"Vancouver Island" Common Water Shrew

Sorex palustris brooksi

Original[1] prepared by Pontus Lindgren and Vanessa Craig

Species Information

Taxonomy

Shrews belong to the Soricidae family, of which there are 13 species in Canada and nine species in British Columbia. Although there is some debate as to the taxonomy of this species, there are currently nine recognized subspecies, two of which are found in British Columbia (Cowan and Guiguet 1973; Nagorsen 1996). The mainland subspecies (*S. palustris navigator)* is found throughout the mainland of the province except for low-lying areas of the Fraser River Valley. The Vancouver Island subspecies (*S. palustris brooksi)* is restricted to Vancouver Island (Anderson 1934).

Literature on the Vancouver Island subspecies of the Common Water Shrew is extremely limited. Much of the information presented in this account is from research on other subspecies, usually *S. palustris palustris*, which are referred to hereafter simply as Common Water Shrews.

Description

The Common Water Shrew is a large shrew, surpassed in size only by the Pacific Water Shrew (Nagorsen 1996; Maser 1998). It has an average length of 152 mm, of which 75 mm is tail, and weighs an average of 10.6 g (Nagorsen 1996). The body is distinctly bicoloured; its dorsal surface has black glossy fur and the ventral surface is silvery white, sometimes a diffuse brown. Similarly, the tail is dark above and whitish below (Anderson 1934; Banfield 1974; Nagorsen 1996). Several adaptations distinguish this shrew from its non-aquatic relatives including long digits on its hind feet that are rimmed with a margin of stiff fringe hairs. The front feet also have these specialized hairs.

The Common Water Shrew has specialized fur that both repels water and traps an insulating layer of air when under water (Calder 1969; Beneski and Stinson 1987). This layer of trapped air reduces heat loss by 50% and gives the shrew a silvery, fish-like appearance when underwater (Calder 1969). In addition to being able to sustain dives of up to 47 seconds, air bubbles trapped beneath the feet of this shrew provide enough buoyancy to enable it to run on the surface of even turbulent water for several seconds (Beneski and Stinson 1987).

Although the Pacific Water Shrew (*S. bendirii*) is similar to the Common Water Shrew in its appearance and behaviour, its range does not overlap with that of the Vancouver Island Common Water Shrew.

