

DESCRIPTIVE ECOLOGY OF A DIVERSE LOWLAND HABITAT ON ELD INLET  
THURSTON COUNTY, WASHINGTON

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Abstract.--Detailed field observations were made of a 12.5 ha diverse lowland habitat on Eld Inlet, Thurston County, Washington from 1 November 1978 to 30 April 1979. Qualitative field observations emphasized identification and phenology of plants and animals. Six habitats were defined and further divided into 12 communities based on plant species. Quantitative assessments were limited to mammal trapping, and a vegetation transect through three habitats.

INTRODUCTION

The landscape unit is a 12.5 ha diverse area near the southern end of Eld Inlet. It is 0.8 mi south of The Evergreen State College, Thurston County, Washington, and accessible by driving south on the Evergreen Parkway to 17th Avenue NW, west 0.25 mi to Mix Road and south 0.8 mi to 5th Avenue NW. A dirt road continues from the west end of 5th Avenue NW past a gravel pit and down a steep hill to the site (Fig. 1).

Physical Description

The landscape unit is located in the NW 1/4, Sec. 18, T 18 N, R 2 W of the Tumwater, Washington 7.5 minute quadrangle. It is a broad peninsula, bounded on the west by Eld Inlet, the southern-most lobe of Puget Sound, and north by a tidal slough, which terminates at a high salt marsh. The unit is bounded east by uplands, and south by a fence dividing agricultural fields.

The area is generally level (0-2% slope) and less than one m above high tide. Soils are of the poorly-drained Puget Silty Clay Loam series: "fairly recently deposited, slightly modified alluvium of fine texture that has accumulated under ponded or stagnated drainage...slightly affected by the surrounding glacial soils of the uplands.\* A midden mound is located at the west end of a field. A profile of this mound exposed at the edge of Eld Inlet shows a humus-rich A horizon above the shell layer, and below it, an old A horizon underlain by a B horizon with "shot" pellets of clay and various oxides. We found a lodgement till on the slope

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\*Ness, A. O. (1958), Soil Survey of Thurston County, Washington, U.S.D.A. Soil Conservation Service and Washington Agricultural Experiment Station, U.S. Government Printing Office, Washington, D.C., 79 pp.

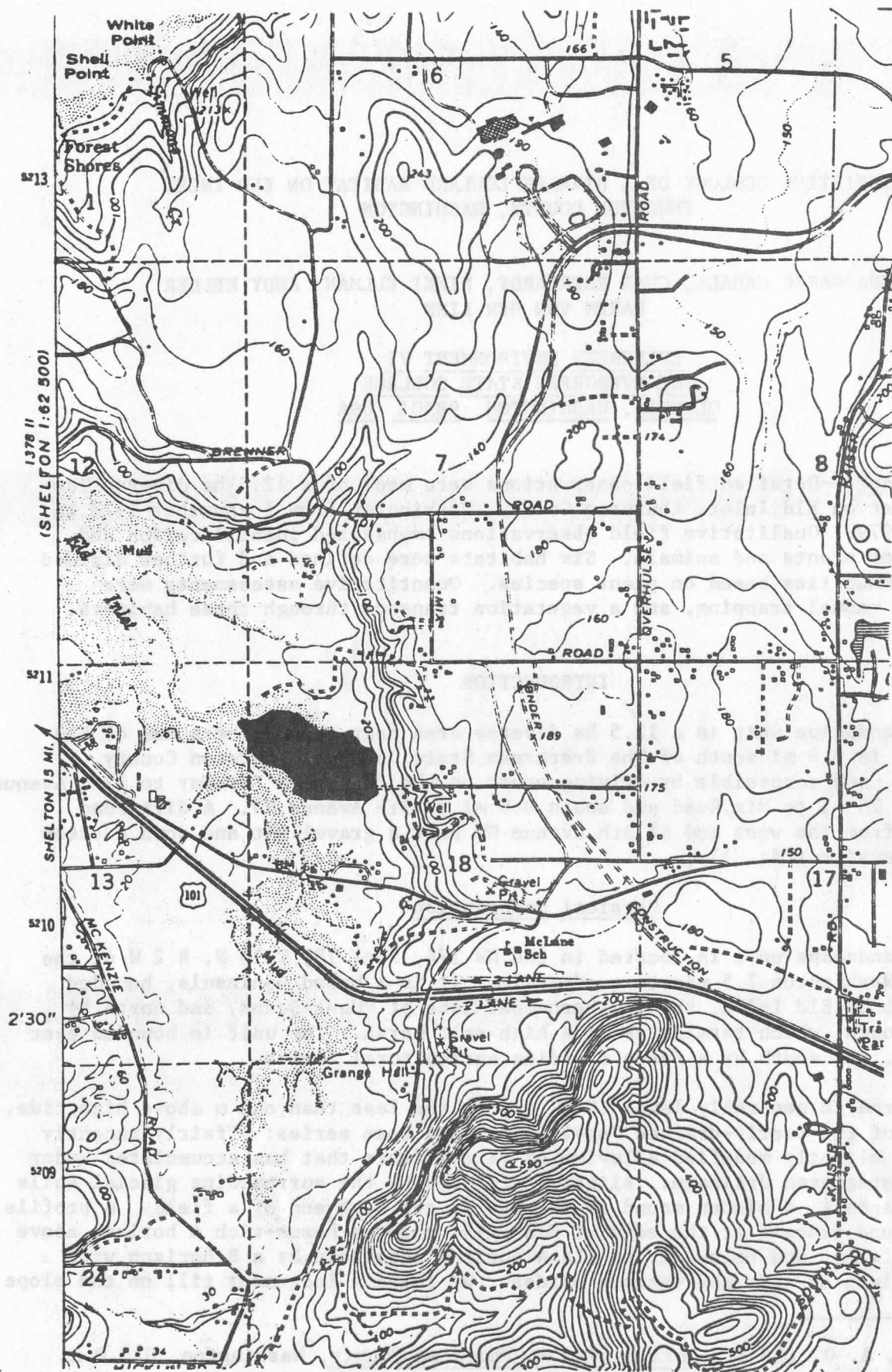


Fig. 1. Map showing the location of the study area within the USGS Tumwater Quadrangle, 7.5 min. series, 1959 (photorevised 1968 and 1973), scale 1: 24,000.

The area was first logged by the Mud Bay Logging Company during the late 19th century. The landscape unit was settled by Isaac and Julia Dye in 1893. An orchard was planted at this time and soon abandoned; another small orchard was maintained until 1943.

The fields on the southern half of the site are owned by Russ Fox and Carolyn Dobbs of Olympia. The forested section to the north is owned by an investment company, Delphi Inc., of Seattle.

The present fields and areas south of the orchard were used to grow beans, cucumbers and hay from the early 1900's until the 1940's. A Beaver (Castor canadensis) dam in the salt marsh, remnants of which exist today, was dynamited by Loretta Egan in the early 1960's. Twenty-five head of cattle were grazed on the field and transition zone as late as 1975. The field was mowed in 1978 to eradicate Senecio jacobaea (tansy ragwort).

Fox and Dobbs plan to graze cattle and llamas this summer on the field, after plowing and planting the area in a seed crop. Delphi Inc. selectively logged Pseudotsuga menziesii (Douglas fir) and T. plicata in the eastern third of the forest in 1978. Their plans for the property are uncertain.

#### BIOLOGICAL DESCRIPTION

Extensive field observations of the site were made from 1 November 1978 to 30 April 1979. Species of plants and animals present were listed and notes taken on phenology and behavior. Six habitats were defined based on our observations: field, freshwater marsh, transition zone, salt marsh, forest and mud flats and open water (Fig. 2). Within these habitats we further described 12 plant communities. Plant species and the habitats in which they occur are represented in Table I. A complete list of organisms identified during the study is found in Appendix A.

Quantitative assessment of vegetation was limited the transition zone. Seven nested quadrats were plotted along a 140 m transect through the forest, transition zone and north field; cover percentages were determined for each plant species (Table II).

Small mammal trapping was conducted 16-21 February and 16-21 April in both the freshwater marsh and transition zone and adjacent forest. Fourteen Sherman live traps (8 x 9 x 23 cm) were baited with peanut butter and rolled oats and set at 10 m intervals in both areas. Traps were baited at dusk and checked in the morning soon after sunrise three consecutive nights in each habitat. Each mammal caught was marked by toe clipping and released. The only species captured was Deer Mouse (Peromyscus maniculatus).

