Recovery Strategy for the Ermine, *haidarum* subspecies (*Mustela ermine haidarum*) in British Columbia

Prepared by the Ermine, *haidarum* subspecies Recovery Team

BRITISH COLUMBIA
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Ministry of Environment

December 2009

About the British Columbia Recovery Strategy Series

This series presents the recovery strategies that are prepared as advice to the province of British Columbia on the general strategic approach required to recover species at risk. The Province prepares recovery strategies to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada – British Columbia Agreement on Species at Risk*.

What is recovery?

Species at risk recovery is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

A recovery strategy represents the best available scientific knowledge on what is required to achieve recovery of a species or ecosystem. A recovery strategy outlines what is and what is not known about a species or ecosystem; it also identifies threats to the species or ecosystem, and what should be done to mitigate those threats. Recovery strategies set recovery goals and objectives, and recommend approaches to recover the species or ecosystem.

Recovery strategies are usually prepared by a recovery team with members from agencies responsible for the management of the species or ecosystem, experts from other agencies, universities, conservation groups, aboriginal groups, and stakeholder groups as appropriate.

What's next?

In most cases, one or more action plan(s) will be developed to define and guide implementation of the recovery strategy. Action plans include more detailed information about what needs to be done to meet the objectives of the recovery strategy. However, the recovery strategy provides valuable information on threats to the species and their recovery needs that may be used by individuals, communities, land users, and conservationists interested in species at risk recovery.

For more Information

To learn more about species at risk recovery in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

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Recommended citation

Ermine, *haidarum* subspecies Recovery Team. 2009. Recovery Strategy for the Ermine, *haidarum* subspecies (*Mustela erminea haidarum*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 23 pp.

Cover illustration/photograph

Recovering Ermine, *haidarum* subspecies at Sewall, Graham Island, 1981. Photo by Janet Gifford-Brown.

Additional copies

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<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Publication information

ISBN: 978-0-7726-6235-4
Date December 4, 2009
British Columbia Ministry of Environment
Recovery Strategy for the Ermine, *haidarum* subspecies (*Mustela erminea haidarum*) in British Columbia [electronic resource]

Disclaimer

This recovery strategy has been prepared by the Ermine, *haidarum* subspecies Recovery Team, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The British Columbia Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada - British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies that are deemed necessary, based on the best available scientific and traditional information, to recover the Ermine, *haidarum* subspecies population in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the recovery team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this strategy. The Ministry of Environment encourages all British Columbians to participate in the recovery of the Ermine, *haidarum* subspecies.

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RESPONSIBLE JURISDICTIONS

The British Columbia Ministry of Environment is responsible for producing a recovery strategy for Ermine, *haidarum* subspecies under the *Accord for the Protection of Species at Risk in Canada*. Parks Canada Agency and Environment Canada's Canadian Wildlife Service participated in the preparation of this recovery strategy.

ACKNOWLEDGEMENTS

Special thanks to Ian Adams for writing the first draft of this recovery strategy and to Louise Blight for editing a later draft. Further thanks to Eric Lofroth and David Nagorsen for providing comments on the final draft.

EXECUTIVE SUMMARY

The Ermine, *haidarum* subspecies is endemic to Haida Gwaii, a group of islands located 80 km off the coast of British Columbia. Genetic work indicates Ermine *haidarum* belong to a lineage of short-tailed weasel which has been subjected to long-term isolation.

While Ermine *haidarum* are thought to occur in low numbers, there is evidence that numbers today are lower than they were historically. In spite of considerable survey effort to detect the presence of Ermine *haidarum*, proof of continued presence is limited largely to occasional sightings and by-catch from trapping for American Marten (*Martes americana*).

While Ermine *haidarum* are classified as habitat generalists, local sightings indicate a preference for low elevation forested landscapes, often within 100 meters of a body of water. Coarse woody debris is thought to be beneficial, both for protection from predators and location of prey. While ermine are predominantly vole specialists, the absence of voles on Haida Gwaii increases the importance of other, less desired dietary items and might make the species more vulnerable to disturbance.

Identified threats and limiting factors include habitat changes brought about by introduced species, small range and low population density, predation by native predators, competition for food, trapping, and forest harvesting. Habitat changes brought about by Sitka black-tailed deer (*Odocoileus hemionus*) specifically have been identified as having a major impact upon Ermine *haidarum* habitat by wholesale removal of understory cover which affects protection from predators, prey availability, and competition for what is already a limited prey selection.

The long-term goal for recovery of the Ermine *haidarum* is to maintain or restore a self-sustaining, wild population of ermine across its historical range. The recovery objectives include: (1) Continue efforts, and investigate new approaches, to determine population size, population density, and distribution; (2) Initiation and evaluation of habitat restoration trials and control of introduced species, particularly in areas which have greater records of Ermine *haidarum*; (3) Development and implementation of a communications plan to engage the public in activities to determine Ermine *haidarum* presence and promote Ermine *haidarum* recovery; and (4) Determination of the necessity and feasibility of population augmentation.

The Ermine, *haidarum* subspecies Recovery Team concluded that recovery of the Ermine *haidarum* would be technically and biologically feasible, but that such a recovery would need to be part of a larger plan to reduce the impact of introduced species to reverse their pressure on the landscape.

Even so, continued sightings of this rare subspecies provide the confidence and inspiration needed to continue work on recovery. An action plan that identifies actions needed to implement the recovery strategy is in preparation and is expected to be completed by 2014.

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BACKGROUND

Species Assessment Information from COSEWIC

Common name: Ermine, *haidarum* subspecies
Scientific name: *Mustela erminea haidarum*
HStatusH: Threatened
Reason for Designation: A distinct subspecies that appears to have greatly declined in density and whose habitat has been severely affected by introduced mammals. A comparison of results of a recent, intensive sampling program with historic trapping records suggests a decline in numbers.
Last Examination and Change: May 2001
Canadian Occurrence: British Columbia
Status History: Designated Special Concern in April 1984. Status re-examined and designated Threatened in May 2001. Last assessment based on an update status report.

