbiae* captured near Juneau and released on Mt. Baldy.

One (or both) of the plantings was apparently referred to by Webster (1932), when he stated that "H. M. Fisher, our county game commissioner who had charge of the introduction of the goats and their welfare after liberation, tells me that on a recent trip to Alaska he learned that the animals were caught in nets, packed seven miles down the mountains, and kept in a corral. They had eighteen in the corral at one time when a slide came down and wiped them out. Had it not been for that, we would have had a much better start." Mr. Fisher died about 1935.

In the judgment of Clallam County sportsmen in 1925, Storm King was a suitable home for mountain goats, and this opinion was apparently shared by the goats themselves, for certain of the animals or their descendants have remained on the planting site for the past 25 years. Others of them struck out across the mountains. In 1930 one goat was seen at Constance Pass, about 30 miles airline from the planting site. Goats are now distributed around two centers, the major one at Storm King (4,534 feet) and the minor one near the southeast corner of the Olympic Park (Mount Constance, Lena Lake, and Marmot Lake). The extremes of the range are about 50 miles apart.

Forest rangers estimated that there were 25 goats on the Olympic Forest in 1937, shortly before most of the goat range was transferred by law into the National Park. Ranger John E. Schwartz saw 10 in early November 1937, on Storm King. Other groups reported from this Peak include: 4 on July 21, 1939 (Fig. 44); 3 adults and 2 kids in August, 1942; and 7 in the summer of 1944. A 1948 estimate by the Park Service places 110 goats in Olympic National Park, and a 1948 estimate by the Forest Service places 50 goats in Olympic National Forest. We assume that most, or all, of the goats that winter in the forest move up to the park meadows in summer.

General.–In the report of the Port Angeles district forest ranger for 1937, two goats were listed as killed by eagles. No details were given.

A story to the effect that a Boy Scout lassoed a mountain goat in the upper Dungeness country has been reported (Webster, 1932).

LITERATURE CITED

Albrecht, C. J. 1921. [Note on capture of sea-lion]. Murrelet, v.2, p.6.

Albrecht, C. J. 1922. The weazel and the rabbit. Murrelet, v.3, p.5.

Anderson, Niilo A. 1940. Mountain goat study. Progress report. Washington State Dept. Game, Biol. Bull. 2; mimeographed, 21 pp.

Bailey, Vernon. 1897. Revision of the American voles of the genus *Evotomys*. Proc. Biol. Soc. Wash., v.11, pp.113-138.

Bailey, Vernon. 1900. Revision of American voles of the genus *Microtus*. N. Amer. Fauna 17, 8 pp.

Bailey, Vernon. 1907. Wolves in relation to stock, game, and the national forest reserve. U.S Forest Service, Bull. 72, 31 pp.

Bailey, Vernon. 1936. The mammals and life zones of Oregon. N. Amer. Fauna 55, 416 pp.

Barnes, C. 1928. Does the mountain lion scream? American Forests, June, 1928, pp.340-342.

Brown, D. E. 1935. Hoary bat taken at Westport, Washington. Murrelet, v. 16, p.72.

Cahalane, Victor H. 1938. A wildlife picture of Olympic National Park. Nat. Parks Bull., v. 14, pp.20-24.

Cahalane, Victor H. 1938A. National Park Service bear problem. Planning and Civic Comment, March, p.32.

Cooper, J. G. 1860. Report upon the mammals collected on the survey. *In* Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean... 1853-1856., v.12, book 2, part 3, no.2, chapter 1, pp.73-88.

Couch, Leo K. 1925. Rodent damage to young forests. Murrelet, v.6, p.39.

Couch, Leo K. 1932. Breeding notes on a few Washington mammals. Murrelet, v.13, p.25.

Couch, Leo K. 1942. Trapping and transplanting live beavers. U. S. Fish and Wildlife Service, Conservation Bull. 30, pp.ii, 20.

Cowan, Ian McTaggart. 1938. Geographic distribution of color phases of the red fox and black bear in the Pacific northwest. Jour. Mamm., v.19, pp. 202-206.

Cowan, Ian McT., and G. Clifford Carl. 1945. The northern elephant seal (*Mirounga angustirostris*) in British Columbia waters and vicinity. Canad. Field Nat., v.59, pp.170-171.

Crisler, Lois. 1946. Wild flowers in the Olympics as I have seen them. Arboretum Bulletin (Seattle), v.9, no.2, pp.1-4, 24-26.