#### Habitats

Field.--Two fields comprise most of the site's southern half and, due to similarities in plant composition, have been treated as one habitat. They total 2.25 ha in area and are separated their entire length by a hedgerow. The fields



east of the site, and above it, an extensive exposure of cross-bedded stratified drift. This was probably deposited as the Puget Lobe receded west to Eld Inlet's channel, then north, during the Pleistocene Epoch (Fraser Glaciation).

Extensive mudflats are exposed in Eld Inlet and the slough at low tide. The Inlet always contains some open water, and the only significant stream draining the site runs through the slough. This stream arises at the base of the hill at the site's east end, and is joined by several tributaries from the north, in the salt marsh and farther west. Drainage is poor throughout the site, but is poorest at the base of the slope. Water from four springs in the hillside collects on the dense Puget soils. The east half of the field was under standing water for most of the winter; drainage is best along the shore.

Thurston County climate is characterized by warm, generally dry summers and wet, mild winters.\*\* Of the 128 cm average annual precipitation (mostly rain), three quarters falls during the six months beginning with October. The winter of 1978-1979 was unusually cold, with 64 freezing nights in November, December and January; the temperature during those months averaged 2.7 C below average. Thirty-seven cm of snow fell in November, which was a 38 year record. A third unusual aspect of the winter was the less than 7.5 cm total precipitation in both December and January. A more normal trend of warmer temperature and almost daily rain began in February.

### History

Aboriginal cultures existed in the lower Puget Sound vicinity for 15-20,000 years prior to the first European settlements in the mid-19th century. Nisqually speaking tribes were first described by Puget in 1792. The Squaxin tribe, presently located at Kamilche, Washington, visited Eld Inlet frequently and established sparse, temporary settlements. A Squaxin burial ground is located opposite the shore of the study area.

Aboriginals were fairly transient, taking salmon, shell fish, berries and roots from the land. They built dwellings for summer use from Typha latifolia (cat-tail) and saplings while winter dwellings were made from Thuja plicata (western redcedar) boards.

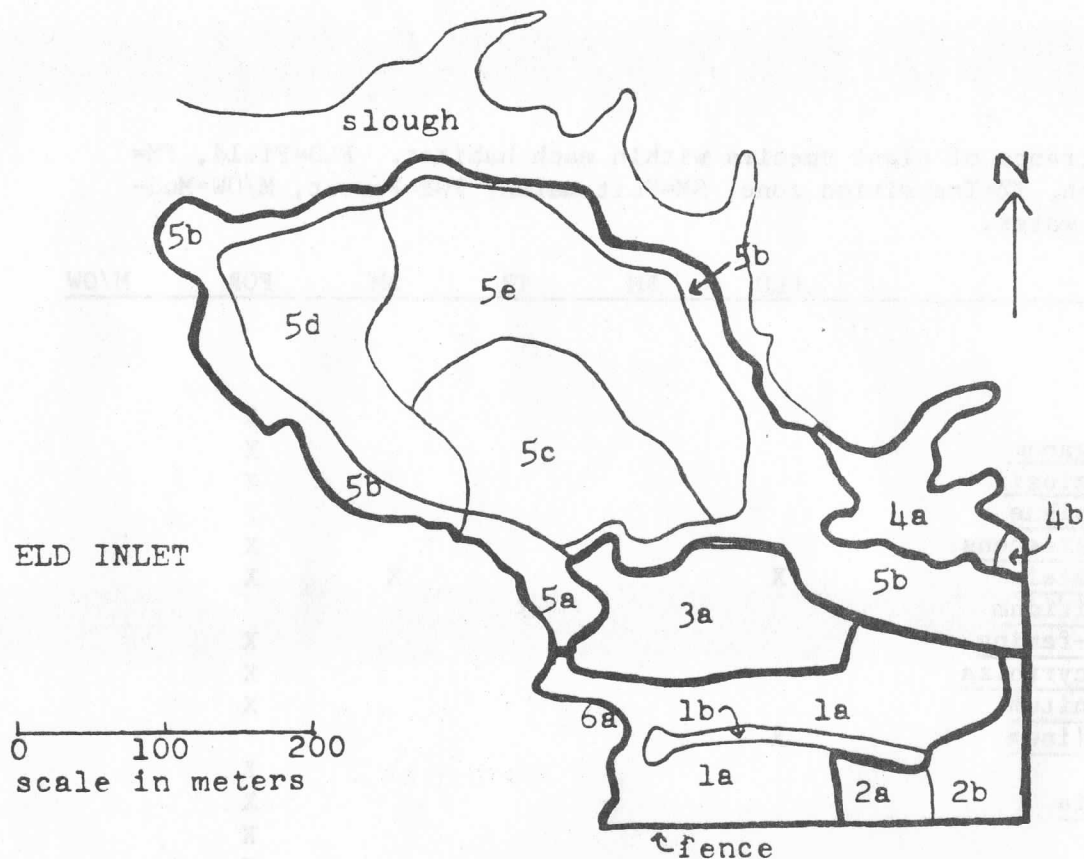
The smoking and drying of shellfish was a common activity of the aboriginals. Middens, formed by the storage and discarding of empty shells, can be seen along the shore of the Inlet. These mounds date as late as the mid-19th century. The one on the shore of the landscape unit contains Olympic Oysters (Ostrea lurida), Mussels (Family Mytilidae), Crinkled Shell, Native Littleneck, and Butter Clam.

Aboriginals made minimal use of trees, selecting individual T. plicata and either burning the trunk or splitting the tree with wedges. With this wood they constructed their winter dwellings and storage caches. A tomahawk and arrowheads were found on the property in the 1920's.

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\*\*Local climatological data from National Weather Service Office, Olympia Airport, Olympia, Washington.





<u>Habitat</u>	<u>Code</u>	<u>Community</u>
Field	1a	<u>Anthoxanthum odoratum-Holcus lanatus/moss</u>
	1b	<u>Rosa pisocarpa-Rosa gymnocarpa-Rubus discolor</u>
Freshwater Marsh	2a	<u>Salix sitchensis/Spiraea douglasii/Juncus effusus</u>
	2b	<u>Alnus rubra/Cicuta douglasii</u>
Transition Zone	3a	<u>Rosa pisocarpa-Spiraea douglasii/Anthoxanthum odoratum</u>
Salt Marsh	4a	<u>Deschampsia caespitosa-Carex lyngbyei</u>
	4b	<u>Typha latifolia</u>
Forest	5a	<u>Pseudotsuga menziesii-Abies grandis</u>
	5b	<u>Pseudotsuga menziesii-Thuja plicata</u>
	5c	<u>Alnus rubra/Acer circinatum</u>
	5d	<u>Acer macrophyllum-Alnus rubra</u>
	5e	<u>Alnus rubra</u>
Mud Flats and Open Water	6a	<u>Salicornia virginica-Distichlis spicata</u>

Fig. 2. Habitats and communities of landscape unit.

Table 1. Occurrence of plant species within each habitat. FLD=Field, FM=Freshwater marsh, TZ=Transition zone, SM=Salt marsh, FOR=Forest, M/OW=Mudflats and open water.

HABITATS	FLD	FM	TZ	SM	FOR	M/OW
SPECIES						
<u>Porella</u> sp.						X
<u>Eurynchium oreganum</u>						X
<u>Leucolepis menziesii</u>						X
<u>Plagiomnium insigne</u>						X
<u>Rhizomnium glabrescens</u>						X
<u>Equisetum telmateia</u>	X			X		X
<u>Botrychium mulifidum</u>			X			
<u>Athyrium filix-femina</u>						X
<u>Polypodium glycyrrhiza</u>						X
<u>Polystichum munitum</u>						X
<u>Pteridium aquilinum</u>	X					
<u>Dryopteris</u> sp.						X
<u>Taxus brevifolia</u>						X
<u>Thuja plicata</u>						X
<u>Abies grandis</u>						X
<u>Pseudotsuga menziesii</u>						X
<u>Picea sitchensis</u>			X			
<u>Tsuga heterophylla</u>						
<u>Salix sitchensis</u>						
<u>Alnus rubra</u>		X	X			X
<u>Corylus cornuta</u>						X
<u>Asarum caudatum</u>						X
<u>Rumex acetosella</u>			X			
<u>Salicornia virginica</u>				X		X
<u>Atriplex patula</u>				X		X
<u>Montia sibirica</u>						X
<u>Cerastium arvense</u>						X
<u>Stellaria longipes</u>		X	X			
<u>Ranunculus uncinatus</u>						X
<u>Berberis nervosa</u>						X
<u>Berberis aquifolium</u>						X
<u>Vancouveria hexandra</u>						X
<u>Dicentra formosa</u>						X
<u>Cardamine angulata</u>						X
<u>Cardamine pensylvanica</u>						X
<u>Ribes sanguineum</u>			X	X		
<u>Amelanchier alnifolia</u>			X			
<u>Crataegus</u> sp.			X			
<u>Fragaria virginiana</u>		X	X			
<u>Holodiscus discolor</u>	X			X	X	

Table 1 continued.

