The MAMMALS, REPTILES, AMPHIBIANS, and FRESHWATER FISHES of the TACOMA AREA

by

John W. Slipp

A thesis submitted in partial fulfillment of the requirements of a program of independent study in the Department of Biology of the College of Puget Sound.

Tacoma, Washington

May 22, 1940

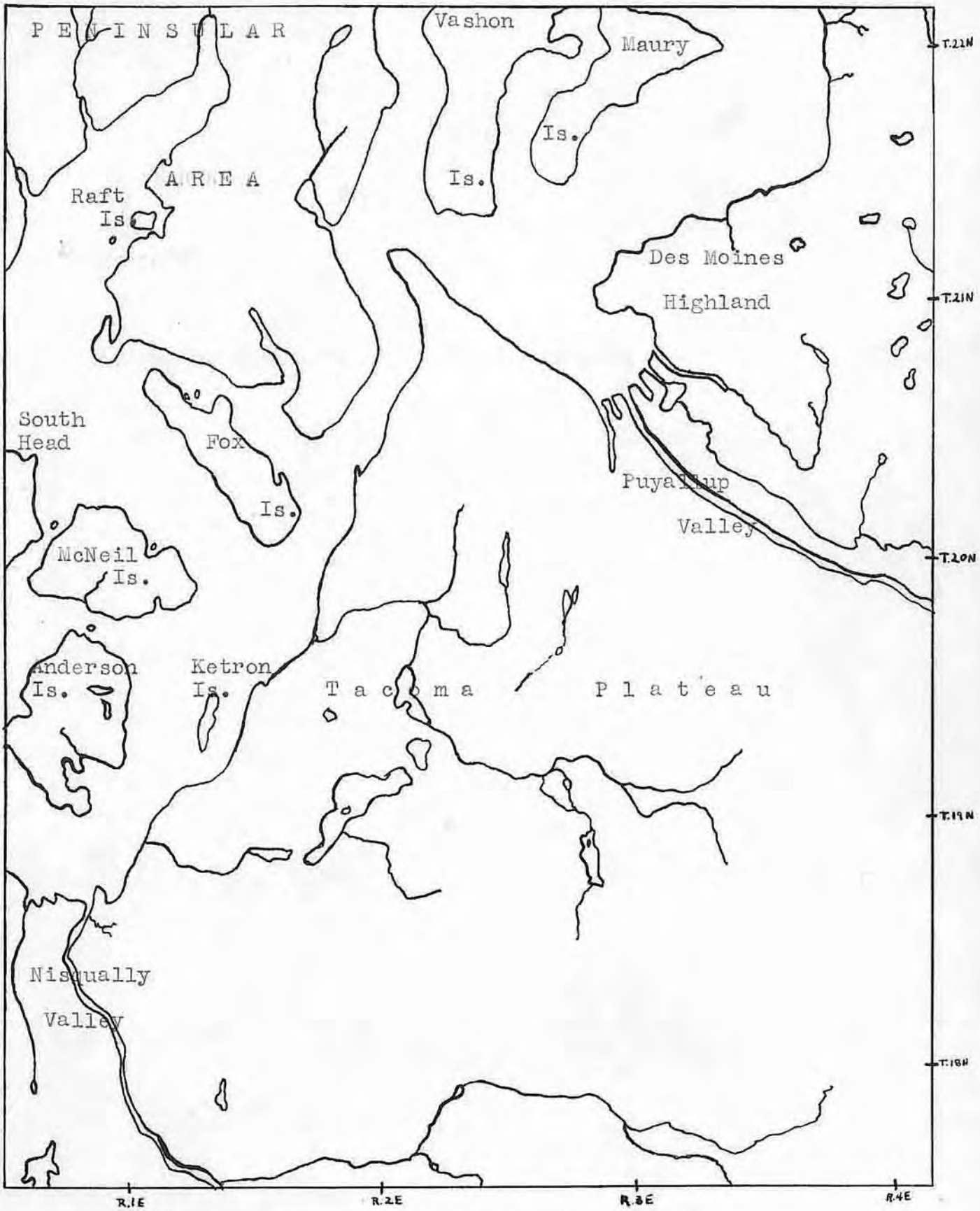

Plate I. Outline Map of the Tacoma Area.

Table of Contents

****

Introduction

History of the Present Investigation. The author's interest in the natural history of Tacoma and vicinity has been a result of his boyhood summers spent in the open, largely at Spanaway Lake south of Tacoma. Since 1931 notes covering a constantly growing field have been kept, observations and other data being recorded faithfully as a kind of hobby. These activities were expanded and continued in a somewhat modified form after enrolling at the College of Puget Sound in 1936. In 1938-9 the exact boundaries of the area to be considered were drawn, and the cooperation of several fellow students obtained on certain phases of the general problem, i. e. the preparation of a more or less encyclopaedic account of the historical, physical, and biological aspects of this territory. Those included in the above program were Miss Jane A. Marchesini (plants), Philip W. Cheney and Richard Kohler (mammals). Prof. James R. Slater gave encouragement to these activities at this time by way of accepting certain portions of the work done in this connection as worthy of research credit.

Purpose of Present Report. The work reported on at this time is not to be regarded as a final product, but rather as a basic outline-report, which, it is hoped, will be of value to others as well as to the author in the further development of the natural history of the area. While the number of species herein listed is so great as to limit special discussions to a minimum, three of the most numerous groups (the vascular plants, birds and marine fishes) are at present entirely omitted. As a basic report, however, it is felt desirable that there should

be included discussion of the location, limits, climate, topography, and physiography of the area sufficient to define the scope, nature, and significance of the general problem. In addition, the bibliography affords an index to the important literature available, the volume and varied nature of which bear testimony to the surpassing interest of the area for naturalists and scientists throughout the history of the "Caucasian Invasion". (It is intended by the author that the history of scientific investigation within this area be made the subject of a separate paper in the near future.)

General Acknowledgements. Besides the above persons (and those specially mentioned from time to time in the following pages), general acknowledgement of services rendered is due the following persons: Mr. and Mrs. W. D. Lyness for various kindnesses; Miss Frances Bjorkman and Miss Jane Marchesini for constant and valuable aid, and particularly to the latter for much time and effort spent in the preparation of the manuscript; Prof. Frederick A. McMillin and Mr. Warren L. Perry of the College of Puget Sound for numerous favors; Chief Naturalist C. Frank Brockman of Mt. Rainier National Park and Mrs. Martha Flahaut of the Washington State Museum for their kind interest and help; Mr. E. A. Kitchin, Mr. Stanton Warburton, Jr., Mr. H. Myhrman, and Dr. Gordon D. Alcorn for their friendly help and many contributions; all those persons who have willingly and unselfishly given of their information; and, last but not least, my parents, Mr. and Mrs. Edward L. Slipp.

Geographic and Geologic Considerations

General Features. The rectangular area under consideration comprises 616 square miles roughly centered about Tacoma, Pierce County, Washington, extending north to Des Moines (King County) and Kitsap County; south to include Roy, and most of Lake Saint Clair (Thurston County); east to include Puyallup; and west to include McAllister Creek (Thurston County), South Head, Glencove, and McNeil Island. The surface of this area is entirely of glacial drift of Pleistocene age and post-glacial sediments; drainage is into Puget Sound, three of the four larger rivers being glacial (Mt. Rainier) in origin; lakes are numerous. The Merriam life zone is the Humid Transition while elevation varies from sea-level to above the 750 foot contour, the average being probably more nearly 250 to 400 feet. Puget Sound varies in depth, within the area, between 30 fathoms (at the Narrows) to 100 fathoms north by west of Ketron Island and 120 fathoms off Point Robinson, Maury Island, the latter two comprising the principal "deeps" of Puget Sound located within our limits (see Bretz, 1913:216-219). The extreme relief is therefore probably about 1350 feet, the two extremes extending about equally above and below sea-level.

Climate. Beyond the simple relegation of this area to the Humid Transition zone, little discussion of the precise climatic conditions obtaining is attempted. Morris M. Leighton (1918) presents a very good and readable analysis of this and other phases of the country about Fort Lewis, illustrating by means of tables, graphs, and direct comparison with other areas, the unusual combination of far northerly position and mildness of

climate found in the Puget Sound basin. While there is ample yearly precipitation (the area lies in the Pacific rain-forest belt), summers are generally quite dry and winters mild, there being but rarely any snow or ice.

Topographical Analysis. For the ready analysis of the locality, distributions, and records cited, the map area is considered as being divided up into three general classifications: (1) peninsular, referring to those portions of the Kitsap Peninsula included, (2) Puget Sound and the islands thereof, and (3) mainland.