Dalquest, Walter W. 1938. Bats in the state of Washington. Jour. Mamm. v.19, pp.211-213.

Dalquest, Walter W. 1948. Mammals of Washington. Univ. Kansas Pub., Mus. Nat. Hist., v.2, 444pp.

Dalquest, Walter W. and Donald R. Orcutt. 1942. The biology of the least shrew-mole, *Neurotrichus gibbsii minor*. Amer. Midland Naturalist., v.27, pp. 287-401.

Dalquest, Walter and Victor B. Scheffer. 1944. Distribution and variation in pocket gophers, *Thomomys talpoides*, in the state of Washington. Amer. Naturalist, v.78, pp.308-333 and 423-450.

Dice, Lee R. 1926. Notes on Pacific coast rabbits and pikas. Univ. Mich. Mus. Zool., Occ. Pap. 166, 28 pp.

Dice, Lee R. 1932. Mammals collected by F. M. Gaige in 1919 at Lake Cushman and vicinity, Olympic Peninsula. Murrelet, v.13, pp.47-49.

Donham, C. R., and B. T. Simms. 1927. Coyote susceptible to salmon poisoning. Jour. Amer. Vet. Med. Assoc. 71, n.s.24, pp.215-217.

Elliot, D. G. 1899. Catalogue of mammals from the Olympic Mountains, Washington, with descriptions of new species. Field Columbian Mus. Pub.32, zool. ser., v.1, pp.241-276.

Engels, W.L. 1936. Distribution of races of the brown bat (*Eptesicus*) in western North America. Amer. Midland Naturalist, v.17, pp.653-560.

Errington, Paul L., and Carolyn Storm Ellington. 1937. Experimental tagging of young muskrats for purposes of study. Jour. Wild. Mgt., v.1, pp.49-61.

[Flett, J.B.]. 1936. [Minutes of meeting, Pac. N.W. Bird and Mammal Soc.]. Murrelet, v.9,p.24.

Gilman, S. C. 1896. The Olympic country. Nat. Geogr. Mag., v.7, pp.133-140.

Gunther, Erna. 1936. A preliminary report on the zoological knowledge of the Makah. In Essays in Anthrop. in Honor of Alfred Louis Kroeber. Univ. Calif. Press, pp.105.

Hall, E. Raymond. 1936. Mustelid mammals from the Pleistocene of North America with systematic notes on some Recent members of the genera *Mustela, Taxidea*, and *Mephitis*. Carnegie Inst. Wash. Pub. 473, pp.41-119.

Hall, E. Raymond. 1945. Four new ermines from the Pacific Northwest. Jour. Mamm., v.26, pp.75-85.

Hall, Frank S. 1932. A historical resume of exploration and survey–mammal types and their collectors in the state of Washington. Murrelet, v.13, pp.62-91.

Hamlett, G W. D. 1938. The reproductive cycle of the coyote. U. S. Dept. Agric. Tech. Bull. 616, 12 pp.

Hollister, N. 1911. A systematic synopsis of the muskrats. N. Amer. Fauna 32, 47 pp.

Howard, W. E. 1949. A means to distinguish skulls of coyotes and domestic dogs. Jour. Mamm., v.30, pp.169-171.

Howell, Arthur H. 1915. Revision of the American marmots. N. Amer. Fauna 37, 80 pp.

Howell, Arthur H. 1929. Revision of American chipmunks (Genera *Tamias* and *Eutamias*). N. Amer. Fauna 52, 157 pp.

Jackson, H. H. T. 1928. A taxonomic review of the American long-tailed shrews (Genera *Sorex* and *Microsorex*). N. Amer. Fauna 51, 238 pp.

[James, Dave]. 1949. Phil's baby bruin enjoys its nip. Simpson Lookout [Simpson Employee Magazine, Seattle], v.3, no.3, p.4, 1 photo.

Jones, George Neville. 1936. A botanical survey of the Olympic Peninsula, Washington. Univ. Wash. Pub. Biol. v.5, 288 pp. [reprinted by lithography 1947].

Kitchin, E. A. 1942. Marmota. The little sentinel of the high country. Published by the author, Port Angeles, Washington, 20 pp.

Kitchin, E. A. 1949. Birds of the Olympic Peninsula. Olympic Stationers, Port Angeles, Washington, pp. x + 262.