Distribution

Global

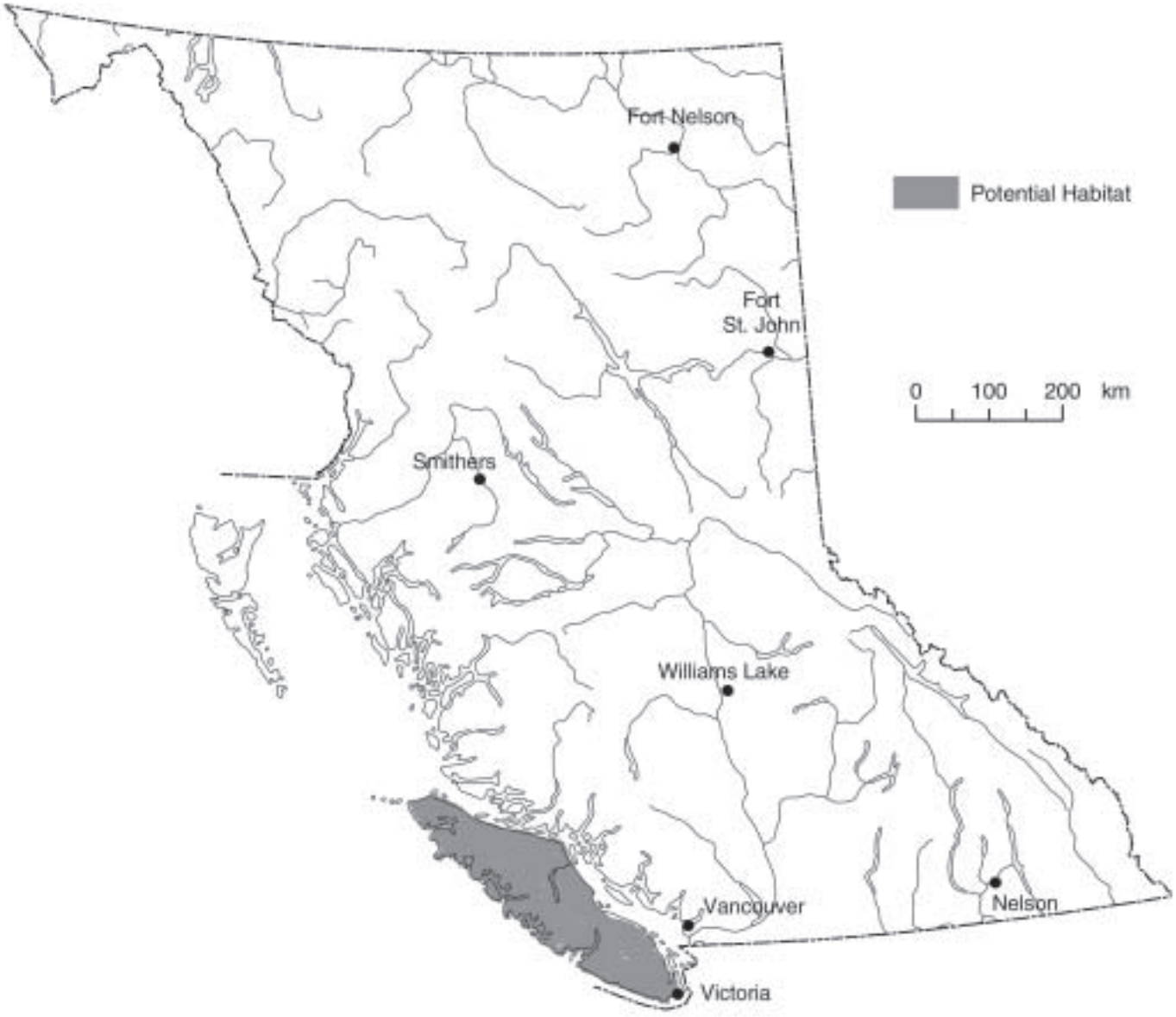
The Common Water Shrew is a widespread species found throughout much of Canada, southwestern Alaska, and cooler mountainous areas of the United States (Beneski and Stinson 1987). The Vancouver Island subspecies is restricted to Vancouver Island. This taxon is the only island population of Common Water Shrew on the entire Pacific Coast of America (Nagorsen 1996).

British Columbia

Although the Vancouver Island subspecies is assumed to be found throughout much of Vancouver Island (Nagorsen 1996), it is known from very few specimens. There are currently 67 known records from 38 locations on Vancouver Island (Craig 2002). It has been documented as far north as Quatse River

1 Draft account for Volume 1 prepared by L. Darling.

Common Water Shrew - subspecies *brooksi*
(Sorex palustris brooksi)



Note: This map represents a broad view of the distribution of potential habitat used by this species. The map is based on several ecosystem classifications (Ecoregion, Biogeoclimatic and Broad Ecosystem Inventory) as well as current knowledge of the species' habitat preferences. This species may or may not occur in all areas indicated.

near Port Hardy (north end of the island), along the east coast at Quinsam River (near Campbell River), as far inland as Robertson Creek and the Lowry Lake area (near Port Alberni), along the west coast at Lost Shoe Creek near Ucluelet, and as far south as Veitch Creek near Victoria (Cowan and Guiguet 1973; Waye 1997; CDC 2001).

The following distribution information represents the known and potential range of the Common Water Shrew on Vancouver Island. Sites from which Common Water Shrews have not been recorded, but where it is possible they occur based on the range of the closely related subspecies from the mainland (Stevens 1995; Nagorsen 1996), are presented in brackets.

Forest region and districts

Coast: Campbell River, North Island, South Island

Ecoprovinces and ecosections

COM: NIM, NWL, WIM

GED: LIM, NAL, SGI

Biogeoclimatic units

CDF: mm

CWH: dm(?),[2] mm1, mm2, vm1, vm2, vh1, xm1, xm2

MH: mm1(?)