HABITATS	FLD	FM	TZ	SM	FOR	M/OW
SPECIES						
<u>Oemleria cerasiformis</u>	X				X	
<u>Prunus emarginata</u>			X			
<u>Pyrus communis</u>			X			
<u>Pyrus malus</u>			X			
<u>Pyrus fusca</u>			X			
<u>Rosa gymnocarpa</u>	X		X		X	
<u>Rosa pisocarpa</u>	X		X			
<u>Rubus spectabilis</u>	X			X	X	
<u>Rubus parviflorus</u>				X	X	
<u>Rubus ursinus</u>			X		X	
<u>Rubus discolor</u>	X				X	
<u>Rubus laciniatus</u>	X				X	
<u>Spiraea douglasii</u>		X	X			
<u>Cytisus scoparius</u>			X		X	
<u>Lupinus sp.</u>			X			
<u>Trifolium pratense</u>	X		X			
<u>Vicia sp.</u>	X		X			
<u>Acer macrophyllum</u>	X				X	
<u>Acer circinatum</u>					X	
<u>Rhamnus purshiana</u>			X		X	
<u>Hypericum anagalloides</u>	X					
<u>Hypericum perforatum</u>	X	X	X			
<u>Viola glabella</u>	X					X
<u>Cicuta douglasii</u>		X				
<u>Daucus carota</u>	X	X	X		X	
<u>Cornus nuttallii</u>					X	
<u>Arbutus menziesii</u>					X	
<u>Gaultheria shallon</u>					X	
<u>Monotropa uniflora</u>					X	
<u>Vaccinium ovatum</u>					X	
<u>Vaccinium parvifolium</u>					X	
<u>Hydrophyllum tenuipes</u>					X	
<u>Solanum dulcamara</u>				X		
<u>Plantago maritima</u>				X		X
<u>Plantago major</u>	X					
<u>Plantago lanceolata</u>	X					
<u>Linnaea borealis</u>			X		X	
<u>Lonicera involucrata</u>						
<u>Sambucus racemosa</u>	X				X	
<u>Symphoricarpos albus</u>	X				X	
<u>Achillea millefolium</u>	X		X			
<u>Adenocaulon bicolor</u>					X	
<u>Cirsium arvense</u>	X				X	
<u>Hypochaeris radicata</u>	X		X			
<u>Jaumea carnosa</u>						X
<u>Matricaria matricarioides</u>					X	
<u>Senecio jacobaea</u>	X		X			
<u>Taraxacum officinale</u>	X					



Table 1 continued.

HABITATS	FLD	FM	TZ	SM	FOR	M/OW
<u>Juncus effusus</u>	X	X	X			
<u>Luzula campestris</u>	X		X			
<u>Carex obnupta</u>	X	X				
<u>Carex lyngbyei</u>				X		
<u>Anthoxanthum odoratum</u>	X		X			
<u>Deschampsia caespitosa</u>				X		
<u>Distichlis spicata</u>				X		X
<u>Holcus lanatus</u>	X		X			
<u>Typha latifolia</u>				X		
<u>Lysichitum americanum</u>					X	
<u>Disporum smithii</u>					X	
<u>Maianthemum dilatatum</u>					X	
<u>Smilacina racemosa</u>					X	
<u>Trillium ovatum</u>					X	
<u>Goodyera oblongifolia</u>					X	

Table II. Cover classes of plant species in transition zone.  
 I = 0-1%, II = 1-10%, III = 11-25%, IV = 26-50%, V = 51-75%, VI = 76-95%  
 VII = 96-100%

QUADRATS	1	2	3	4	5	6	7
SPECIES							
<i>Peltigera</i> sp.					II	II	v
Moss	II	V		VII	VII	VI	V
<i>Athyrium filix-femina</i>		III					
<i>Polystichum munitum</i>		I					
<i>Thuja plicata</i>	II						
<i>Pseudotsuga menziesii</i>	VI	VI	II	II			
<i>Salix</i> sp.				II			
<i>Stellaria longipes</i>					I	I	
<i>Ranunculus</i> sp.		II					
<i>Berberis nervosa</i>	I				III	II	
<i>Amelanchier alnifolia</i>	III	II	I		II	III	
<i>Pyrus</i> spp.	I			II			
<i>Rosa gymnocarpa</i>	I				VII	VII	
<i>Rosa pisocarpa</i>			I	VI	I		
<i>Rubus spectabilis</i>		II	I				
<i>Rubus ursinus</i>		I					
<i>Rubus laciniatus</i>		I					
<i>Galium</i> sp.	I					I	
<i>Trifolium pratense</i>			I				II
<i>Acer circinatum</i>	VI						
<i>Rhamnus purshiana</i>		I		II	II	III	
<i>Hypericum perforatum</i>					II	III	
<i>Gaultheria shallon</i>	I						
<i>Plantago lanceolata</i>			II	I		I	
<i>Hypochaeris radicata</i>							II
<i>Senecio jacobaea</i>				I	II	I	I
Grass			I	VII	VII	VI	VII
Unknown tree 1	I						
Unknown tree 2		II					
Unknown herb 1	I						
Unknown herb 2							
Unknown herb 3							
Unknown herb 4							

are dominated by a Holcus lanatus - Anthoxanthum odoratum/ moss sp. (Common velvet-grass - Sweet vernalgrass/Moss) community with scattered clumps of Juncus effusus var. pacificus (soft rush) and Carex obnupta (slough sedge) in wetter areas. The soils of both fields are saturated at their eastern ends, bordering the freshwater marsh, and become drier towards the shore. Herbs are found throughout, including Daucus carota (Queen Anne's lace), Hypochaeris radicata (spotted cats-ear) and Hypericum perforatum (common St. John's-wort). Senecio jacobaea is abundant in the south field.

The hedgerow, averaging 2.5 m in height, was designated as a second community, Rosa pisocarpa - R. gymnocarpa - Rubus discolor (Clustered wild rose - Baldhip rose - Himalayan blackberry). These species as well as sparse Rubus spectabilis (salmonberry) and Sambucus racemosa (red elderberry) are found at its eastern end. They grade into pure R. pisocarpa 48 m from its western extreme. Both fields are bordered to the west by a two m wide strip of vegetation; this was not considered a distinct community. It is composed of Acer macrophyllum (big-leaf maple), P. menziesii, Pyrus fusca (western crabapple) and P. communis (cultivated pear) with an understory of Rosa spp., Oemleria cerasiformis (Indian plum) and Symphoricarpos albus (common snowberry).

Feeding birds were a conspicuous feature of this habitat. Killdeer (Charadrius vociferus), Crow (Corvus sp.), Common Flicker (Colaptes auratus), Savannah Sparrow (Passerculus sandwichensis), Barn Swallow (Hirundo rustica), Violet-green Swallow (Petrochelidon pyrrhonota), and especially American Robin (Turdus migratorius) were prevalent. Ruffed Grouse (Bonasa umbellus), Ring-necked Pheasant (Phasianus colchicus), and Swainson's Thrush (Hylocichla ustulata) were observed on occasion. Mounds made by Townsend Mole (Scapanus townsendi) were a prominent feature, as were small mammal tunnels. Pacific Tree Frog (Hyla regilla) was heard singing at the north edge of the field in the spring. Coyote (Canis latrans) scat was also found.

