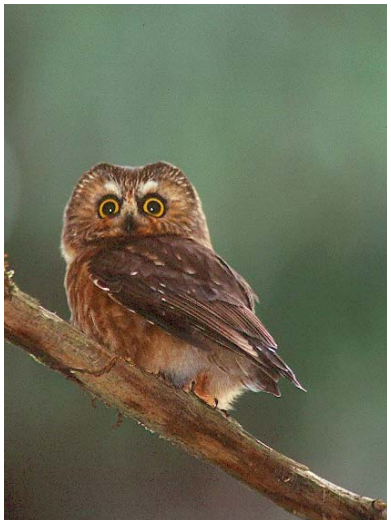
COSEWIC
Assessment and Status Report

on the

Northern Saw-whet Owl *brooksi* subspecies
Aegolius acadicus brooksi

in Canada



THREATENED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE IN
CANADA

COSEPAC
COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Production note:

COSEWIC would like to acknowledge Carmen I. Holschuh for writing the status report on the Northern Saw-whet Owl *brooksi* subspecies *Aegolius acadicus brooksi* in Canada, prepared under contract with Environment Canada, overseen and edited by Richard Cannings, Co-chair, COSEWIC Birds Species Specialist Subcommittee.

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Northern Saw-whet Owl *brooksi* subspecies — Photo by Jared Hobbs – used with permission.

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COSEWIC
Assessment Summary

Assessment Summary – April 2006

Common name
Northern Saw-whet Owl *brooksi* subspecies

Scientific name
Aegolius acadicus brooksi

Status
Threatened

Reason for designation
This is a distinct subspecies endemic to Canada, with a small world population (ca. 1900 adults) restricted to the Queen Charlotte Islands. It is a forest specialist, preferring older forests with abundant nesting snags and an open understory in a landscape where such resources are continually becoming scarcer due to forest harvest.

Occurrence
British Columbia

Status history
Designated Threatened in April 2006. Assessment based on a new status report.

COSEWIC
Executive Summary

Northern Saw-whet Owl
brooksi subspecies
Aegolius acadicus brooksi

Species information

The *brooksi* subspecies of Northern Saw-whet Owl (*Aegolius acadicus*), sometimes called the Haida Gwaii Saw-whet Owl, is endemic to the Haida Gwaii/Queen Charlotte Islands archipelago off the northwest coast of British Columbia. Like its continental counterpart (*A. a. acadicus*), this is a small owl about 20 cm in length. Overall, plumage is darker than in the nominate counterpart, having an overall buffy appearance with a more mottled look on the chest. Northern Saw-whet Owls have yellow eyes, a prominent round facial disk and no ear tufts.

Distribution

Although the continental subspecies of Northern Saw-whet Owl is found across much of the southern half of Canada and much of the USA, the *brooksi* subspecies is endemic to Haida Gwaii/Queen Charlotte Islands.

Habitat

During the breeding season, these owls are found primarily in mature and old forest habitats at lower elevations (below 300 m), placing them in the Coastal Western Hemlock Biogeoclimatic Zone. Saw-whet owls are secondary cavity nesters, and appropriately sized cavities (>7.5 cm diameter opening) are a limiting factor across the landscape. They occur most commonly in old forest, and more in Western Hemlock and Sitka Spruce stands than in those of other tree species. Due to forest harvest, the amount of suitable habitat is declining, with an almost 13% decline in the past 10 years. Outside the breeding season, the habitat requirements are largely unknown, but evidence suggests that some move towards coastal areas to capitalize on a rich and accessible food source, intertidal isopods and amphipods. About 2,250 km^2 of the islands (not all suitable habitat) are protected in the form of Gwaii Haanas National Park Reserve, Naikoon Provincial Park and 12 Wildlife Habitat Areas.