Broad ecosystem units

CD, CH, CW, FR, (CB, CG, CR, DA, GO, MF, WL)

Elevation

30–558 m but possible between 0 and 2400 m

Life History

Diet and foraging behaviour

No diet studies have been conducted on the Vancouver Island Common Water Shrew. All shrews are insectivorous, primarily feeding on insects and other invertebrates. Whitaker and French (1984) report that the diet of the Common Water Shrew consists mainly of insect larvae, spiders, slugs, snails, and flies. Beneski and Stinson (1987) note that slugs and earthworms comprise 50% of this shrew's diet. The importance of an aquatic food source is indicated by the frequent occurrence of aquatic invertebrates, small fish (up to 8 cm in length), fish eggs, and Pacific Giant Salamander larvae found in the stomachs of this shrew (Conaway 1952; Sorenson 1962; Banfield 1974; Nagorsen 1996; Maser 1998). Its varied diet suggests that it may be an opportunistic forager (Buckner and Ray 1968).

Prey appear to be located by sound and by exploring the forest floor and rotten logs with their sensitive vibrissae (whiskers) and flexible snout, although the importance of the vibrissae has been questioned (Sorenson 1962). These tactile senses also appear to be used when locating prey under water (Svihala 1934; Nagorsen 1996). The Common Water Shrew is semi-aquatic and is a skilled swimmer that readily enters streams in search of food (Maser 1998). The ability to echolocate has also been suggested (Sorenson 1962; Gould et al. 1964); however, how this shrew uses this sense is not well understood (Nagorsen 1996). Shrews immobilize their prey with several rapid bites along the length of the body. Although prey may be seized underwater, food is always consumed on land. The Common Water Shrew feeds every 10 minutes and consumes its own weight in food every 24 hours (Conaway 1952; Sorenson 1962; Beneski and Stinson 1987). When food is plentiful, this shrew has been observed to cache extra food, often within hollow logs (Banfield 1974; Beneski and Stinson 1987; Nagorsen 1996).

Reproduction

Very little is known about the breeding biology of the Common Water Shrew and no studies have been conducted in British Columbia. Common Water Shrews mature in their first winter. A pungent odour originating from scent glands located on the flanks of males may function as a form of communication between sexes during the breeding season (Svihala 1934; Sorenson 1962). Nagorsen (1996) reports that female Common Water Shrews in British Columbia are mature (pregnant or caring for young) from May

2 (?) Indicates possible occurrence but has not been confirmed.

to September. Common Water Shrews have two or three litters, averaging six young, before dying prior to their second winter (Beneski and Stinson 1987; Nagorsen 1996). Shrews can live up to 18 months but most probably do not survive their first winter.

Site fidelity

Not much is known but this species likely maintains established home ranges.

Home range

Not known. Because Common Water Shrews on Vancouver Island have been captured almost exclusively at the land/water interface, their home range is likely a long, linear strip along the water's edge.

Movements and dispersal

No information exists on the movement patterns of the Vancouver Island subspecies (Nagorsen 1996). Most movements are likely concentrated near or within the banks of the stream it inhabits. This assumption is made because of the trap success observed immediately next to streams and creeks, often under stream bank overhangs (Conaway 1952; Nagorsen 1996; Waye 1997; Hartman 2002). Hartman (2002) reports that capture rates more than doubled after pitfalls were placed at the water's edge, instead of 1 m away. Conaway (1952) reported that the farthest a Common Water Shrew was captured from water was 18 cm. Although this shrew is active during all hours of the day throughout the year, it is more active at night and is observed to have two periods of hyperactivity: just before dawn and just after dusk (Conaway 1952; Nagorsen 1996; Maser 1998). Its movement has been described further as consisting of repeating cycles of 30 minutes of activity, followed by 60 minutes of rest (Sorenson 1962; Beneski and Stinson 1987).

Habitat

Structural stage

Proximity to suitable aquatic habitat appears to be more important than structural stage of the surrounding habitat (Steven and Lofts 1988). Common water shrews occur in riparian habitat within all vegetated structural stages (stages 1b to 7), as long as the riparian habitat is intact. Vancouver Island Common Water Shrews have been captured along riparian corridors in young forests (age classes 1 and 2) through to older forest (age class 7; Craig 2002). If the riparian corridor is harvested, then water shrews likely will not be present until the water quality and riparian zone recovers (likely structural stages 3–7).

