APPENDIX A

Draft Avian Assessment

DRAFT
AVIAN ASSESSMENT

Prepared for:

U.S. Army Corps of Engineers,
Seattle District
Seattle, Washington

Prepared by:

Jim Eldridge of
Science Applications International Corporation
18706 North Creek Parkway, Suite 110
Bothell, Washington 98011

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1.0 INTRODUCTION

This appendix provides an assessment of avian use in the Commencement Bay Study Area. The objective of this assessment is to provide a current and historical perspective on the cumulative changes in avian diversity and abundance as a result of human activities and developments in Commencement Bay.

This appendix will assist regulators in developing restoration options for Commencement Bay under the authority of the U.S. Department of the Interior's Natural Resource Damage Assessment Regulations (43 CFR Subtitle A, Part 11). The restoration options are to be based on an ecosystem or landscape ecology approach which includes consideration of all habitat types in the study area and special aquatic sites.

The Primary Study Area (Commencement Bay) is defined in the Restoration Plan and programmatic Environmental Impact Statement (RP/EIS). This encompasses the nearshore area along the Ruston shoreline from the mouth of the Thea Foss Waterway to Point Defiance, and the area from the mouth of the Hylebos Waterway to Browns Point. The tideflats portion includes the Hylebos, Blair, Sitcum, St. Paul, Middle, Wheeler-Osgood, and Thea Foss Waterways. The area also includes the Puyallup River upstream to the State Route 161 (Meridian Road), and the adjacent land areas. The marine portion of the primary study area is limited to the Bay waters and sediments to depths less than 60 feet below mean low-low water line.

The Expanded Study Area includes most of the Puyallup River basin (see Figure 1.1-4 of the Draft EIS). This expanded area was included to evaluate important ecological connections with the natural resources of the Bay.

2.0 HISTORICAL HABITAT ALTERATION AND INDUSTRIAL POLLUTION

Historical and current descriptions of habitat conditions at Commencement Bay have been documented in several reports (Shapiro & Associates, 1992; David Evans & Associates, 1991; Thom and Hallum, 1991; Dames and Moore, 1981). The reader is referred to these reports for further information on the historical development of the area, or for detailed habitat descriptions.

2.1 Pristine Conditions

Prior to the turn of the century, the Commencement Bay system was once characterized by extensive tidal marshes and broad mudflats (approximately 6,100 acres) that comprised the Puyallup River Delta. Wapato Creek, Hylebos Creek, and numerous tidal creeks connected the delta system by providing pathways for estuarine water flow. These creeks provided access routes for estuarine organisms, such as juvenile salmonids. Detritus organic matter within the estuarine system provided habitat and food for invertebrates. The invertebrates and marsh vegetation supported fish, birds, and other animals by providing food, refuge, and breeding areas.

The mature forest surrounding Commencement Bay also provided a rich diversity of organisms and birds. Many birds, such as the marbled murrelet, nest in mature forest stands and feed in the bays and inlets of the area.

Major river deltas in Puget Sound served as part of the Pacific Flyway providing feeding and nesting areas for migrating waterfowl and shorebirds. Currently, the Nisqually Delta, with approximately 2,700 acres of combined mudflat and emergent marsh, is the largest non-coastal stopover area between the Columbia River and the Skagit Flats. It is likely that the Puyallup River Delta was also a major feeding and nesting area, prior to the loss and degradation of extensive habitat.

2.2 Habitat Alterations

As the growth of the City and Port of Tacoma expanded, hundred of acres of mudflat and marsh were lost or altered by construction of various waterways, filled areas, and conversion of marsh habitat to agricultural use. Changes in the chemistry of water and sediments also became apparent. In addition, the lower Puyallup River was dredged and channelized, and dams in the upper reaches of the watershed altered sedimentation patterns and fish migrations.

These developments resulted in a direct loss of mudflat and marsh habitat available for avian foraging and nesting; altered tidal mixing zones; changes in water and sediment quality; and, a shift from marsh habitat to upland habitat.

By 1988, 96 percent of the emergent marsh and mudflat habitats were lost from historical levels (David Evans and Associates, 1991). In addition, most of the emergent marshes that remain are located in isolated drainages and depressions and not hydraulically connected to the estuary. Development of the nearshore areas also altered the physical and biological dynamics of the delta ecosystem. Major implications to nearshore bird populations are apparent:

- the remaining nearshore habitats have lost much of their original character and quality; these habitats are fragmented into isolated patches that do not function as an interconnected landscape;

- the loss of mature forests in the Commencement Bay area contributed to a shift in species utilization to open habitats or suburban woodlands;

- competition for remaining available nest sites, roosting areas, feeding grounds, colony/flock space, and territorial requirements;

- critical life stage requirements (e.g., breeding, nesting, rearing, and feeding) of many birds have been altered by loss of available habitat which resulted in reduced colonization rates and abundance, and a reduction in the ability to resist impacts from environmental changes in water/sediment quality or hydrology.

The diminished habitats have also resulted in a decreased potential for production of biotic resources within the community. Impacts from industrial pollution, log storage, and other activities have had deleterious effects on plants and animals in addition to those caused by habitat loss. The continuing demand for waterfront property to accommodate expanding industrial and commercial activity in Commencement Bay further stresses the remaining habitats.

3.0 CURRENT HABITAT UTILIZATION

3.1 Existing Habitats and Bird Assemblages

Birds, like other wildlife, are often associated with particular habitats. For the purposes of this study, six habitat types within the Commencement Bay system have been identified for characterizing bird assemblages. These habitat types are briefly discussed below. General locations of these habitats can be found on the Commencement Bay Habitat Map (Figure 2.1-2 of the RP/EIS). Tables 1 through 6 show avian assemblages associated with each habitat type and provide general information regarding reproduction, feeding, resting, and preferred food. It is quite common for a species to utilize several different types of habitat, provided these habitats have common features that the bird finds essential (e.g., food and refuge). In the case of migratory birds, the breeding habitat is often very different from the one occupied during the non-breeding season. Most of the migratory birds that visit the Commencement Bay area do not breed or nest locally.

The release of hazardous substances has potentially affected each of the habitat areas either directly or indirectly. However, the potential for injured avian resources from such releases is more likely in the nearshore habitats than in the freshwater riparian or woodland/forest habitat types located further from the sources. Consequently, those birds that inhabit or utilize the nearshore environment where their prey-base or nesting habitats have been injured are most affected.

Subtidal/Open Water - This zone typifies the open water habitat of Commencement Bay not associated with the shore or bottom. However, this includes subtidal areas usually in the constructed channels and embayments. These waters primarily provide feeding and resting habitat for waterfowl (Table 1). Birds commonly associated with this habitat type are migratory and include piscivorous (fish eating) waterfowl and some birds of prey such as the osprey and eagles.

Waterfowl and seabirds commonly feed in vegetated shallows of eelgrass and macroalgae beds which support a diverse assemblage of marine invertebrates. Waterfowl utilizing eelgrass habitats include scaup, coots, scoters. Herons and mergansers often feed on Pacific herring and shiner perch, and the osprey prefers salmon fry in this habitat.

Since many of the birds within this habitat type are migratory, their susceptibility to potential injury from releases of hazardous substances is expected to be less than for year-round resident birds utilizing this habitat type.

Intertidal Gravel-Cobble Shores - These habitats have substrates composed of a mixture of cobble and gravel. Due to wave and current action, the habitat tends to be formed as beaches and bars. Gravel-cobble beaches are distributed in the most exposed regions of embayments and along the margins of Commencement Bay. These areas contribute to a rich assemblage of invertebrates and attached macroalgae. Nearshore birds such as gulls,

Table 1. Avian Assemblage for Subtidal/Open Water Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
American Coot				X	EV
Barrow's Goldeneye			X	X	I
Black Brant			X	X	F
Bufflehead				X	MA, I
Canvasback			X	X	EV, I
Cassin's Auklet			X	X	F
Common Loon			X	X	F
Common Merganser			X	X	F
Double-crested Cormorant			X	X	F
Gadwall				X	EV
Glaucous-winged Gull		X	X	X	F
Greater Scaup			X	X	MA, I
Greater Yellowlegs				X	I
Mew Gull				X	I
Osprey	X		X		F
Pigeon Guillemont		X	X	X	F
Red-breasted Merganser			X	X	F
Red-necked Grebe			X	X	F
Rhinocerous Auklet			X	X	F
Surf Scoter			X	X	I
Western Grebe			X	X	F
White-winger Scoter			X	X	I

EV Emergent vascular plants
I Invertebrates
F Fish
MA Macro Algae

Table 2. Avian Assemblage for Intertidal Gravel - Cobble Shore Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
Barrow's Goldeneye			X	X	I
Black Turnstone		X	X		I
Bufflehead			X		I
Double-crested Cormorant		X	X	X	F
Horned Grebe			X		F
Least Sandpiper				X	I
Mew Gull		X	X		F
Spotted Sandpiper			X		I
Western Grebe			X		F

Table 3. Avian Assemblage for Mudflat Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
Common Goldeneye			X		I
Common Snipe			X		I
Dunlin			X	X	I
Great Blue Heron	X		X		F
Greater Yellowlegs			X		I
Least Sandpiper			X	X	I
Short-billed Dowitcher			X		I
Spotted Sandpiper			X	X	I
Western Sandpiper			X	X	I

I Invertebrates
F Fish

Table 4. Avian Assemblage for Emergent Marsh Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
American Coot		X	X		EV
American Goldfinch		X	X	X	S, I
American Widgeon		X	X	X	MA, I
Bald Eagle			X		V
Barn Swallow		X	X		I
Bufflehead			X	X	I
Canada Goose		X	X	X	EV
Common Goldeneye			X	X	I
Common Yellowthroat		X	X	X	I
Gadwall		X	X	X	EV
Great Blue Heron	X	X	X	X	F
Greater Yellowlegs			X	X	I
Green-winged Teal		X	X	X	EV
Killdeer		X	X	X	I
Least Sandpiper			X	X	I
Long-billed Marsh Wren		X	X	X	I
Mallard		X	X	X	EV
Pintail		X	X	X	EV
Red-tailed Hawk			X		V
Redwing Blackbird		X	X	X	EV
Savannah Sparrow		X	X	X	I
Short-billed Dowitcher			X	X	I
Spotted Sandpiper		X			I

EV Emergent vascular plants
I Invertebrates
F Fish
V Vertebrates
MA Macro Algae
S Seeds/Fruit