Freshwater marsh.--The freshwater marsh is a 0.3 ha area in the southeast corner of the site. It is bounded on the south by a fence, on the west by the field and on the north by the hedgerow. The eastern boundary extends into the adjacent Alnus rubra (red alder) forest at the base of the uplands. Runoff from the hill above contributes to the continual wetness of the habitat.

The habitat was divided into two communities: A. rubra/Cicuta douglasii (Red alder/Western water-hemlock) along the eastern boundary and Salix sitchensis/Spirea douglasii/Juncus effusus (Sitka willow/Spirea/Soft rush) in the remaining area. Dominance grades from a high concentration of S. douglasii and R. pisocarpa in the southwest corner to J. effusus and C. obnupta in the northwest corner. Scattered clumps of S. sitchensis occur throughout, most frequently near the edge of the A. rubra forest.

The dense vegetation in this habitat provided cover for many small birds and both small and large mammals. Winter Wren (Troglodytes troglodytes), Song Sparrow (Melospiza melodia), Rufous Hummingbird (Selasphorus rufus), and Common Yellowthroat (Geothlypis trichas) were regularly observed. Mule deer (Odocoileus hemionus) sign included tracks and probable bedding sites (flattened vegetation). Coyote scat was found on several occasions.



Trapping was conducted from 16 to 18 February and 16 to 18 April. Ten individual Deer Mouse were caught in February and 7 in April.

Transition zone.--A 1.25 ha section between the logged woods and the north field appears to be in a successional stage between field and forest. This was the location of the old orchard which, since it was abandoned in 1943, has been invaded by shrubs and small trees. It is dominated by a Rosa pisocarpa - Spiraea douglasii/Anthoxanthum odoratum (Clustered wild rose - Spirea/Sweet vernalgrass) community. R. pisocarpa forms dense, 1-2 m tall, thickets interspersed with patches of A. odoratum, H. lanatus and herbs, including Lupinus sp. (lupine), Fragaria virginiana var. playpetala (broadpetal strawberry), Prunella vulgaris (self-heal) and H. radicata. Ranunculus spp. (buttercup), Veronica scutellata (marsh speedwell) and J. effusus are found in wetter areas; S. douglasii is concentrated in the northeastern and southeastern corners. Trees averaging five m in height are scattered throughout, including A. rubra, Rhamnus purshiana (cascara) and Amelanchier alnifolia (western serviceberry). P. communis, P. malus (cultivated apple) and P. fusca are remnants of the orchard. Lonicera involucrata (black twinberry), Ribes sanguineum (red-flowering currant), Prunus emarginata (bittercherry) and Crataegus sp. (hawthorn) are found along the northern and western edges.

Approximately 30 P. menziesii averaging five m in height occur in the eastern two-thirds of the zone, apparently reproduced from the adjacent forest. One four m tall Picea sitchensis (Sitka spruce) was found. Minimal quantitative assessment was made to help determine plant composition and successional trends, and data confirmed previous observations (Table II).

The greatest diversity and abundance of passerines occurred in this habitat. Bird species included Black-capped Chickadee (Parus atricapillus), Winter Wren, American Robin, Dark-eyed Junco (Junco hyemalis), Song Sparrow, Common Yellowthroat, Yellow Warbler (Dendroica petechia), and White- and Golden-crowned Sparrow (Zonotrichia leucophrys and Z. atricapilla). Mammal sign included Mule Deer bedding sites, and rabbit scat and fur. A Shrew-mole (Neurotrichus gibbsi) was also seen. Tunnels in the grass were common evidence of small mammals. Reptiles included Common Garter Snake (Thamnophis sirtalis).

Trapping in the transition zone and forest habitats was conducted from 19-21 February and 19-21 April. Thirteen individual Deer Mouse were caught in February and 10 in April.

Salt marsh.-- A stream flows into the slough through a 0.5 ha meadow in the northeast corner of the site where tidal flooding supports salt marsh vegetation. The stream passes through the remnants of the Beaver dam at the northwestern end. Snags bordering the marsh remain as evidence of the Beaver pond.

Two plant communities were distinguished. A pure T. latifolia community borders the stream and two tributaries at the eastern end. A Deschampsia cespitosa - Carex lyngbyei var. robusta (Tufted hairgrass - Lyngby's sedge) community is found throughout the rest of the habitat, with C. lyngbyei often growing in pure stands along the stream banks. Other grasses grow densely in the marsh, with Plantago maritima var. junocoides (seaside plantain) and Atriplex patula var. hastata (fat-hen) scattered throughout. Salicornia virginica (pickleweed) is concentrated in depressions which hold salt water while Potentilla pacifica (Pacific silverweed) grows along the north side and in the southeast corner.

The tall snags fringing this habitat attracted many woodpeckers. Yellow-bellied Sapsucker (Sphyrapicus varius), Common Flicker, Hairy Woodpecker (Dendrocopos villosus), Downy Woodpecker (D. pubescens), and Pileated Woodpecker (Dryocopus pileatus) were observed. The snags also attracted occasional Red-tailed Hawk (Buteo jamaicensis), Steller's Jay (Cyanocitta stelleri), and many Crow. Black-capped Chickadee, Winter Wren, Rufous-sided Towhee (Pipilo erythrophthalmus), and Song Sparrow were seen in the brush surrounding the marsh, along with Chestnut-backed Chickadee (Parus rufescens) and Red-breasted Nuthatch (Sitta canadensis). Douglas Squirrel (Tamiasciurus douglasi) were also seen, along with piles of cone scales they had left. Coyote scat was found on a large log and Pacific Tree Frog were often heard.

Forest.--Second-growth forest occupies 7.7 ha north of the field (61.5 of the site). Within this habitat, we identified five major plant communities. Two conifer communities occupy better-drained sites along the forest's perimeter, and three A. rubra communities grow on wetter soils in the interior. Trillium ovatum (white trillium) is the only plant distributed throughout the forest, but Polystichum munitum (sword fern) is characteristic of most areas.

P. menziesii-Abies grandis (Douglas fir-Grand fir) community is located between Eld Inlet and the transition zone. This community consists of a dense stand of young trees, very close in age, with almost no shrub or herb species. Between the stand and Eld Inlet is an 8 m x 25 m clearing with vegetation similar to the field shore, but with much Cytisus scoparius (Scot's broom) and Berberis aquifolium (shining Oregongrape).

P. menziesii-T. plicata (Douglas fir-Western redcedar) is the most widespread community. It is continuous along both the Eld Inlet and slough shores, forms a narrow strip north of the transition zone, and occupies the area between the salt marsh and the field. Arbutus menziesii (Pacific madrone) is common along Eld Inlet; A. grandis and Taxus brevifolia (Pacific yew) occur in the western half, and Tsuga heterophylla (western hemlock) is a minor element east of the A. rubra forest. Gaultheria shallon (salal) is present throughout the community, but is best developed in the open woods in the northwest corner of the peninsula; there it forms a 1.5 m high thicket. Berberis nervosa (dull Oregongrape) is common along the slough, and Vaccinium parvifolium (red bilberry) and V. ovatum (evergreen huckleberry) are of frequent but scattered occurrence. The logged area is relatively open and has many herbaceous species, including Ranunculus uncinatus var. uncinatus (little buttercup), Adenocaulon bicolor (trail-plant), and Maianthemum dilatatum (beadruby). The area is also crossed by an intermittent stream along which grows Lysichitum americanum (skunk cabbage) and R. spectabilis. Many snags are present and R. spectabilis grows thickly along the south edge of the salt marsh.

The wettest ground in the forest is occupied by an A. Rubra/Acer circinatum (Red alder/Vine maple) community. At the center of the stand, A. circinatum forms an almost impenetrable 2-5 m high shrub layer under the A. rubra canopy. Isoetecium stoloniferum (moss) covers the upright A. circinatum branches and Hylocomium splendens (moss) is the most common bryophyte on horizontal branches. Where A. circinatum grows densest, the ground is bare of herbs, with patches of Plagiomnium insigne (moss) and Leucolepis menziesii (moss). P. munitum and Montia siberica (western springbeauty) dominate in more open areas.

An A. macrophyllum-A. rubra (Big-leaf maple-Red alder) community near the peninsula's northwest end ranges from pure A. macrophyllum to almost pure A. rubra, but a characteristic understory of P. munium and Dicentra formosa (Pacific bleedingheart) occurs throughout. The shrub layer is very poorly developed, and I. stoloniferum, H. splendens, and Polypodium glycyrrhize (licorice fern) grow on A. macrophyllum.