The first or peninsular area comprises about 63 square miles lying wholly within Pierce County, is surfaced everywhere with glacial till or sediments, was originally heavily forested with fir, hemlock, and cedar, rises to elevations probably nowhere exceeding 500 feet*, and has been comparatively little investigated during the present program.

The second or Puget Sound division comprises roughly about 90 square miles of water surface, and includes five large islands (southern half of Vashon only) and a number of smaller ones, all similar in structure and plant cover to the preceding area.

By far the largest part of the map area is the mainland portion, which is further subdivided as follows.

The northeastern portion south to the Puyallup Valley is

* No contour map is available for the western half of the area, the Tacoma Quadrangle including only the eastern portions. Maps used in this study are as follows: Tacoma Quadrangle (1900:U.S.G.S.); Map of the Puget Sound Country and Map of Western Washington, D. H. White, 1005 Fidelity Bldg., Tacoma; road map distributed by the Shell Oil Co. for Seattle, Tacoma, and Vicinity (1936); pocket maps listed as plates XXII-XXIV of Bretz' Glaciation of the Puget Sound Region, bull. 8 of Washington Geological Survey, 1913, from one of which the bathymetrical measurements are taken; U.S.Army Terrain Map of Fort Lewis, 3 sheets, 1930.

designated the Des Moines Highland, a vast hill rising in places to the 500 foot contour level, composed almost entirely of Admiralty sediments commonly capped with a layer of Vashon till, bearing numerous isolated lakes and a number of short peripheral streams, and covered originally with a dense forest containing a high percentage of cedar and hemlock. Extending north to Elliot Bay and bounded on the east by the Duwamish-Puyallup Valley (a portion of which is included in the extreme northeastern corner), in the limits of the present map area it is terminated principally on the south and west by the Puyallup Valley and Puget Sound respectively.

The Puyallup Valley itself comprises a second subdivision which, like the Valley of the Nisqually (yet a third subdivision, located in the southwest), is the channel of a Mt. Rainier glacial stream.

The large, elevated Tacoma plateau remaining within the map area south of the sound and the Puyallup Valley, comprising a strong two-fifths of the entire surface area, has not only received the most intensive study but is by far the most interesting historically, for it includes the Steilacoom and Nisqually outwash plains which attracted the founders of Nisqually House in the early days. These gravelly outwash plains, which give the region under consideration its claim to biological and physiographical uniqueness, extend south to the Nisqually Valley, west to the sound by virtue of the Chambers and Sequalitchew deltas, and north to include South Tacoma; being bounded on the north, northeast, east, southeast by a crescentic succession of morainic hills and till ridges broken only by the Vashon glacial lake outwash channels of South Tacoma and Clover Creek. It is in this morainic area, in the

extreme southeastern corner of the map area, that the maximum elevation occurs, the 750 foot contour being there attained. Isolated morainic elevations also occur frequently on the outwash prairies, chiefly in the broad marginal portions, while groves of oak and young forests of Douglas fir are numerous.

Geological History. J. Harlen Bretz (1913) has given us the most complete account of our local geology yet attempted, and his "Glaciation of the Puget Sound Region" is chief authority for most of the statements in the following brief account.

The Puget Sound basin is genetically synclinal, belonging to the most western synclinorium of North America, which includes the Gulf of Georgia to the north, and the Willamette Valley, Great Valley of California, and the Gulf of California to the south. It is bounded on the east by the Cascades (a spur of which forms the San Juan Archipelago crossing the northern portion of the basin) and on the west by the Olympics, both mountain ranges probably of late Pliocene or early Pleistocene age.

During the latter epoch extensions of the Cordilleran ice mass reached southward through the basin, the first or Admiralty Glaciation aggrading a great plain of sedimentary deposits as it retreated. In the succeeding Puyallup Interglacial Epoch this plain was deeply trenched into three great drainage systems which remain today, modified by the succeeding Vashon Glaciation, as the troughs of Puget Sound. Aside from this modification by erosion and limited aggradation, the latter advance had a much less profound effect on most of the region than did its predecessor. The exception to this generalization is found in the formation of vast gravel outwash plains in the southern portions of the basin, including those of the area specially considered in this report.

At a point about 15 miles south of the present southern end of Puget Sound the great ice mass ceased to advance. While the terminal moraine today is fragmentary and unimpressive, the outwash plains, quite generally characterized by the famous mounds of the region, are strikingly developed. The more southerly of these plains record a great southward flow into the Chehalis Valley, and gravel was carried therein all the way to the Pacific at Grays Harbor. With further retreat the drainage pattern was altered again and again, and with the exposure of the low divide between the Chehalis and Puget Sound depressions a long and complicated series of glacial lakes was begun. Lake Russell, the most central and important of these, drained into the Chehalis by way of the Gate Pathway, a channel extending south-southwest from Budd Inlet at Olympia. This lake continued to grow as the ice mass withdrew northward, occupying the present sound basin and assuming impressive proportions as it united with the various flanking lakes of similar type, its existence terminating only when drainage became possible into the Straits of Juan de Fuca. Many of the phenomena of the local topography and geology are to be explained only on the basis of the behavior and interrelationships of these great bodies of glacial water. Here again is a subject by no means exhausted and of gripping interest to the student.

While further discussion of the glaciation in the Tacoma Area itself is impossible at the present time, certain general observations may profitably be included as being directly related to the biology of the region. First, no rock exposures occur within this area, fossils being limited to Indian remains and to a few marine shell beds occurring in elevated terraces, both of post-Vashon

age; and to occasional mammoth teeth and tusks (Hoods Canal, Seattle, and elsewhere in the region), a whale vertebra and elk antlers (Seattle), lignite beds and shell beds (Foulweather Bluff and Seattle), in the Admiralty sediments. Secondly, the Vashon sheet, extending entirely across the basin and crowding up onto the ranges on either side in the face of local glaciers, rendered the area virtually sterile about 25,000 years ago. Thirdly, the nature of the post-glacial surface and its geographic position conspired to make this a "transition area" as regards the post-glacial distribution of numerous biological forms. *

* For further information on the most interesting of these, the Indians, see Haeberlin and Gunther, 1930.

ANNOTATED LISTS OF SPECIES

The following lists include all species of certain or probable occurrence, the latter marked with an asterisk.

I. FRESHWATER FISHES

Acknowledgement for courtesies extended by members of the Biology Department of the College of Puget Sound in connection with the collection of fishes is hereby given, those particularly helpful being Miss Frances Bjorkman, Miss Jane Marchesini, Prof. James R. Slater, Mr. Delbert McBride, Mr. Richard Vimont, Mr. William Sidders, Mr. Philip Cheney, and Mr. Frank Seabeck. Mr. G. P. Luzader, Mr. B. J. West, and Mr. Harold Hilton of the state hatchery at Chambers Creek, Mr. Ellis of the Minter Creek Biological Station, and Mr. H. O. Hoggatt of the Voight's Creek Hatchery were generous with their information dealing largely with the salmon and trout. Mr. Luzader kindly read and criticised the manuscript.

In the following list of fishes 40 species of 10 families are recorded. Subtracting the 10 species included doubtfully, a certain total of 30 species is obtained.

PETROMYZONIDAE. Lamprey 'eels'.

Entosphenus tridentatus (Gairdner). Three-toothed Lamprey. One specimen listed for Fort Steilacoom by Girard (1858:383) under name of Ammocoetes cibarius Girard, being listed as of this species by Schultz and DeLacy (1935:366) in synonymy and records. (Description, etc., seems to me more like Lampetra). Schultz (1930a:137) says of E. tridentatus: "...not abundant in the tributaries of Puget Sound, but is very common in the coastwise streams..."

*Lampetra fluviatilis (Linnaeus). Parasitic River Lamprey.

Not a common form apparently, but should occur. Recorded for Lake Washington (one specimen) and Lake Cushman (Schultz and DeLacy, 1935:266; Schultz, 1930a:137).

Lampetra planeri (Bloch). Non-parasitic Brook Lamprey.

Common in all (?) our streams. Specimens from Anderson Island (JWS 65, taken by H. W. Myhrman) and a tributary of Chambers Cr. at the Steilacoom Game Farm (JWS 40c20).

SALMONIDAE. Salmon and Trout.

Oncorhynchus gorbuscha (Walbaum). Pink or Humpback Salmon.

Humpbacks run in alternate years, preferring glacial streams. There is a well known run in the Puyallup; other streams in this area in which they are reported to occur being Nisqually (Luzader) and Minter Creek (Ellis). Mr. Luzader is authority for the statements that these fish were running in the Nisqually (Mashel) about 1922, and that there was a native run in Chambers Creek which died out some thirty years, and which was artificially restored about twenty years ago without lasting success. The run is early and not of long duration, usually beginning in August and not lasting more than a month.