Table 5. Avian Assemblage for Riparian Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
Bald Eagle	X		X		V
Belted Kingfisher		X	X	X	F
Common Crow			X		I
Common Merganser		X	X	X	F
Great Blue Heron	X	X		X	F
Great Horned Owl			X	X	V
Green Heron		X	X	X	F
Osprey	X	X	X	X	F
Purple Martin	X	X	X		I
Red-tailed Hawk		X	X	X	V
Tree Swallow			X	X	I
Violet-green Swallow		X	X		I
Wood Duck		X	X	X	I
Yellow-rumped Warbler			X	X	I
Song Sparrow		X	X	X	EV

EV Emergent vascular plants
I Invertebrates
F Fish
V Vertebrates

Table 6. Avian Assemblage for Woodland/Forest Habitat

	Sensitive Species	Primary Reproductive Habitat	Feeding Habitat	Resting Habitat	Preferred Food
American Robin		X	X	X	I
Band-tailed Pigeon	X	X	X	X	S
Black-capped Chickadee		X	X	X	I, S
Black-head Grosbeak		X	X	X	S, I
Bushtit		X	X	X	I
Common Flicker		X	X	X	I
Dark-eyed Junco		X	X	X	S
European Starling		X		X	I
Fox Sparrow		X	X	X	I, S
Purple Finch		X	X	X	S, I
Rufus Hummingbird		X	X	X	N
Rufus-sided Towhee		X	X	X	I
Varied Thrush		X	X	X	I, S
Western Screech Owl		X	X	X	V

I Invertebrates
V Vertebrates
S Seeds/Fruit
N Nectar

grebes, sandpipers, and goldeneyes frequent this habitat type. As indicated in Table 2. benthic and epibenthic invertebrates (e.g., mussels and crabs) and fish (copper rockfish, starry flounder, cutthroat trout fry, and herring eggs) comprise most of the diet for these birds. Birds that feed and utilize this habitat for nesting and rearing (e.g., black turnstone, double-crested cormorant, and mew gull) may be more susceptible to contamination than those that occasionally visit these shores.

Mudflats - These are low-gradient intertidal shores not vegetated by macrophytes and with unconsolidated sediment particles smaller than stones, predominately silt and clay; the substrate usually has high organic content, and often exhibits anaerobic conditions below the surface. Mudflats often occur between the emergent marsh habitats and the water line along the channels and at the foreshores of Bay drainages. These areas provide nursery and feeding habitat for diverse populations of invertebrates, juvenile salmon, and demersal fish; and feeding and resting for waterfowl, shorebirds, and other animals.

The abundance of clams, worms, shrimps, and crabs that reside in the mudflat habitat provide food for a number of shorebirds such as sandpipers, dunlins, dowitchers, and goldeneye ducks (Table 3).

Emergent Marshes - Emergent marshes occur as intertidal and freshwater shores of unconsolidated substrate that are colonized by erect, rooted, herbaceous hydrophytes; perennial plant vegetation dominates most of the growing season in most years. Sediments vary from compacted clays, unconsolidated muds, to a mixture of coarse sand and gravel. Depending on topography and habitat alterations by man, emergent marshes tend to form conspicuously in the mixing region, where tidal energy generates flood tide periods with high settling of suspended material. These areas exhibit high rates of primary productivity. The detrital material also contributes to the food web of invertebrate populations and juvenile salmon. The tall emergent vegetation provides cover, nesting sites, and food for a wide diversity of ducks, shorebirds, songbirds, and raptors.

As shown in Table 4, emergent marsh habitat serves as a primary reproductive area for numerous species, in contrast with the previous three habitat types discussed above. Competition for suitable nest sites and rearing areas is a major factor in the smaller pockets of marshes that remain in the Commencement Bay area (Ramsey, personal comm.). Some of the more important marsh plants used for feeding and refuge include macro algae, bulrush, cattail, pickleweed, saltgrass, and rushes (Carex spp). Carex species also provide refuge for salmon fry as they transition from freshwater to the marine environment. Insect larvae and barnacles are among the numerous invertebrates utilized for food by many waterfowl. The great blue heron will feed on fish along the waterways. Hawks and other accipiters will feed primarily on small rodents.

The wide diversity of birds that utilize emergent marsh for cover, refuge, nesting, and food would likely be at risk from contamination of the water, sediments, and invertebrates within this habitat type.

Riparian - These habitats are upland freshwater systems along the banks of the Puyallup River, Wapato and Hylebos creeks; and within the floodplain of the Puyallup River and its tributaries in the Expanded Study Area. Vegetation consists primarily of mixed shrubs and deciduous trees interspersed with conifers. Riparian areas offer cover and nesting habitat. Food sources in these areas are also attractive to many species of birds including waterfowl, songbirds, and raptors (Table 5).

The nests of many birds in riparian areas are often found in the wooded thickets. Cottonwoods, alder, and cascara are important trees for many riparian birds for refuge and perching. Much of the invertebrate food-base shifts to flying insects and crawlers among the shrubs and in leaf litter.

Many of the upland riparian zones have generally been more impacted by habitat changes than by contamination in the Commencement Bay study area.

Woodland/Forest - Woodland habitats within the Commencement Bay Study area include tracts along the Hylebos Waterway, Ruston Way toward Point Defiance, and wooded lots dispersed throughout the urban areas. Large expanses of woodlands exist in the expanded study area. These woodlands are dominated by a mix of conifers (e.g., Douglas fir), deciduous trees (red alder and big leaf maple) and shrubs (blackberry and salmonberry). Like the other habitat types, woodlands provide niches for many birds such as wrens, thrushes, vireos, warblers, sparrows, finches, which feed on insects, seeds and fruit. Owls, hawks and other raptors inhabiting or visiting this habitat type rely principally on small rodents for sustenance.

This habitat type is probably the least affected by hazardous substance releases in the Commencement Bay area. However, some species of birds that may nest in forested areas and feed along the shoreline (e.g. eagles, harlequin ducks) are more susceptible to injury.

3.2 OCCURRENCE OF BIRDS IN THE STUDY AREA

Information on bird observations in the study area have been summarized from sources including Dames & Moore (1981), Thom et al. (1991), Simenstad et al. (EHAP, 1991), Christmas Bird Count (CBC) summaries, and from conversations and/or notes from individuals knowledgeable of birds in the area (T. Bock, personal comm., 1995; D. Nyswander, personal comm. 1995; B. Ramsey, personal comm., 1995).

The greatest avian diversity for Commencement Bay appears to be associated with the emergent marshes. However, most of the recorded observations focused on the Bay shoreline and the Gog-li-hi-te Marsh, rather than randomly through the study area. Because of the migratory nature of many species observed in the Bay area, counts made during peak migratory periods are not considered typical for the area year-round. Since much of the data are from CBC counts and other winter months, flock sizes and abundance estimates only provide basic trends and do not characterize year-round populations.

Shorebirds and waterfowl inhabit the nearshore areas of Commencement Bay. Shorebirds such as sandpipers, dowitchers, and dunlins are observed regularly along the mudflats and cobbled beaches of the bay waterways, particularly near the Hylebos Waterway and the sandflats off the mouth of the Puyallup River. Flocks of waterfowl have been seen in both the nearshore and open bay regions. Based on the CBCs, flock sizes are usually less than 50 birds. Dames & Moore (1981) noted flock sizes greater than 100 birds for the dunlin, mallard, pintail, green-winged teal, ring-necked duck, greater scaup, and western grebe. In winter surveys conducted by the U.S. Fish and Wildlife Service from 1978 through 1984, the numbers of western grebe and surf scoter averaged 221 and 70, respectively. The double-crested cormorant counts averaged approximately 9 birds over eight winter surveys (USFWS, 1995).

Many of the dabbling waterfowl (e.g., American widgeon, northern shoveler, pintail, mallard, and gadwall) and diving waterfowl (e.g., canvasbacks, redheads, ruddy ducks, and lesser scaup) usually select cattails, bulrushes, and smartweeds as cover within a marsh. Many ducks, such as Barrow's goldeneye, utilize structures and piling as roosting sites. Waders, such as herons, or the more elusive rails and bitterns, also inhabit marshes of the area.

Gulls are widely distributed and concentrations of these birds can be found on intertidal mudflats pier pilings, and log storage areas. The glaucous-winged gull and mew gull were reported by Dames & Moore (1981) to be the most abundant gull species in the study area. The California gull is usually seen in the marsh areas. A glaucous-winged gull colony exists near the Simpson Tacoma Kraft Mill site.

Seabirds are primarily found in the open bay waters, with the exception of cormorants which roost on Bay pilings and along the Ruston way shoreline. The seabirds typically occur in smaller flock sizes, usually less than 20 birds. Commonly observed seabirds include scoters, grebes, gulls, and cormorants.

A variety of birds inhabit woodland and riparian habitats scattered throughout the study area. The forested ravines along the east branch of Hylebos Creek and the riparian wetlands along the west branch of the creek are utilized by many species each season of the year. Sparrows, chickadees, band-tailed pigeons, swallows, warblers, and owls are among the birds known to occur in these areas. Similarly, riparian zones and wooded areas throughout the Puyallup and White river watersheds have a wide diversity of birds.

The city, parks, and suburbs, support birds that tolerate human settlements. The more common species include the American robin, rock dove, starling, house finch, and house sparrow. These species occur in other habitats as well. Log pilings, wires, fences and other structures throughout the urbanized area are utilized for roosting and sometimes for nesting. Competition for such sites may be observed between birds. For example, swallows and starlings which often feed and nest in fairly large colonies may displace the much smaller groups of purple martin.

Agricultural areas, particularly in the Wapato Creek area and in areas south of Interstate Highway 5, support sizable populations of birds. Gulls, Canadian geese, robins, and waterfowl are among the birds that frequent these areas. These bird populations are also dependent on the season and agricultural activity. For example, flooded fields may attract a variety of ducks, whereas summer fields may attract more geese, starlings, swallows, and wrens.

Raptors such as osprey and eagles which roost and nest in more forested areas are often observed feeding along the Bay shores. The northern harrier frequents the marshes, and hawks are seen in the more upland areas.

For many birds species, transient migration between the waters of southern Puget Sound and inland areas occurs. A number of birds within the Commencement Bay study area also utilize habitats within the upper Puyallup and White River watersheds. Palustrine wetlands, riverine, marshes, lakes, and forests provide roosting, feeding, and nesting areas. Wood ducks, goldeneyes, and harlequin ducks nest in tree cavities of forested areas, and utilize the Bay area. Bufflehead ducks, and grebes will use the Bay and the larger lakes within the watershed (e.g., Lake Tapps). Numerous passerine birds are also transient visitors throughout the watershed, however these birds are not likely to be as impacted from releases of hazardous substances in the Bay.