Biology

Northern Saw-whet Owls live between five and seven years, and start breeding during their first spring (one year old). The eggs are incubated and the altricial young

brooded solely by the female, while the male hunts and provides food for the female and nestlings. Although much asynchrony exists between individuals in the breeding season, courtship activities tend to start in early March, and young begin fledging in June and July. Nests are in cavities excavated mostly by woodpeckers. Although there are some potential predators on Northern Saw-whet Owls on Haida Gwaii, most of these are diurnal and likely do not have a major impact on owl numbers. The *brooksi* subspecies differs from the *acadicus* subspecies by being non-migratory; it remains on Haida Gwaii year-round.

Population sizes and trends

Population sizes and trends have been calculated using estimates of density in disturbed and contiguous habitats and extrapolating these densities to the amount of appropriate habitat available across the landscape. Using these estimates, there are approximately 926 $\pm$ 290 territories (breeding pairs) on the Queen Charlotte Islands and a projected decline for the next 15 years (three generations) of about 9%.

Limiting factors and threats

This subspecies is endemic to an isolated archipelago, where its populations appear to be declining in areas affected by timber harvest. Having this limited range, there is no external source population to temper a decline in the population due to decreasing habitat. The introduction of Sitka Black-tailed Deer has led to a decline in understory vegetation by browsing. This change in the forest habitat may affect songbird, rodent and invertebrate populations, all important food sources to Northern Saw-whet Owls.

Special significance of the species

This is a distinctive subspecies endemic to Canada.

Existing protection

Federally, Northern Saw-whet Owls in Gwaii Haanas National Park Reserve are protected from hunting, trafficking or possession under the Canada National Parks Act. Provincially, the *brooksi* subspecies is Blue-listed. Internationally, these owls are listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2006)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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2006

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SPECIES INFORMATION

Name and classification

The Northern Saw-whet Owl (*Aegolius acadicus*) belongs to the family Strigidae, the 'typical owls'. There are four species in the genus Aegolius; two of these are found only in neotropical forests, while the Boreal Owl (*Aegolius funereus*) is found in boreal forests throughout the Holarctic. There are two subspecies of *Aegolius acadicus*; the nominate subspecies found in continental North America and closely adjacent islands and the focal *brooksi* subspecies found only on Haida Gwaii/Queen Charlotte Islands (Cannings 1998). Common names for this endemic subspecies include: Queen Charlotte Owl (Bent 1961, Johnsgard 1988), Haida Gwaii Saw-whet Owl and Queen Charlotte Saw-whet Owl. The French name for Northern Saw-whet Owl is Petite Nyctale.

Figure 1. Left: The *brooksi* subspecies of Northern Saw-whet Owl. (Photo by Jared Hobbs – used with permission). Right: adult Northern Saw-whet Owl specimens, *acadicus* subspecies on left, and *brooksi* subspecies on right. (Photo by Laurie Savard – used with permission. Specimens from Royal BC Museum).

Morphological description

The Northern Saw-whet Owl *brooksi* subspecies is a small owl about 20 cm in length (Fig. 1). Reverse sexual dimorphism is strong; females are up to 20% larger than males. These owls have a relatively large head with a prominent round facial disk and no ear tufts. Their eyes are yellow to orange. Upper parts are a buffy brown colour, with buffy and white streaking on the crown that converges in a V-like pattern between the eyes. White 'eyebrows' are prominent in some individuals. Underparts are buffy and broadly striped with dark reddish-brown. The rounded wings are also buffy reddish brown colour, with lighter spotting on the scapulars.

Overall the *brooksi* subspecies has a darker plumage than the nominate subspecies (Fig. 1), which characteristically has more white where *A. a. brooksi* has a

buffy appearance, particularly on the underparts (Fleming 1916, Bent 1961, Guiguet 1978, Johnsgard 1988, Cannings 1993, Sealy 1998, Koenig *et al*. 1999).

Genetic description

Haida Gwaii hosts a diverse suite of endemic species and subspecies. Whether or not this radiation of new taxa is a result of Haida Gwaii being a glacial refugium has been of great debate (e.g. Scudder and Gessler 1989). More recent evidence suggests a glacial refugium on the continental shelf that is now below Hecate Strait (e.g. Byun *et al.*1997). In the case of the Northern Saw-whet Owl, genetic analysis of highly conserved regions of DNA (cytochrome b gene on mitochondrial DNA) revealed very little genetic differentiation between the subspecies, suggesting that the Haida Gwaii Saw-whet Owls diverged from a population of owls that migrated post-glacially from the mainland, likely from refugia to the south of the Cordilleran ice sheet (Byun 1998). To better reflect the shorter-term changes in the genetic structure of the Saw-whet Owls, comparative microsatellite DNA analysis between the two subspecies is ongoing (Kevin Winker, pers. comm.).