Lauckhart, Burton. 1940. Supplemental deer report, 1940. Wash. State Dept. Game, Biol. Bull. 4 (mimeographed), 29 pp.

May, Franklin H. 1937. The food of the fur seal. Jour. Mamm., v.18, pp.99-100.

Merriam, C. Hart. 1890. Description of a new marten (*Mustela caurina*) from the northwest coast region of the United States. N. Amer. Fauna 4, pp.27-29.

Merriam, C. Hart. 1898. Descriptions of three new rodents from the Olympic Mountains, Washington. Proc. Acad. Nat. Sci. Phila. 1898, pp.352-353.

Merriam, C. Hart. 1901. Preliminary revision of the pumas (*Felis concolor* group). Proc. Wash. Acad. Sci., v.3, pp.577-600.

Moore, A. W. 1933. Food habits of Townsend and coast moles. Jour. Mamm. v.14, pp.36-40.

Moore, A. W. 1940. Wild animal damage to seed and seedlings on cut-over Douglas fir lands of Oregon and Washington. U. S. Dept. Agric. Tech. Bull. 706, 28 pp.

Nelson, E. W. 1909. The rabbits of North America. N. Amer. Fauna 29, 314 pp.

Newcombe, C. F., H. Greenwood, and C. Fraser. 1918. Preliminary report of the commission on the sea-lion question, 1915. Contrib. Canadian Biol. 38-a, pp.5-51.

Osgood, H. 1909. Revision of the mice of the American genus *Peromyscus*. N. Amer. Fauna 28, 285 pp.

Preble, E. A. 1899. Revision of the jumping mice of the genus *Zapus*. N. Amer. Fauna 15, 41 pp.

Reagan, Albert B. 1909. Animals of the Olympic Peninsula, Washington. Proc. Indiana Acad. Sci. for 1908, pp.193-199.

Reagan, Albert B. 1917. Archaeological notes on western Washington and adjacent British Columbia. Proc. Calif. Acad. Sci., 4 ser., v.7, pp.1-31.

Sanborn, Colin Campbell. 1947. Catalogue of type specimens of mammals in Chicago Natural History Museum. Fieldiana: Zoology, v.32., no.4, pp.209-293.

Scheffer, T. H. 1924. Breeding habits of the mole and the pocket gopher. Murrelet, v.5, pp.3-4.

Scheffer, T. H. 1927. American moles as agricultural pests and as fur producers. U. S. Dept. Agric., Farmers' Bull. 1247, 21 pp.

Scheffer, T. H. 1929. Mountain beavers in the Pacific northwest. U. S. Dept. Agric. Farmers' Bull. 1598, 18 pp.

Scheffer, Victor B. 1935. Stream improvement in the Olympic National Forest, 1935. U. S. Forest Service, Olympia, Wash., mimeographed, 43 pp.

Scheffer, Victor B. 1938. Notes on wolverine and fisher in the state of Washington. Murrelet, v.19, pp.8-10.

Scheffer, Victor B. 1940. The sea otter on the Washington coast. Pac. N. W. Quart., v.3, pp.370-388.

Scheffer, Victor B., and Walter W. Dalquest. 1942. A new shrew from Destruction Island, Washington. Jour. Mamm., v.23, pp.333-335.

Scheffer, Victor B. and Preston P. Macy. 1944. Airplane reconnaissance of sea lions in Washington. Jour. Wild. Mgt., v.8, pp.340-341.

Scheffer, Victor B., and John W. Slipp. 1944. The harbor seal in Washington state. Amer. Midland Naturalist, v. 32 , pp.373-416.

Schultz, Leonard P., and A. Morris Rafn. 1936. Stomach contents of fur seals taken off the coast of Washington. Jour. Mamm., v.17, pp.13-15.

Schwartz, John E. [1943] Range conditions and management of the Roosevelt elk on the Olympic Peninsula. U. S. Forest Service Portland, Ore., mimeographed, 65 pp.

Seton, Ernest Thompson. 1929. Hoofed animals. *In* Lives of game animals. New York, Doubleday, Doran and Company, v.3, part 1, 412 pp.

Shaw, William T. 1944. Brood nests and young of two western chipmunks in the Olympic Mountains of Washington. Jour. Mamm., v.25, pp.274-284.

Simpson, George Gaylord. 1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist., v.85, pp. i-xvi, 1-350.

Sperry, Charles C. 1941. Food habits of the coyote. U. S. Dept. Interior, Wildlife Research Bull., 4, pp. iv + 70.