Description of the Species

The Ermine, *haidarum* subspecies (*Mustela erminea haidarum*) has been described as "the most morphologically distinct" of all ermine (Reimchen and Byun 2005; Eger 1990; Cowan 1989; Foster 1965). Originally classified as a distinct species (Preble 1868 in Edie 2001), it is now recognized as a subspecies of the Ermine (also known as holarctic short-tailed weasel; Hall 1951 in Edie 2001).

Genetic work has shown Ermine *haidarum* belong to a unique lineage of short-tailed weasel that has been isolated from continental and Beringial lineages since prior to the latest glaciation (Fleming and Cook 2002; Byun 1998). The *haidarum* subspecies is closely related to two subspecies found on Alaskan islands across Dixon Entrance from Haida Gwaii (also known as the Queen Charlotte Islands): *M. e. celenda*, found on Prince of Wales Island and *M. e. seclusa* on Suemez and Heceta Islands (Fleming and Cook 2002). Genetic evidence suggests that these three subspecies are likely glacial relics which persisted through the Wisconsin glaciation, possibly in a coastal refugium (Fleming and Cook 2002; Byun 1998; Heusser 1989).

Ermine or Short-tailed Weasels are members of the family Mustelidae, which also includes American Mink (*Neovison vison*), American Marten (*Martes americana*), Northern River Otter (*Lontra canadensis*), Sea Otter (*Enhydra lutris*), and Wolverine (*Gulo gulo*). Ermine are a small mustelid with males measuring 251 to 315 mm, weighing 67 to 106 g and females measuring 2/3 that weight and length. Ermine, *haidarum* show much less sexual dimorphism than other ermine (Eger 1990; Foster 1965). Ermine have long, slender bodies, a small face, furred tail, short oval ears, and scent glands which produce a strong musky odour. In summer, pelage is reddish-brown above and creamy white below. The tail-tip remains black throughout the year. Ermine on Haida Gwaii moult to a white coat during winter, which may not be advantageous since snow cover at low elevations is infrequent.

Populations and Distribution

Ermine *haidarum* is globally ranked as G5T2, meaning that while the species is globally secure, the *haidarum* subspecies is globally imperilled (NatureServe 2008). Nationally, Ermine *haidarum* is N2 (nationally imperilled) and has been reassessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened. COSEWIC up-listed Ermine *haidarum* status from its earlier status of Special Concern based on small population size and continued decline (COSEWIC 2001). In British Columbia (B.C.) Ermine *haidarum* is ranked S2 and is on the provincial Red list, indicating it is considered a candidate for provincial listing as endangered or threatened (Conservation Data Centre 2003). The B.C. Ministry of Environment has assigned Ermine *haidarum* as priority 2 under Goal 1 of the B.C. Conservation Framework (see http://www.env.gov.bc.ca/conservationframework/ for details).

Ermine *haidarum* is endemic to Haida Gwaii. The Haida Gwaii archipelago is approximately 300 km long and lies some 80 km west of the B.C. mainland (Figure 1). The range extent of Ermine *haidarum* is approximately 9,276 km^2, the total area of the islands from which *haidarum* is known.

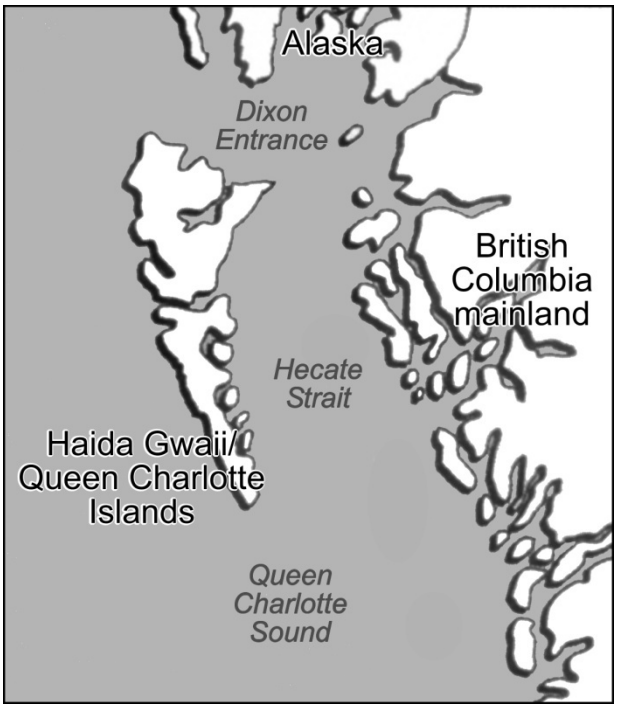

Figure 1. Location of Haida Gwaii.

Ermine *haidarum* are thought to have occurred at naturally low numbers since at least the most recent glaciation (Foster 1965; Cowan 1989). Current abundance of Ermine *haidarum* is unknown, but based on sightings, trapping records, and live-trapping efforts for inventory purposes, it continues to be very rare (Reid et al. 2000).

Detailed historic and present population data to definitively describe population trends are not available and indirect evidence of any population trend is difficult to discern. However, there is

evidence that Ermine *haidarum* numbers are lower today than in historic times based on a substantial but unsuccessful effort to inventory the population during the 1990s. Although ermine are not shy or secretive animals, only two individuals were captured in over 6,700 trap nights from 1992 through 1997. Almost 23 km of snow tracking and 2,692 track-plate station-nights in 1997 and 1998 failed to return any signs of ermine (Reid et al. 2000). More recent surveys have met with a similar lack of success; extensive use of live traps, hair snares, den boxes, and automatic camera stations have only yielded two possible ermine scats (see Table 1).

Table 1. Methods used and efforts expended to detect Ermine *haidarum* presence*.