Approximately 185 species of birds have been recorded in the Commencement Bay area. Of these, only approximately 40 species are known to have or likely nest in the area. Most of the these nesters are of the taxonomic order Passeriformes (perching birds e.g., swallows, crows, chickadees, sparrows, and warblers). Most waterfowl, shorebirds, and other seabirds are migratory and do not nest in the area with the exception of a colony of green and great blue herons at Dumas Bay and a glaucous-winged gull colony near the Simpson Tacoma Kraft Mill property.

Many species of birds are relatively tolerant of sound disturbances as a result of human activity. For example, the American widgeon, Canada goose, common snipe, mallard, gadwall, short-billed dowitcher, great blue heron, and the red-tailed hawk are generally more tolerant of noise disturbance, even during reproductive periods (Simenstad, et al, 1991). This higher level of tolerance contributes to an increased ability to adapt in areas of human disturbance.

Attachment A provides a list of 185 bird species that have been identified in the Commencement Bay study area and provides some observational comments. The list was compiled from field observations by several sources taken primarily during the winter months when migratory waterfowl and shorebird numbers are particularly high. Comprehensive lists of birds that may be found in the general area are available in Alcorn (1978); Bowles (1906, 1922); Dames & Moore (1981); Gabrielson and Jewett (1970); Speich and Wahl (1989); Thom, et al. (1991); the Christmas Bird Count lists; and others.

Seasonality, frequency, and abundance are also presented in Attachment A. Seasonality is generalized into migrant, resident (year-round, winter, and summer resident), and transient. A relative frequency of birds observed in the Commencement Bay area is provided in three broad categories: 1) Common - seen during most field observations; 2) Uncommon - observed occasionally; and 3) Rare - documented sightings but rarely seen during field observations.

Abundance is also subdivided into three general categories to provide a relative estimate of the number of individuals observed per locality: 1) Abundant - usually over 100 individuals; 2) Medium - between 10 and 100 individuals usually seen; and, 3) Low - usually less than ten individuals sighted.

3.3 SENSITIVE BIRD SPECIES

Several species of birds in the Commencement Bay area are listed under the federal Endangered Species Act (50 CFR 17.11), and other birds have been placed on the Washington State Priority Species List. Birds on these lists (Table 7) are considered sensitive for this report. Each of the birds listed in Table 7 have been observed in the Commencement Bay area with the exception of the western bluebird and the yellow-billed cuckoo. Most of these sensitive species breed within the expanded study area, except, Vaux's swift, western bluebird, and the yellow-billed cuckoo. Nest boxes for the purple martin have been placed near the mouth of the Hylebos Waterway. The abundance of Great Blue Herons in the Bay area appears to have declined (T. Bock, personal comm.,1995), however quantitative information for this trend is very limited. Attachment A provides additional information on these species.

The importance of nearby areas including the expanded study area are important for most of these sensitive birds. For example, harlequin ducks nest in riparian areas in the upper Puyallup River watershed and may overwinter in Commencement Bay. The marbled murrelet nests in mature forests but visits the Bay waters in search of food. Great blue herons nest in Dumas Bay and generally forage in Commencement Bay.

Table 7. Sensitive Bird Species in the Commencement Bay Area

Name	Comments
Endangered (Federally listed)	
Peregrine Falcon *Falco peregrinus*	Nests on tall buildings in Tacoma. Migrant and winter visitor to shoreline. Feeds on ducks and shorebirds.
Threatened	
Bald Eagle *Halieetus leucocephalus*	Occasional resident nesting at Pt. Defiance and Brown's Point. Prefers to feed on fish and birds.
Marbled Murrelet *Brachyramphus marmoratus*	Nests in mature forests. Occasionally seen in the Bay. Feeds primarily on fish.
Candidate Species	
Harlequin Duck *Histrionicus histrionicus*	Winter visitor to Brown's Point. Feeds on snails, chitons, and crabs along rocky shores. Nests in mountainous riparian areas.
Washington State Priority Species	
Band-tailed Pigeon *Columba fasciata*	Resident in open forest, particularly in Madrona in winter. May breed along the forested slopes east of the Hylebos Waterway.
Great Blue Heron *Ardea herodias*	Resident in Commencement Bay. Breeds nearby at Dumas Bay County Park in Federal Way. The colony is declining in size and has low productivity.
Osprey *Pandion haliaetus*	Feeds along the Puyallup and White Rivers and occasionally over the Bay. Breeds near Purdy, increasing in numbers, presently a summer visitor and migrant.
Purple Martin *Progne subis*	Breeds in the Hylebos Waterway, downtown Tacoma, and Titlow Beach. Declining throughout western U.S., probably due to competition with starlings for nest sites.
Vaux's Swift *Chaetura vauxi*	Summer and migrant visitor to tideflats. Prefers forested areas. Breeds in hollow trees in open forest at Fort Lewis. Typically occurs May through September.
Western Bluebird *Sialia mexicana*	Prefers open woodland and pasture lands where old trees provide nest sites. Efforts at Fort Lewis have helped re-establish this species in Pierce County. Not recorded in Commencement Bay area.
Yellow-billed Cuckoo *Coccyzus americanus*	Was reported as an uncommon summer nester at Tacoma (Bowles 1906). Has bred as recently as 1990 in western Oregon, but disappeared in western Washington in the 1930s with a decline in quality riparian areas.

4.0 CHANGES IN AVIAN DIVERSITY AND ABUNDANCE

Commencement Bay no longer is an area of major importance to migrating and resident waterfowl and shorebirds. Today, other less industrialized areas such as the Nisqually delta estuary, Carr Inlet, and Quartermaster Harbor support substantially greater populations of waterfowl. The loss of over 96 percent of historical foraging, nesting, and resting habitat has resulted in lower species abundance and evidence of lower diversity. When habitat utilization by birds in Commencement Bay are compared to the Nisqually Delta, the CBC data suggest that the bird populations of Commencement Bay have been significantly impacted (i.e., the numerical counts are generally higher for many birds, particularly migratory waterfowl).

The available census data and other bird observations made by individuals only represent a "snapshot" in time. Quantitative observations of birds in the Commencement Bay area tend to be seasonal (i.e., Christmas Bird Counts) or very localized (observations from specific geographical points). In addition, many records only note the presence of species, with fewer notes on nesting observations, habitat encounters, or flock sizes. Year-to-year variation in numbers and species in the study area preclude reliable quantification of population trends for individual species or bird groups. Counts made during migratory periods are not reflective of abundance estimates during other time periods. Similarly, natural variations in bird populations are not understood for the Commencement Bay area. The severity of winter in lower Puget Sound will alter residence times of many bird species. Furthermore, qualitative individual interpretations by people knowledgeable of birds in the study area vary by experience and focus. Despite these limits on quantification of trends, qualitative evidence based on valuable insights from individuals familiar with birds in the area will continue to be useful in developing future trends.

Early observations of birds in the vicinity of Tacoma have been documented by Bowles (1906, 1922), Kitchin (1922) and others. These observations provide only a glimpse of the types and relative abundance of species during the periods of observation. Bowles (1906) provided a list of 201 species of birds observed in the Tacoma area, and a few notes regarding the status or relative abundance of each. The 185 species listed in the attachment primarily reflects differences in some of the more rare migrant species, such as visitors from the outer coast or birds east of the Cascade mountains. However, Bowles reported the spotted owl and the yellow-billed cuckoo as local nesters. These two species are no longer observed in the area.

Dramatic changes have occurred in the past century in the local populations of birds that use the Commencement Bay study area. Populations of purple martin, Vaux's swift, western bluebird, harlequin duck, yellow-billed cuckoo, and wood duck have declined in western Washington. These species were likely found in higher numbers within the Bay area prior to urbanization and industrialization.

Some waterbirds of the Alcidae family, such as Murres, Auklets, and the pigeon guillemont, appear to have declined in Commencement Bay (D. Nysewander, personal comm., 1995).

The threatened marbled murrelet which nests in mature forest stands, had more nesting habitat several decades ago. Auks and the pigeon guillemont prefer rocky shores and cliffs. They typically nest in rock crevices or burrows and usually have only one egg. Development along Puget Sound shorelines have restricted available nest sites for these waterbirds.

Over the past decade or two, approximately 100 or more great blue herons could be observed on and near the log piling areas in winter but recently only some 50 to 60 of these birds may be seen (T. Bock, personal comm.,1995). Bock further noted that insufficient information exists to analyze population trends of these specific herons.

Populations of migratory scoters have declined in southern Puget Sound in the past 15 years, however this may be related to their loyalty to particular wintering sites that may correspond to trends in Alaska (D. Nysewander, personal comm., 1995). However, preliminary findings using radio telemetry to track wintering surf scoters in Commencement Bay suggest these birds tend to localize (site fidelity =87%) and feed in a relatively small area for a significant amount of time during the winter season (M. Mahaffy, personal comm., 1995).

The Virginia rail and sora (Rallidae) are resident marsh-dwellers that seldom fly. They were likely present in larger numbers prior to the loss of habitat and competition for available nesting sites.

In contrast, some habitat-edge species may have increased with the development of suburban and agricultural land. The Brewer's blackbird, American robin, European starling, northwestern crow, and dark-eyed junco are likely more common today than they were at the turn of the century (Butler and Campbell, 1987). A variety of ducks (redheads, teals, and northern shovelers) appear to have increased in the area probably due to shifts in wintering grounds in response to climatic trends. Some accipiters (e.g., red-tailed hawk) have also been increasing, which may be related to prey-base changes (B. Ramsey, personal comm., 1995).

Populations of Caspian terns and western grebes have also been increasing over the past 30 years (D. Nysewander, personal comm., 1995). In general, western grebes use the protected waters of Puget Sound and tend to feed at night in preferred feeding areas. These birds and other diving birds are more susceptible to oil spills.

Urbanization of the delta combined with the loss of wetland habitat shifted the species composition from predominately waterfowl to less wetland-adapted passerines and song birds inhabiting the urban/suburban areas.

Portions of the upper Puyallup and White River watersheds have also been altered by human disturbance such as logging and other agricultural practices. This, in turn, has affected the abundance of some species like the harlequin duck, marbled murrelet, and Vaux's swift.