Storer, Tracy I. 1938. The muskrat as native and alien: a chapter in the history of animal acclimatization. Calif. Fish and Game, v.24, pp.159-175.

Suckley, George. 1860. Report upon the mammals collected on the survey. *In* Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean...1853-1856., v.12, book 2, part 3, no. 2. chapter 2, pp.89-106.

Suckley, George, and George Gibbs. 1860. Report upon the mammals collected on the survey. *In* Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean... 1853-1856., book 2, part 3, no.2, chapter 3, pp.107-139.

Svihla, Arthur. 1931. The Olympic red-backed mouse. Murrelet, v.12, p.54.

Svihla, Arthur. 1932. Notes on the meadow mouse (*Microtus oregoni oregoni*) (Bachman). Murrelet, v.13, pp.94-95.

Svihla, Arthur. 1933. Notes on the deer-mouse *Peromyscus maniculatus oreas* (Bangs). Murrelet, v.14, pp.13-14.

Svihla, Arthur, and Ruth D. Svihla. 1931. Mink feeding on clams. Murrelet, v.12, p.22.

Svihla, Arthur, and Ruth D. Svihla. 1932. The least weasel in the state of Washington. Murrelet, v.13, p.24.

Svihla, Arthur, and Ruth D. Svihla. 1933. Mammals of Clallam County, Washington. Murrelet, v.14, pp.37-41.

Svihla, Arthur, and Ruth D. Svihla. 1933A. Notes on the jumping mouse *Zapus trinotatus trinotatus* Rhoads. Jour. Mamm., v.14, pp.131-133.

Taylor, Walter P. 1916. Revision of the rodent genus *Aplodontia*. Univ. Calif. Pub. Zool., v.17, pp.435-504.

Taylor, Walter P., and William T. Shaw, 1929. Provisional list of land mammals of the state of Washington. Occ. Pap. Charles R. Conner Mus., Pullman 2, 32 pp.

U.S. National Park Service. 1943. Wildlife conditions in national parks, 1941. Washington, D. C., processed, 59 pp.

Webster, E. B. 1920. The king of the Olympics. The Roosevelt elk and other mammals of the Olympic Mountains. Published by the author, Port Angeles, Washington, 227 pp.

Webster, E. B. 1924. Cougar attacks man on woodland trail. Murrelet, v.5, p.12.

Webster, E. B. 1925. Introduction of mountain goats in the Olympic Mountains. Murrelet, v.6, p.10 [Edited by Frank S. Hall "from newspaper clippings sent in by E. B. Webster of Port Angeles, Washington."].

Webster E. B. 1932. Status of mountain goats introduced into the Olympic Mountains, Washington. Murrelet, v.13, p.25.

Young, Stanley P. and Edward A. Goldman. 1944. The wolves of North America. American Wildlife Institute, Washington, D. C. 636 pp.

Young, Stanley P. and E. A. Goldman. 1946. The puma–mysterious American cat. American Wildlife Institute, Washington, D. C., 354 pp.

TABLE 1. KINDS OF MAMMALS REPRESENTED IN THE OLYMPIC FAUNA[1]

Common name	Family	*Number of kinds* within the Olympic National Park	on the Olympic Peninsula as a whole
Shrews	Soricidae	6	7
Shrew-moles and moles	Talpidae	3	4
Bats	Vespertilionidae	7	11 (4 STR)
Rabbits	Leporidae	1	1
Mountain-beavers	Aplodontidae	1	1
Marmots and squirrels	Sciuridae	6	6
Pocket gophers	Geomyidae	1	2
Beavers	Castoridae	1	1
Native mice and rats	Cricetidae	9	10
Jumping mice	Zapodidae	1	1
Porcupines	Erethizontidae	0	1 (1 STR)
Wolves and foxes	Canidae	2 (1 EXT)	3 (1 EXT, 1 STR)
Bears	Ursidae	1	1
Raccoons	Procyonidae	1	1
Weasel allies	Mustelidae	8	9 (1 EXT)
Cats	Felidae	2	2
Eared seals	Otariidae	0	3 (2 STR)
Earless seals	Phocidae	0	2 (1 STR)
Elk and deer	Cervidae	3 (1 INT)	3 (1 INT)
Goats	Bovidae	1 (1 INT)	1 (1 INT)
	TOTALS	54	70

[1] Abbreviations: EXT-exterminated by man, INT-introduced by man, STR-straggler. For a complete check list of species and subspecies please see pages 23-25.