Important habitats and habitat features

Aquatic

Vancouver Island Common Water Shrews appear to be very closely associated with aquatic habitat and up to 50% of a Common Water Shrew's diet is made up of aquatic animals and invertebrates (Conaway 1952; Sorenson 1962; Banfield 1974). Although the Common Water Shrew has been found using a variety of aquatic habitats, it is considered to be particularly productive within the banks of swift flowing, high elevation, cool streams with an abundance of rocks and boulders within and around the stream (Svihala 1934; Conaway 1952; Beneski and Stinson 1987; Nagorsen 1996; Pagels et al. 1998). Previous research in the United States emphasized high elevation sites (up to 2900 m; Conaway 1952) These types of habitats have been preferentially sampled in the past (Conaway 1952). Shrew captures have also been reported from small seepages and intermittent streams (Kinsella 1967).

The Vancouver Island Common Water Shrew has been captured in a wide variety of waterways, ranging from 1.2 to 26 m wide, next to still pools of water and slow-flowing waterways as well as swift-flowing streams, along both permanent and intermittent watercourses (Craig 2002). Most of the sites sampled for this shrew on Vancouver Island have been <10 m wide, low gradient, low elevation watercourses;. The majority of captures were along streams with a gravel or cobble substrate; unsuccessful sampling sites often had a bedrock substrate (Craig 2002). At this time, any riparian habitat, whether it borders a marsh, pond, lake, or slow- or fast-moving stream should be considered potential habitat for this shrew.

Terrestrial

In addition to aquatic food sources, this shrew readily consumes terrestrial invertebrates found throughout the forest floor, especially within litter and decomposed coarse woody debris and hollow logs (Whitaker and French 1984; Beneski and Stinson 1987; Nagorsen 1996; Maser 1998). This shrew appears to prefer complex riparian habitat with overhanging vegetation, undercut banks with exposed tree roots and crevices, and in-stream coarse woody debris (Conaway 1952; Craig 2002). Nests that have been found were very close to water and most were under or in logs (Nagorsen 1996).

Nagorsen (1996) notes that Common Water Shrews have been found inhabiting low elevation forest, open wetlands, and high alpine habitat, and Buckner and Ray (1968) report this shrew in bog habitat. Craig (2002) reports Vancouver Island Common Water Shrews from young forests. Most sites surveyed for the Vancouver Island subspecies of the Common Water Shrew have been low elevation; the highest elevation capture site was 558 m. Because of the wide range of habitats this shrew has been documented within, all vegetated structural and seral stages with an intact riparian zone should be considered potential habitat (Conaway 1952; Beneski and Stinson 1987; Nagorsen 1996).

Conservation and Management

Status

The Vancouver Island Common Water Shrew is on the provincial *Red List* in British Columbia. Its status in Canada has not been determined (COSEWIC 2002).

Summary of ABI status in BC and adjacent jurisdictions (NatureServe Explorer 2002)

BC	Canada	Global
S2	N2	G5T2

Trends

Population trends

Believed to be declining due to habitat loss on southeast Vancouver Island (CDC 2001; Craig 2002). There are no details regarding population trends (Nagorsen 1996) because of its rarity, and the removal methods that have been used to sample this species. The B.C. Conservation Data Centre has mapped 17 occurrences (CDC 2001). In total, there are 67 records from 38 locations. Most of the known records are along the east coast of Vancouver Island (Craig 2002). There are considerable data from field studies and fossil records that suggest that this species is rare even within ideal habitats (Svihala 1934; Beneski and Stinson 1987; Nagorsen 1996; Waye 1997).

Habitat trends

Urban development and forestry practices occurring within riparian habitats throughout Vancouver Island are undoubtedly degrading and reducing the amount of preferred habitat (CDC 2001). In the last 20 years, four of the 16 identified watershed groups on Vancouver Island had up to 30% of their riparian habitat (30 m on either side of a stream >200 m long) clearcut logged and an additional 10 watersheds had up to 20% of riparian habitat logged (MELP 1999). Reid et al. (1998) reported that 93% of 14 second-order streams and 165 watersheds they examined along the east coast of Vancouver Island showed changes in the riparian zone associated with upstream forest harvesting or urbanization.

Forests cover 91% of Vancouver Island and the results based code (RBC) applies to approximately two-thirds of the forested land (Government of B.C. 2000). While S1, S2, and S3 streams and other water bodies are buffered from forestry activity by the RBC, smaller and/or non-fish bearing streams are not protected, even though these streams potentially provide important habitat for Common Water Shrews.

The human population of Vancouver Island is concentrated in the south and along the east coast. Between 1991 and 1997 the population increased by

19%, and is expected to increase by a similar amount over 1997 levels by 2012 (Government of B.C. 2000). Increasing population density will be associated with increasing road density, industrialization, and general urbanization, all of which have the potential to degrade, fragment, or remove Vancouver Island Common Water Shrew habitat.