Activity	Years	Survey effort	Results
Live traps	1992-97	6700+ days/nights	2 Ermine *haidarum*
Track plates	1997-98	2692 days/nights	no Ermine *haidarum* tracks
Snow tracking	1997-98	23 km surveyed	no Ermine *haidarum* tracks
Trap type test	2004-05	100+ days/nights	2 American Marten, 1 rat, numerous mice
Hair snares	2004-05	871 days/nights	11 samples: 8 American Marten, 3 unknown
Den boxes	2004-06	3460 days/nights	3 scats (thought to be 2 Ermine *haidarum* and 1 American Marten, currently being analyzed)
Marten carcasses	2003-06	Carcasses collected from trappers for stomach analysis	57 American Marten carcasses examined. No ermine found in their diet.
Cameras (film)	2004-07	99 photos	American Marten, American Robin (*Turdus migratorius*), mouse, Northern Goshawk (*Accipiter gentilis laingi*) , and Black Bear (*Ursus americanus*)
Cameras (digital)	2005-07	598 photos	American Marten, Black Bear, deer, Northern Goshawk, mouse, Ravens (*Corvus corax*), Raccoons (*Procyon lotor*), Bald Eagle (*Haliaeetus leucocephalus*), Red Squirrel (*Tamiasciurus hudsonicus*), rats (*Rattus spp.,* dogs (*Canis familiaris*), and cat (*Felis catus*)

*Data sources: Burles et al. 2008, Wijdeven, unpublished data, Reid et al. 2000.

Ermine *haidarum* were trapped by settlers throughout the 1900s, but never in great quantities (Buck 1998) and most occurred as by-catch in leg-hold traps set for American Marten. Of the 19 active trappers interviewed in 1997/98 only four reported ever catching an ermine (Buck 1998). Local ermine never fetched high prices on fur markets, as Haida Gwaii winters are too short and mild for high quality furs to develop. With the introduction of body-gripping traps and the move to tree-sets, ermine by-catch has been greatly reduced. All contemporary trappers, however, have observed ermine tracks in the snow. Many reported sightings and some reported bait removed by ermine (Buck 1998).

Interviews with trappers and others further indicate that Ermine *haidarum* numbers appear to have decreased (Buck 1998; Reid et al. 2000; Edie 2001). Edie (2001) concluded that early collection data suggested ermine were more common in the early 1900s.

On a more positive note, Ermine *haidarum* sightings continue to be reported: three in 2003, seven in 2004, two in 2005, six in 2006, eight in 2007, and three in 2008 (B. Wijdeven unpub. data). While the accuracy of all of these sighting could not be confirmed, observers include conservation officers, wildlife technicians, and others with established observation skills. Due to the lack of a formal reporting structure, the number of yearly sightings is likely greater than what has been communicated.

Ermine *haidarum* have been recorded on only four of the major Haida Gwaii islands: Graham, Moresby, Louise, and Burnaby (Figure 2). The majority of records originate from eastern parts of Graham Island and the north-east corner of Moresby Island, though this may be a reflection of human use rather than distribution of Ermine *haidarum* within the archipelago (Burles et al. 2004). Most of the sightings (93%; Reid et al. 2000) have occurred within the wet, hypermaritime coastal western hemlock subzone (CWHwh1) (Meidinger and Pojar 1991).

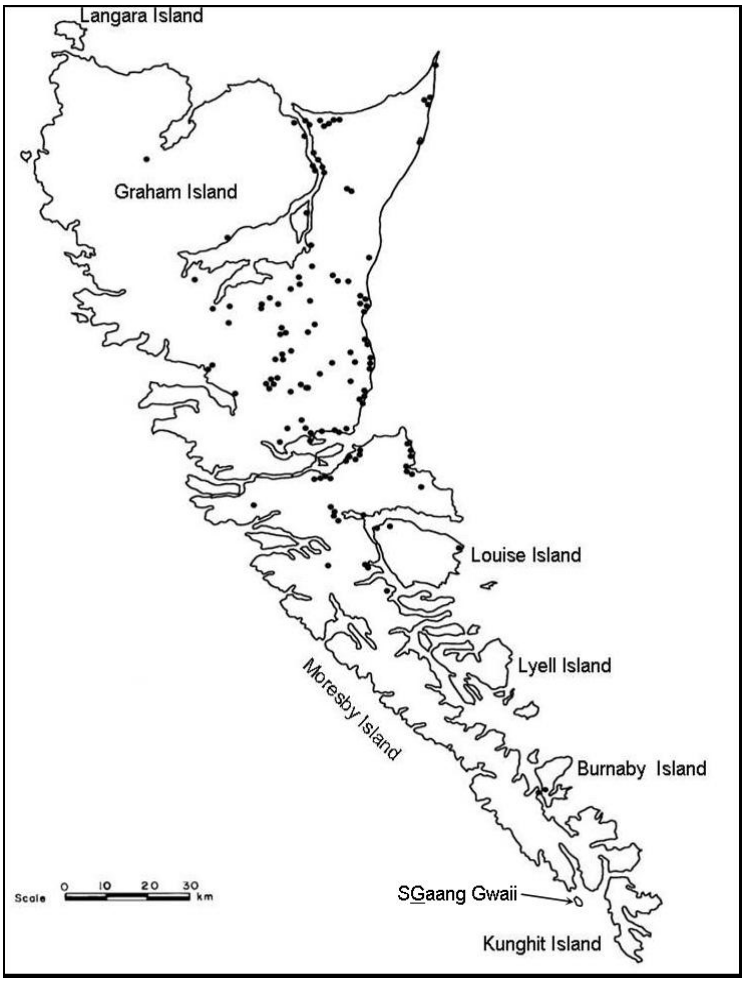

Figure 2. Distribution of historic Ermine *haidarum* records (observed, trapped or tracks) on Haida Gwaii (Source: Burles et al. 2004).

The proximate factors which affect the spatial distribution of Ermine *haidarum* across the multitude of islands which make up Haida Gwaii are undetermined. There is no known estimate

of how wide a body of water ermine are able to swim. However, islands on which Ermine *haidarum* have not been detected are separated by a minimum of 100 meters of water from the nearest inhabited island (Burles et al. 2004).

Ermine *haidarum* distribution on smaller islands is not well documented. A longhouse on SGaang Gwaii island was named for a hole in the ground frequented by an ermine (Guujaaw, pers. comm. 2003), indicating that ermine were present at least historically.