Oncorhynchus keta (Walbaum). Chum or Dog Salmon.

Abundant, occurring in numbers in every suitable stream in the area. Run of long duration, beginning about the last of September (not until much later in some streams, as at Dumas Bay) and extending into March. Luzader and West report the existence of a break in the run in Chambers Creek, a two week hiatus about Christmas time dividing the run into an early and a late phase.

Specimens: Chambers Cr., JWS 87 and 88; Glencove, JWS 92a-d (eggs).

Oncorhynchus kisutch (Walbaum). Silver and Coho Salmon. Abundant, but less so than the Dog Salmon. Run begins somewhat earlier than in the case of the dog, but likewise in September; duration about two months. Occur in many or most of the streams in which the preceding species occurs. Besides all the larger rivers--Nisqually, Puyallup, White, and Green--known positively from Minter Cr. and Chambers.

Oncorhynchus nerka (Walbaum). Red, Sockeye, or Blueback Salmon; Redfish; Silver or Blood Trout. Occurs in the fresh waters of this area only in the dwarf, land-locked form known as Silver Trout (or Kennerly's Salmon, O.n.kennerlyi). Known to be present in American, Steilacoom, and Spanaway lakes, but just what its status is in the latter two lakes (and elsewhere, if it occurs) is not certain; thought to be native in American at least. Rare or extirpated now in Spanaway. Dies after spawning, as in the anadromous form. Run is in the fall, in November at American Lake. Specimens: American Lake, JWS.

Oncorhynchus tschawytscha (Walbaum). King, Chinook, or Spring Salmon. Does not run in the spring in this area. Fall runs occur in the Green and Puyallup Rivers, and, according to Luzader, in the Nisqually (Mashel). Stragglers probably also occur in several of the larger non-glacial streams, as they are known to do in Minter and Chambers Creeks. Prefers glacial streams, and is of the greatest commercial importance.

Salmo clarkii clarkii (Richardson). Coastal Cutthroat Trout. Abundant in all suitable waters of the area; frequently anadromous.

Known to follow salmon runs for eggs, one dying of over-gorging in Minter Creek (Ellis). According to Mr. Luzader the run Chambers Creek was once of magnificent proportions, the fish measuring from 12 to 22 inches, beginning to spawn June 27th and continuing 90 days. (Note: Crescenti Trout (S.c.crescentis), listed for American Lake in the third edition of "Fishing Guide to the Northwest" (1938, edited by David Pollock, General Publishing Corp., Seattle) is characterized on page 38 of the same volume as a local race incapable of separation from the coastal fish, in a feature article by Schultz and Hanson.) Specimens: Spanaway Lake, JWS 15; Nisqually, Dash Pt., Chambers Cr., JWS.

Salmo clarkii lewisi (Girard). Montana Blackspotted Trout. This more highly colored and differently patterned form has been introduced into western Washington. Much less common than the native coastal fish. Specimens: Spanaway Lake, JWS 16.

Salmo gairdnerii gairdnerii Richardson. Rainbow &/or Steelhead Trout. Like the cutthroat, this species is prone to descend to saltwater when this is possible, returning to spawn and feed on salmon roe annually. Catches of the fish are not infrequent in December in the Puyallup and Nisqually, but the run gets better later on. B. J. West gives the spawning dates for Chambers Cr. as February 5 to April 15. The sea-run steelhead occurs in all the rivers and major streams of the area, while the landlocked rainbows are known in certain of the lakes, notably Doloff and probably several others. Whether native or not the latter are largely hybridized with the introduced variety shasta. Specimens from Chambers Cr. (JWS 86) and Clarks Cr. at Puyallup R. (JWS).

(Note: Although the lumping of the rainbow (S. irideus) and the steelhead (S. gairdnerii) is the culmination of decades of contention, this decision is not universally accepted. Moreover, the inclusion of beardsleei and crescentis as subspecies of this same group, inasmuch as they are both endemics of Lake Crescent, would seem to require revision.)

*Salmo trutta Linnaeus. Brown Trout. (Note: Loch Leven Trout, S. levenensis, included here.) Listed as present in American Lake in the 3rd edition of the "Fishing Guide to the Northwest" (1938, published by the General Publishing Corporation of Seattle), this fish is quite possibly established in certain of our waters.

Cristivomer namaycush (Walbaum). Lake Trout, Mackinaw Trout. Listed as present in American Lake in the "Fishing Guide" (see foregoing species). If it does occur in this area, this would be a most logical place....Mr. Luzader reports as follows: In the neighborhood of 2,000,000 eggs planted in the waters of Pierce, Thurston, and Mason Counties about 1925. Known to have persisted in Lake St. Clair at least, one of 22 inches being subsequently caught by him.

*Salvelinus fontinalis (Mitchill). Eastern Brook Trout. Extensively planted in the past in several or many of the waters of this area, but has persisted nowhere below an elevation of 700 feet (Luzader). Two were taken in a fish trap on Chambers Creek between Feb. 24th and April 20th, 1938, according to the hatchery records. These were probably 'escapes' from the hatchery ponds.

Salvelinus malma spectabilis (Girard). Dolly Varden Trout.
Listed for the Puyallup and Duwamish Rivers by Suckley in 1874. Not encountered in my field work, now known to Luzader, in this area.

COREGONIDAE. Whitefishes.

Prosopium williamsoni (Girard). Rocky Mountain Whitefish.
All larger streams entering Puget Sound (Crawford, 1925). I have fishermen's reports for the Green, Nisqually, and Muck (Puyallup).

CATOSTOMIDAE. Suckers.

Catostomus macrocheilus Girard. Coarse-scaled Columbia River Sucker. Abundant in lakes Spanaway, Steilacoom, and American, and in the Puyallup and Nisqually rivers to the writer's knowledge. Probably occurs quite generally elsewhere with the exception of such land-locked lakes as Wapato and those of the southern portions of the Des Moines Highland. Specimens: Spanaway Lake, JWS 94; Clark's Cr., JWS; Chambers Cr., JWS 40C21(1-3).

CYPRINIDAE. Minnows, Chubs, etc.

*Cyprinus carpio Linnaeus. Common Carp.
Quite possibly present in some of the lakes of the area. Numbers seen by the writer in Lake Tapps (extralimital) about 1932.

*Carassius auratus (Linnaeus). Common Goldfish.
Quite possibly established in some of our lakes or ponds.

Mylocheilus caurinus (Richardson). Columbia River Chub.
Recorded for Steilacoom by Girard (1857b, 1858) and by Suckley (1860; M. lateralis). Specimens from Spanaway L., JWS 18 and 93.

Ptychocheilus oregonensis (Richardson). Squawfish.

Known to the author as an abundant and interesting inhabitant of Spanaway, Steilacoom, American, and possibly Sequalitchew lakes. Recorded from Steilacoom by Girard (1857b, 1858).

Richardsonius balteatus balteatus (Richardson). Red-sided Bream.

Recorded for Steilacoom by Girard (1857b, 1858). Known to the author from Spanaway Cr.; reported from Chambers Cr. by Philip Cheney.

*Tinca tinca (Linnaeus). Green or Golden Tench.

Has been introduced into lakes Union and Washington, and might occur in the present area; doubtfully included.

*Rhinichthys cataractae dulcis (Girard). Long-nosed Dace.

Native in the coastal streams, and Tacoma Cr. and Stillaguamish River north of Seattle. Might occur rarely; doubtfully included.

Apocope oscula nubila (Girard). Black-sided Dace.

Fort Steilacoom, Girard 1857b, 1858; Suckley 1860. Chambers Cr., JWS 40D11b5.

AMEIURIDAE. Catfishes.

Ameiurus melas (Rafinesque). Black Catfish, Horned Pout.

Specimens from Hoodlum Lake, JWS 7a and 7b, have been so classified. The species is not otherwise recorded in the northwest. Further work on more recent specimens from this locality (now drained) is necessary for certain determination. Indeed, by the key in Jordan and Evermann (1934:23) platycephalus is indicated rather than melas, a classification of less probability, however, and not to be highly regarded considering the key and the immaturity of the specimens.

Ameiurus nebulosus (Le Sueur). Catfish, Horned Pout, Bullhead. Specimens: Lk. Josephine, Anderson Island, JWS 67a-u; Wapato L., JWS 91a-k. Commonly introduced.

GASTEROSTEIDAE. Sticklebacks.