Threats

Population threats

Rarity and a restricted distribution make this subspecies vulnerable to environmental change and extinction.

Habitat threats

Hartman (2002) noted that several recent and historical capture sites are now encircled by, or crossed by roads, potentially reducing the suitability of the habitat for the Vancouver Island Common Water Shrew.

The primary threat to habitat of the Vancouver Island Common Water Shrew is loss, fragmentation, and degradation, due to urban development along the east coast and on southern Vancouver Island, as well as forest practices that affect riparian habitat and water quality (CDC 2001).

Water quality influences the abundance and diversity of aquatic invertebrates and other aquatic food sources which are essential for water shrews (Svihala 1934; Conaway 1952; Sorenson 1962; Banfield 1974; Cairns and Pratt 1993; Nagorsen 1996; Vuori and Joensuu 1996). Changes in water quality can be caused by changes in riparian vegetation, erosion, siltation, or removal of the riparian zone by forest harvesting, or in more urban areas, water contamination from residential stormwater, industrial waste, or runoff of pesticides or chemicals. All of these factors can have detrimental effects on the food source and habitat of the Common Water Shrew.

Fragmentation of riparian habitat on Vancouver Island will likely be an increasing threat to this subspecies. The close association of this shrew with intact riparian zones suggests that its ability to move among fragmented riparian zones might be limited. This subspecies has not been reported more than 1 m from the water's edge, and the majority of sightings and captures have been at the water's edge (Craig 2002). The current distribution of this shrew on Vancouver Island will likely decrease if its ability to recolonize areas (essential for gene flow in the population) is restricted.

Even within relatively large tracts of undeveloped riparian habitat, edge effects may render the habitat unsuitable for a habitat specialist like the Common Water Shrew. Examples of edge effects that are particularly detrimental include loss of canopy closure resulting in decreased security (Nagorsen 1996) or changes in water quality (Noel et al. 1986); increased disturbance which can penetrate up to 70 m from an edge (Matlack 1993); and, in urban areas, increased predation by domestic cats on small animals, of which 80% of captures are shrews (Fitzgerald 1988).

Legal Protection and Habitat Conservation

The Common Water Shrew is protected, in that it cannot be killed, collected, or held in captivity without special permits, under the provincial *Wildlife Act.*

There are records of this subspecies from protected areas on Vancouver Island, but because of the sparse data the proportion of the population that is protected is unknown. Records show that this shrew occurs in Goldstream Provincial Park (388 ha), the Greater Victoria Water District adjacent to the park, Pacific Rim National Park (155 km^2), Miracle Beach Provincial Park (137 ha), Veitch Regional Park and Niagara Catchment, Dudley Marsh, and possibly Marble River Provincial Park (1512 ha). Approximately 13% of the land base of Vancouver Island is in protected areas of which 32% is in the Mountain Hemlock and Alpine Tundra biogeoclimatic zones (Government of B.C. 2000) where no water shrews have been reported to date. An additional (unknown) amount of habitat is protected in regional parks and private land managed for conservation purposes.

The results based code recommendations for landscape level planning and riparian management may conserve several beneficial attributes of Water Shrew habitat, if implemented. Where landscape level planning can address maintenance of landscape connectivity, particularly along natural features such as streams and rivers, or can address natural vegetative species composition and requirements for coarse woody debris retention, then the recommendations may partially address this species' requirements. However, these aspects are only opportunistically being applied.

Riparian management recommendations may in some cases partially address the requirements of this species. Current riparian management recommendations for streams and wetlands vary depending on the size and classification of the aquatic feature. General recommendations include minimizing windthrow risk; maintaining wildlife trees; and conserving stream channel shape, bank stability, and water quality; as well as guidelines for minimizing detrimental effects of range, roads, and culverts. Where these recommendations are applied they may contribute to the maintenance of this species' habitat.

Although these habitat provisions provide several beneficial recommendations for the habitats of the Vancouver Island Common Water Shrew, these provisions are not sufficient to ensure the conservation of this rare taxon. Urban planning and stewardship programs will be an important component of this subspecies recovery. In addition the range of this species overlaps with private land or private managed forest land. For the Vancouver Island Common Water Shrew to be addressed within the Private Managed Forest Land regulations it must be designated as Identified Wildlife.