In addition to the direct loss of primary nesting, feeding, and refuge habitat; noise disturbance from human activities has also contributed to a shift in the distribution of birds in the remaining habitat areas. For example, mallards and Canada geese may dominate a particular open space in place of other waterfowl sensitive to disturbance. Competition between birds, space requirements (for bird colonies), and prey-base changes have also contributed to population shifts in most species from historical times.

Based on a review of historical records of bird observations, it appears that substantial changes in the diversity of avian species has not occurred. However, a significant loss of abundance has occurred for many species. For example, it is estimated that several thousand waterfowl and other shorebirds visit the Nisqually River delta annually. Higher numbers of these birds likely occurred in the past in the Puyallup River delta. Recent seasonal census efforts and monitoring of shorebirds, marine birds, and waterfowl generally indicate numbers in the hundreds or less at any one time for the Commencement Bay area (Nysewander et al., 1994; Everson and Buchannan, 1993).

The Gog-li-hi-te constructed wetland system (near Lincoln Avenue) provides valuable insights to the relationship of habitat changes and bird utilization. The Gog-li-hi-te construction included establishment of a sedge marsh connected to the Puyallup River estuary via a breach in the river dike in 1986. Monitoring of the system was required for a period of 5 years. Results of the monitoring have shown that the wetland system continues to undergo rapid and dramatic physical, chemical, and biological changes (Thom et al. 1991). Between 1986 and 1990, 118 bird species were noted in the 10-acre system. Shifts in composition and abundance, apparently in response to marsh dynamics, were also noted (T. Bock, personal comm., 1995). The cumulative number of species climbed over the monitoring period, suggesting that species diversity can increase with creation of new habitat types.

5.0 IMPACT OF WATER QUALITY AND SEDIMENT QUALITY

As the City and Port of Tacoma located along the waterways and bay shorelines, a myriad of chemical substances were discharged into the Bay. Contaminants from indirect or non-point sources also migrated into the waters and sediments of the Commencement Bay System.

Contaminant loadings into Bay and waterways via point sources, stormwater runoff, and other sources have had biological effects. The Washington Pollution Control Commission (1950) found several waterway areas that had low biological activity. Investigations of water and sediment quality in the Commencement Bay area, performed in the 1970s and 1980s, showed that histopathological disorders in fish (bottomfish) were most prevalent in areas of the bays and waterways where the sediment was most contaminated (Long, 1988). Contaminated sediments in the waterways were found to support fewer macroinvertebrate species than other less contaminated bay areas, indicating generalized effects from contamination (EPA, 1985). Toxic levels of metals and arsenic from smelter operations in Ruston were also found in nearby soils and sediments. Contaminated assemblages of aquatic plants and animal species have resulted in bioaccumulation of contaminants into birds through the food web (Block, 1992).

Chemical contamination in an area reduces its habitat value. Contamination of the water and sediments directly affects those organisms living in contact such as fish, benthic, and epibenthic invertebrates. Effects can range from avoidance, to chronic disorders and reduced population survivability, to acute lethality. The contaminants are either ingested or taken up directly from the media, or ingested through the food web where bioaccumulation may occur.

Various studies in Commencement Bay and in Puget Sound have documented hazardous substances in birds. Henny et al. (1990) found that western grebes wintering at the head of Commencement Bay (bordering the waterways) accumulated significant amounts of mercury, arsenic, Polychlorinated biphenyls (PCBs), and organochlorine pesticides (OCs). Many of the high contaminant levels were found in grebes that spent longer periods of time overwintering and feeding in the Bay.

Riley et al. (1983) analyzed tissue from the great blue heron, pigeon guillemont, and glaucous-winged gull from urban and non-urban areas. The birds collected from Commencement Bay had higher tissue concentrations of PCBs than birds collected from Protection Island and Sequim Bay. In addition, the concentration of mercury was generally higher in birds from Commencement Bay than in other marine birds from around the world.

Block (1992) and Norman (1991) evaluated levels of OCs, PCBs, and trace metals in great blue herons in Dumas Bay and the Nisqually National Wildlife Refuge. Dumas Bay egg samples from adults which generally forage in Commencement Bay had significantly higher levels of OCs than eggs collected from the Nisqually colony. PCB concentrations in the eggs

of the Dumas Bay great blue herons were detected at levels which are known to cause deleterious reproductive effects, including egg mortality (J.P. Giesy, personal comm., 1995).

Other studies (Henny et al. 1991; Norman, 1991; and Calambokidis et al., 1991) have documented the presence of elevated contaminants in aquatic birds in Commencement Bay. Plans to continue monitoring contaminants in Puget Sound waterbirds (Mahaffy, 1994) will likely increase the current level of understanding of contaminant levels and effects in birds. The combination of contaminated water, sediments, and organisms, along with marginal habitat conditions likely contribute to alterations in avian productivity in the Bay area.

Despite the presence of contamination in several bird species, limited information exists regarding adverse effects to populations of these birds. However, certain groups of birds are more likely to be exposed to releases of hazardous substances. In particular, resident breeding and nesting birds are likely to be more impacted than migratory and transient species. It is estimated that approximately 20 species of non-passerine birds breed in the Commencement Bay area.

The proximity and feeding habits of bird species are major factors affecting their potential exposure to contaminated areas. For example, shorebirds which feed on invertebrates in sediments are likely to be more exposed to contamination than other birds in the vicinity that feed on seeds or berries. Sediments may comprise up to 30 percent of the diet in sandpipers (Beyer et al., 1991). For those hazardous substances which biomagnify through the food web (e.g., PCBs, and DDT), some birds may also be exposed to contaminants through ingestion of food items. For example, piscivorous birds may accumulate contaminants even though they are far removed from contaminant sources.

Because most of the birds that inhabit riparian and woodland/forest habitat areas (particularly in the upper watershed) are not located near known contaminated areas, these birds are likely to be affected by habitat changes rather than chemical stress. While information regarding long-term chronic effects from hazardous substances to birds within the study area is currently limited, efforts to minimize further avian exposure will likely reduce chemical stress to birds.

6.0 CONCLUSIONS AND RECOMMENDATIONS

As the City and Port of Tacoma developed, substantial loss of historical habitat occurred. The cumulative effects of this loss and the releases of chemical contaminants has resulted in a decline of many bird populations. These greatly altered habitats have reduced or eliminated some bird species while favoring others. For example, some birds associated with suburban forest edge have fared well, while birds associated with emergent marshes have suffered population declines.

Statistical data regarding trends in diversity and abundance of bird species in the area are unavailable. However, qualitative assessments based on numerous observational records of birds over time (T. Bock, personal comm. 1995; B. Ramsey, personal comm., 1995; D. Nysewander personal comm., 1995) indicate declines in abundance for many bird species in the Commencement Bay area over the past several decades. These data also indicate that relatively high diversity of birds still exist in the area overall, although localized avian diversity along heavily disturbed waterways and upland areas is low.

Most birds can cope with many human activities if provided with suitable resting and feeding areas, and if there is some continuum of functional habitat (less fragmented). Some habitats can be enhanced or re-created, particularly tree and shrub areas and seasonal wetlands. Habitats which are more difficult to re-create successfully include salt and brackish marshes and mudflats. However, the constructed wetlands of the Gog-li-hi-te marsh (approximately 10 acres) in 1986 has been monitored for a number of years and has demonstrated an increasing trend in ecological function.

To assist in the prioritization of opportunities for restoration of injured species, the following criteria should be considered: 1) Federally listed and State sensitive birds as mentioned in Table 7, 2) resident breeding and nesting birds, 3) specific feeding requirements (e.g., low tolerance to prey-base changes), 4) roosting and refuge needs (e.g., lack of roosting sites and low tolerance to noise disturbance), and 5) other critical life-stage requirements.

The following considerations for avian restoration opportunities are recommended:

- Because resident nesters that feed on benthic and epibenthic invertebrates in proximity to contaminated areas are likely to be more at risk than other birds, restoration of alternate attractive habitats should be considered (for example, extension and enhancement of intertidal mudflats at the mouth of the Puyallup River).

- Alternate roosting or perching sites for some waterbirds particularly for cormorants and pigeon guillemonts should be considered. Unused pilings, and other structures in close proximity to contaminated areas could be removed or

alternate structures could be built in more suitable areas. Potential roosting structures should be explored along both the east and west Bay shores.

- To attract waterfowl and seabirds in the open-water habitat, enhance and restore eelgrass beds within Commencement Bay where bed characteristics are suitable.

- Plantings of large trees such as cottonwoods interspersed throughout the waterways would offer perch/roost and escape sites for a variety of birds as well as nest sites for warblers and vireos. Planting and maintenance of other large native fruit and seed-bearing trees and shrubs (e.g., Cascara) offer attractive feed and potential nest sites (Ramsey personal comm.). Willows also provide bank stabilization and an important food source for insects, which in turn, provide an important resource for salmon smolts and insectivorous birds.

- Unless contamination is severe, benthic invertebrates can prosper in small localized areas and provide a food source for shorebirds. Opportunities exist for increasing habitat area for these invertebrates by establishing marine-edge plants important to waterfowl (e.g. pickleweed, and bulrushes), or inducing their expansion may also provide benefits. However, unmaintained plantings (overruns by blackberries) or spraying for bugs may have other effects.

- Due to the complex territorial needs and competition for forage and nesting areas, minimum space requirements for potential restoration opportunities may vary greatly. The location and proximity to alternate suitable habitat areas should be considered. For example, greater benefit is likely to be gained from conversion of small vacant or agricultural parcels to palustrine wetlands if the parcel is located adjacent to existing, productive palustrine areas and also near urban openspace zones. This would increase the territory and potential resource base for more birds. Similarly, potential conversion of select vacant parcels to estuarine marshes is likely to be more successful if the location offers a habitat continuum or is in close proximity to existing habitat. Potential opportunities exist along the Puyallup River and the Hylebos waterway.

- The establishment of nest boxes for certain species (such as for the purple martin) may be successful if some of the dynamics of territory and competition among birds and other animals are examined in localized areas.

- A potential exists to enhance the ability of certain birds to interact with preferred habitats in nearby areas. Critical life-stages (e.g., nesting) for many birds exist outside of the study area. For example, Dumas Bay supports a colony of great blue herons, and the upper watersheds provide nesting for other birds and waterfowl that utilize the Bay. Enhancement of breeding habitat in these areas combined with mitigation efforts within the Commencement Bay study area may increase overall productivity.