DISTRIBUTION

Global range

The distribution of the nominate subspecies of Northern Saw-whet Owl is widespread throughout North America (Figure 2), including the islands on the Alaska panhandle just north of the Queen Charlotte Islands (Sealy 1997). Individuals of the nominate subspecies that breed at more northern latitudes tend to move south in winter, sometimes to areas south of the breeding range. The range of the *brooksi* subspecies, however, is limited to Haida Gwaii/Queen Charlotte Islands of British Columbia.

Canadian range

The *brooksi* subspecies of the Northern Saw-whet Owl is endemic to Haida Gwaii and is non-migratory (Figure 3).

A. a. brooksi have never been observed off Haida Gwaii, in the range of *A. a. acadicus*, despite numerous owl banding projects throughout British Columbia (e.g. Rocky Point and Mackenzie Bird Observatories). Although individuals of the nominate subspecies, *A. a. acadicus*, have been recorded on Haida Gwaii during post-breeding season movements, they are not thought to breed in the area (Sealy 1997). *A. a. brooksi* has been recorded on both of the large islands of Haida Gwaii (Graham and Moresby; Gill and Cannings 1997, Sealy 1998) as well as on the smaller islands throughout the archipelago, at least in the breeding season (Holschuh, in prep.; Sealy 1998 and references therein). Hence the total Extent of Occurrence is about 10,000 km^2. The extent of suitable forest habitats on the islands is about 5,488 km^2, the best estimate for the Area of Occupancy (see Habitat).

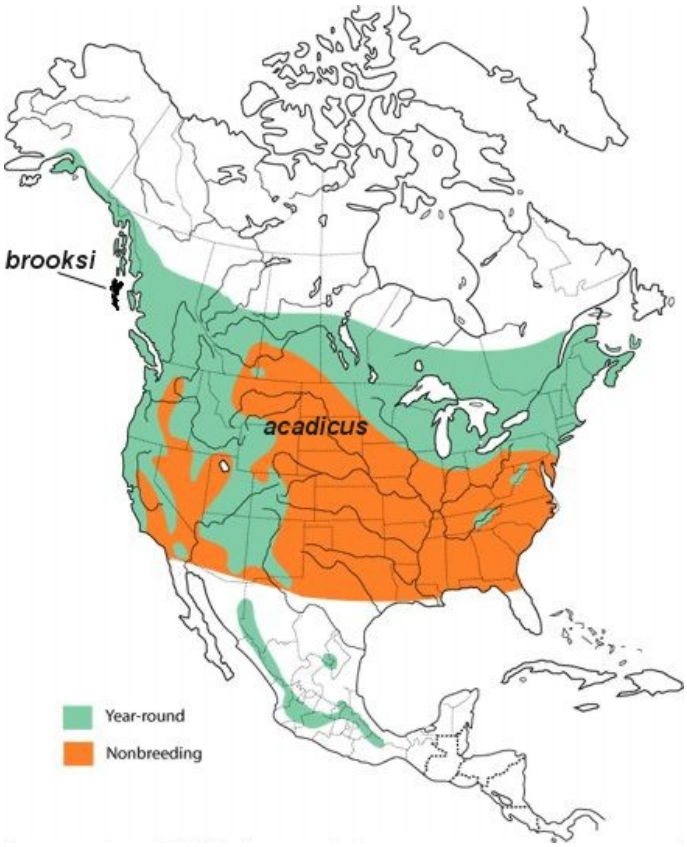

Figure 2. Map showing the breeding range of two subspecies of Northern Saw-whet Owl. *A. a. acadicus* is found on continental North America and *A. a. brooksi* (black) is found only on Haida Gwaii/Queen Charlotte Islands, off north-western British Columbia (adapted from Cannings 1993).