The Haida, who have lived on these islands for some 10,000 years, have been well aware of the presence of ermine. This is reflected in the number of clans which chose the ermine as a crest component. The Ninstints people of the Raven Clan, Stawaas xaad iagaii (Witch People), Naay yu aans xaada gaay (People of the Big House), Na saga xaada gaay (People of the Rotten House) and Qaay llnagaay (People of the Sea-lion town) of the Eagle Clan all incorporated ermine as a crest figure. Ermine, or "Tllga" in Haida, also occasionally found their way into Haida lore as in the SGaang Gwaii story mentioned above (Burles et al. 2004).

In spite of this rich history, there is sparse contemporary knowledge regarding the Haida relationship to Ermine *haidarum* (Collison 2004). It is therefore not known whether the Haida trapped ermine. During the sea otter fur-trading period, ermine pelts were a popular commodity brought to the islands as a trade item (Howay 1932). Though the head regalia of Haida Chiefs include decorations with ornamental ermine, it is impossible to determine without physical analysis whether these pelts were sourced locally or obtained as trade goods (Figure 3).

Figure 3. Ermine Head Regalia. American Museum of Natural History Collection, New York.

Needs of the Ermine, *haidarum* subspecies

Habitat and biological needs

Current habitat associations and features for Ermine *haidarum* are not well documented. Inferences can be made from empirical data gathered elsewhere in North America and from occurrence data collected on Haida Gwaii.
Ermine are usually classified as habitat generalists (King 1989; Fagerstone 1987; King 1983). In Washington's Olympic Peninsula (habitat similar to that on Haida Gwaii), ermine were captured most often in thinned second-growth Douglas-fir (*Pseudotsuga menziesii*) stands with dense understory (Wilson and Carey 1996). Ermine in southwest Yukon were found mostly in open areas, consistent with the habitat of their main vole (*Microtus* spp.) prey (O'Donoghue et al.

2001). In Ontario boreal forests, ermine showed no preferences for stand age or cut vs. uncut areas (Thompson et al. 1989).

At a coarse level, some inferences can be made from the occurrence database gathered by Reid et al. (2000). Virtually all sightings of Ermine *haidarum* (93%, n=121) were from the Coastal Western Hemlock, Submontane Wet Hypermaritime biogeoclimatic subzone (CWHwh1), which comprises most of the eastern side of the Haida Gwaii archipelago below approximately 350 m (Figure 4). Eighty seven percent of sightings occurred within forested landscapes with 69 % from coniferous forests. Eighty eight percent of sightings were below 50 m in elevation, and 77% of sightings were within 100 m of water, usually the ocean, a creek or river (Reid et al. 2000). These results should be interpreted with caution. Most human activity occurs in areas within the CWHwh1 variant. Consequently, occurrence data may reflect human habitat use more than that of Ermine *haidarum*. The paucity of ermine sightings on the west coast of the archipelago may reflect low human use rather than lack of ermine. However, Mowat et al. (2000), working in northwestern Vancouver Island habitats very similar to those on Haida Gwaii, also detected few ermine (*M. e. anguinae*) overall and only in open, shrubby habitats in the relatively drier, eastern sections of their study area. They found no sign of ermine in the wetter and higher western sections.

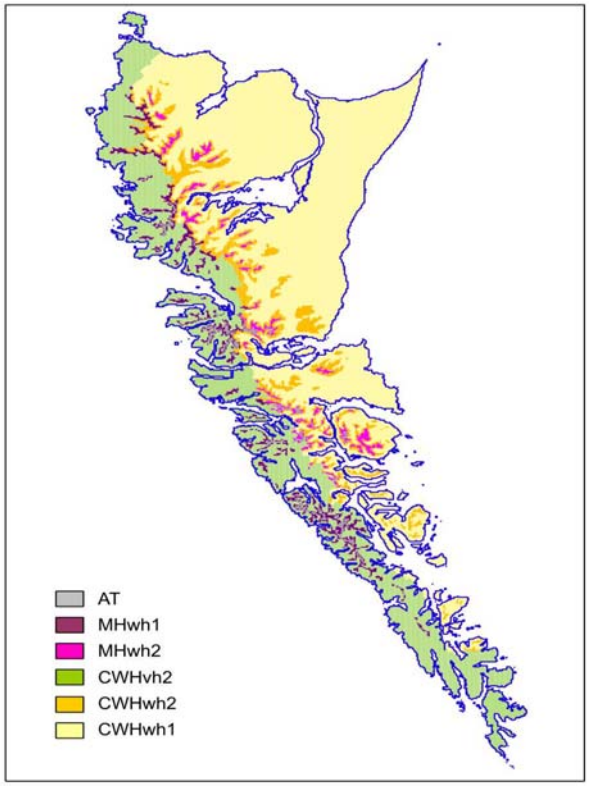

Figure 4. Biogeoclimatic subzone variants on Haida Gwaii.

Despite the biased distribution of observers in Haida Gwaii, Reid et al. (2000) conclude that the clumping of Ermine *haidarum* sightings is likely a fairly accurate reflection of ermine distribution. Even along major roads, sightings tended to be clumped at water courses and river

mouths. Despite an extensive network of logging roads, there were virtually no records of ermine from upland sites, with only 12% of sightings located above 50 m in elevation.

Ermine habitat associations from elsewhere support these coarse level findings. Higher use in riparian areas than upland sites has been documented in the Olympic Peninsula (Wilson and Carey 1996), northern Vancouver Island (Mowat et al. 2000), and B.C.'s Okanagan Valley (Gyug 1994). Using sooted track plates and cameras in coastal western hemlock forests of northwestern Vancouver Island, Mowat et al. (2000) detected ermine in edge habitats associated with forest openings and riparian habitats. They suggest that ermine in CWH forests of northwestern Vancouver Island are "likely to be found in areas where the forest has been removed or opened naturally, in river estuaries for example" (Mowat et al. 2000). Others also note that ermine are more common in early successional stands (Simms 1979a; Simms 1979b) with low densities of regenerating trees (Sullivan et al. 2001).