- To minimize further fragmentation of remaining habitat islands, protect and reclaim those parcels in the primary study area (e.g., palustrine wetlands along the Wapato Creek watershed) that provide additional "edge-effect" environments and/or corridors of habitat continuum with larger undeveloped parcels in the secondary area.

- Implement a long term monitoring scheme of habitat changes and bird utilization at the Gog-li-hi-te marsh or other restoration areas. This information combined with the data gathered previously will provide a measure to guide future restoration efforts with respect to desired habitat types and bird use. Maintenance of enhanced or restored areas should also be considered to minimize deterioration of the desired effect.

These recommendations for birds and waterfowl must be viewed in light of other ecological processes in order to maximize overall ecological function, especially if food sources, competition, or other habitat conditions are marginal.

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ATTACHMENT A

Avian Species Observed in Commencement Bay Study Area

ATTACHMENT A

This Attachment provides a list of 185 bird species that have been identified in the Commencement Bay study area and provides some observational comments. The list was compiled from field observations by several sources taken primarily during the winter months when migratory waterfowl and shorebird numbers are particularly high.

Other bird species that have occurred at other locations in Puget Sound may be present in the Commencement Bay area, but have not been recorded in the available literature reviewed. The primary sources for this list include Alcorn (1978); Bowles (1906, 1922); Dames & Moore (1981); Gabrielson and Jewett (1970); Thom, et.al. (1991); the Christmas Bird Count lists from the Tahoma Audubon Society; and others.

Seasonality is generalized in the table as:

Migrant - **M**
Resident (year-round) - **R**
Winter resident - **WR**
Summer resident - **SR**
Transient - **T**

In addition, nesting is symbolized by the following:

Nests observed - **N**
Nests suspected -***N**

The relative frequency of birds observed in the Commencement Bay area is provided in three broad categories:

Common - **C** seen during most field observations
Uncommon - **U** observed occasionally
Rare - **R** documented sightings but rarely seen during field observations

Abundance provides a relative estimate of the number of individuals observed per locality:

Abundant - **A** usually over 100 individuals
Medium - **M** between 10 and 100 individuals usually seen
Low - **L** usually less than ten individuals sighted