Figure 3. Distribution of *Aegolius acadicus brooksi* (Queen Charlotte Islands in black).

HABITAT

Habitat requirements

Breeding habitat

In a systematic survey of habitat use by Haida Gwaii Saw-whet Owls during the breeding season, Gill and Cannings (1997) found that owls were detected more often at points closer to riparian areas and in habitats containing greater amounts of mature and old forest. They found that elevation, distance to saltwater and distance to a change in habitat type did not influence the likelihood of detecting an owl. As well, the condition of male owls in the breeding season appears to be appreciably lower when territories contain less mature and old forest. When the mature and old forest content within 500 m of a territory core falls below 60-70%, significant declines in calling rate, an indirect measure of condition, of the territory occupants have been noted (Holschuh 2004b, Holschuh and Otter submitted). Active owl sites were all found below 300 m elevation despite searches that included higher elevations. Active sites have been mostly in the CWHwh1 (submontane wet hypermaritime coastal western hemlock variant) and CWHvh2 (central very wet hypermaritime coastal western hemlock variant) biogeoclimatic zones. Although some owl sites have been located in the higher elevation CWHwh2 (montane wet hypermaritime coastal western hemlock variant), none have been detected in the mountain hemlock or alpine tundra biogeoclimatic zones on Haida Gwaii. Although survey logistics largely inhibit placing call playback surveys in these high-elevation habitats, calling owls at higher elevations would have been in earshot during numerous surveys conducted at lower elevations.

In habitat surveys of 25 active sites in 2002 and 2003, Holschuh (2004) found most sites to have structurally complex forest, namely mature or old forest types with relatively abundant snags. The mean height of veteran trees was 37.4 m (± 8.74 m S.D.), while the main tree canopy was 28.2 ± 7.24 m and the subcanopy 17.5 ± 5.53 m in height. The main tree canopy generally had the greatest density (25-50% cover), while other tree layers generally had less than 25% cover. The most common tree species of the occupied sites were Western Hemlock (*Tsuga heterophylla*), Sitka Spruce (*Picea sitchensis*), Western Redcedar (*Thuja plicata*), and to a lesser degree Mountain Hemlock (*Tsuga mertensiana*), Yellow Cedar (*Chamaecyparis nootkatensis*) and Shore (Lodgepole) Pine (*Pinus contorta*).

Overall, breeding habitat of the Saw-whet Owls on Haida Gwaii includes mature and old forest; these forests characteristically are structurally complex (Gill and Cannings 1997, Holschuh 2004). The upper canopy is generally composed of older trees that have persisted through disturbances in combination with a younger, regenerating layer of shade-tolerant trees at various levels of establishment (Meidinger 1999). It is these structurally complex old forests that tend to be richest in appropriate nesting cavities, which appear to be a limiting factor across the landscape (Doyle unpubl. data).

Feeding habitat requirements are likely similar to those of the nominate subspecies, where owls forage in openings or along forest edges (Cannings 1993). For instance, an unmated male that was radio-tagged in late April was found along forest edge, >1 km from the territory core, and was presumably foraging along the riparian and road corridors (Holschuh and Otter, unpubl. data). Mature and old forest habitats also provide a more open interior ideal for foraging, while young, dense forests are generally avoided (Cannings 1993).

I calculated available habitat on Haida Gwaii through data from the Haida Gwaii/Queen Charlotte Islands Land Use Plan Background Report (LUP 2003). Assuming few if any owls would be in the Mountain Hemlock or Alpine Tundra zones, areas reported as containing old forests in the Western Hemlock Zone were added together. Using this technique, there were 2927 km^2 in landscapes with ongoing forest harvest and 2561 km^2 in landscapes with no forest harvest at present.

Non-breeding habitat

Habitat use by Northern Saw-whet Owls outside the breeding season has not been systematically documented on Haida Gwaii. Nevertheless, data on the diet of birds collected primarily during the fall (road collisions), suggest high levels of marine invertebrate consumption (Hobson and Sealy 1991, Sealy 1999), suggesting that the owls may be shifting to habitats closer to coastal areas during the fall and winter (S. Sealy, pers. comm.).