Coarse woody debris has been identified as beneficial to ermine although this may be more important in areas where their main prey are voles which heavily utilize debris piles (Lisgo et al. 2002; Gyug 1994). On Haida Gwaii, potential Ermine *haidarum* prey appear to be more associated with herbaceous ground cover (Doyle 1990), though specifics remain unknown. Coarse woody debris imparts a degree of protection to ermine and their prey from predation by larger animals (Reid et al. 2000; Samson and Raymond 1998; Doyle 1990). Retaining and recruiting large woody debris in second-growth stands is an important aspect to forest management for ermine and other ground-dwelling wildlife species (Lofroth 1998; Stevens 1997).

The distribution of Ermine *haidarum* is likely best explained by a combination of prey availability and protection from predators (Burles et al. 2004) as well as specific habitat features. Based on local distribution data and ermine studies elsewhere, the following qualitative habitat features may be key to the survival and recovery of Ermine *haidarum* on Haida Gwaii:

- well-structured understory
- extensive ground cover
- large coarse woody debris
- low-elevation, riparian forests

The two species assumed to comprise the majority of Ermine *haidarum* prey, Dusky Shrew (*Sorex monticolus*) and Northwestern Deermouse (also known as Keen's Mouse) (*Peromyscus keeni*) are associated with a diversity of habitats. Shrews may be more prevalent in moist or riparian habitats with dense undergrowth, while avoiding open fields, wet meadows, and grassland (Burles et al. 2004). The Northwestern Deermouse is found in virtually all terrestrial sites, from sea shore to alpine. Their abundance is more related to food supply than physical features of habitat (Hanley and Barnard 1999).

Food

Ermine are predominantly arvicolid rodent (vole) specialists (Fagerstone 1987). There are no voles, however, on Haida Gwaii. Native mammalian prey species are limited to Northwestern Deermouse and Dusky Shrew. Mice and shrews are less preferred by ermine where arvicolid prey are available (Fagerstone 1987; Nams 1981). Stomach, intestine and scat analyses of

Ermine *haidarum*, though limited (n=9), have found remnants of Northwestern Deermouse (*Peromyscus keeni*), a small fish (gunnel or prickle back), Winter Wren (*Troglodytes troglodytes*), Dusky Shrew (*Sorex monticolus*), and a large unidentified bird (probably gull) (D. Nagorsen unpubl. data).

Though primarily vole specialists, ermine readily prey on a wide variety of food. The list of dietary items includes insects, rats, birds, fruit and berries, earthworms, and eggs (King 1983). It appears Ermine *haidarum* will utilise ground- and shrub-nesting bird species and their eggs as prey. However, these birds have been affected by wide-spread removal of ground cover and understory by introduced Sitka Black-tailed Deer (*Odocoileus hemionus*; deCalesta 1994; Vila et al. 2001). This has increased their vulnerability to nest predation not only by ermine but also by other introduced species such as red squirrels, rats, and raccoons with a subsequent reduction in the availability of birds as prey.

Ermine are not aquatic. However, they may feed on marine invertebrates in intertidal zones and scavenge post-spawning salmon, especially those moved inland by Black Bears (Reimchen 2000).

There is some indication Ermine *haidarum* occasionally hunt introduced Roof Rats (*Rattus rattus*) and Red Squirrels (*Tamiasciurus hudsonicus*) as alternative food sources (Reid et al. 2000). However, ermine studies elsewhere suggest that the Ermine *haidarum's* relatively small size may limit its effectiveness as a predator of squirrels and rats (Lisgo 1999).

The abundance of Northwestern Deermouse, and to a lesser extent, Dusky Shrew, fluctuate widely from year to year on Haida Gwaii (Burles et al. 2004). Further, high marten numbers and other introduced mammals are believed to increase competition for an already limited food source (Reid et al. 2000).

Reproduction

Ermine can reproduce in their first year and in most populations females are pregnant annually (Fagerstone 1987). Litter sizes of ermine in North America range from four to thirteen, averaging about six (Hamilton 1933 in Fagerstone 1987). Given the lack of voles and low diversity of alternate prey, mean litter sizes for Ermine *haidarum* may be in the lower part of the range (Edie 2001). The only data on litter size in Ermine *haidarum* comes from a necropsy performed on a cat-killed pregnant female. Three foetuses were present in the uterus, but it was not possible to determine foetus sex or records of previous implantation (H. Schwantje unpubl. data).

Ermine are polygamous – males breed with several females and the home range of males can contain several exclusive female home ranges (Erlinge 1977). Like most mustelids, ermine exhibit delayed implantation (King 1983). Mating may occur in the spring shortly after the young are born but implantation is delayed for nine to ten months (Fagerstone 1987). Suspected low population densities may provide limited mating opportunities, leading to demographic effects that can negatively affect population viability (Shaffer 1981). Whether reproduction is a factor limiting Ermine *haidarum* recovery remains uncertain. Ermine rely on high reproductive output to maintain population size since turnover of populations is generally high (King 1983).

Annual survival rate elsewhere is estimated at 40% and average life expectancy is about 1 to 1.5 years (Fagerstone 1987).

Reproduction in weasels is closely tied to prey availability. Least weasels **(***Mustela nivalis*) require minimum spring prey densities before breeding will take place (Erlinge 1974) and ermine reproduction is depressed with increased competition for food resources (Erlinge 1983). When food is limited, implantation may not proceed even if breeding occurs.

Ecological role

Ermine are a mid-level predator. Their abundance is closely tied to both their prey species and potential predators (Fagerstone 1987). Endemic terrestrial mammalian predators on Haida Gwaii are limited to Ermine, *haidarum*, American Marten, and Black Bear (Cowan 1989). Elsewhere, ermine populations play an important role in controlling prey populations (Korpimäki et al. 1991; Fagerstone 1987). On Haida Gwaii, Ermine *haidarum* may historically have contributed to regulation of Northwestern Deermouse populations.