Table A-1

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Red-throated Loon *Gavia stellata*	WR	C	M	Noted as *Gavia lumme* by Bowles as not uncommon. As many as 75 seen in 16 of 17 in CBC count.
Pacific Loon *Gavia pacifica*	WR	C	M	As many as 12 seen in 9 of 17 years CBC count.
Common Loon *Gavia immer*	M, WR	C	L	Listed as "not uncommon summer resident" by Bowles. Migrant and winter resident on Commencement Bay. Seen in 9 of 17 years in the CBC counts.
Pied-billed Grebe *Podilymbus podiceps*	*N, WR	C	L	Listed as common summer resident (Bowles 1906). As many as 5 seen in 12 of 17 years 1977 to 1993 in the Tacoma CBC. The pied-billed grebe frequents open freshwater and marine habitats and breeds in freshwater and brackish marshes with emergent vegetation.
Red-necked Grebe *Podiceps grisegena*	WR	C	M	Seen all years (1977-1993) in the CBC. The red-necked grebe is widely distributed in marine and riverine habitats in winter.
Horned Grebe *Podiceps auritus*	WR	C	M	The horned grebe frequents nearshore areas. Seen in all years in the Tacoma CBC.
Eared Grebe *Podiceps nigricollis*	WR	U	L	As many as 9 seen in 4 of 17 years in the Tacoma CBC count.
Western Grebe *Aechmophorus occidentalis*	WR	C	A	The most numerous and widely distributed grebe, the western grebe is often found in large, tight flocks. "Hundreds seen" (Bowles, 1906), seen in all years in of the Tacoma CBC count.
Clark's Grebe *Aechomophorus clarkii*	M	R	L	Clark's grebe is considered a rare migrant. One was observed in 1987.
Brown Pelican *Pelecanus occidentalis*	M	R	L	Two found at Brown's Point in 1993.
White Pelican *Pelecanus erythrohynchos*	M	R	L	The white pelican is listed as a very rare migrant (Bowles, 1906). Seen at Gog-le-hi-te Marsh and on the Hylebos Waterway in fall 1990 (Thom et al, 1991).
Double-crested Cormorant *Phalacrocorax auritus*	*N, WR	C	M	As many as 103 seen in all years in the Tacoma CBC count.
Brandt's Cormorant *Phlacrocorax penicillatus*	WR	U	L	Listed as "common during migration and in winter" by Bowles. Seen on 5 of the last 8 CBCs, with a maximum of 5.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Pelagic Cormorant *Phlacrocorax pelagicus*	WR	C	M	The pelagic cormorant is widely distributed in deep clear waters. Noted as "probably not uncommon visitor" by Bowles. As many as 13 seen in 15 of 17 years in the CBC count.
American Bittern *Botaurus lengitinosus*	M	R	L	The American bittern frequents brackish marshes. It breeds in cattail marshes. Listed as "rare but regular migrant" by Bowles.
Great Blue Heron *Ardea herodias*	*N, R	C	M	The great blue heron is widely distributed and uses both aquatic and terrestrial habitats. Colony feeding occurs in nests in northern area of Commencement Bay. As many as 100 have been seen in all years of the CBC count.
Green Heron *Butorides striatus*	N, R	U	L	It is frequently seen along sloughs, irrigation ditches and quiet stretches of rivers. Uncommon at the Gog-li-hi-te Marsh. At least three nests in 1992 and 1993. Records show birds arrive in April and leave the end of August at Gog-li-hi-te.
Black-crowned Night-Heron *Nycticorax nycticorax*	R	R	L	This heron is seen along shores of wooded sloughs and nests in dense shrub areas along back sloughs. Seen in Gog-li-hi-te Marsh, May 1993.
Tundra Swan *Cygnus columbianus*	M	R	L	Small numbers frequent the immediate forshore areas such as mud flats and marshes. Noted as "rather rare but regular migrant" by Bowles. Also considered rare in winter and spring.
Greater White-fronted Goose *Anser albifrons*	M	R	L	Most migrants bypass the study area using a more coastal route. Noted as a "common migrant' by Bowles. Seen at Gog-li-hi-te Marsh and during a few CBCs.
Snow Goose *Anser caerulescens*	M	R	L	Considered rare in winter and spring. Seen autumn 1985 and 1989 in Gog-li-hi-te Marsh.
Black Brant *Branta bernicla*	M	C	M	The brant frequents tidal areas and beaches. During the past 50 years, it has declined following a general trend along the Pacific coast of the United States. Listed as a migrant and wintering resident in 1992 by Bowles.
Canada Goose *Branta canadensis*	N, R	C	A	As many as 356 in the Tacoma CBC count.
Wood Duck *Aix sponsa*	T	U	L	The wood duck prefers freshwater habitats, including sloughs and avoids marine waters. Listed as "rare summer resident," migrant by Bowles. Two sightings in 1991 and 1 in 1993 at Gog-li-hi-te Marsh.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Mallard *Anas platyrhynchos*	N, R	C	A	Mallards are widely distributed and occur in fields and every wetland habitat. They nest in upland areas, occasionally in cattail marshes. Noted as "common breeding resident" by Bowles. Seen all years of the Tacoma CBC count.
Green-winged Teal *Anas crecca*	N, WR	C	A	The green-winged teal is one of the more numerous species of wintering fowl, along with the mallard, frequenting mud flats, shallow marshes and flooded fields. Food items of importance to the green-winged teal are *scirpus* and *carex*, found in tidal marshes. Seen all years of the Tacoma CBC count.
Northern Pintail *Anas acuta*	M, WR	C	A	Northern pintails prefer flooded agricultural areas, but open waters, mud flats and shallow marshes are used extensively. They nest in relatively open, low, vegetated areas such as agricultural fields. As many as 300 seen in 16 of 17 years of the Tacoma CBC count.
Blue-winged Teal *Anas discors*	M, WR	U	L	The blue-winged teal prefers grassy areas bordering ditches, dikes, sloughs, ponds as well as open farmlands. Considered uncommon in summer and rare in winter. Five were seen on the 1979 CBC. Seen a few years at the Gog-li-hi-te Marsh.
Cinnamon Teal *Anas cyanoptera*	*N	U	L	Considered uncommon in summer and rare in winter. Sighted at Gog-li-hi-te Marsh.
Northern Shoveler *Anas clypeata*	N, WR	C	M	The northern shoveler prefers shallow, wet fields, mud flats and shallower parts of tidal waters. Breeding occurs is short, dry grassy areas close to water, usually near still or very slow-moving water. As many as 22 seen in 9 of 17 years of the Tacoma CBC count.
Gadwall *Anas strepera*	N, WR	C	M	Gadwalls frequent marshes and wet grassy areas, including fresh, marine and brackish waters. For breeding, gadwalls prefer areas with short emergent growth. Noted as "rare migrant, wintering" species by Bowles. As many as 76 seen in all years of the Tacoma CBC count.
European Wigeon *Anas penelope*	M	C	L	The Eurasian wigeon probably originated from breeding grounds in Siberia. Today this species is a regular visitor to the Pacific coast, and the number appears to be slowly increasing. A few birds seen in 6 of last 8 years in the CBC counts.
American Wigeon *Anas americana*	N, WR	C	A	The American wigeon seems to prefer edges of brackish sloughs and marshes; it may rest and feed along shorelines, but feeds mostly on wet agricultural fields. Unlike the green-winged teal, mallard and northern pintail, items consumed by the American wigeon on agricultural areas were of greatest importance include winter rye grass and other vegetation. Commonly seen in the tideflats. As many as 421 seen all years in the Tacoma CBC count.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
White-winged Scoter *Melanitta fusca*	M, WR	C	M	Unlike other scoters, the white-winged scoter is more often seen in brackish and less saline waters, but it also occurs in open coastal marine waters. They feed mainly on bivalves. Barnacles and crabs are also eaten. As many as 12 seen in 14 of 17 years in the Tacoma CBC count.
Common Goldeneye *Bucephala clangula*	M, WR	C	M	The common goldeneye occurs in small scattered groups along shorelines, river channels, ditches, sloughs and ponds. They feed mostly on crustaceans. Listed as *Clangula clangula* (Bowles, 1906). As many as 61 seen in all years of the Tacoma CBC count. Sighted at Gog-li-hi-te Marsh.
Barrow's Goldeneye *Bucephala islandica*	N, R	C	M	Barrow's goldeneye prefers rocky sections, including breakwaters, jetties and local pebble beaches. On Bowles 1922 list. As many as 306 seen in all years of the Tacoma CBC count. Breeds near forested lakes.
Bufflehead *Bucephala albeola*	M, WR	C	M	The bufflehead is widely distributed in all aquatic habitats. As many as 46 seen in all years of the Tacoma CBC count. Four recorded sightings at Gog-li-hi-te Marsh.
Hooded Merganser *Lophodytes cucullatus*	N, M	C	M	The hooded merganser prefers brackish and freshwater sloughs, ponds and river channels, but also frequents sheltered saltwater areas. As many as 12 seen in 12 of 17 years of the Tacoma CBC count. Also sighted at Gog-li-hi-te Marsh.
Common Merganser *Mergus merganser*	N, R	C	M	The common merganser frequents river channels, large sloughs and waters protected by breakwaters and jetties. Seen along the Hylebos Waterway. As many as 17 seen in 13 of 17 years of the Tacoma CBC count.
Red-breasted Merganser *Mergus serrator*	M, WR	C	M	This species prefers more marine waters than the other two species of mergansers. Listed as "common migrant (1906) and a winter resident (1992)" (Bowles). As many as 47 seen in all years of the Tacoma CBC count. Also sighted in spring at Gog-li-hi-te Marsh.
Ruddy Duck *Oxyura jamaicensis*	WR	U	L	The ruddy duck frequents shallow, fresh and brackish waters and sloughs.
Turkey Vulture *Cathates aura*	T	R	L	The turkey vulture is seen soaring over fields and exposed mud flats. Considered a transient usually in autumn.
Osprey *Pandion haliaetus*	N, SR	U	L	A summer breeder, uncommon but increasing in number, rare in winter.
Bald Eagle *Haliaeetus leucocephalus*	N, WR	U	L	Uncommon during early spring migration wintering areas. As many as 3 seen in 6 of 17 years of Tacoma CBC count.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Northern Harrier *Circus cyaneus*	*N, WR	R	L	The northern harrier frequents open habitats, including marshes, grass fields, and even mud flats. Observed during the Tacoma CBC count.
Sharp-shinned Hawk *Accipiter striatus*	M	C	L	The sharp-shinned hawk frequents all terrestrial habitats and marshes and hunts along the edges of waterways--the widest range of all accipiters. It feeds on birds (passerine). Has been recorded on 14 of 17 years of the Tacoma CBC.
Cooper's Hawk *Accipiter cooperi*	N, R	U	L	The Cooper's hawk frequents wooded areas along dikes and hedgerows. All nests are in conifers. Considered uncommon in winter, rare in summer.
Red-tailed Hawk *Buteo jamaicensis*	N, R	C	L	The red-tailed hawk prefers open and semi-open habitats bordered by trees and tall shrubs. It breeds in deciduous or mixed woodlands, usually close to open areas. Noted as a common resident breeder. As many as 13 seen in 16 of 17 years of the Tacoma CBC count.
Rough-legged Hawk *Buteo lagopus*	M, WR	U	L	This species inhabits open, treeless areas, especially farmland. Its principal food is the Townsend's vole.
American Kestrel *Falco sparverius*	T	U	L	The American kestrel frequents farmland and suburban/industrial areas but breeds in mountains.
Merlin *Falco columbarius*	T	U	L	The merlin is a transient which frequents more habitats than other falcons. Uncommon in winter and often breeds in the mountains. As many as 2 seen in 9 of 17 years of the Tacoma CBC count.
Peregrine Falcon *Falco peregrinus*	N, R	U	L	The peregrine falcon frequents habitats where shorebirds and waterbirds are concentrated, including all marshes, tidal flats and flooded farmlands. Generally a rare migrant, but has bred in Tacoma.
Ring-necked Pheasant *Phasianus colchicus*	*N, R	C	L	The ring-necked pheasant frequents open country, such as cultivated fields, shrub rows and wet brackish and freshwater marshes. Weed seeds constitute most of its diet. Reported most years in the CBC count.
Ruffed Grouse *Bonasa umbellus*	*N, R	R	L	The ruffed grouse is found mostly in stands of deciduous woodlands. Ruffed grouse are reported in the CBC count.
California Quail *Callipepla californica*	N, R	C	M	This species of quail is found in small coveys in brushy and weedy areas. Populations have declined since shrubby areas were turned into farmland. As many as 51 seen in 15 of 17 years of the Tacoma CBC count, and a few sightings at the Gog-li-hi-te Marsh.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Virginia Rail *Rallus limicola*	*N, R	U	L	The Virginia rail frequents all wetland habitats where emergent vegetation provides some cover, mostly in estuarine marshes. It breeds in freshwater and brackish marshes. As many as 2 seen in 3 of 17 years of the Tacoma CBC count.
Sora Rail *Porzana carolina*	R	R	L	None seen during 17 years of the Tacoma CBC count. A few sightings at Gog-li-hi-te Marsh.
American Coot *Fulica americana*	*N, R	C	M	The American coot prefers sloughs, shallows, brackish and freshwater marshes and exposed tidal river banks. For breeding, it prefers nontidal marshes bordering sloughs and ponds. As many as 83 seen in all 17 years of the Tacoma CBC count.
Black-bellied Plover *Pluvialis squatarola*	M	C	M	The black-bellied plover frequents mud flats and farm fields and upper beaches. Noted more commonly in autumn.
Semipalmated Plover *Charadrius semipalmatus*	M	U	L	This species frequents intertidal areas. Birds were also sighted at the Gog-li-hi-te Marsh.
Killdeer *Charadrius vociferus*	N, R	C	M	The killdeer prefers agricultural lands, mud flats and shores of rivers and sloughs. As many as 58 seen in 15 of 17 years of the Tacoma CBC count.
Greater Yellowlegs *Tringa melanoleuca*	M	C	L	The greater yellowlegs prefers marshes, wet farmlands and edges of shallow sloughs. Generally more common in autumn. Sighted at the Gog-li-hi-te Marsh.
Lesser Yellowlegs *Tringa flavipes*	M	C	L	The lesser yellowlegs more often frequents tidal areas than the greater yellowlegs. Less common than the greater yellowlegs. Also sighted at the Gog-li-hi-te.
Bar-tailed Godwit *Limosa lapponica*	R	R	L	The bar-tailed godwit was seen at Gog-li-he-te Marsh in fall 1986.
Spotted Sandpiper *Actitis macularia*	N, SR	C	L	The spotted sandpiper prefers a wide variety of freshwater habitats, including brackish areas and rarely intertidal areas. It nests near fresh water in Commencement Bay. As many as 5 seen in 9 of 17 years of the Tacoma CBC count.
Whimbrel *Numenius phaeopus*	M	U	L	The whimbrel frequents sand and mud flats, agricultural fields and freshwater sloughs and ponds. Listed as "very common spring migrant, but never seen in the fall" (Bowles, 1906).
Sanderling *Calidris alba*	M	R	L	The sanderling prefers sandy habitats and also intertidal flats. More common on the beaches of the outer coast. Seen at Brown's Point in 1991 CBC.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Glaucous Gull *Larus hyperboreus*	M	R	L	The glaucous gull is most often found at garbage dumps or with other gulls along beaches and mud flats. Birds often seen at Gog-li-hi-te.
Black-legged Kittiwake *Rissa tridactyla*	M	R	L	An outer coast gull frequenting cliffs and rocky areas. Reported in Commencement Bay by Dames & Moore in 1991.
Caspian Tern *Sterna caspia*	M	R	L	The Caspian tern frequents coastal areas, including bays and estuaries as well as manmade jetties and breakwaters for roosting. Considered a rare summer visitor. Has been seen at the Hylebos.
Common Tern *Sterna hirundo*	M	C	M	The common tern frequents offshore areas, but is often found around bays, off jetties and resting with gulls on beaches. A fall migrant.
Common Murre *Uria Adlge*	WR	C	M	The common murre is found in marine habitats. Uncommon in winter. As many as 28 seen in 14 of 17 years of the Tacoma CBC count.
Pigeon Guillemot *Cepphus columbia*	N, WR	U	L	The pigeon guillemot frequents marine littoral waters. As many as 2 seen in 4 years of the Tacoma CBC count.
Marbled Murrelet *Brachyramphus marmoratus*	*N, WR	U	L	The marbled murrelet prefers marine waters, but also frequents estuarine and brackish waters. As many as 15 seen in 8 of 17 years of the Tacoma CBC count.
Ancient Murrelet *Synthliboramphus antiquus*	WR	R	L	This species prefers offshore waters. Considered a rare autumn transient.
Cassin's Auklet *Ptychoramphus aleuticus*	WR	R	L	An oceanic wintering seabird. Reported in Commencement Bay by Dames & Moore, 1991.
Rhinocerous Auklet *Cerorhinca monocerata*	WR	C	M	This species prefers marine waters. As many as 77 seen in 16 of 17 years of the Tacoma CBC count.
Rock Dove *Columbia livia*	N, R	C	M	The rock dove frequents urban and suburban areas, farmlands and industrial areas. For breeding, the rock dove prefers man-made structures.
Band-tailed Pigeon *Columbia fasciata*	N, R	C	M	The band-tailed pigeon frequents cultivated farmlands and woodland edges. The Tacoma CBC count held the National High Count on some years with over 2,500 birds above the Hylebos Waterway on the hillside.
Mourning Dove *Zenaida macroura*	*N, R	U	M	The mourning dove prefers bare or grassy areas in agricultural and residential areas, including parks. This species has declined in recent years due in part to the destruction of lowland open space, but apparently increased greatly in numbers in the mid-1800's as habitat increased.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Western Sandpiper *Calidris mauri*	M	C	M	These birds feed on the mud flats and roost along the beach. Listed as "more common in fall, with some birds remaining through the winter, very common migrant" (Bowles, 1906). There were 125 on the 1982 CBC in Area 2 of the Tacoma CBC count, but only several birds were seen on 2 other CBCs.
Least Sandpiper *Calidris minutilla*	M	C	M	The least sandpiper frequents sand and mud flat, shores of ponds and sloughs and flooded fields. Listed as a "common migrant" (Bowles, 1906). As many as 48 seen in all years of the Tacoma CBC count, and at the Gog-le-hi-te Marsh.
Pectoral Sandpiper *Calidris melanotos*	M	U	L	This species prefers wet and damp field, sand and mud flats. Listed as "common in fall, regular but not at all common migrant" (Bowles, 1906). Sighted often at Gog-le-hi-te Marsh.