Table 2. ESTIMATED NUMBERS OR RELATIVE ABUNDANCE OF CERTAIN MAMMALS OF OLYMPIC NATIONAL PARK, 1939 TO 1949[1]

	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949
Bear (black)	C	–	C	C	C	C	C	C	C	C	C
Beaver	U	R	U	U	U	–	U	U	U	U	U
Bobcat	–	C	C	C	C	C	C	C	C	C	C
Cougar	U	U	R	R	U	U	U	U	U	U	U
Coyote	U	C	C	U	U	U	U	U	U	U	U
Deer (black-tailed)	C	C	C	5,000	C	A	A	A	A	A	A
Elk	C	C	C	4,500	4,500	4,500	4,500	4,600	4,600	4,600	4,600
Fisher	R	R	R	R	R	R	–	–	R	R	R
Goat	–	R	R	35	R	R	R	R	100	110	R
Marten	R	R	U	U	U	U	U	U	–	U	U
Mink	–	–	C	C	U	U	U	U	U	U	U
Muskrat	–	–	–	U	–	–	–	–	–	–	–
Otter	–	R	C	U	U	U	U	U	U	U	U
Raccoon	–	C	–	–	–	–	–	–	–	–	U
Skunks	–	C	C	–	–	–	–	C	C	C	C
Weasels	–	C	C	–	–	–	–	–	–	–	C
Wolf	–	–	–	–	–	–	–	–	–	–	R

[1] A - abundant, C - common, R - rare, U - uncommon. From National Park Service files.

Table 3. ESTIMATED NUMBERS OF CERTAIN MAMMALS OF THE OLYMPIC NATIONAL FOREST, 1918-1948

(Five-year averages compiled from rangers' reports)

	1918-1924[1]	1925-1929	1930-1934	1935-1939	1918-1939[2]	1940-1944	1945-1948[3]
Bear	1,300	1,800	1,700	1,400	1,600	970	1,100
Beaver	2,000	1,100	320	400	960	2,800	3,800
Bobcat	1,400	1,300	750	1,300	1,200	1,600	1,700
Cougar	180	170	150	230	180	230	370
Coyote	230	350	350	330	320	1,100	1,700
Deer	6,900	8,900	6,400	5,600	7,000	6,500	8,400
Elk	6,500	7,600	6,000	6,300	6,600	3,900	4,000
Fisher	590	150	170	130	260	330	300
Goat	0	2	7	13	–	0	50
Marten	1,600	1,800	1,400	1,400	1,600	2,300	2,600
Mink	2,000	2,500	2,200	2,300	2,300	2,700	3,100
Muskrat	300	–	1,100	1,300	900	1,800	1,700
Otter	220	125	300	250	220	110	90
Raccoon	600	–	790	1,500	960	1,500	1,900
Skunk	400	–	3,600	6,000	3,000	9,800	11,100
Weasel	700	1,400	2,800	4,300	2,300	4,600	4,800
Wolf	50	30	1	2	0	0	0

[1] Five years: 1918, 19, 22, 23, 24. For certain animals in certain years, no data are available, and the averages may be based, in such cases, on fewer than 5 years.

[2] Due to the transfer of a considerable portion of the Forest to the Olympic National Park in 1939, the data for the period 1918-1939 are not comparable with the data for later years.

[3] Four years only.

Table 4. AVERAGE NUMBER OF FURBEARERS REPORTED TAKEN ANNUALLY FROM THE OLYMPIC PENINSULA DURING THE FIVE TRAPPING SEASONS 1945 TO 1949[1]

County	Clallam	Jefferson	Grays Harbor	Mason	All
Number of trappers	41	50	116	59	268
Marten	0	9	0	4	14
Mink	420	67	608	28	1,385
Muskrat	370	120	2,682	953	4,125
Otter	59	8	101	28	196
Raccoon	122	59	394	178	754
Skunk, spotted	61	41	87	38	228
Skunk, striped	159	29	25	41	255
Weasels	8	7	41	30	87
All species	1,201	341	3,941	1,563	7,048

Table 5. STATE BOUNTIES PAID ON COYOTES FOR THE TEN-YEAR PERIOD ENDING MARCH 31, 1948[2]