The apparent association of ermine with low elevation and riparian areas in Haida Gwaii (Reid et al. 2000) suggests that there may be an association between Ermine *haidarum* and aquatic habitats. Ermine may partially fill the ecological niche of a water-land interface predator left vacant by the absence of American Mink in Haida Gwaii (Eagle and Whiteman 1987).

Threats and Limiting Factors

Threat classification

Table 2. Classification of threats and limiting factors to Ermine *haidarum*.

Threat	Threat level
Habitat changes brought about by introduced species	High
Small range and low abundance	High
Predation by native predators	Medium
Competition for food	Medium
Trapping	Medium
Forest harvesting	Low

Description of the threats and limiting factors

Habitat changes brought about by introduced species
Extended isolation from other subspecies and lineages has allowed Ermine *haidarum* to become a unique subspecies. This isolation may also have contributed to it having become at risk. Island taxa typically have higher risk of extinction (Purvis et al. 2000; MacArthur and Wilson 1967) and introduced species can increase this risk (Diamond 1989).

Exotic species are often cited as threats to species at risk (Lawler et al. 2002). Non-native mammal species introduced to Haida Gwaii over the past 120 years (see Table 3) represent a significant ecological threat to the endemic island taxa (Engelstoft and Bland 2002; Golumbia 2000). For Ermine *haidarum*, introduced species likely exacerbate other threats, particularly competition for food and increased predation.

Table 3. Mammal species introduced to Haida Gwaii and possible effects on Ermine *haidarum*.

Species	Introduced	Possible effects on Haida ermine
Sitka Black-tailed Deer (*Odocoileus hemionus)*	1880 – 1925[1]	• Habitat alteration – removal of understory and ground cover leading to increased predation risk and lower habitat quality for prey. • As carrion, possible food source to ermine, but more available to marten.
Wapiti (*Cervus elaphus*)	1929[2]	• Impacts may be similar to deer, but much less pronounced because of a limited distribution.
Common Muskrat (*Ondatra zibethicus*)	unknown	• Very limited food source as carrion • Likely insignificant impact
Red Squirrel (*Tamiasciurus hudsonicus*)	1947[3]	• Possible prey • Likely major food source for marten leading to increased competition and predation risk from increased marten populations.
American Beaver (*Castor canadensis*)	1947[3]	• Limited food source as carrion • Habitat alteration
House Mouse (*Mus musculus*)	unknown	• Prey source
Roof (Black) Rat (*Rattus rattus*)	late 1700s ?[1]	• Prey source
Brown (Norway) Rat (*Rattus norvegicus*)	more recent than late 1700s[1]	• Prey source
Raccoon (*Procyon lotor*)	1940s[1]	• Competitor for food • Likely preys opportunistically on ermine
Domestic Cat (*Felis catus*)	unknown	• Competitor for food • Preys opportunistically on ermine
Domestic Dog (*Canis familiaris*)	unknown	• Could prey opportunistically on ermine

[1] after Golumbia (2000); [2] after Engelstoft and Bland (2002); [3] after Cowan (1989).

Sitka Black-tailed Deer, introduced between 1880 and 1925, have had some of the greatest impacts on forest ecosystems in Haida Gwaii and have affected most native species directly or indirectly. The removal of understory cover by Sitka Black-tailed Deer in Haida Gwaii (Daufresne and Martin 1997) may have particular consequences for Ermine *haidarum* and its prey. In coastal cedar hemlock forests ermine are typically more common in sites with substantial understory (Mowat et al. 2000; Wilson and Carey 1996). Deer carrion may provide an additional food source to ermine, but can also benefit competing species such as American Marten (Nagorsen 2006; Burles et al. 2004).

Introduced species such as Red Squirrel, Roof Rat, Brown Rat, and Common Muskrat provide additional food sources for Ermine *haidarum*; Reid et al. (2000) recorded observations of ermine chasing rats and scavenging a dead muskrat. These species, however, tend to be on the upper end

of the scale of accessible food sizes (Burles et al. 2004; Lisgo 1999) as Ermine *haidarum* are significantly smaller than other ermine subspecies (Byun 1998; Eger 1990; Foster 1965). Introduced species have more notably facilitated an increase in American Marten populations, with probable resulting negative effects on ermine populations through increased competition (Nagorsen 2006; Reid et al. 2000).

Ermine *haidarum* may be naturally limited by prey availability and several researchers have argued that this factor, rather than predation, is what drives ermine population levels (summarised in Nagorsen 2006). The presence of introduced species competing with ermine for food thus may be an important threat.

Introduced predators also pose a threat to Ermine *haidarum*. Domestic Cats are known to depredate the subspecies (H. Schwantje unpubl. data; Reid et al. 2000) and anecdotal evidence suggests that Ermine *haidarum* were less frequently sighted at Masset Inlet (Graham Island) after Raccoons were introduced to the archipelago (J. Gifford-Brown pers. comm. 2006), though this may be caused by increased competition for limited prey rather than by predation.

Small range and low abundance
Small populations are inherently more at risk of extinction than large ones due to their vulnerability to stochastic events and other factors such as inbreeding. Ermine *haidarum* are therefore at increased risk of extinction as a result of their geographically limited range and low abundance (Purvis et al. 2000; Simberloff 1998).

Predation by native predators
Predation by native predators may also affect ermine numbers. Craighead and Craighead (1956 in Powell 1973) found that raptors predated approximately 70% of the post-reproduction spring ermine population in southern Michigan. This number is probably not as high in Haida Gwaii where forest birds of prey such as northern goshawk (*Accipiter gentilis laingi*), sharp-shinned hawk (*Accipiter striatus*), and northern saw-whet owl (*Aegolius acadicus brooksi*) are not as numerous (F. Doyle pers. comm. 2006).

Reduced cover as a result of increased deer browse likely increases risk of predation by native and non-native predators. Ermine generally prefer habitats with dense understory and ground cover (Mowat et al. 2000; Wilson and Carey 1996; Fagerstone 1987; Simms 1979a). Understory provides both habitat structure for prey species as well as visual protection and escape cover for ermine from predators, especially avian ones.