Habitat trends

The amount of contiguous, suitable old forest habitat is declining on Haida Gwaii largely due to forest harvest. Many of the most productive watersheds on interior Graham Island and northern Moresby Island have been logged extensively, and the regenerating forest currently lacks the structural attributes necessary for high-quality habitat (snags, open flyways for foraging, etc.). Although forestry activities are less focused on eastern Graham Island, much of the area has extensive boggy areas, also unsuitable as habitat during the breeding season (see Figure 4). Currently, approximately 5,500 km^2 of the total 10,000 km^2 area of Haida Gwaii is potentially suitable habitat, down from approximately 6,300 km^2 in 1993, an almost 13% decrease over the last 10 years. This information is derived from a BC Forest Service Forest Inventory (1993) and the Haida Gwaii/Queen Charlotte Islands Land Use Plan Background Report (LUP 2003). Current projections suggest forest harvest rates of about 2,000 ha/year, concentrated mainly in old-growth habitats. Figure 5 shows annual harvest rates over the past century.

Figure 4. Map of Queen Charlotte Islands showing newly harvested forests (yellow), older forests (dark green) and boggy areas (brown).

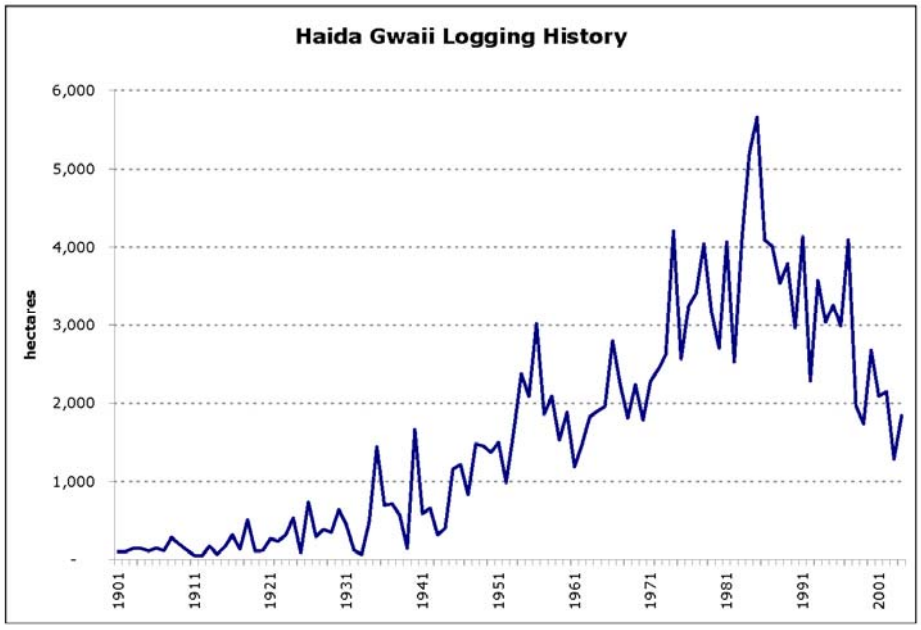

Figure 5. Forest harvest rates on the Queen Charlotte Islands, 1901-2001 (Gowgaia Institute data).

Habitat protection/ownership

On Haida Gwaii approximately 3,250 km^2 are currently managed as Tree Farm Licences (TFL 39, TFL 25, TFL 47) and 4,250 km^2 are classified as provincial Timber Supply Area. The remaining 2,250 km^2 of land are protected parks and/or reserves. The largest protected area is Gwaii Haanas National Park Reserve, occupying the southern half of Moresby Island and adjacent islands, with a total area of 1,470 km^2. The north-eastern corner of Graham Island is protected from resource extraction in Naikoon and Pure Lake Provincial Parks (690 km^2). It should be noted that although this area provides areas of good habitat, much of these latter two parks is boggy habitat, which does not provide many of the attributes associated with suitable breeding habitat. There are a further 93 km^2 of ecological reserves scattered around Haida Gwaii (LUP, 2003).