Gasterosteus aculeatus aculeatus Linnaeus. Common 3-spined Stickleback. Specimens so catalogued now number only one, JWS 3a; all others subspecifically classified are referred to microcephalus. As a form with more completely ossified lateral plates and capable of entering salt water (or rather vice versa--capable of entering fresh water), its actual existence in nature seems doubtful to me. The specimen above referred to is one of two taken from a large school in a brackish tidewater pool east of Day Island, the other of which is classed as microcephalus after being kept alive for weeks in a fresh water aquarium. Moreover, a single 'microcephalus' was taken in the salt water on the west shore of Day Island (JWS 32). If the distinction between the two actually does break down, microcephalus would become a synonym of this form, of course.

Gasterosteus aculeatus microcephalus Girard. Three-spined Stickleback. Specimens: Ponce de Leon Cr., JWS 4a-d; Univ. Place, JWS 3b; Day Island, JWS 32. Specimens from Chambers Cr., Crystal Springs, Puyallup Valley, etc. are also likely referable to this form. It was recorded for Ft. Steilacoom by Girard (1857a; 1858:93) as G. pugetti. As above indicated, I find myself unable to appreciate any real difference between aculeatus and microcephalus, either in habits or structure, as represented in this locality. No claim to any exhaustive work is, however, intended.

PERCIDAE. Perch, Wall-eyed Pike, etc.

Perca flavescens (Mitchill). Yellow Perch.

Introduced into virtually every lake in the area; known also to occur on occasion in Chambers and Spanaway Creeks. A most excellent panfish. Specimens: Spanaway L., JWS 17, 18; Chambers Cr., JWS 35; Wapato L., JWS 90.

CENTRARCHIDAE. Bass and Sunfish.

Aplites salmoides Rafinesque. Large-mouthed Black Bass.

A favorite and hardy game fish which has been introduced into virtually every perennial pond and lake in the area. Specimens: Wapato L., JWS 6 and 2; Spanaway L., JWS 13, 14.

Micropterus dolomieu Lacepede. Small-mouthed Black Bass.

I have examined specimens from American Lake, and it is reported on rather good authority to occur in Shavers Lake, Muck Creek, and (formerly at least) in Lake Nisqually. A favorite game fish -- "Inch for inch and pound for pound the gamest fish that swims".

*Eupomotis gibbosus (Linnaeus). Pumpkinseed Sunfish.

Listed as in lakes of the Puget Sound region generally by Schultz and DeLacy (1936:72); introduced. Not encountered in the present investigation unless a tiny specimen from a pond near Lacey (Thurston County, extralimital) was of this species (specimen misplaced).

Ambloplites rupestris (Rafinesque). Rock Bass.

Not recorded by Schultz and DeLacy. Known to the author from Lake St. Clair, American L., and Steilacoom L. One specimen, JWS 34, from the head of Chambers Cr.

*Pomoxis annularis Rafinesque. White Crappie.

Schultz and DeLacy (1936:72) give this species as introduced into Lakes Union and Washington. Not known definitely from this area, but may quite possibly occur.

Pomoxis sparoides (Lacepede). Black Crappie.

Introduced commonly into most of the lakes of the area, preferring and persisting (only ?) in those which are more or less turbid. Good pan fish. Specimens: Spanway L., JWS 95, and others.

COTTIDAE. Bullheads, Sculpins, etc.

Cottus asper Richardson. Prickly Bullhead.

Common or abundant in all accessible waters of the area. Reported from Steilacoom by Girard in 1858. Specimens: Spanaway L., JWS 28a-b; Chambers Cr., JWS 36a-e; and others not yet catalogued. See Schultz (1930) for a general discussion of all our local forms.

Cottus aleuticus Gilbert. Bullhead.

Three specimens from Anderson Island have been so classified, JWS 66a-c.

Cottus rhotheus (Rosa Smith). Bullhead.

Listed for Nisqually River by Schultz and DeLacy (1936a:129), this species is represented in the collection of the author by only one specimen, 39J26a2 from Clarks Cr.

*Cottus gulosus (Girard). Bullhead.

A stream form not yet recorded definitely for this area, but ought surely to occur.

II. AMPHIBIANS. Frogs, Toads, and Salamanders.

Acknowledgement is due Prof. James R. Slater of the College of Puget Sound for the major role he played in the author's early interest and study in this group, and for the courtesies extended the author as a member of the Biology Department. Thanks are accorded Mr. Oscar I. Anderson and Mr. Walter C. Brown for their cooperation in the matter of specimen collection, and for numerous other kindnesses.

In this and the following list (reptiles), authority for the general statements made is found in the field notes of the author, and in the collections of the College of Puget Sound and of the author, unless otherwise indicated.

In the present list 13 species of 6 families are recorded. Subtracting the 2 species included doubtfully, a certain total of 11 species is obtained.

SALAMANDRIDAE. Newts.

Triturus granulosus (Skilton). Pacific Northwest Newt.
Occurs quite abundantly in all three of the major land areas. Except for spring and fall migrations and its abundance in suitable bodies of water during breeding season, a rather obscure form. Rare in the outwash-prairie areas; known from Vashon, Maury, Fox, McNeil, and Anderson islands.

AMBYSTOMIDAE.

Ambystoma gracile (Baird). Northwestern Salamander.
A secretive species, the adult form seldom encountered. Known in the map area from the Des Moines Highland, Puyallup Valley, Tacoma and vicinity, and Vashon Island.

Ambystoma macrodactylum Baird. Long-toed Salamander.

An inconspicuous cosmopolitan species of great abundance. Common throughout the mainland and peninsular areas, and has so far been collected from Ketron and Maury Islands.

Dicamptodon ensatus (Eschscholtz). Pacific Giant Salamander.

In western Washington this is generally a montane or sub-montane species, although there is a specimen from the Univ. of Wash. campus at Seattle in the CPS collection. Delbert McBride's reports led directly to the author's discovery of the species in the tributary streams of the lower Nisqually Valley, specimens being taken in both Pierce and Thurston Counties and as low as five to ten feet above high tide level. Should be looked for in similar situations along the Puyallup River Valley.

PLETHODONTIDAE.

*Plethodon vandykei Van Denburgh. Washington Salamander.

A rare form generally, usually found at somewhat higher elevations especially in the foothills of mountains. Should be looked for particularly in the moist wooded portions of the mainland area; doubtfully included.

Plethodon vehiculum (Cooper). Western Red-backed Salamander.

A not common form in this area, with the possible exception of the lower Nisqually Valley. Specimens from Epworth Heights (Des Moines Highland), Mason and Buckley gulches in Tacoma, and the lower Nisqually Valley, all on the mainland portion of the map area.

Ensatina eschscholtzii Gray. Red Salamander.

Quite common form of wooded area generally; apparently absent from the prairie woods. Known from Maury, Vashon, Anderson, Fox, and Ketron islands.

*Aneides ferreus Cope. Clouded Salamander.

This species is included on the state list by virtue of a specimen taken on the Kitsap Peninsula near Bremerton (Slater, 1939). If there has been no mistake, the probability of its being found in at least the peninsular portion of the present area is fair.

BUFONIDAE. Toads.

Bufo boreas boreas (Baird and Girard). Northwestern Toad.

Common in many places throughout the mainland, and likewise present on the Kitsap Peninsula, this species has yet to be taken on any of the islands of this area.

HYLIDAE. Tree Frogs.

Hyla regilla Baird and Girard. Pacific Tree-frog.

Very common and vociferous species throughout the area, and perhaps our most interesting and useful amphibian. Occurs on Maury, Vashon, McNeil, Anderson, Ketron, and Raft islands, and probably others as well.

RANIDAE. Frogs.

Rana aurora aurora (Baird and Girard). Western Wood Frog.

Occurs very generally throughout the area, in or near moist places or bodies of water. Capable of extended wanderings, particularly in wet weather. Breeds quite usually in ponds which dry up in late summer. Recorded from Raft, Fox, Anderson, McNeil, Maury, and Vashon islands.

Rana pretiosa pretiosa (Baird and Girard). Western Spotted Frog.

Known at present within the area only from prairie lakes and streams; may quite possibly be located elsewhere on the mainland or even the peninsular portions. A more strictly aquatic species than aurora, frequenting perennial waters and occasionally wandering at night or in wet weather. Has not yet been found on any of the islands of the state.

Rana catesbeiana Shaw. Bullfrog.

Introduced, and now abundantly and generally established about permanent bodies of water. It has been found, however, on only one of the islands, Anderson, herein considered. The author has reason to believe that it occurs also on Vashon.

III. REPTILES. Lizards, Snakes, Turtles.

In the following list 11 species of 5 families are certainly listed.