	Number of coyotes bountied										
County	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**	**1948**	**Total**
Clallam	12	4	3	14	29	39	75	97	64	41	378
Jefferson	4	7	4	4	7	23	39	22	35	6	151
Grays Harbor	21	39	32	46	34	41	115	63	91	97	579
Mason	17	19	16	27	16	12	35	34	36	35	247
TOTALS	54	69	55	91	86	115	264	216	226	179	1,355

[1] From records supplied through the courtesy of the Washington State Department of Game, September 22, 1949. The trapping season in each year was from November 1 to January 15. The per cent of trappers reporting varied from 58 to 94, with an average of 83. "County" represents the home of the trapper, not necessarily the locality where the furbearer was trapped. Striped and spotted skunks were originally reported as "skunk" and "civet cat," respectively. Long-tailed weasels and ermines were reported collectively as "weasels." While skunks and weasels are included here as "furbearers," they are legally classed as "predatory animals." The raccoon was reclassified as a "game animal", on June 6, 1949.

[2] The bounty rate was in 1939, $2.50 for an adult and $1.00 for a pup (that is, a young animal presented for bounty previous to August 1); from 1940 to 1948, $5.00 for an adult and $1.00 for a pup. No coyotes were taken from Olympic National Park.

TABLE 6. STATE BOUNTIES PAID ON OLYMPIC BOBCATS FOR THE TEN-YEAR PERIOD ENDING MARCH 31, 1948[1]

	Number of bobcats bountied										
County	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**	**1948**	**Total**
Clallam	193	71	43	91	74	110	240	163	136	65	1,186
Jefferson	77	48	42	73	37	62	30	31	34	16	450
Grays Harbor	144	110	56	181	85	84	157	103	156	86	1,162
Mason	34	15	6	22	14	6	30	24	31	18	200
TOTALS	448	244	147	367	210	262	457	321	357	185	2,998

[1] The bounty rate was $5.00. No bobcats were taken from Olympic National Park.

TABLE 7. PERCENTAGES OF FOOD ITEMS IN STOMACHS OF 21 OLYMPIC BOBCATS[1]

	Rabbit	Mountain-beaver	Flying squirrel	Fish	Winter Wren	Black-tailed deer	Deer mouse
	100	Trace	–	–	–	–	–
	–	Trace	–	–	–	–	–
	–	100	–	–	–	–	–
	–	100	–	–	–	–	–
	100	–	–	–	–	–	–
	–	100	–	–	–	–	–
Lot A	100	–	–	–	–	–	–
	100	–	–	–	–	–	–
	–	100	–	–	–	–	–
	90	–	–	–	–	10	–
	–	100	–	–	–	–	–
	–	–	Trace	–	–	–	–
	100	–	–	–	–	–	–
	–	–	100	Trace	–	–	–
	100	–	–	–	–	–	–
	100	–	–	–	–	–	–
Lot B	–	–	100	–	–	–	–
	–	–	–	100	–	–	–
	70	–	–	30	–	–	–
	40	–	59	–	–	–	1
	80	–	–	–	20	–	–
Number of occurrences	11	7	4	3	1	1	1

[1] *Explanation.* –Food remains were reported on a percentage basis, that is, if the stomach contained only rabbit, regardless of the amount, the contents were listed as rabbit 100%.

***Lot A*:** Stomachs of 11 bobcats trapped and 4 bobcats treed by dogs, December 1937-January 1938, from all 4 Olympic counties; collected by Victor B. Scheffer and examined by Charles C. Sperry. Three additional stomachs were empty.

***Lot B*:** Stomachs of 6 bobcats, January-February 1936, from the Hoh River; collected by John E. Schwartz and examined by Cecil S. Williams. One additional stomach was empty.

TABLE 8. STATE BOUNTIES PAID ON OLYMPIC COUGARS FOR THE TEN-YEAR PERIOD ENDING MARCH 31, 1948[1]

	Number of cougars bountied										
County	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**	**1948**	**TOTAL**
Clallam	12	14	0	3	5	2	11	20	22	29	118
Jefferson	17	6	14	17	18	15	10	27	24	16	164
Grays Harbor	2	4	1	4	4	1	7	3	9	13	48
Mason	2	1	0	0	0	1	0	5	5	4	18
TOTALS	33	15	15	24	27	19	28	55	60	62	348

[1] Bounty rate $50; raised to $75 effective April 1, 1949. No cougars were taken from Olympic National Park.