About 75% of the Haida Gwaii landscape is available for forest harvest and approximately 25% of Haida Gwaii has already been harvested. The areas of highest harvest density are also the most productive watersheds on Haida Gwaii, and may have provided some of the best breeding habitat on the island. The density of owls throughout the patchy harvested landscape appears to be considerably lower (Holschuh 2004a; see Abundance) than in unharvested areas. Although the population in Gwaii Haanas appears to be at higher density than other areas surveyed in the past, the area of Gwaii Haanas may not be sufficient to sustain this endemic subspecies.

Twelve Wildlife Habitat Areas (WHAs) have been proposed for the Northern Saw-whet Owl on the Queen Charlotte Islands (D. Fraser, pers. comm.). These cover

901 ha and correspond to 12 owl breeding territories located through surveys. If approved, these WHAs would exclude forest harvest and road development within their boundaries. Proposed WHAs for Northern Goshawk and Marbled Murrelets might also protect an unknown number of Saw-whet Owl territories if approved.

BIOLOGY

Information on the biology of the Haida Gwaii subspecies of Northern Saw-whet Owls comes from various sources, including past and ongoing research on habitat (Gill and Cannings 1996; Holschuh 2004a, Holschuh 2004b.), diet and related life history characters (Sealy 1998; Sealy 1999; Hobson and Sealy, 1991). General knowledge on the biology of Northern Saw-whet Owls in general is mainly derived from Cannings (1993). As well, relevant information gathered through the personal observations of researchers and naturalists is also presented.

Life cycle and reproduction

Like the nominate subspecies of Northern Saw-whet Owl, these owls are secondary cavity nesters, requiring cavities with an opening no less than 75 mm in diameter. Although cavities are often described as being in the lower third of the canopy (e.g. Terrill 1931, Johns *et al*. 1978), nest cavities may also be found higher in the canopy. On Haida Gwaii, most cavities are probably excavated by Northern Flickers (*Colaptes auratus*) or Hairy Woodpeckers (*Picoides villosus*). Four nests of the Haida Gwaii Saw-whet Owl have been found and described; two were in western hemlock and two in Sitka spruce snags that ranged from 61 to 130 cm in diameter at breast height (Tarver, 2001; S. Charest, C. Epners, pers. comm.; Holschuh 2004a).

Saw-whet owls are highly territorial of the area near potential nests during the spring breeding season. Males defend core areas that appear to be around 70-100 ha in size. Their home ranges, however, are often much larger than this, as movements up to 2 km from the territory core being defended have been noted with telemetry monitoring (Holschuh and Otter, unpubl. data). Much of this activity was also pre-dusk, and the owls are thought to be foraging during this time. Haida Gwaii's latitude leads to short summer nights, and hence it may not be surprising that nocturnal species may also hunt during the day during the critical spring breeding time, in order to meet energetic demands.

Cavities are thought to be limited across the Haida Gwaii landscape (Doyle, pers. comm.), and found more often in Sitka Spruce and Western Hemlock snags, than in Western Redcedar snags (F. Doyle, unpubl. data). As cavities are limited and primary cavity excavators are known keystone species (Martin *et al*. 2004), woodpecker habitat needs may provide an important link to Northern Saw-whet Owl population dynamics on Haida Gwaii.

Northern Saw-whet Owls are solitary breeders, and the pair actively defends their nest territory. Observations of the nominate subspecies of Northern Saw-whet Owl indicate that females choose the nest sites but are guided by the male's advertisement/territorial call (Cannings 1993). At both nests that have been found on Graham Island, the male was consistently observed calling from within 100 m of the nest tree, likely guiding the female to possible nest sites (CIH, pers. obs.).