Stilt Sandpiper *Calidris himantopus*	M	R	L	The stilt sandpiper frequents shallow, freshwater ponds and marshes. Sighted at Gog-li-hi-te Marsh.
Dunlin *Calidris alpina*	M, WR	C	A	The dunlin prefers mud and sand flats, but is also found on wet agricultural fields, upper beaches (roosting) and jetties. Dunlin forage for food by pecking and probing for invertebrates in the mud and sand flats. Listed as "common during migrations and in winter" (Bowles, 1906). As many as 390 seen in all but one year of the Tacoma CBC count.
Short-billed Dowitcher *Limnodromus griseus*	M	R	L	Found in mud flats and shallow, brackish marshes. Usually less common than long-billed dowitcher.
Long-billed Dowitcher *Limnodromus scolopaceus*	M	C	L	The long-billed dowitcher frequents habitats similar to those of the short-billed dowitcher, but prefer those with more fresh water (e.g., flooded fields).
Surfbird *Arphriza virgata*	M	R	L	The surfbird is strictly a species of the outer coast. One was sighted in Commencement Bay (Dames & Moore, 1991).
Ruddy Turnstone *Arenaria interpres*	M	R	L	The ruddy turnstone prefers pebble beaches, rocky shores, and rock breakwaters and jetties. One was seen on the 1979 CBC count.
Black Turnstone *Arnearia melanocephala*	M	C	M	The black turnstone frequents any habitat with rocky components, including beaches and breakwaters. As many as 31 seen in 10 of 17 years of the Tacoma CBC count.
Common Snipe *Gallinago gallinago*	*N, M	U	L	The common snipe frequents freshwater grassy areas, including pastures, fields and shallow marshes. As many as 12 seen in 10 of 17 years of the Tacoma CBC count.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Common Flicker *Colaptes auratus*	*N, T	C	L	This flicker prefers any habitat with trees, as well as open areas such as cultivated fields and log beaches. Also known as "Red-shafted" or "Northern Flicker." This species often feeds on the ground.
Pileated Woodpecker *Dryocopus pileatus*	*N, T	R	L	This species frequents woodlands. Occurs at Dash Point State Park north of Brown's Point, and likely occurred nearer to Commencement Bay in earlier years.
Western Wood-Pewee *Contopus sordidulus*	N, R	U	L	This species frequents almost any habitat with trees and breeds in riparian woodland habitats. These summer breeders are associated with forests. The wood pewee has been seen on 3 occasions at the Gog-li-hi-te Marsh.
Willow Flycatcher *Emphidonax traillii*	*N, M	U	L	Migrants frequent all habitats with trees and tall shrubs, but prefer those bordering waterways and open fields or marshes. They are probable nesters at the Gog-li-hi-te Marsh.
Eastern Kingbird *Tyrannus tyrannus*	T	R	L	There is a record in 1991 at the Gog-li-hi-te Marsh.
Horned Lark *Eremophila alpestris*	T	R	L	The horned lark is found on bare ground, especially in disturbed areas, including cultivated fields. This species nested at the old Tacoma Golf Course (Bowles, 1922).
Tree Swallow *Tachycineta bicolor*	T	R	L	The tree swallow frequents a variety of habitats associated with fresh and brackish waters. A much rarer species in Commencement Bay than other swallows, with 3 records at the Gog-li-hi-te Marsh, as this species nests further inland at higher elevations.
Violet-green Swallow *Tachycineta thalassina*	N, R	C	M	The violet-green swallow prefers man-made structures, including under eaves in buildings and nest boxes. This species is a common summer breeder in Commencement Bay, and has been recorded at the Gog-li-hi-te Marsh regularly.
Northern Rough-winged Swallow *Stelgidopteryx serripennis*	M	U	L	Listed as a "common summer resident, nests chiefly along the salt water" (Bowles, 1906). There is one record in 1991 from the Gog-li-hi-te Marsh. Along with the Kingfisher, these species need embankments for nesting.
Purple Martin *Progne subis*	N, R	C	M	Declining populations of the purple martin have caused it to be placed on the Washington State Priority Species List, probably due to competition with starlings for nest sites. Prefers open woodlands and city buildings.
Cliff Swallow *Hirundo pyrrhonota*	N, R	C	M	The cliff swallow often forages over cultivated fields and farmlands and along beaches and marshes. This species has been recorded at the Gog-li-hi-te Marsh regularly.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Common Barn-Owl *Tyto alba*	N, R	U	L	This nocturnal species prefers agricultural lands with brush fence rows for hunting. Small mammals constitute 98 percent of the barn-owl's diet. Sightings from Commencement Bay include several on the CBC file.
Western Screech Owl *Otus kennicottii*	R	C	L	The western screech-owl frequents all mixed coniferous and deciduous woods. Most common in small watersheds.
Great Horned Owl *Bubo virginianus*	N, R	U	L	The great horned owl has a preference for woodlands and is frequently seen along treed windrows.
Snowy Owl *Nyctea scandiaca*	M	R	L	Listed as a rare winter visitor. Typically from the Arctic; prefers treeless country.
Common Nighthawk *Chordeiles minor*	*N, M	U	L	The common nighthawk is widely distributed and often found roosting on fence posts, beach logs and jetties. This species has become decidedly rare in the last 50 years.
Vaux's Swift *Chaetura vauxi*	M	U	M	The Vaux's swift shows a preference for large sloughs, rivers, open woodlands and shrubby fields.
Rufous Hummingbird *Selasphorous rufus*	N, R	C	M	The rufous hummingbird frequents any habitat that has nectar-bearing plants. It breeds in shrubs and bushes and edges of coniferous woodlands. Beginning in March this species occurs in a variety of woodlands along the slopes of Commencement Bay.
Belted Kingfisher *Ceryle alcyon*	N, R	U	L	The belted kingfisher is found in a variety of freshwater, brackish water and submarine habitats. Seen along the Hylebos and western Bay slopes.
Red-breasted Sapsucker *Sphyrapicus ruber*	*N, T	R	L	This bird frequents all woodland habitats, but prefers stands of alders and cottonwood. It is seen primarily during winter.
Downy Woodpecker *Picoides pubescens*	*N, R	C	M	The downy woodpecker prefers riparian woodlands, especially along sloughs and rivers. It can also be found along dikes, orchards and parks. Recorded in all recent CBCs, as well as in the Tideflats.
Hairy Woodpecker *Picoides villosus*	T	R	L	The hairy woodpecker is found in mature, open woodlands, tall conifers and deciduous trees along dikes and sloughs. In winter, it uses a variety of trees in residential areas. This species has been recorded on only 1 occasion in the Tacoma CBC in the last 8 years.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Wilson's Phalarope *Phalaropus tricolor*	M	R	L	This species prefers shallow, freshwater habitats, including marshes. Considered a summer transient.
Red-necked Phalarope *Phalaropus lobatus*	M	R	L	Listed as "common fall migrant, but never seen in spring" (Bowles, 1906).
Parasitic Jaeger *Stercorarius parasiticus*	M	R	L	Uncommon migrant in the fall. Observed in Commencement Bay.
Franklin's Gull *Larus pipixcan*	M	R	L	Considered a rare autumn transient.
Bonaparte's Gull *Larus philadelphia*	WR	C	M	The Bonaparte's gull frequents bays, estuarine marshes, rivers, mud flats and flooded agricultural fields. As many as 47 seen in 12 of 17 years of the Tacoma CBC count.
Mew Gull *Larus canus*	WR	C	A	The mew gull is found in a wide variety of aquatic and terrestrial habitats, depending on food. Estimates on the Tacoma CBC count in Commencement Bay have ranged from 42 to 1,067.
Heerman's Gull *Larus heermani*	M	R	M	Heerman's gull is usually seen during "El Nino" years in Commencement Bay and on the Hylebos Waterway.
Ring-billed Gull *Larus delawarensis*	WR	U	M	The ring-billed gull is widespread, occurring along beaches, in agricultural fields and on banks of river channels. As many as 8 seen in 8 of 17 years of the Tacoma CBC count. Birds were also seen at the Gog-li-hi-te Marsh.
California Gull *Larus californicus*	WR	C	L	Generally more common in autumn than the Ring-billed Gull. As many as 4 seen on 3 of the Tacoma CBC counts, but has been seen on 12 occasions in Gog-li-hi-te Marsh.
Herring Gull *Larus argentatus*	M	U	M	The herring gull frequents mud flats, garbage dumps and banks of river channels. Generally less frequently seen than the Thayer's Gull during winter. As many as 32 seen in 5 of 17 years of the Tacoma CBC count.
Thayer's Gull *Larus thayeri*	WR	C	A	Thayer's Gull is more terrestrial than the herring gull. As many as 285 have been seen in 13 of 17 years of the Tacoma CBC count.
Western Gull *Larus occidentalis*	M	R	L	The western gull prefers open sea, sandy beaches and rocky shores. Breeds on the coast. Has been reported on 3 CBCs from 1990 - 1992 in the Tacoma count.
Glaucous-winged Gull *Larus glaucescens*	N, R	C	A	The glaucous-winged gull is widespread and frequents all aquatic and terrestrial habitats. As many as 110 have been seen in the Tacoma CBC counts.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Barn Swallow *Hirundo rustica*	N, R	C	M	The barn swallow occurs widely in all open situations and shows a preference for brackish waters. It breeds in a variety of man-made structures. This species is a common summer breeder in Commencement Bay, and has been recorded at the Gog-li-hi-te Marsh regularly.
Steller's Jay *Cyanocitta stelleri*	*N, R	R	L	The Steller's jay prefers coniferous woodlands or mixed woodlands interspersed with large conifers. This species has adapted well to suburban areas.
Northwestern Crow *Corvus caurinus*	N, R	C	M	Small numbers of these feed in family groups in parks and along marine beaches. They nest mainly in tall shrubs and trees near residential areas, parks and beaches. Listed as "common in flocks along the coast, breeds colonially in reeds along the tideline" (Butler and Campbell, 1987).
Common Raven *Corvus corax*	T	R	L	The common raven frequents woodlands, beaches, flats and farmlands. Listed as a "rare visitor to the tideflats" (Bowles, 1922)
Black-capped Chickadee *Parus atricapillus*	N, R	C	M	The black-capped chickadee frequents all types of woodlands and tall thickets of willow and alder. It prefers edges along waterways. This species is a common resident and has been seen along the slopes of Hylebos, and has occurred at Gog-li-hi-te Marsh in all months.
Bushtit *Psaltriparus minimus*	*N, R	C	M	The bushtit frequents a wide variety of habitats and nests in open deciduous woodlands with tall understory. This species has occurred at the Gog-li-hi-te Marsh.
Bewick's Wren *Thyromanes bewickii*	N, R	C	M	The Bewick's wren prefers edges of riparian woodlands, hedgerows, parks and patches of shrubs bordering agricultural fields. This species occurs regularly at the Gog-li-hi-te Marsh.
Winter Wren *Troglodytes troglodytes*	WR	U	L	Winter wrens prefer dense coniferous forests, but frequent a variety of riparian woodlands. This species would be expected along the slopes of Hylebos in winter, and has occurred at the Gog-li-hi-te Marsh.
Marsh Wren *Cistothorus palustris*	N, T	C	M	The marsh wren prefers forshore and riverine marshes and wet upland fields. They nest in cattail and *Scirpus* marshes in the upper foreshore marshes. This species occurs all year round at the Gog-li-hi-te Marsh.
Golden-crowned Kinglet *Regulus satrapa*	N, R	C	A	This species is mostly found in mixed coniferous and deciduous woodlands. This abundant coniferous forest resident has been seen along the slopes of Hylebos in winter.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Ruby-crowned Kinglet *Regulus calendula*	M, WR	C	A	The ruby-crowned kinglet is most numerous in riparian habitats, especially willows and alders bordering sloughs, ditches and marshes. This abundant migrant and wintering species in the Puget Sound lowlands had been seen along the slopes of Hylebos in winter. It has been recorded at the Gog-li-hi-te Marsh.
Swainson's Thrush *Catharus ustulatus*	N, R	C	M	This species frequents dense undergrowth, including woodlands and edges of sloughs. Abundant summer breeding thrush of the woods, so it would be expected along the slopes of the Hylebos.
Hermit Thrush *Catharus guttatus*	T	U	L	The hermit thrush prefers a mixed coniferous/deciduous woodland with dense plant cover. This species has been seen along the slopes of Hylebos in winter and in migration.
American Robin *Turdus migratorius*	N, WR	C	A	Widely distributed in agricultural areas, residential areas and parks.
Varied Thrush *Ixoreus naevius*	N, R	C	M	The varied thrush is most numerous in coniferous and mixed coniferous/deciduous woodlands. This species has been seen along the slopes of Hylebos in winter.
Water-Pipit *Anthus spinoletta*	WR	C	M	Frequents open country and short grass fields. This insectivorus bird nests on the ground.
Cedar Waxwing *Bombycilla cedrorum*	*N, R	C	M	The cedar waxwing frequents a wide variety of open and sparse woodlands along dikes, riparian locations and edges of farmlands. This species has been seen along the slopes of the Hylebos Waterway and probably breeds there.
Northern Shrike *Lanius excubitor*	M	U	L	Considered an uncommon winter visitor from the Arctic. Hunts in the open spaces in the Tideflats. This species has been recorded in the Tacoma CBC on 5 of the last 8 years, with an many as 4 individuals. It has also been seen twice at the Gog-li-hi-te Marsh.
European Starling *Sturnus vulgaris*	N, R	C	A	The European starling is widespread in farmlands, cultivated fields, residential areas, and deciduous woodlots. Also known as "Common Starling."
Solitary Vireo *Vireo solitarius*	*N, SR	R	L	Listed as a "summer resident of Tacoma" (Bowles, 1922). May breed in wooded areas.
Hutton's Vireo *Vireo huttoni*	*N, R	R	L	This species has been recorded in the Tacoma CBC. It is a resident species associated with mixed woods and extensive undergrowth.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Orange-crowned Warbler *Vermivora celata*	*N, T	C	M	Migrants pass through all natural woodland habitats, as well as residential areas and along beaches. This species has been recorded in the fall months at Gog-li-hi-te Marsh.
Yellow Warbler *Dendroica petechia*	*N, T	U	M	The yellow warbler prefers riparian habitats, especially willows and alders bordering sloughs, rivers and marshes. It breeds mostly in willows. This species has historically bred in the area (Bowles, 1922).
Yellow-rumped Warbler *Dendroica coronata*	*N, T	C	M	It is most abundant in riparian habitats and shrubs adjacent to agricultural areas. This species has occurred at the Gog-li-hi-te Marsh.
Black-throated Gray Warbler *Dendroica nigrescens*	M, *N	R	L	This is a summer nesting species in wet wooded areas, and probably nested along the Puyallup River (Bowles, 1922).
Common Yellowthroat *Geothypis trichas*	N, R	C	M	The common yellowthroat prefers freshwater and brackish marshes, as well as riparian thickets. This species is a common breeder at the Gog-li-hi-te Marsh.
Wilson's Warbler *Wilsonia pusilla*	M	U	L	Wilson's warblers show a preference for riparian locations. A few of this species have been recorded at the Gog-li-hi-te Marsh.
Black-headed Grosbeak *Pheuticus melanocephalus*	*N, R	C	M	This species is found mostly in open second-growth deciduous or mixed deciduous/coniferous woodlands, frequently near water. This summer breeding species is regularly seen at the Gog-li-hi-te Marsh.
Lazuli Bunting *Passerina amoena*	T	R	L	Listed as a summer resident by Bowles (1922) and noted by Dames & Moore (1991). More common east of Cascades range.
Rufous-sided Towhee *Pipilo erythrophthalmus*	N, R	C	M	The rufous-sided towhee prefers woodland edges. It breeds in open second-growth and brushy woodlands with some undergrowth. This resident species of brushy habitat has been seen along the wooded slopes of the Hylebos Waterway, as well as at Gog-li-hi-te Marsh.
Savannah Sparrow *Passerculus sandwichensis*	N, SR	R	M	The Savannah sparrow frequents almost any open area, but prefers agricultural fields, beaches, weedy areas, shores of sloughs and marshes. Nests are in open areas with grass or short vegetation. This species is common in summer at the Gog-li-hi-te Marsh.
Fox Sparrow *Passerella iliaca*	N, WR	C	M	This wintering species of brushy habitat has been seen along the wooded slopes of the Hylebos, as well as at Gog-li-hi-te Marsh.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Northern Oriole *Icterus galbula*	*N, T	R	L	The northern oriole prefers open deciduous woodlands along sloughs and marshes. For breeding, they prefer willows, birches, black cottonwood. Nests are usually situated along the edge of large tracts of woodlands. This summer nesting species of the lowlands would be expected along the slopes of the Hylebos Waterway or at Gog-li-hi-te Marsh, but no records exist.
Purple Finch *Carpodacus purpureus*	*N, R	C	M	The purple finch is widespread in open coniferous and mixed woodlands and residential areas with evergreen shrubs. This resident species of coniferous forest would be expected along the slopes of Hylebos Waterway.
House Finch *Carpodacus mexicanus*	N, R	C	A	The house finch is widespread and frequents all terrestrial habitats, but prefers weedy, grassy and agricultural areas for foraging. This species occurs in most areas.
Pine Siskin *Carduelis pinus*	*N, T	C	M	This widespread species occurs in the winter in forested areas, and has been seen along the Hylebos slopes.
American Goldfinch *Carduelis tristis*	N, R	C	M	American goldfinches frequent fields, agricultural areas, parks and shrub patches. This species is an abundant resident and breeds in open field in the Tideflats, and occurs all months at the Gog-li-hi-te Marsh.
Evening Grosbeak *Coccothraustes vespertinus*	T	C	M	This species is a common resident of mixed woodlands and wanders widely. It has been seen along the slopes of the Hylebos Waterway.