IGUANIDAE. Swifts, etc.

Sceloporus occidentalis occidentalis (Baird and Girard). Pacific Blue-bellied Lizard. Locally abundant along sea-cliffs in certain places, spreading to adjacent clearings or prairies when suitable. Known from north of Steilacoom, Manitou, and Point Defiance (mainland); Point Fosdick and Green Point (peninsular); Vashon, McNeil, and Ketron islands. (Note: records for Sceloporus graciosus gracilis for Kelso and near Puget Sound (cf. Van Denburgh, 1922:285) are regarded as very dubious.)

ANGUIDAE. Alligator Lizards, Glass-snakes, etc.

Gerrhonotus coeruleus principis (Baird and Girard). Northern Alligator Lizard. Generally distributed, preferring dry, exposed surfaces or localities but occurring also in wooded or heavily overgrown situations, sometimes abundantly. Known from Maury, Vashon, Fox, McNeil, and Anderson islands.

BOIDAE. Boas.

Charina bottae bottae (Blainville). Pacific Rubber Boa. A snake of very retiring habits, quite probably more common than seems to be the case. VanDenburgh (1922:642) cites records for Fort Steilacoom and Seattle, I have specimens from Wapato Lake and north of Greendale, and there are specimens in the CPS collection from East Cromwell, Fox Island, and Chambers Cr.

COLUBRIDAE.

Coluber constrictor mormon (Baird and Girard). Western Yellow-bellied Racer. Rare on our prairies; possibly more abundant in the early days. Suckley cites a specimen taken at Fort Steilacoom and gives the species as found sparingly at Puget Sound. (in J. G. Cooper, Pac. R.R. Reports, vol. XII, part 3, page 301; 1860). We have a recent specimen from Lakeview (CPS 3034), and one from near the Northern Pacific Railway west of Shaver Lake (CPS collection).

Pituophis catenifer catenifer (Blainville). Coast Gopher Snake. Not encountered in this investigation and we have no specimens. Specimens are cited for Puget Sound and Steilacoom in VanDenburgh (1922:710), and Suckley (in Cooper, 1860a:300) gave it as "Found sparingly at Puget Sound." Perhaps should be recorded as of uncertain status.

Contia tenuis (Baird and Girard). Sharp-tailed Snake. Two specimens of this snake are known from this area, the type specimen taken by the "Wilkes Expedition" (U.S.N.M. 7289) and one brought in to Prof. Slater by Mr. E. A. Baker in August of 1939 from Gravelly Lake. The latter has been reported on by Prof. Slater (1939a:5) and deposited as CPS 3486. It was first identified by the present author.

Thamnophis ordinoides ordinoides (Baird and Girard). Puget Garter Snake. Generally distributed and usually abundant throughout the area, being outnumbered only locally by the two other common garter snakes. Coloration and scale counts decidedly variable. Known from Maury, Vashon, Fox, Anderson, Cutt's and

Raft islands. A timid and beneficial form.

Thamnophis ordinoides vagrans (Baird and Girard). Wandering Garter Snake. Widely distributed, but less common generally than the above species; locally abundant, as at South Tacoma Swamp. Most vicious of our garter snakes; feeds quite commonly on small mammals and even birds (nestlings).

Thamnophis sirtalis parietalis (Say). Prairie Garter Snake. A specimen from Camp Seymour on Henderson Bay, to be deposited in the CPS collection, establishes this red-barred form as a native of the Tacoma Area. (Note: the classification herein adopted, reviving pickeringii as a valid subspecies and including parietalis as present in the state is the work of Dr. Murray L. Johnson and the present author.)

Thamnophis sirtalis pickeringii (Baird and Girard). Nisqually Garter Snake. This greenish barred and striped form is the common race of sirtalis in the area. It is abundant over most of the prairies about the lakes and ponds where it feeds heavily on Hyla regilla, and is also present in lesser numbers in adjacent areas and north through the Des Moines Highland, being present also on the Kitsap Peninsula. As yet unknown on any of our islands.

TESTUDINIDAE. Turtles.

Clemmys marmorata (Baird and Girard). Pacific Terrapin. Quite a common form on our prairies, in the larger ponds, lakes, and streams. Slater (1939b:32) has reported on his knowledge of this species in Washington. Besides the localities listed

by Slater I have evidence* of its occurrence at lakes Gravelly, Nisqually, Louise, Shaver, Steilacoom, St. Clair (?), Wapato, American, and Sequalitchew, and at South Tacoma Swamp and Nisqually. As a boy I kept them for pets at Spanaway Lake, where they were formerly much more common than they are now. (Note: Chrysemys bellii bellii is a species quite commonly escaping from captivity in this vicinity. There is no apparent reason why it should not become established in some of our prairie lakes at least.)

* Based in every case on either reports in the form of good descriptions from evidently reliable persons who had captured specimens, or my personal observations, or both. Less definite reports have frequently been received but are not relied upon.

IV. MAMMALS

Work on the mammals of the area was begun by the writer in March 1937 and has been carried on more or less steadily since that time. Mr. Philip W. Cheney and Mr. Richard Kohler became interested sufficiently in the spring of 1939 to carry on an intensive campaign of study and collection of the land forms, lasting into the summer of that year. Mr. Cheney has continued since that time in a more specialized campaign on the forms of the islands of upper Puget Sound (partly included in the present area), and has been most generous with his time and information in connection with the present paper. With the foregoing exceptions, specialized work on the mammals of this area has not been done in recent years to my knowledge, although other workers have naturally collected here from time to time in connection with more generalized programs (see Taylor and Shaw, 1929:3-4). Perhaps the reports in the Pacific R. R. Survey Reports for Fort Steilacoom by Cooper, Suckley, and Gibbs constitute the only other work ever carried out with any particular reference to the area herein defined.

Special thanks are due Dr. Murray L. Johnson who was in large part responsible for the writer's early interest and activity in mammalogy. Wilhelm Jordan and Cecil Brosseau of the Point Defiance Aquarium, and Mr. Morell of the Steilacoom Game Farm have gone out of their way to make their information available. Mr. Walter W. Dahlquest of the University of Washington has been exceedingly helpful and generous with his information.

In the following list 72 species of 23 families are listed; 18 of these are only probable, making a certain total of 54.

TALPIDAE. Moles.

Scapanus townsendii (Bachman). Townsend Mole.

This species is undoubtedly common in this area. Taylor and Shaw (1927:28) say "The ridges and hills of the Townsend mole are all too familiar to the prairie dwellers of western Washington, where the conspicuous piles of earth often interfere with farming." One specimen recorded (CPS 634) from Puyallup.

Scapanus orarius orarius True. Coast Mole.

Bailey (1936:353) lists a male and female from Puyallup, Wash. Probably less common than the preceding species.

Neurotrichus gibbsii gibbsii (Baird). Gibb's Shrew Mole.

Specimens recorded for Fircrest (CPS 677) and Epworth Heights (CPS 705). P. W. Cheney has a specimen from Fox Island (edge of cliff at Gibson Point). Very recently I have examined specimens from Vaughn (peninsular) and McAllister Cr. (CPS).

SORICIDAE. Shrews.

*Sorex cinereus streatori Merriam. Streator Cinereous Shrew.

Specimens are recorded by Jackson (1928:55) for Cedarville (Grays Harbor Co.), Whatcom Co., and Glacier, thereby placing the present area in the projected general range of the species.

Sorex trowbridgii trowbridgii Baird. Trowbridge Shrew.

One of our commonest shrews. Specimens in the CPS collection are from Epworth Heights, Edgewood, Point Defiance Park, and Chambers Cr. Jackson (1928:96) lists a specimen for Kapowsin, two for Point Defiance Park, five for Puyallup, Three for Steilacoom, one each for five miles east and six miles south of Tacoma.

Sorex vagrans vagrans Baird. Vagrant Shrew.

One of our two commonest shrews. Specimens (CPS collection) are from Maury Island (1), Ketron Island (5), Epworth Heights (1), Edgewood (1), Tacoma Tideflats (2), CPS campus (1), Fircrest (1), Chambers Cr. (2), and south of Spanaway L. (2). Jackson (1928:106) lists a number for this area, including series from Puyallup and Nisqually.

Sorex obscurus setosus Elliot. Olympic Dusky Shrew.

Jackson (1928:137) gives the following collections: Kapowsin (extralimital, 1), Puget Sound (2), Olympia (extralimital, 1), Roy (1), Steilacoom (2), Tacoma (1), 5 miles east of Tacoma (1).

Sorex bendirii bendirii (Merriam). Bendire Marsh Shrew.