Northern Saw-whet Owls start breeding once they are one year old and those of the migratory, nominate race are thought to survive between five and seven years (Cannings 1993); survivorship of *brooksi* individuals is unknown but may be longer due to their non-migratory habits. The onset of the breeding season seems to be highly asynchronous in Haida Gwaii Saw-whet Owls, with some birds defending their territories as early as late February, while others do not become territorial until mid-May (CIH pers. obs.). When Saw-whet Owls begin establishing their nests, the level of territorial vocalizations (and thus territorial defence) drops dramatically (R.J. Cannings, pers. comm.; CIH pers. obs.) suggesting that nesting is equally asynchronous, ranging from mid-March until the end of May.

The late dates of territorial activity may represent two possibilities; the owls at some territories may begin breeding later than most, or owls at some territories may begin breeding even earlier in February and establish a second nest later in the spring. Although some evidence of this has been collected in *A. a. acadicus* (Marks *et al*. 1989), there has been no evidence of second broods or polygyny in the Haida Gwaii subspecies.

Activity at the nest has been observed in detail at one nest site on East Limestone Island (ELI) (Tarver 2001). At this nest, calling activity began on 5 May, a full month before nesting activity began on 7 June. Juveniles were first detected begging from within the nest cavity July 7. Incubation is done solely by the females, and the period of incubation is 27-29 days (Cannings 1993).

The young are altricial upon hatching and are brooded exclusively by the female, while the male delivers food to the nest for the female and young (Tarver 2001, Cannings 1993). The young in the ELI nest apparently fledged approximately one month after hatching (between 27 July and 1 August).

Hence, evidence from the ELI nest (Tarver 2001) as well as from observations in the nominate subspecies (Cannings 1993) suggest that the nesting phase from egg laying to fledging lasts approximately 2 months. Overall, as breeding activity on Haida Gwaii may begin as early as March and as late as June, the sensitive breeding period for these owls appears to be from early March until August.

Some level of territory site fidelity is apparent in this species. In a two-year study of *A. a. brooksi*, 7 of 13 sites that were monitored for both years were active in the second year (Holschuh 2004). Further, evidence from two of three test sites using recognition of individual calls suggested the territories were occupied by the same individual for both

years (Holschuh and Otter 2005). Site fidelity is uncommon in the nominate subspecies (Cannings 1993). This possible behavioural difference between the two subspecies may be a result of *A. a. brooksi* being non-migratory, and hence less likely to be as nomadic as *A. a. acadicus* (Marks 1997).

No data on the fecundity or breeding success of *A. a. brooksi* are available. In the nominate subspecies, the average clutch size is 5-6 eggs (Cannings, 1993). These birds can feasibly breed yearly, but it is not known whether individuals establish nests annually. Possible limiting factors may be food shortage (rodents) or a lack of suitable cavities (for more detail, refer to section on limiting factors). Further, as individuals occupying areas with decreased old growth forest appear to be in lower condition, as was indicated by decreased expression of a condition dependent signal (Holschuh 2004a), their reproductive output may also be affected.

Predation

Due to the general lack of nocturnal raptors, there are likely not many avian predators on adult Northern Saw-whet Owls on Haida Gwaii. Nonetheless, Northern Goshawks (*Accipiter gentilis*) occasionally take Northern Saw-whet Owls (Frank Doyle, pers. comm.).

Rates of nest predation have not been studied directly; however, Northern Saw-whet Owls are probably vulnerable to mammalian nest predators such as the American Marten (*Martes americana*). Further, introduced species including Red Squirrel (*Tamiasciurus hudsonicus*) (Martin and Joron 2003) and Common Raccoon (*Procyon lotor*) likely pose an even greater predatory threat on the Saw-whet Owls, as both are well known to be effective nest predators (Eder and Pattie 2001).

Physiology

Studies on the energetic food requirements of captive birds found that a female Northern Saw-whet Owl has to consume approximately 18% of her body weight daily to maintain her body weight. The daily energetic intake is around 95 kcal/day for male birds and 125 kcal/day for female birds (Cannings 1993 and references therein). The normal body temperature for Saw-whet Owls is approximately 38-39°C, but increases when the ambient temperature exceeds 33°C (Cannings 1993 and references therein), indicating these birds are adapted to temperate environments.