A highly variable A. rubra (Red alder) community includes isolated representatives of almost all of the tree species on the site. This community is best characterized by well-developed shrub and herb layers, with O. cerasiformis, S. racemosa, P. munitum and M. sibirica as the most abundant species. Galium sp. (bedstraw), Vancouveria hexandra (inside-out flower), Smilacina racemosa (false spikenard), Asarum caudatum (wild ginger) and Urtica dioica (stinging nettle) occur regularly. A. rubra grades into all of the surrounding communities.

Passerines were the primary birds observed in this habitat, including Ruby- and Golden-crowned Kinglet (Regulus calendula and R. satrapa), Winter Wren Rufous-sided Towhee, and Black-capped Chickadee. Varied Thrush (Ixoreus naevius), Ruffed Grouse, Fox Sparrow (Passerella iliaca), Cooper's Hawk (Accipiter cooperii), and Bewick's Wren (Thryomanes bewickii) also occurred. Crow, Great Blue Heron (Ardea herodias), and Belted Kingfisher (Megasceryle alcyon) perched in the trees along the shore. Douglas Squirrel was regularly observed and Brush Rabbit (Sylvilagus bachmani) and Townsend Chipmunk (Eutamias townsendi) were each seen once. Mammal sign included coyote scat, mule deer tracks, and small burrow holes.

Mudflats and open water.--At low tide the underlying mudflats of the slough and much of Eld Inlet are exposed. A strip of beach bordering the fields is periodically flooded and supports salt-tolerant vegetation. The dominant plant community is Distichlis spicata - Salicornia virginica (Seashore saltgrass-Pickleweed); other species present are Jaumea carnosa (jaumea), P. maritima var. juncooides and A. patula var. hastata.

This habitat was extremely rich in bird life, especially waterfowl. Horned Grebe (Podiceps auritus), Great Blue Heron, Bufflehead (Bucephala albeola), and Glaucous-winged/Western Gull hybrid (Larus sp.) were regularly observed. Less common were Double-crested Cormorant (Phalacrocorax auritus), Western Grebe (Aechmophorus occidentalis), Ruddy Duck (Oxyura jamaicensis), and Red-breasted and Common Merganser (Mergus serrator and M. merganser). Several species of sandpiper were present. River Otter (Lutra canadensis) was seen once, and fish were often observed jumping. A study independent of ours was conducted by Campbell (1978) which included identification of invertebrate organisms in the mudflats at our site (Appendix B).

## PHENOLOGY

### Autumn

Observations of the area began 1 November 1978. Many trees and shrubs had already lost their leaves, including A. macrophyllum, R. purshiana, Pyrus spp., A. rubra and Rosa spp. Leaves were changing color on S. douglasii, Cornus



nuttallii (Pacific dogwood), A. circinatum and A. alnifolia while Rosa spp., S. albus and Solanum dulcamara (bittersweet) still retained berries. T. latifolia had gone to seed. The only plants still in flower were Stellaria longipes var. longipes (longstalk starwort), S. jacobaea and C. scoparius. By late November and early December all other deciduous trees and shrubs had lost their leaves, with the exceptions of Rubus laciniatus (evergreen blackberry) and R. discolor on which leaves persisted through the winter.

Occurrence of individual bird species fluctuated throughout the study period. Data on location and abundance is summarized in Table III. Bird activity in the autumn was concentrated on Eld Inlet. Waterfowl included Horned Grebe, Scaup (Aythya spp.), Rufflehead, and Common Goldeneye (Bucephala clangula): the only sightings of Dowitcher (Limnodromus sp.), Northern Shoveler (Spatula clypeata), Hooded Merganser (Lophodytes cucullatus), and American Wigeon (Mareca americana), occurred. Canvasback (Aythya valisineria) were present consistently into February, but were most abundant from mid-November to mid-December. Species present all year included Yellowlegs (Totanus spp.), Great Blue Heron and Kingfisher in the water habitat, and Crow, American Robin and Winter Wren on the rest of the site. Golden-crowned Sparrow were first sighted in early December.

The only sighting of Townsend Chipmunk and Shrew-mole occurred, and Mule Deer sign was conspicuous.

#### Winter

The site was not observed between 13 December 1978 and 1 January 1979. Little new plant activity was evident when observations resumed. Grasses, C. obnupta and J. effusus were dry and brown, as well as the vegetation on the beach. Young leaves of H. radicata, S. jacobaea, H. perforatum and Ranunculus spp. were present in the field.

During January buds matured on all trees and shrubs. O. cerasiformis was the first to leaf out in mid-February. New grass and C. lyngbyei shoots were found in the salt marsh and L. americanum leaves began unfolding in the northeast corner of the site. Trifolium pratense (red clover) and Equisetum spp. (horsetail) shoots came up. A single Botrychium multifidum (leathery grape-fern) plant was found in the transition zone.

Plant activity increased notably in March: leaves developed on R. discolor, R. spectabilis, S. douglasii, Rosa spp., S. racemosa, Holodiscus discolor (ocean spray), R. purshiana and C. nuttallii. Male catkins matured on A. rubra and A. spectabilis and S. sitchensis flowered. Herbs appeared throughout the site, including U. dioica, M. dilatatum, M. sibirica and D. formosa. T. ovatum flowered and Pteridium aquilinum (bracken fern) fiddleheads emerged.

Many new species were observed in January. Swainson's Thrush, Starling (Sturnus vulgaris), and Barrow's Goldeneye (Bucephala islandica) were seen for the first time. Large flocks of Dunlin (Calidris alpina) appeared later, and Ruddy Duck, which had been present in small numbers, became more abundant.

TABLE III: BIRD SPECIES RELATIVE ABUNDANCE AND HABITAT OCCURENCE

Species	Nov		Dec		Jan		Feb		Mar		Apr		FM	SM	TZ	FOR	FLD	M/OW
	1-14	15-30	1-14	15-31	1-14	15-31	1-14	15-28	1-14	15-31	1-14	15-30						
common loon								B										X
red-throated loon							B											X
horned grebe	C	C	C		B	C	B	D	D	C	D	D						X
western grebe	C	C	B		B	B		B	C	B	B	C						X
eared grebe		B			B	B												X
double-crested cormorant	C	C	B		B	B	B	B	B	C	B	B						X
great blue heron	C	C	B		C	C	C	C	C	B	C	C		X		X		X
mallard	C	C			C		B	C	C	C	C	C	X				X	X
cinnamon teal												B						X
American wigeon		B																X
northern shoveler	B																	X
canvasback	B	D	D		B	B	B		B			B						X
scaup	D		B		C	D	D	D	D	C	C	C						X
common goldeneye	C	D	B		C	C	B	B	D	C	C	C						X
Barrow's goldeneye						B	C	D	B	C	C	C						X
bufflehead	D	D	C		D	C	D	C	D	D	D	C						X
white-winged scoter	B					B												X
surf scoter								B	D	D								X
ruddy duck	B	B	C		C	D	D	C	B			B						X
hooded merganser	B	B																X
common merganser	B	C			C			B	D	B	B							X
red-breasted merganser	B	C						B	B	B	B	C						X
Cooper's hawk	B							B		B	B					X		X
red-tailed hawk	B	B			B	B		B	B	B	B	B		X		X		X
bald eagle								B		B								X
ruffed grouse	B				B	B	B					B				X	X	X
ring-necked pheasant					B	B						C	B			X	X	X
killdeer	B	B	B		B	C	C	C	C	B	C	C	X		X	X		X
common snipe												B	B					X
spotted sandpiper	B	C	B		C	C		B		B								X
yellowlegs	C	C	C		C	C	B	C	C	B	C	C						X
dunlin		D			D	D	D	D	D									X
dowitcher	B																	X
western sandpiper										B								X
glaucous-winged/western gull								B			C	D						X
California gull								B		B								X
Bonaparte's gull		C			B		D	C	B	D	C							X
band-tailed pigeon														X				X
rufous hummingbird										C	C	C		X	X			X
belted kingfisher	C	C					B	B	B	B	B	B						X
common flicker	D	D	B		B	B	B	B	B	B	B	B		X				X
pileated woodpecker	B	B	B		B	B	B		B	B	B			X				X
yellow-bellied sapsucker	B				B			B	B	B	B			X				X
hairy woodpecker	B					B		B	B	B	B			X				X
downy woodpecker	B				B		B		B	B	B			X				X
violet-green swallow										B	D	D	X					X
barn swallow										B	D	C	X	X				X
cliff swallow												C	X	X				X
Steller's jay	B	B				B				B	B			X				X
crow	D	D	D		D	D	D	D	D	D	D	D	X	X				X
black-capped chickadee	D	D			C	B		C	D	B	D	B	X	X	X			X
chestnut-backed chickadee									C	C	C	B		X	X			X
red-breasted nuthatch	B							B	B	B	B			X	X			X
brown creeper	B							B		B	B							X
house wren	B							B						X	X			X
winter wren	C	C	C		C	C	C	C	C	C	C	C	X	X	X			X
Bewick's wren	B				B				B	B				X	X			X
American robin	D				D	D	D	D	D	D	D		X	X	X			X
varied thrush								B	B	B			X		X			X
hermit thrush											B			X				X
Swainson's thrush					B	B					B		X					X
golden-crowned kinglet	C	B			D	B			D	B				X	X			X
ruby-crowned kinglet	B	B			B	B			B	B	B			X	X			X
water pipit												C			X			X
starling					B	B		B					X		X			X
Hutton's vireo									B			B					X	X
yellow warbler												B			X			X
yellow-rumped warbler												B						X
common yellowthroat											B	C	X		X			X
western meadowlark											B		X					X
red-winged blackbird						C	C	B			B				X			X
brown-headed cowbird											B			X				X
evening grosbeak											B							X
pine siskin										B	B			X				X
American goldfinch										E					X			X
rufous-sided towhee	C	C	C		B	C	B		C	B	B	C		X	X			X
savannah sparrow											C	C		X	X			X
dark-eyed junco	D	D	C		B			D	D	D	B			X	X			X
white-crowned sparrow											B	B			X			X
golden-crowned sparrow					B						B	C		X	X			X
fox sparrow											B	C		X	X			X
song sparrow	C	C			B	C	B	B	C	C	C	C		X	X			X