Identified Wildlife Provisions

Sustainable resource management and planning recommendations

Strategic or landscape level planning should promote connectivity among remnant patches of suitable riparian habitat by restoring forest habitat along watercourses and wetlands, especially within the South Island Forest District. Whenever possible, large buffer widths around riparian areas should be maintained to compensate for the fragmentation that is occurring.

Wildlife habitat area

Goal

Protect current and historical habitat of the Vancouver Island Common Water Shrew.

Feature

Establish WHAs at current or historical occurrences where suitable habitat still exists. Emphasis should be placed on protecting areas with intact riparian areas (undisturbed watercourses) of varying classes (including wetlands) to protect a diversity of habitat.

Size

Generally between 5 and 45 ha but will ultimately depend on the size of the water feature, area of suitable habitat, and potential threats to riparian habitats and water quality. In more urban areas (along the east coast and southern Vancouver Island), WHAs should be larger to minimize edge effects and contamination of waterways.

Design

The WHA should include suitable riparian and aquatic habitats, extend the entire length of the stream or wetland, and encompass as many tributaries or wetlands within 1 km as possible. The WHAs should encompass a minimum of 1 linear km of riparian habitat. In areas with greater threats (i.e., more urbanized areas), WHAs should include a 30 m core area and a 45 m management zone on each side of the stream or around wetland/wetland complexes. In other areas, the WHA design should be based on the size and type of the aquatic feature. Wetlands should have a minimum 20 m core area and a 30 m management zone. Larger streams (S1) should have a 50 m core area and 20 m management zone on either side of the stream. Mid-sized streams (S2, S3, S5) streams should have a minimum 30 m core area and a 30 m management zone on either side of the stream, and smaller streams (S4, S6) should have a minimum 20 m core area and 30 m management zone on either side of the stream.

Measurements of slope distance should be consistent with the *Riparian Management Area Guidebook*. Where slopes exceed 60%, the WHA should extend to the top of the inner gorge.

General wildlife measures

Goals

1. Maintain hydrological regime.
2. Maintain water quality and physical integrity of riparian habitat.
3. Maintain or promote natural microclimatic conditions and structural elements known to be preferred by this species, such as stream bank stability, abundance of rocks and boulders within and around stream, good ground cover, coarse woody debris, and litter layer.
4. Minimize edge effects and windthrow.

Measures

Access

- Do not construct roads.

Harvesting and silviculture

- Do not harvest or salvage within core areas or riparian reserve areas.
- Use partial-harvesting systems within the management zone that maintain 70% basal area. Partial harvesting within the management zone should promote natural microclimate and maintain wildlife trees and coarse woody debris.
- Restrict activities that may alter the vegetation, hydrology, stream structure, or soils, particularly the upper soil layers.

Pesticides

- Do not use pesticides.

Recreation

- Do not establish recreational trails, structures, or sites within WHA.

Additional Management Considerations

When operating immediately adjacent to WHAs, minimize disturbance to soil, water quality of occupied streams, litter layer and ground cover.

It is recommended that additional WHAs be established around nearby (interconnected) streams or wetlands to protect an entire subpopulation.

Because of the urban development occurring on Vancouver Island, particularly in the south and along the east coast, a significant portion of the habitat for this shrew is threatened. It is important to consider this species within urban planning and stewardship programs.

Information Needs

1. Taxonomy. Existing preserved specimens should be sufficient to perform the modern systematic research into the taxonomy of this subspecies.
2. Distribution and basic demographic parameters including home range size, movement patterns, and ability to recolonize areas are needed. Live-trapping methods should be used during future investigations into this and other rare shrew species (Craig 2002; T. Sullivan, pers. comm.).
3. Preferred habitat attributes and the effects of habitat fragmentation. Many potentially suitable habitat types such as wetlands, high elevation, and/or high gradient streams have not been surveyed for water shrews on Vancouver Island. Future survey work should investigate and only use non-lethal methods of assessing their presence, such as faecal samples obtained in bait tubes (Churchfield et al. 2000) or track plates (Ellenbroeck 1980).

Cross References

Douglas-fir/Alaska onion grass, Keen's Long-eared Myotis, Marbled Murrelet, "Queen Charlotte" Goshawk, Scouler's corydalis

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