Jackson (1928:196) lists nineteen for Puyallup, one for Steilacoom, one from six miles south of Tacoma, and three from five miles east of Tacoma.

VESPERTILIONIDAE. Common Bats. *

Myotis lucifugus alascensis Miller. Alaska Brown Bat.

Myotis yumanensis saturatus Miller. Miller Bat.

Myotis evotis evotis (H. Allen). Little Big-eared Bat.

Type specimen from Puget Sound.

Myotis volans longicrus (True). Northwestern Long-legged Bat.

Type specimen from Puget Sound.

Myotis californicus caurinus Miller. Northwest Coast Bat.

Eptesicus fuscus fuscus (Beauvois). Big Brown Bat.

Recorded for Olympia (Taylor and Shaw, 1929:9).

*We have no identified material from this group; therefore the forms likely to occur (see Taylor and Shaw, 1929; Bailey, 1936) are simply listed for the most part.

*Lasionyctris noctivagans (LeConte). Silver-haired Bat.

Nycteris cinerea (Peale and Beauvois). Hoary Bat.

Reported for Puyallup by Couch (1934:26) and for Seattle by Flahaut (1933:77).

*Corynorhinus rafinesquii townsendii (Cooper). Jack-rabbit Bat.

*Antrozous pallidus pacificus Merriam. Pacific Pale Bat.

URSIDAE. Bears.

Euarctos americanus altifrontalis (Elliot). Olympic Black Bear.

Recent occurrences of the bear in this area are occasionally reported in the newspapers (Gig Harbor, Orting, etc.), and they undoubtedly do occasionally wander in. Bailey (1936:321) lists the skull of an adult male from Hoodsport, Wash. (extralimital). Suckley and Gibbs (1860:120) write as follows: "The common black bear is quite abundant throughout the wooded portions of Oregon and Washington Territories. In the latter they are especially abundant in the timbered districts near the coast. I obtained at Fort Steilacoom several fine skins of adults, and one very perfect skin of a cub, which was presented me by my kind friend Dr. J. B. Webber."

PROCYONIDAE. Raccoons.

Procyon lotor pacifica Merriam. Pacific Raccoon.

Verbal reports have been obtained from Vashon, Maury, Fox, and Anderson Islands; and from the Kitsap Peninsula at Bremerton (extralimital) and Shavers Lake near Roy. Dahlquest reports them occurring on all the northern islands of the sound. Suckley and Gibbs (1860:118) give the raccoon as "quite abundant on Puget Sound" and say they "obtained many specimens of this species at

Fort Steilacoom", listing a "fine male" obtained there October 21, 1856. Bailey (1936:315) lists specimens from Steilacoom (1) and Lake Cushman (extralimital).

MUSTELIDAE. Martens, Weasels, Otters, Skunks.

*Martes caurina caurina (Merriam). Northwestern Pine Marten.
A wide-ranging species, listed as quite common in Mt. Rainier National Park by Taylor and Shaw (1927:45). Given by the same authors (1929:9) and by Bailey (1936:296) as occurring in the mountains and coastal area, the nearest lowland record apparently being one for Mount Vernon (T & S).

*Martes pennanti pacifica (Rhoads). Pacific Fisher.
Rare in the Olympic and Cascade mountains; doubtfully included.

Mustela cicognanii streatori (Merriam). Puget Sound Weasel.
Doubtless occurs, but no definite records as far as could be determined. Very probably a common animal throughout the mainland area at least, on the basis of range of the species.

Mustela washingtoni (Merriam). Washington Weasel.
One adult female from the Mile Hill, west side of Tacoma, JWS M26. Otherwise recorded west to Mt. Rainier, and at Happy L., Olympic Mountains, by Taylor and Shaw (1929:11), this being apparently a first lowland record.

Mustela longicauda saturata (Merriam). Siskiyou Weasel.
Specimens from three and four miles south of Olympia in collection of Leo K. Couch (extralimital; Taylor and Shaw, 1929:11) and one from north of Greendale on the Fort Lewis Reservation (CPS). Bailey gives it as occurring north to southwestern British Columbia west of the Cascades.

Mustela vison energumenos (Bangs). Pacific Mink.

Numerous verbal reports for the shores of Puget Sound, Chambers and Muck Creeks, and Anderson, Fox, and Ketron (?) islands. Live specimens seen by the author at South Tacoma Swamp and the mouth of Chambers Cr. Dahlquest reports them as on the northern islands (of Puget Sound) commonly, and Suckley and Gibbs (1860:115) record them as common on the islands of Puget Sound. One specimen from Chambers Cr., JWS 40E19a1.

Lutra canadensis pacifica Rhoads. Pacific Otter.

Undoubtedly present on our lakes and streams in the earliest days. Nearest (?) definite record Mt. Vernon (Taylor and Shaw, 1929); possibly casual even today in our limits (?).

*Latax lutris nereis Merriam. Southern Sea Otter.

Formerly along the coast, entering Gray and Willapa Harbors according to Mr. Robert S. Bach of the Biological Survey. I find no mention of its occurring on the sound in any of the literature at my disposal, except that Suckley and Gibbs (1860: 116) say "The sea otter is called by the Nisqually Indians Kah-hahtt." It may be that members of this tribe occasionally visited the coast, or their contacts may have been with the pelts only. On the other hand, there seems to be no good reason for assuming that the sea otter never ascended to the upper sound.

Spilogale phenax olympica Elliot. Puget Sound Spotted Skunk.

According to the literature should certainly occur. Good verbal reports (of specimens captured) from the Kitsap Peninsula near Bremerton (extralimital), and from Shaver Lake near Roy.

Mephitis occidentalis spissigrada Bangs. Puget Sound Striped Skunk. Common, especially on the prairies south of Tacoma. Specimens: CPS 556 from Spanaway, and one from Draper Lake, Fort Lewis Reservation, by Philip Cheney. I have examined specimens from Lakeview, the Puyallup Valley, and Ohop Valley.

CANIDAE. Foxes, Coyotes, Wolves.

Canis latrans lestes Merriam. Mountain Coyote.

Not uncommon, especially on the prairies. Definite reports for Spanaway, Greendale, Shaver Lake, Kitsap Peninsula at Bremerton (extralimital).

Canis lycaon gigas (Townsend). Timber Wolf.

Wolves were reported as quite common formerly but becoming less so on the Nisqually Plains by Suckley and Gibbs (1860:110,111), and specimens were taken. Since extirpated (?) within the area under consideration. I have, however, obtained verbal reports of specimens being killed in recent years in the Ohop Valley (extralimital), and near Bremerton (extralimital).

FELIDAE. Mountain Lions, Lynxes, Bobcats.

Felis oregonensis oregonensis Rafinesque. Northwestern Cougar.

Formerly common in this area but now extirpated, a report of one south of Tacoma appearing in the newspapers of last year notwithstanding. Suckley and Gibbs (1860:108) wrote: "The cougar is quite abundant in the thickly wooded sections of Washington Territory, near the coast, being especially abundant on some of the heavily timbered river valleys, such as that of the Cowlitz, Chehalis, Nisqually, and others. Near Fort Steilacoom a few are killed every year, occasionally near the garrison."

Lynx rufus fasciatus Rafinesque. Northwestern Wildcat.

Taylor and Shaw (1929) list a specimen for Fort Steilacoom. Suckley and Gibbs (1860:109-110) state that this species was then abundant in this and surrounding areas, numbers being killed at Fort Steilacoom and specimens listed. Reports of this cat in recent years were obtained for near Shavers Lake near Roy, and on the Kitsap Peninsula near Bremerton. Cheney has dubious reports for Ketron and Fox islands.

PHOCIDAE. Hair Seals, Harbor Seals, Sea-lions.

*Eumetopias jubata (Schreber). Steller's Sea Lion.

Reported as being encountered rarely in the waters about Tacoma by Mr. Cecil Brosseau, who, with Mr. Wilhelm Jordan, is on the sound regularly throughout the year and habitually pays attention to the marine mammals encountered. He is certain of this identification and has some knowledge of practical and technical differences, besides being perfectly familiar with the harbor seal. Last one seen this spring (1940).

Phoca richardii richardii (Gray). Vancouver Harbor Seal.

Rather common, despite persecution, in all waters of the bay. Specimen: CPS 516-517, Nisqually Flats.

SCIURIDAE. Marmots, Squirrels, Chipmunks.

Eutamias townsendii townsendii (Bachman). Townsend Chipmunk.