Relative abundance code:  
 B- irregular; 1-2 sitings per 2-week period.  
 C- regular; seen on most visits.  
 D- always present in numbers greater than 5.

Habitat code:  
 FM- Freshwater marsh  
 SM- Salt marsh  
 TZ- Transition zone  
 FOR- Forest  
 FLD- Field  
 M/OW- Mud flats and open water

No Kingfisher were seen during December or January and at the end of January Song Sparrow were first heard singing. River Otter was observed on the Inlet: a Brush Rabbit was seen in the woods and rabbit fur was found in the transition zone. Clumps of J. effusus in the field had been browsed, probably by Mule Deer.

In February woodpecker activity was high, with five species present in the salt marsh. Barrow's Goldeneye had become more common, and Scaup populations peaked. Large flocks of Dunlin were still regularly observed. Birds seen for the first time this month were Surf Scoter (Melanitta perspicillata), Bald Eagle (Haliaeetus leucocephalus), California and Bonaparte's Gull (Larus californicus and L. philadelphia), Common and Red-throated Loon (Gavia immer and G. stellata), and Varied Thrush. Small groups of Red-winged Blackbird (Agelaius phoeniceus) appeared early in the month, and Red-breasted Nuthatch and Red-breasted Merganser were seen for the first time since November.

In March Violet-green Swallow (Tachycineta thalassina) and Rufous Hummingbird arrived. Other new species included Hutton's Vireo (Vireo huttoni), Pine Siskin (Spinus pinus), and American Goldfinch (Spinus tristis). Red-breasted Nuthatch had become more conspicuous, and Surf Scoter and Dunlin were still present in large numbers. Woodpecker were active and Red-tailed Hawk were sighted several times. California Gull and Bald Eagle were each seen later in the month. Winter Wren were first heard singing on 9 March and on 12 March. Chestnut-backed Chickadee were seen exploring woodpecker holes on snags in the salt marsh; Mallard (Anas platyrhynchos) pairs were noted. During mid-March Crow were observed carrying mud in their bills, however no conspicuous pairing of individuals was seen. There was little mammal activity this month. Common Garter Snake were seen in the transition zone, and Pacific Tree Frog were heard in the salt marsh.

### Spring

Frequent rain in April caused an outburst of new plant growth and the overall appearance of the site was changed. The field was lush with grasses, of which H. lanatus and A. odoratum flowered. Other flowering graminids were C. obnupta, C. lyngbyei and Luzula campestris var. multiflora (field woodrush). More trees and shrubs developed leaves, including Corvulus cornuta (western hazel), A. rubra, A. circinatum and S. sitchensis. By mid-April the following trees and shrubs had flowered: R. sanguineum, P. emarginata, L. involucreta, C. scoparius, Acer spp. and Berberis spp. Hydrophyllum tenuipes (Pacific waterleaf), Actaea rubra (western red baneberry) and A. bicolor were found in the forest and D. formosa, M. sibirica, F. virginiana var. platypetala, Cardamine spp. (bittercress), R. uncinatus var. uncinatus and A. caudatum flowered. H. perforatum grew up to 15 cm tall in the transition zone and freshwater marsh and Athyrium filix-femina (lady-fern) appeared in the northeastern corner of the site. New P. pacifica and P. maritima var. juncoides growth was found in the salt marsh. By 30 April, when observations ended, P. maritima var. juncoides had flowered and was releasing pollen, new A. patula var. hastata and S. virginica shoots were seen and the following plants had flowered: V. parvifolium, S. racemosa, R. discolor, V. scutellata, Disporum smithii (fairy lantern), P. lanceolata and Taraxacum officinale (common dandelion). A patch of Corallorhiza maculata (Pacific coral-root) emerged in the woods bordering the transition zone and new leaf growth was found among the Goodvera oblongifolia (rattlesnake plantain) in the P. menziesii - T. plicata community. A. Filix-femina was up to 9 dm and P. munitum was 6 dm tall.



In April many new bird species arrived and we began seeing courtship and territorial behavior. The number of Horned Grebe increased, and early in the month males were seen in breeding plumage. A male Rufous Hummingbird regularly perched on three trees in the freshwater marsh. On two occasions in mid-April two males were observed on the north side of the marsh and appeared to be chasing each other. Early in the month courtship display flight had been observed several times in the southeast corner and on 2 May more than one individual was heard. These occurrences suggest the presence of a nest site within the territory of one male. In mid-April Common Yellowthroat was first observed and heard singing in the freshwater marsh. Two males here had well-defined territories. Another was heard in the transition zone.

Birds seen for the first time included Common Snipe (Capella gallinago), Band-tailed Pigeon (Columba fasciata), Hermit Thrush (Hylocichla guttata), Water Pipit (Anthus spinoletta), Western Meadowlark (Sturnella neglecta), Brown-headed Cowbird (Molothrus ater), Evening Grosbeak (Hesperiphona vespertina), Cinnamon Teal (Anas cyanoptera), and male Red-breasted Merganser. Barn Swallow arrived early in the month, and Cliff Swallow followed a week later. Dunlin, Red-winged Blackbird and Varied Thrush were no longer present.

Yellow-rumped Warbler (Dendroica coronata) and Yellow Warbler were seen in the transition zone, and the latter were heard singing on 25 April. Savannah Sparrow song was heard early in the month. Two males had territories along the fence south of the freshwater marsh and another was seen in the hedgerow; individuals were seen chasing each other in these areas. On 2 May Song Sparrow were seen carrying nesting material and White-crowned and Fox Sparrow were first noted. By the middle of the month adult Bonaparte's Gull were in breeding plumage, and Golden-crowned Sparrow and Ruby-crowned Kinglet were first heard singing. Crow were observed carrying nesting material, often to the woods southwest of the salt marsh. Common Garter Snake and Pacific Tree Frog were common, as were Lady Beetle (Family Coccinellidae), Banded Woollybear (Isia isabella), Harvester Ant (Family Formicidae), and slugs (Ariolimax columbianus, Prophysaom andersoni, and Arion ater.)