American Marten have been implicated as a factor in the presumed decline of ermine on Haida Gwaii. While fur returns specific to Haida Gwaii are not available prior to 1985 (G. Schultze pers. comm. 2003), registered trappers generally agree that marten populations have increased five- to ten-fold since the 1940s (Edie 2001; Reid et al. 2000). Due to low fur market values, few trappers are currently actively trapping marten, so local populations remain high.

Marten will prey on ermine (Jędrzejewski et al. 1995; Thompson and Colgan 1990; Weckworth and Hawley 1962), however this predation is likely opportunistic, with ermine representing a very minor prey item. Nagorsen (2006) reviewed 26 diet studies on American Marten and found

that ermine remains were reported in only four studies, with a frequency of occurrence from 0.5% to 1.6% (Nagorsen 2006). Nagorsen et al. (1991) reported no ermine remains in 97 Haida Gwaii marten examined for diet analysis, and Nagorsen (2006) compared the contents of 55 marten stomachs with a re-examination of those from the 1991 study and found no evidence of ermine. Weckwerth and Hawley (1962) found no more than 0.1% of 1,758 marten scats in Montana to contain ermine remains. Edie (2001) argues that because ermine numbers are very low, even a very low level of marten predation could have a significant impact on ermine populations. However, given the current state of knowledge (Nagorsen 2006), marten predation of ermine should be considered at most a moderate threat.

Predation on Ermine *haidarum* during winter months on Haida Gwaii may be higher than in other populations. Snow at lower elevations across the archipelago is rare and ephemeral but Ermine *haidarum* still turn white, likely making them more visible to predators. Decreased vegetation cover may exacerbate this threat.

Competition for food
American Marten are likely competitors for food. Higher marten numbers on Haida Gwaii and significant diet overlap between marten and ermine likely result in less food being available to Ermine *haidarum*. Whether this is due to a reduction in prey numbers or to competitive exclusion is currently unknown.

Trapping
Trapping has been closed to ermine on Haida Gwaii since 1985 but Ermine *haidarum* are still occasionally captured in traps set for marten. Since it is likely not all incidents are reported, rates of annual bycatch rate are unknown. Based on conversations with trappers, rates were thought to be minimal (G. Husband and J. LaRose pers. comm. 2004). However, the introduction in 2007 of certified marten traps which comply with the Agreement on International Humane Trapping Standards coincided with the by-catch kills of five Ermine *haidarum*. While it is too early to determine whether the new traps are responsible for this sudden increase in reported Ermine *haidarum* by-catch, trapping continues to present a threat.

Forest harvesting
Approximately 25% of CWHwh1 forests on Haida Gwaii have been logged or are included in existing logging plans (A. Cober pers. comm. 2003). However, given the broad habitat associations of ermine and the possibility of increased abundance of mice, shrews, and songbirds in early successional forest stands, logging is not thought to be a major threat to Ermine *haidarum*.

Forest harvesting may indirectly negatively affect Ermine *haidarum*. Deer browse limits regeneration of forest stands and reduces ground cover. If deer browse increases in recent cutblocks, this may leave ermine at greater predation risk due to loss of protective cover.

Actions Already Completed or Underway

The following recovery and management actions for Ermine haidarum have occurred or have been initiated to date:

- Habitat receives protection in Gwaii Haanas National Park Reserve, Naikoon Provincial Park, Vladimir Krajina Ecological Reserve as well as in 11 new Conservancies and other existing protected areas which, in total, provide habitat protection on 50% of the land base of Haida Gwaii.
- Existing and new detection methodologies continue to be field tested in hopes that populations can be inventoried and habitat associations established.
- Site surveys have been, and will continue to be initiated whenever an Ermine *haidarum* sighting occurs.
- Ermine *haidarum* are currently protected from trapping on Haida Gwaii.

Knowledge Gaps

Effective recovery of the Ermine *haidarum* will be hampered by a substantial lack of information regarding the species. Population dynamics, habitat requirements, prey selection, and threats are inferred rather than observed. Substantially more information is required to enable effective recovery efforts.

RECOVERY

Recovery Feasibility

The recovery team determined that Ermine *haidarum* were biologically and technically feasible to recover in B.C. based on criteria outlined Section 4.0 of Environment Canada's DRAFT policy on the feasibility of recovery (Environment Canada 2005).

1. Are individuals capable of reproduction currently available to improve the population growth rate or population abundance? YES.

While current abundance of Ermine *haidarum* is thought to be low, sporadic though persistent sightings indicate that the ermine population persists. A necropsy performed on a female ermine, killed by a cat in 2003, determined that the ermine was pregnant, providing evidence that individuals capable of reproduction are available.

2. Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration? YES.

It is thought that the primary reason for decline of the Ermine *haidarum* population is not habitat loss, but habitat alteration and interactions with introduced species. Sufficient habitat is or can therefore be made available to support the species.

3. Can significant threats to the species or its habitat be avoided or mitigated through recovery actions? YES.

The habitat alterations brought about by introduced species are thought to be largely reversible.

4. Do the necessary recovery techniques exist and are they demonstrated to be effective? YES. Direct or cumulative effects of invasive non-native species are the most important potential threat. Techniques exist to control or eliminate non-native mammals and to restore habitat degraded by browsing.

Recovery Goal

The long-term recovery goal is to maintain or restore a self-sustaining, wild population of Ermine *haidarum* across its historical range.

"Self-sustaining" is defined as being of sufficient size and distribution such that continuing threats do not limit overall population viability, in particular susceptibility to stochastic events.

Rationale for the Recovery Goal

The recovery goal is broad at this time because the recovery team lacks information on historic and current population sizes of Ermine *haidarum*. The recovery team has outlined a number of activities and associated timelines which will give the team the opportunity to learn more about population size and dynamics. Once more information has been obtained, the recovery goal and objectives will be refined and updated.