Table A-1 (continued)

Avian Species Observed in Commencement Bay Study Area

Name	Seasonality	Frequency	Abundance	Comments
Song Sparrow *Melospiza melodia*	N, R	C	M	The song sparrow breeds in grassy, brushy and shrubby areas along or close to water courses such as ditches, edges of marshes and ponds. This resident common species of brushy habitat has been seen along the wooded slopes of the Hylebos, as well as at Gog-li-hi-te Marsh.
Lincoln's Sparrow *Melospiza lincolnii*	T	C	M	The Lincoln's Sparrow occurs in low underbrush in disturbed or edge situations. This wintering species of brushy habitat has been seen along the wooded slopes of the Hylebos, as well as at Gog-li-hi-te Marsh.
White-throated Sparrow *Zonotrichia albicollis*	M	R	L	Overwintering species that prefers brushy habitat. Has been seen along the wooded slopes of the Hybelos.
Golden-crowned Sparrow *Zonotrichia atricapilla*	M, WR	C	M	This species prefers brush along edges of woodlands, dikes, agricultural fields, parks and residential areas. This wintering species of brushy habitat has been seen along the wooded slopes of the Hylebos, and at the Gog-li-hi-te.
White-crowned Sparrow *Zonotrichia leucophrys*	N, T	C	A	This species is commonly seen breeding in open fields in the Tideflats and is seen migrating along the wooded slopes of the Hylebos and Gog-li-hi-te Marsh.
House Sparrow *Passer domesticus*	N, R	C	A	The house sparrow prefers urban, residential and agricultural areas. This species is an abundant, semi-domesticated, and nests in a variety of areas.
Dark-eyed Junco *Junco hyemalis*	N, WR	C	M	The dark-eyed junco frequents woodland edges adjacent to open areas, agricultural lands, open ground along beaches and dikes and short grass and wide fields. This species has been seen along the wooded slopes of the Hylebos, as well as at Gog-li-hi-te Marsh.
Red-winged Blackbird *Agelaius phoeniceus*	*N, R	C	M	Large flocks of these forage on agricultural lands, lawns in residential parks and stubble fields. They breed in freshwater and brackish marshes. This is a common resident at the Gog-li-hi-te Marsh, presumably breeding.
Western Meadowlark *Sturnella neglecta*	WR	U	M	The western meadowlark prefers open grassy areas and agricultural lands. Considered an uncommon winter visitor. This species has been recorded at the Gog-li-hi-te Marsh.
Brewer's Blackbird *Euphagus cyanocephalus*	N, WR	C	M	The Brewer's blackbird inhabits agricultural areas. They breed in shrubs and blackberry hedgerows bordering farmlands and roads. This abundant species has been recorded at the Gog-li-hi-te Marsh.
Brown-headed Cowbird *Molothrus ater*	*N, SR	C	M	This species is widespread in open country in grass and agricultural land. Summer species and has been recorded regularly at the Gog-li-hi-te Marsh.