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APPENDIX A - LIST OF ORGANISMS

Non-vascular Plants

(All names after Lawton, 1971, Moss Flora of the Pacific Northwest)

Family Mniaceae

- Leucolepis menziesii (Hook.) Steere  
Plagiomnium insigne (Mitt.) Koponen  
Rhizomnium glabrescens (Kindb.) Koponen

Family Brachytheciaceae

- Eurhyncium oreganum (Sull.) Jaeg.  
Isothecium stoloniferum Brid.

Family Hylocomiaceae

- Hylocomium splendens (Hedw.) B.S.G.

Vascular Plants

(All names after Hitchcock and Cronquist, 1973, Flora of the Pacific Northwest)

Family Equisetaceae (horsetails)

- Equisetum telmateia Ehrh. (common horsetail)

Family Ophioglossaceae (adder's tongue)

- Botrychium multifidum (Gmel.) Trevis (leathery grape-fern)

Family Polypodiaceae (polypody or common fern)

- Athyrium filix-femina (L.) Roth. (lady fern)  
Dryopteris sp. Adans (shield fern)  
Polypodium glycyrrhiza D.C. Eat. (licorice fern)  
Polystichum munitum (Kaulf.) Presl. (sword fern)  
Pteridium aquilinum (L.) Kuhn (bracken fern)

Family Taxaceae (yew)

- Taxus brevifolia Nutt. (Pacific yew)

Family Cupressaceae (cypress)

Thuja plicata Donn. (western redcedar)

Family Pinaceae (pine)

Abies grandis (Dougl.) Forbes (grand fir)

Pseudotsuga menziesii var. menziesii (Mirbel) Franco. (Douglas fir)

Picea sitchensis (Bong.) Carr (Sitka spruce)

Tsuga heterophylla (Raf.) Sarg. (western hemlock)

Family Salicaceae (willow)

Salix sitchensis Sanson (Sitka willow)

Family Betulaceae (birch)

Alnus rubra Bong. (red alder)

Corylus cornuta Marsh. (western hazel)

Family Aristolochiaceae (birthwort)

Asarum caudatum Lindl. (wild ginger)

Family Polygonaceae (buckwheat)

Rumex acetosella L. (sheep sorrel)

Family Chenopodiaceae (goosefoot)

Salicornia virginica L. (pickleweed)

Atriplex patula var. hastata (L.) Gray (fat-hen)

Family Portulacaceae (purslane)

Montia siberica (L.) Howell (western springbeauty)

Family Caryophyllaceae (pink)

Cerastium arvense L. (field chickweed)

Stellaria longipes var. longipes Goldie (longstalk starwort)

Family Ranunculaceae (buttercup)

Ranunculus uncinatus var. uncinatus D. Don (little buttercup)

Family Berberidaceae (barberry)

Berberis nervosa Pursh. (dull Oregongrape)

Berberis aquifolium Pursh. (shiny Oregongrape)

Vancouveria hexandra (Hook) Morr. & Dec. (inside-out flower)

Family Fumariaceae (fumitory)

Dicentra formosa (Andr.) Walp. (wild bleedingheart)



Family Brassicaceae (mustard)

- Cardamine angulata Hook. (angled bittercress)
- Cardamine pennsylvanica Muhl. (Pacific bittercress)

Family Grossulariaceae (currant or gooseberry)

- Ribes sanguineum Pursh. (red-flowering currant)

Family Rosaceae (rose)

- Amelanchier alnifolia Nutt. (western serviceberry)
- Crataegus sp. (hawthorn)
- Fragaria virginiana var. platypetala Duchesne (broadpetal strawberry)
- Holodiscus discolor (Pursh) Maxim (creambush ocean-spray)
- Oemleria cerasiformis (H. & A.) Landon (indian plum)
- Prunus emarginata (Dougl.) Walp. (bittercherry)
- Pyrus communis L. (cultivated pear)
- Pyrus malus L. (cultivated apple)
- Pyrus fusca Raf. (western crabapple)
- Rosa gymnocarpa Nutt. (baldhip rose)
- Rosa pisocarpa Gray (clustered wild rose)
- Rubus spectabilis Pursh. (salmonberry)
- Rubus parviflorus Nutt. (thimbleberry)
- Rubus ursinus Cham. & Schlecht (Douglasberry)
- Rubus laciniatus Willd. (evergreen blackberry)
- Rubus discolor Weihe. & Nees. (Himalayan blackberry)
- Spirea douglasii Hook. (spirea)

Family Fabaceae (pea)

- Cytisus scoparius (L.) Link (Scot's broom)
- Lupinus L. (lupine)
- Trifolium pratense L. (red clover)

Family Aceraceae (maple)

- Acer macrophyllum Pursh (big-leaf maple)
- Acer circinatum Pursh (vine maple)

Family Rhamnaceae (buckthorn)

- Rhamnus purshiana D. (cascara)

Family Hypericaceae (St. John's wort)

- Hypericum anagalloides C. & S. (bog St. John's wort)

Family Violaceae (violet)

- Viola glabella Nutt. (stream violet)

Family Araliaceae (ginseng)

- Hedera helix L. (English ivy)

Family Apiaceae (parsley)

- Cicuta douglasii (DC.) Coult. & Rose (western water-hemlock)  
Daucus carota L. (Queen Anne's lace)

Family Cornaceae (dogwood)

- Cornus nuttallii Aud. (Pacific dogwood)

Family Ericaceae (heath)

- Arbutus menziesii Pursh. (Pacific madrone)  
Gaultheria shallon Pursh. (salal)  
Monotropa uniflora L. (indian-pipe)  
Vaccinium ovatum Pursh. (evergreen huckleberry)  
Vaccinium parvifolium Smith (red bilberry)

Family Hydrophyllaceae (waterleaf)

- Hydrophyllum tenuipes Heller (Pacific waterleaf)

Family Lamiaceae (mint)

- Prunella vulgaris L. (self-heal)

Family Solanaceae (potatoe or nightshade)

- Solanum dulcamara L. (bittersweet)

Family Scrophulariaceae (figwort)

- Veronica scutellata L. (marsh speedwell)

Family Plantaginaceae (plantain)

- Plantago maritima var. juncoides (Lam.) Hult. (seaside plantain)  
Plantago major L. (common plantain)  
Plantago lanceolata L. (English plantain)

Family Caprifoliaceae (honeysuckle)

- Linnaea borealis L. (twinline)  
Lonicera involucrata (Rich.) Banks (black twinberry)  
Sambucus racemosa var. arborescens (T. & G.) Gram (red elderberry)  
Symphoricarpos albus (L.) Blake (snowberry)

Family Asteraceae (aster)

- Achillea millefolium L. (yarrow)  
Adenocaulon bicolor Hook. (trail-plant)  
Cirsium Sp. Mill (thistle)  
Hypochaeris radicata L. (spotted cats-ear)  
Jaumea carnosa (Less.) Gray (jaumea)  
Matricaria matricarioides (Less.) Porter (pineapple weed)  
Senecio jacobaea L. (tansy ragwort)  
Taraxacum officinale Weber (common dandelion)

Family Juncaceae (rush)

- Juncus effusus var. pacificus Fern. & Wieg. (soft rush)  
Luzula campestris var. multiflora (Ehrh.) Celak. (field wood-rush)

Family Cyperaceae (sedge)

- Carex obnupta Bailey (slough sedge)  
Carex lyngbyei var. robusta Hornem. (Lyngby's sedge)

Family Poaceae (grass)

- Anthoxanthum odoratum L. (sweet vernalgrass)  
Deschampsia cespitosa (L.) Beauv. (tufted hairgrass)  
Distichlis spicata var. borealis (Presl.) Beetle (seashore saltgrass)  
Holcus lanatus L. (common velvet-grass)

Family Typhaceae (cat-tail)

- Typha latifolia L. (common cat-tail)

Family Araceae (arum or calla-lilly)

- Lysichitum americanum Hulten & St. John (skunk cabbage)

Family Liliaceae (lily)

- Disporum smithii (Hook.) Piper (fairy lantern)  
Maianthemum dilatatum (Wood) Nels & Malbe (beadruby)  
Smilacina racemosa (L.) Desf. (false spikenard)  
Trillium ovatum Pursh. (white trillium)

Family Orchidaceae (orchid)

- Corallorhiza maculata Raf. (Pacific coral-root)  
Goodyera oblongifolia Raf. (rattlesnake plantain)

Birds

(All names after Peterson, 1961, A Field Guide to Western Birds; and Udvardy, 1977, The Audubon Society Field Guide to Western Birds.)