Recovery Objectives

The recovery goal will be achieved by focusing on the following objectives:

1. Continue efforts, and investigate new approaches, to determine population size, population density, and distribution.

2. Initiate and evaluate habitat restoration trials and control of introduced species, particularly in areas which have greater records of Ermine *haidarum*.

3. Develop and implement a communications plan to engage the public in activities to determine Ermine *haidarum* presence and promote Ermine *haidarum* recovery.

4. Determine necessity and feasibility of population augmentation.

Approaches Recommended to Meet Recovery Objectives

Recovery planning table

Table 4. Broad strategies to address threats and limiting factors facing Ermine *haidarum* recovery.

Priority	Broad Strategy	Recommended approaches to meet recovery objectives	Deliverable	Threat or concern addressed	Timeline (initiation-completion)
Objective 1: Continue efforts, and investigate new approaches, to determine population size, population density, and distribution.					
High	Research	Determine population size, density, and distribution	Field test existing and new detection methodologies.	Knowledge gaps; Small range and low abundance	2001-2012
High	Research	Determine population size, density, and distribution	Develop population, density, and distribution models.	Knowledge gaps; Small range and low abundance	2009-2014
Objective 2: Initiate and evaluate habitat restoration trials and control of introduced species, particularly in areas which have greater records of Ermine *haidarum*.					
High	Research; Stewardship	Assess impact of habitat restoration and control of introduced species on landscape	Create pilot projects in controlled locations (such as exclosures) to allow habitat to be restored and monitored.	Knowledge gaps: habitat changes brought about by introduced species; Predation by native predators; Competition for food	2009-2014
Objective 3: Develop and implement a communications plan to engage the public in activities to determine Ermine *haidarum* presence and promote Ermine *haidarum* recovery.					
Medium	Stewardship; Outreach	Broaden general interest and sighting reports by involving public.	Engage public and trappers through outreach and education strategies.	All	2009-2014
Objective 4: Determine necessity and feasibility of population augmentation.					
Medium	Research	Determine necessity of augmenting ermine population.	Develop population, density and distribution models.	Small range and low abundance	2009-2014
Medium	Research	Determine feasibility of augmenting ermine population.	More accurately determine genetic linkages with Alaska ermine. Determine availability/suitability of transplant stock.	Small range and low abundance	2009-2014

Performance Measures

Performance measures to evaluate success include the following:

Objective 1: Successful approach to determine population size, population density, and distribution estimates has been determined or all possible detection methods have been exhausted by 2014.

Objective 2: Habitat restoration trials and control of introduced species have been initiated and evaluated by 2014.

Objective 3: Communications plan has been developed and is being implemented by 2010.

Objective 4: Necessity and feasibility of population augmentation has been determined by 2014.

Critical Habitat

No critical habitat as defined under the federal *Species at Risk Act* (S.2) is proposed for identification at this time. In order for critical habitat to be defined, information is needed regarding the species' life history, population ecology, distribution, and habitat requirements. Given our current state of knowledge regarding the species, identification of critical habitat is not feasible.

Recommended schedule of studies to identify critical habitat

Identification of critical habitat for the Ermine *haidarum* is currently not possible due to the difficulty of locating individuals. Until a successful method has been found to inventory populations and establish habitat associations, there is little point in speculating about further steps to define critical habitat. Possible inventory methodologies such a large scale motion detection camera studies or scat sniffing dog research are currently being investigated; these efforts will continue until 2014.

Existing and Recommended Approaches to Habitat Protection

Approximately 50% of the landbase of Haida Gwaii currently enjoys some form of habitat protection. Gwaii Haanas National Park Reserve and Haida Heritage Site is protected under the Canada National Parks Act while Naikoon Provincial Park, Vladimir Krajina Ecological Reserve and eleven new Conservancies are protected through provincial designations. Since ermine *haidarum* are classified as habitat generalists substantial portions of these areas should be considered ermine habitat. On the remaining landbase, the Haida Gwaii Strategic Land Use Agreement (SLUA), currently being finalized, commits to implement Ecosystem Based Management (EBM) logging practices and protect riparian zones, Haida cultural areas and wildlife areas set aside for murrelets, goshawks and saw-whet owls, providing further protected habitat suitable for Ermine *haidarum*.

Effects on Other Species

Competition, predation, and habitat alteration by invasive species affects a suite of native species on Haida Gwaii. Habitat alteration by deer specifically has drastically changed the landscape, impacting plants, invertebrates, and mammals (Allombert et al. 2005; Stockton et al. 2000; Vila et al. 2001). Reduction of the impact of deer will not only counter this threat to ermine but will benefit other species at risk on Haida Gwaii that are impacted by the changes to their habitat.

Socioeconomic Considerations

Since Ermine *haidarum* are habitat generalists, are thought to be widely distributed and not significantly impacted by logging activities, the economic impact of ermine recovery is likely to be small or non-existent. Reduction of impacts of introduced species on Ermine *haidarum*, specifically of Sitka Black-tailed Deer could create a socioeconomic impact. Since the introduction to the islands, deer hunting has become a much appreciated food gathering activity. The significant reductions of deer populations needed to reverse habitat impact will need to be weighed against these considerations. This impact reduction, however, would not be specific to Ermine *haidarum* recovery but would be part of a multi-species recovery effort. Benefits associated with Ermine *haidarum* recovery include the importance to Haida culture, a continuing ecological role as part of a limited mammalian presence on Haida Gwaii, and maintenance of what has been called the most unique subspecies of *Mustela erminea* (Eger 1990; Cowan 1989; Foster 1965).

Recommended Approach for Recovery Implementation

While determining Ermine *haidarum* population size and dynamics is of primary importance, confronting the habitat changes brought on by introduced species, particularly Sitka Black-tailed Deer will be key in restoring habitat to conditions more favorable to locally threatened species, including Emine *haidarum.* A multispecies approach would be the favoured approach which would include implementation of an introduced species control program, as well as stewardship initiatives and educational programs.

Statement on Action Plans

Work on an action plan has been initiated. A draft is expected to be completed (accepted by the team and submitted for review) by 2014.

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Personal Communications

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