TABLE 9. FUR SEALS TAKEN BY NATIVES OF THE WASHINGTON COAST, 1912 TO 1941[1]

Year	Months	Males	Sex not recorded Females	Unborn young	Total
1912		–	–	–	0
1913	April-May	1	90	–	91
1914	April	2	12	–	14
1915		–	–	–	0
1916		66	313	91	470
1917	May-June	209	304	4	517
1918	April-June	251	142	2	395
1919		251	303	–	554
1920	April-June	656	630	1	1,287
1921		214	352	1	567
1922	May-June	641	462	4	1,107
1923		271	569	1	875
1924		539	359	–	1,029
1925		823	883	2	1,765
1926		291	715	–	1,035
1927		95	178	–	282
1928		252	456	–	708
1929	February-June	166	421	1	591
1930	January-July	131	319	–	450
1931	April-June	24	141	–	165
1932		26	47	–	73
1933	March-May	17	12	–	29
1934	February-May	6	17	–	23
1935	January-May	9	66	–	75
1936	April	2	26	–	28
1937	January-May	10	35	–	45
1938	March-May	4	88	–	92
1939	February-May	–	30	–	30
1940	May	2	26	1	29
1941		1	20	–	21
TOTALS		4,960	7,016	107	264	12,348

[1] From published annual reports (and MS file for 1924) of the U.S. Fish and Wildlife Service. While the total catch in a given year is approximately correct, the breakdown into sexes and unborn young is, in many cases, unreliable. From 1942 to the present (1949) no seals have been taken.

TABLE 10. NUMBER OF ELK REPORTED KILLED ON THE OLYMPIC PENINSULA, 1933 TO 1948[1]

Year	Number of elk reported killed	Approximate number of hunters
1933	157 bulls	448
1936	278 bulls	–
1937	811 both sexes	3,000
1938	117 bulls	487
1939	525 both sexes	1,444
1940	90 bulls	295
1941	100 bulls	–
1942	180 bulls	–
1943	1,430 both sexes[2]	–
1944	670 bulls	–
1945	1,355 both sexes	–
1946	550 both sexes	–
1947	528 bulls	–
1948	548 both sexes	–
	TOTAL	7,339

[1] Clallam, Jefferson, Grays Harbor and Mason counties outside of the Olympic National Park. Data supplied by courtesy of Washington State Department of Game.
[2] Regular season, 1,246, extra season on Dosewallips River, December to March, 158; extra season on Elwha, December to March, 26.

TABLE 11. HUNTING STATISTICS, BLACK-TAILED DEER, OLYMPIC PENINSULA[1]

	Deer reported killed by hunters			
County	1936	1937	1938	1939
Clallam	65	80	111	195
Jefferson	65	99	139	160
Grays Harbor	65	143	181	208
Mason	60	133	214	371

Number of deer killed per unit of area, October 1-22, 1939

County	Total hunting range, sq. mi.	No. deer killed	No. killed per ten sq. miles
Clallam	1,616	195	1.20
Jefferson	1,687	160	0.94
Grays Harbor	1,542	208	1.34
Mason	850	371	4.36

Antler-point classes of bucks killed, October 1-22, 1939

County	Total no. antlered bucks	Points on one antler					
		1	2	3	4	5	?
Clallam	195	–	109	49	24	11	2
Jefferson	160	–	85	54	20	1	–
Grays Harbor	208	–	114	67	23	4	–
Mason	276	36	127	72	35	6	–

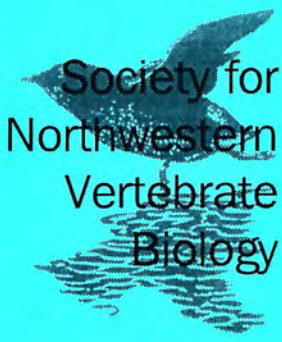
[1] After Lauckhart (1940). No deer were killed in Olympic National Park.

TABLE 12. CAUSES OF MORTALITY AMONG DEER OF ALL SPECIES[1]

	Per cent
Killed by man's devices (cars, trains, fences, wells, bridges, and traps)	49%
Killed by man out of season (mostly illegally; some for protection of property)	31%
Killed by natural causes (accidents, disease and malnutrition; "natural death")	9%
Killed by animals (dogs, coyotes, cougars, bears, and bobcats)	7%
Undetermined	4%
TOTAL	100%

[1] After Lauckhart (1940).

NORTHWEST FAUNA



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