Occurs less commonly than the pine squirrel in this area. I have examined specimens from the Kitsap Peninsula north of Burley and from Spanaway Lake, and have seen it on Hylebos Hill and Epworth Heights on the Des Moines Highland, and at the mouth of Chambers Cr., Nisqually, and Nisqually L. A

fairly common species throughout the mainland and peninsular areas. Specimens: Northeast Tacoma (CPS), and Gravelly L.(JWS).

Sciurus douglasii douglasii Bachman. Douglas Pine Squirrel. Seen commonly throughout the area. Specimens: CPS collection: Vaughn (2), Camp Seymour (Glencove;1), Edgewood (1), American Lake (3), Ketron Island (3); Raft Island (1; JWS coll.).

Sciurus griseus griseus Ord. California Gray Squirrel. Seen (and specimens examined) commonly on the prairies south of Tacoma, north to the Puyallup Valley and Point Defiance. I have a lay report for its occurrence north to Auburn. Specimens: Spanaway Lake (JWS, 1), Gravelly Lake (CPS, 1), Draper Lake (CPS, 1).

Glaucomys sabrinus oregonensis (Bachman). Oregon Flying Squirrel. Probably occurs quite generally throughout much of the area. Reports from Fox Island, Chambers Cr., and Shaver Lake (specimen trapped); and from Auburn where I have examined a specimen killed on the highway.

GEOMYIDAE. Pocket Gophers.

Thomomys douglasii yelmensis Merriam. Yelm Pocket Gopher. Range given in Taylor and Shaw (1929:19) as follows: "West side, vicinity of Yelm Prairie, north and east to Spanaway, east to Roy, south and west to Rochester."

Thomomys douglasii tacomensis Taylor. Tacoma Pocket Gopher. "West side, north to six miles south of Tacoma, west to four miles south of Olympia." (Taylor and Shaw, 1929:19).

CASTORIDAE. Beavers.

Castor canadensis pacificus Rhoads. Pacific Beaver. At present known definitely to occur at Nisqually, the animals seen (McBride) and dams examined. Reports on questionable authority for Sumner and near Bremerton (extralimital).

CRICETIDAE. American Mice and Rats.

Peromyscus maniculatus austerus (Baird). Lowland White-footed Mouse. Occurs abundantly throughout the area. Numerous specimens from the mainland, peninsular, and island divisions. Known from all the larger islands.

Peromyscus maniculatus oreas Bangs. Washington White-footed Mouse. This slightly longer-tailed, questionably distinct form is tentatively represented in our collections by one specimen from Epwort Heights, taken and classified by Philip Cheney.

*Neotoma cinerea occidentalis Baird. Western Bushy-tailed Wood Rat. On basis of range alone, this species should occur, but we have no evidence of it. Absence of rock outcrops may account for this. Suckley and Gibbs (1860:128) gave it as common in Washington Territory west of the Cascades, at first bothering the cabins of settlers but retreating before the "ship rat".

Clethrionomys gapperi occidentalis (Merriam). Western Red-backed Mouse. One specimen, taken by Philip Cheney at the rim of the sea-cliff at Gibson Point, Fox Island.

Microtus townsendii (Bachman). Townsend Meadow Mouse. Specimens: Spanaway (PWC); Maury Island (CPS 690); Ketron Island (CPS 691). A lowland form, generally distributed.

*Microtus mordax macrurus Merriam. Olympic Meadow Mouse.

Not detected, but included in this list on the basis of the range given in Taylor and Shaw, who also say, "...ordinarily a mountain and not a lowland form, although there are records at or near sea-level." (T & S, 1929:25).

Microtus oregoni oregoni (Bachman). Oregon Meadow Mouse.

Specimens: Fircrest (CPS 713); Point Defiance (CPS 672); Meeker (JWS). Inconspicuous, probably more common here than is at present indicated.

Fiber zibethica osoyoosensis Lord. Rocky Mountain Muskrat.

Abundant form quite generally throughout the area. Frequently wanders considerable distances from its normal aquatic habitat, as evidenced by the finding of dead specimens on the highways north of Parkland, north of Bellarmine High School, and at Cedar and Center Streets in Tacoma. Specimens from Sequalitchew L., Gardenville, and Parkland.

MURIDAE. Old World Rats and Mice.

Rattus rattus rattus (Linnaeus). Black Rat.

Known from specimens taken in building at rim of Buckley Gulch, Tacoma (JWS).

*Rattus rattus alexandrinus (Geoffrey). Roof Rat.

"Probably of general distribution, at least in seaport towns, though the writer has examined material from Orcas Island only." (Taylor and Shaw, 1929:26).

Rattus norvegicus (Erxleben). Norway Rat.

Abundantly represented about human habitations. Known from Fox and Anderson islands.

Mus musculus musculus Linnaeus. House Mouse.

Generally distributed in cities, towns, and settled districts.

APLODONTIDAE. Mt. Beavers.

Aplodontia rufa rufa (Rafinesque). Brown Aplodontia.

Supposedly the Mountain Beavers of the eastern half of the area are referable to this subspecies which intergrades with olympica "between Puyallup and Steilacoom". We have several skins from the latter area, the species being quite generally distributed throughout the region with the exception of the islands and outwash prairies.

Aplodontia rufa olympica Merriam. Olympic Aplodontia.

See above species. The mountain beavers of the peninsular portion of the area would certainly be of this race, as will as those from south of Steilacoom on the mainland.

ZAPODIDAE. Jumping Mice.

Zapus trinotatus trinotatus Rhoads. Northwest Jumping Mouse.

One specimen only, from lower Chambers Cr. by Philip Cheney. One was watched closely for some time by the writer at Talb Marsh on the Fort Lewis Reservation.

ERETHIZONTIDAE. American Porcupines.

Erethizon epixanthum epixanthum Brandt. Yellow-haired Porcupine.

Mr. Arthur Anderson's report of a porcupine killed by his car at 6th Avenue and Jackson-Alexander Road (west side of Tacoma) establishes this form as present in this area. Mr. Anderson, who is an observant practical naturalist, brought the animal to his home in Tacoma where it is buried.

LEPORIDAE. Hares and Rabbits.

Lepus washingtonii washingtonii Baird. Washington Varying Hare. Not common in recent years in this area. I have noted it on the Fort Lewis Reservation, in Tacoma at McKinley Hill, east of Day Island, at Spanaway, Auburn, Steilacoom Lake, Chambers Cr., and on the Kitsap Peninsula near Bremerton and Vaughn. Specimen: south of McChord Field (JWS-PWC M67).

CERVIDAE. Deer and Elk.

Cervus canadensis occidentalis Hamilton Smith. Roosevelt Elk. Doubtless numerous in this area in the early days; still so on the Olympic Peninsula. I have taken the bones of this animal from an Indian midden at the mouth of Chambers Cr. (JWS-MJM collection.)

Odocoileus columbianus columbianus (Richardson). Columbia Black-tailed Deer. Occurs throughout the area; known from Fox, McNeil, and Anderson islands. Specimens examined from south and west of Tacoma.

*Odocoileus virginianus leucurus (Douglas). Coastal White-tailed Deer. Now extinct (?). A valley-loving species, shunning the hills; thought to have occurred in the present area, north at least to Whidby Island (Baird, 1857:649-653, figures an antler from the latter place as number 3203, and cites a piece of skin from a specimen sent from Fort Steilacoom (no. 1478), but does not include the Whidby Island specimen in his table of specimens. See also Suckley and Gibbs, 1860:134).

*Alces americanus shirasi Nelson. Shiras Moose.

"Horns were obtained from some point north of Steilacoom."

(Suckley, 1860:105). It is regarded as very doubtful if the moose ever occurred here. (Cf. reports by Cooper, Suckley, and Suckley and Gibbs in vol. XII, part 3,of Pac. R. R. Reports.)

RHACHIANECTIDAE.[1]

*Rhachianectes glaucus (Cope). Gray Whale.

A migratory species along our coast, reported as frequenting bays and estuaries. Recorded for Neah Bay and quite possibly also enters Admiralty Inlet.

*Balaenoptera davidsoni Scammon. Lesser Rorqual.

Given by Bailey (1936) as occasionally visiting the large estuaries along shore. Type locality Admiralty Inlet (near Port Townsend). Very probably has occurred in our limits.

Megaptera versabilis Cope. Pacific Humpback Whale.

(Probably synonymous with nodosa (Bonaterre)). One killed at Oakland Bay, August 22, 1930, reported on by Couch in the Murrelet, vol. XI, no. 3, p. 75. "This is the first time in 32 years that a large whale has been seen in Puget Sound."

DELPHINIDAE

Lagenorhynchus obliquidens Gill. Pacific Striped Dolphin.