Family Gaviidae (loons)

- Gavia immer (common loon)  
Gavia stellata (red-throated loon)

Family Podicipedidae (grebes)

- Podiceps auritus (horned grebe)  
Podiceps caspicus (eared grebe)  
Aechmophorus occidentalis (western grebe)

Family Phalacrocoracidae (cormorants)

Phalacrocorax auritus (double-crested cormorant)

Family Ardeidae (herons and bitterns)

Ardea herodias (great blue heron)

Family Anatidae (swans, geese and ducks)

Anas platyrhynchos (mallard)

Anas cyanoptera (cinnamon teal)

Mareca americana (American wigeon)

Spatula clypeata (northern shoveler)

Aythya valisineria (canvasback)

Aythya marila (greater scaup)

Bucephala clangula (common goldeneye)

Bucephala islandica (Barrow's goldeneye)

Bucephala albeola (bufflehead)

Melanitta deglandi (white-winged scoter)

Melanitta perspicillata (surf scoter)

Oxyura jamaicensis (ruddy duck)

Lophodytes cucullatus (hooded merganser)

Mergus merganser (common merganser)

Mergus serrator (red-breasted merganser)

Family Accipitridae (hawks)

Accipiter cooperii (Cooper's hawk)

Buteo jamaicensis (red-tailed hawk)

Haliaeetus leucocephalus (bald eagle)

Family Tetraonidae (grouse)

Bonasa umbellus (ruffed grouse)

Family Phasianidae (pheasants and quail)

Phasianus colchicus (ring-necked pheasant)

Family Charadriidae (plovers)

Charadrius vociferus (killdeer)

Family Scolopacidae (sandpipers)

Capella gallinago (common snipe)

Actitis macularia (spotted sandpiper)

Totanus melanoleucus (greater yellowlegs)

Totanus flavipes (lesser yellowlegs)

Calidris alpina (dunlin)

Limnodromus sp. (dowitcher)

Ereunetes mauri (western sandpiper)



Family Laridae (gulls)

- Larus glaucescens (glaucous-winged gull)
- Larus californicus (California gull)
- Larus philadelphia (Bonaparte's gull)

Family Columbidae (pigeons)

- Columba fasciata (band-tailed pigeon)

Family Trochilidae (hummingbirds)

- Selasphorus rufus (rufous hummingbird)

Family Alcedinidae (kingfishers)

- Megaceryle alcyon (belted kingfisher)

Family Picidae (woodpeckers)

- Colaptes auratus (common flicker)
- Dryocopus pileatus (pileated woodpecker)
- Sphyrapicus varius (yellow-bellied sapsucker)
- Dendrocopus villosus (hairy woodpecker)
- Dendrocopus pubescens (downy woodpecker)

Family Hirundinidae (swallows)

- Tachycineta thalassina (violet-green swallow)
- Hirundo rustica (barn swallow)
- Petrochelidon pyrrhonota (cliff swallow)

Family Corvidae (crows, magpies, jays)

- Cyanocitta stelleri (Steller's jay)
- Corvus sp. (crow)

Family Paridae (titmice)

- Parus atricapillus (black-capped chickadee)
- Parus rufescens (chestnut-backed chickadee)

Family Sittidae (nuthatches)

- Sitta canadensis (red-breasted nuthatch)

Family Certhiidae (creepers)

- Certhia familiaris (brown creeper)

Family Troglodytidae (wrens)

- Troglodytes aedon (house wren)
- Troglodytes troglodytes (winter wren)
- Thryomanes bewickii (Bewick's wren)

Family Turdidae (thrushes)

- Turdus migratorius (American robin)
- Ixoreus naevius (varied thrush)
- Hylocichla guttata (hermit thrush)
- Hylocichla ustulata (Swainson's thrush)

Family Sylviidae (old world warblers)

- Regulus satrapa (golden-crowned kinglet)
- Regulus calendula (ruby-crowned kinglet)

Family Motacillidae (pipits)

- Anthus spinoletta (water pipit)

Family Sturnidae (starlings)

- Sturnus vulgaris (European starling)

Family Vireonidae (vireos)

- Vireo huttoni (Hutton's vireo)

Family Parulidae (wood warblers)

- Dendroica petechia (yellow warbler)
- Dendroica coronata (yellow-rumped warbler)
- Geothlypis trichas (common yellowthroat)

Family Icteridae (blackbirds and orioles)

- Sturnella neglecta (western meadowlark)
- Agelaius phoeniceus (red-winged blackbird)
- Molothrus ater (brown-headed cowbird)

Family Fringillidae (finches)

- Hesperiphona vespertina (evening grosbeak)
- Spinus pinus (pine siskin)
- Spinus tristis (American goldfinch)
- Pipilo erythrophthalmus (rufous-sided towhee)
- Passerculus sandwichensis (savannah sparrow)
- Junco hyemalis (dark-eyed junco)
- Zonotrichia leucophrys (white-crowned sparrow)
- Zonotrichia atricapilla (golden-crowned sparrow)
- Passerella iliaca (fox sparrow)
- Melospiza melodia (song sparrow)

## Mammals

(All names based on Burt & Grossenheider, 1976, A Field Guide to the Mammals.)

Family Talpidae (moles)

Neurotrichus gibbsi (shrew-mole)

Scapanus townsendi (Townsend mole)

Family Mustelidae (weasels, skunks, etc.)

Lutra canadensis (river otter)

Family Canidae (dogs, wolves and foxes)

Canis latrans (coyote)

Family Sciuridae (squirrels)

Eutamias townsendi (Townsend chipmunk)

Tamiasciurus douglasi (Douglas squirrel)

Family Cricetidae (mice, rats, lemmings and voles)

Peromyscus maniculatis (deer mouse)

Family Leporidae (hares and rabbits)

Sylvilagus bachmani (brush rabbit)

Family Cervidae (deer)

Odocoileus hemionus (mule deer)

## Reptiles

(All names based on Stebbins, 1966, A Field Guide to Western Reptiles and Amphibians.)

Family Colubridae (colubrids)

Thamnophis sirtalis (common garter snake)

## Amphibians

(All names based on Stebbins, 1966, A Field Guide to Western Reptiles and Amphibians.)

Family Hylidae (tree frogs and their allies)

Hyla regilla (Pacific tree frog)

Invertebrates

(All names based on Barror, 1970, A Field Guide to the Insects of America, North of Mexico; and Kozloff, 1976, Plants and Animals of the Pacific Northwest.)

Phylum Mollusca (mollusks)

Class Gastropoda (snails, slugs)

Phylum Anelida

Class Oligochaeta (earthworms)

Phylum Arthropoda

Subphylum Chelicerata

Class Arachnida

Order Araneida (spiders)

Order Phalangida (harvestmen, daddy long legs)

Subphylum Mandibulata

Class Crustacea

Subclass Entomostraca

Order Cirripedia (barnacles)

Class Insecta

Order Odonata (dragonflies)

Order Orthoptera (grasshoppers, roaches)

Order Isoptera (termites)

Order Trichoptera (caddis flies)

Order Lepidoptera (moths, butterflies)

Order Hemiptera (true bugs)

Order Homoptera (Aphids, leaf hoppers)

Order Diptera (true flies)

Order Coleoptera (beetles)

Order Hymenoptera (ants, wasps, bees)



APPENDIX B

Organisms collected in mud flats and open water  
on Eld Inlet shoreline.<sup>1</sup>

<u>Species</u>	<u>Class</u>
Unsegmented worm	---
Polychaete A	---
Polychaete B	---
Polychaete C	---
Polychaete D	---
Polychaete E	---
<u>Mya arenaria</u> (soft-shelled clam)	Mollusca
<u>Macoma balthica</u> (baltic tellin)	Mollusca
<u>Prothaca</u> sp.	Mollusca
<u>Ostrea lurida</u> (true edible oyster)	Mollusca
<u>Mytilus edulis</u> (blue mussel)	Mollusca
<u>Crepidula</u> sp.	Mollusca
<u>Balanus glandula</u> (encrusting barnacle)	Arthropoda

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<sup>1</sup>Campbell, Susan. 1978. Unpublished paper in Puget Sound Resource Inventory Collection. The Evergreen State College, Olympia, Washington.