"Specimens in the National Museum collection from near San Francisco and Puget Sound...." (Bailey, 1936:347). "Abundant along the Pacific coast and more numerous in the larger bays and lagoons than in mid ocean." (Ibid.) This is likely

---

1 The Cetacea, comprising the remainder of the list, are so uncertainly treated in even the best works, that the list here given considers only those of certain or very likely occurrence in Puget Sound, and is probably quite inadequate. Bailey (1936) and Anthony (1928) should be consulted for a more satisfactory treatment.

the dolphin reported to me for Puget Sound about Tacoma by Wilhelm Jordan of the Point Defiance Park Aquarium.

*Orcinus rectipinna (Cope). Pacific Killer.

Reported for the lower sound by Victor Scheffer and Con Troxill. Good descriptions from Day Island and Point Fosdick (by residents of those localities) of a "blackfish" swimming along the surface with a slender erect dorsal fin five to seven feet long are very probably of this species.

Globicephalus scammonii Cope. North Pacific Blackfish.

Abundant and conspicuous in the waters of Puget Sound at certain times.

*Phocaena phocaena (Linnaeus). Harbor Porpoise.

"Inhabits Atlantic and Pacific coastal bays and harbors, possibly including many forms." (Bailey, 1936:349) "They make a quick puff and quickly disappear below the surface, seeming to prefer the darkness below and never making playful gambols as do the larger porpoises (Scammon, 1874, p. 97)." (Ibid.)

*Delphinapterus leucas (Pallas). White Whale, Beluga.

Cecil Brosseau tells of an occurrence this spring of a pure white whale in our waters. The description given (color, size, horizontal tail flukes) makes it seem probable that here is an anomalous occurrence of the normally far-northern species. This particular animal was approached very closely by Brosseau and Wilhelm Jordan, in shallow water, the animal diving under the boat once, and at one time scraping the bottom in plain sight.

SUMMARY

The paper is intended as a preliminary report on a general research program carried on with reference to the natural history of Tacoma and vicinity. Consideration is given the precise boundaries ascribed to the area, and the climatic, geologic, and geographic features; and annotated faunal lists are included encompassing four of the major groups studied.

A numerical summary of each of these groups is given at the head of each list, these totalling as follows: families listed 44, total number of species 136, species of uncertain occurrence 30, species of certain occurrence 106. The latter is a minimum figure certain to be increased.

BIBLIOGRAPHY

Anthony, H. E.

1928. Field book of North American Mammals. xxv & 625 pp., illus. New York and London:Putnam's.

Bailey, Vernon

1936. The mammals and life zones of Oregon. No. Amer. Fauna 55. 416 pp., illus.

Baird, Spencer F.

1857. Mammals. Pac. R. R. Rept., vol. VIII, pt. 1, pp. xlvii & 1-757.

1859. Reptiles. Pac. R. R. Rept., vol. X, pt. 3, pp. (9-) 16.

Bretz, J. Harlen

1913. Glaciation of the Puget Sound Region. Wash. Geol. Surv. Bull. 8, pp. 1-244, illus.

Brown, W. C. and J. R. Slater

1939. The amphibians and reptiles of the islands of the State of Washington. Occ. Pap. Dept. Biol. College of Puget Sound, no. 4, pp. 6-31.

Chapman, Wilbert M. and Allen C. DeLacy

1933. Notes on the fishes of the State of Washington. Copeia (2):102-103.

Coombs, Howard A.

1936. The geology of Mount Rainier National Park. Univ. Wash. Publ. Geol., vol. 3, no. 2, pp. 131-212, 28 figs.

Cooper, J. G.

1860. Report upon the mammals collected on the survey. Pac. R.R. Rept., vol. XII, pt. 3, pp. 73-88.

1860a. Report upon the reptiles collected on the survey. Pac. R.R. Rept., vol. XII, part 3, pp. 292-306.

Cope, Edw. Drinker

1889. The Batrachia of North America. U.S. Nat. Mus. Bull. 34:1-525, 86 pls.

1900. The crocodilians, lizards, and snakes of North America. Rept. U.S. Nat. Mus. for year ending June 30, 1898; part 2, pp. 155-1270, 347 figs., 47 pls.

Couch, Leo K.

1930. Humpback whale killed in Puget Sound, Washington. Murrelet, vol. XI, no. 3, p. 75.

1934. A second hoary bat record for western Washington. Murrelet, vol. XV, p. 26.

Crawford, D. H.

1925. Field characteristics identifying young salmonoid fishes in fresh waters of Washington. Univ. Wash. Publ. Fish., I (2):67-76.

Dickerson, Mary C.

1931. The frog book. vii & 253 pp., illus. Garden City, N. Y.:Doubleday, Doran & Co., Inc.

Fenneman, N. H.

1931. Physiography of the western United States. 534 pp. New York:McGraw-Hill.

Flahaut, Martha

1933. Hoary bat taken in Seattle, Wash. Murrelet, XIV:77.

Girard, Charles

1857a. Contributions to the ichthyology of the western coast of the United States, from specimens in the

Museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Phila., VIII, 1856:131-137.

1857b. Researches upon the cyprinoid fishes inhabiting the fresh waters of the United States west of the Mississippi Valley, from specimens in the Museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Phila., VIII, 1856:165-213.

1858. Fishes. Pac. R.R. Rept., vol. X, pt.4, pp. xiv & 1-400.

Haeberlin, Hermann and Erna Gunther

1930. The Indians of Puget Sound. Univ. Wash. Publ. Anthropology, vol. 4, no. 1, pp. 1-84.

Jackson, H. H. T.

1928. A taxonomic review of the American long-tailed shrews (Genera Sorex and Microsorex). North Amer. Fauna no. 51, pp. vi & 238, figs. 24.

Jones, George N.

1936. A botanical survey of the Olympic Peninsula, Washington. Univ. Wash. Publ. Biol., vol. 5, pp. 1-286, 9 pls., 7 figs.

Jordan, David Starr and Barton Warren Evermann.

1896-1900. The fishes of North and Middle America. Bull. U.S. Nat. Mus., 47 (1-4):1-3313, pls. 1-392.

1934. American food and game fishes. 1st ed., 2nd issue. 1 & 574 pp., illus. Garden City, New York: Doubleday, Doran & Co., Inc.

Jordan, D. S., B. W. Evermann, and Howard Walton Clark.

1930. Check list of the fishes and fish-like vertebrates of North and Middle America.... Doc. 1055, Rept. U.S. Comm. Fish., 1928, (2):1-670.

1936c. 5th instal., vol. XI, no. 4, pp. 275-290.

Slater, James R.

1936. Notes on Ambystoma gracile Baird and Ambystoma macrodactylum Baird. Copeia (4):234-236.

1939. Some species of amphibians new to the state of Washington. Occ. Pap. Dept. Biol. College of Puget Sound, no. 2, pp. 4-5.

1939a. Contia tenuis rediscovered in Washington. Ibid., no. 3, p. 5.

1939b. Clemmys marmorata in the state of Washington. Ibid. no. 5, p. 32.

Slevin, Joseph R.

1928. The amphibians of western North America. Occ. Pap. Calif. Acad. Sci., 16:152, pls. 23.

Stejneger, Leonhard and Thomas Barbour

1933. A check list of North American amphibians and reptiles. Cambridge: Harvard Univ. Press. (The more recent 4th edition is less satisfactory for our western species than that cited above.

Storer, Tracy I.

1925. A synopsis of the Amphibia of California. Univ. Calif. Publ. Zool., vol. XXVII, pp. 308, illus.

Suckley, George

1860. Rept. explorations and survey.....from the Mississippi River to the Pacific Ocean, 1853-1855. Zool. Rept. Washington, 36th Congress, 1st Session, XII (2): 302-368.

1860a. Report upon the mammals of the survey. Pac. R.R. Rept., Vol. XII, pt. 3, pp. 89-106.

1874. On the North American species of salmon and trout. Rept. U.S. Comm. Fish. for 1872 and 1873. (1874): 91-160.

----------and George Gibbs

1860. Report upon the mammals collected on the survey. Pac. R.R. Rept., vol. XII, pt. 3, pp. 107-139.

Taylor, Walter P. and William T. Shaw.

1927. Mammals and birds of Mount Rainier National Park. Dpt. Int., National Park Service, 249 pp., illus.

1929. Provisional list of land mammals of the state of Washington. Occ. Pap. Charles R. Conner Museum, Wash. State College, Pullman, Wash., no. 2, pp. 32.

Twitty, V. C.

1935. Two new species of Triturus from California. Copeia, 2:71-80.

Van Denburgh, J.

1922. The reptiles of Western North America. Occ. Pap. Calif. Acad. Sci., 10:1-1028, in 2 vols.