Dispersal and migration

The Northern Saw-whet Owl *brooksi* subspecies is a non-migratory resident of the Queen Charlotte Islands/Haida Gwaii. No vagrants have been detected outside of the archipelago, either in southern Alaska or British Columbia (Sealy 1997). This is in contrast to the nominate subspecies, in which individuals are known to undergo large-scale movements both in eastern North America (e.g. Zusi 1958, Weir *et al*. 1980) and through British Columbia (Levesque 2002, Mackenzie Nature Observatory 2003).

On Haida Gwaii, there are no data on the dispersal of young in these owls, and because of their non-migratory nature, comparisons with the nominate subspecies cannot be made. Some evidence based on diet and behaviour (increased detections/collisions with cars along coastline in fall and winter) suggests that the birds may shift from more interior-island habitats to more coastal habitats for the winter, presumably to capitalize on the rich intertidal food source (Hobson and Sealy 1991, Sealy 1999).

As *A. a. brooksi* is non-migratory and endemic to the Haida Gwaii archipelago, the rescue effect does not apply.

Interspecific interactions

No other species of owls are known to nest on Haida Gwaii, although there are non-breeding records of Short-eared Owls (*Asio flammeus*) and Snowy Owls (*Nyctea scandiaca*) (Peter Hamel, pers. comm.). As there are no other nocturnal avian predators known to occupy Haida Gwaii, niche-specific competition is probably minor.

Saw-whet owls are secondary cavity nesters and their population may be affected by fluctuations in primary cavity excavators. Thus, indirectly, the owl population may interact with Northern Flickers, Hairy Woodpeckers and Red-breasted Sapsuckers. The Hairy Woodpeckers on Haida Gwaii are also an endemic subspecies (*P. v. picoides*) thought to exist at low densities across the landscape. Thus, it is likely that potential nesting cavities have been built up as a function of time, rather than a function of high densities of woodpeckers. Declines in nesting habitat for primary cavity nesters (suitable snags) may therefore have long-term effects on Saw-whet Owls.

Direct interactions with introduced species may also affect these owls. For instance, European Starlings (*Sturnus vulgaris*) may compete with the owls for nesting cavities and are known to harass cavity holders, although nest observations throughout the spring showed that the owls were not displaced (CIH, pers. obs.). Continued harassment by starlings may lead to the abandonment of active nest sites (K. Otter, pers. comm.).

Adaptability

Current evidence suggests that the Haida Gwaii subspecies has diverged quite recently, and thus current differences between the *acadicus* and the *brooksi* subspecies are likely related to adaptations to the local environment on the archipelago (Byun 1998). One important difference between the subspecies appears to be their over-winter movement towards the coastline, where there is an abundant and easily accessible food source, intertidal amphipods and isopods (Sealy 1999). Furthermore, in their foraging, the Haida Gwaii Saw-whet Owls seem to be more generalist that the nominate subspecies, taking locally available food items other than rodents, which are thought to be the major food source of Northern Saw-whet Owls elsewhere. For example, on East Limestone Island, which houses one of the few breeding colonies of Ancient Murrelets (*Synthliboramphus antiquus*), a Northern Saw-whet Owl has been observed taking

downy murrelet chicks (Gaston 1992). Overall, the adaptability to very localized differences in food availability is likely an important factor in the persistence of this subspecies, as is illustrated by the high mortality rate, apparently due to starvation, of other owl species when they move through Haida Gwaii (P. Hamel, pers. comm.).

POPULATION SIZES AND TRENDS

Search effort

To date, three sets of surveys have been conducted on the Haida Gwaii subspecies of Northern Saw-whet Owl. First, Gill and Cannings (1997) did a systematic survey in 1996, where 238 survey stations across a variety of habitat types on Graham and northern Moresby Island were sampled twice during the spring breeding season, leading to the detection of 61 owls. Second, CIH undertook two years of targeted searches for Saw-whet Owls (2002/2003) on the southern half of Graham Island in maturing and old forested habitats. In total, 24 and 26 occupied sites were found in 2002 and 2003 respectively (Holschuh 2004). Third, CIH undertook a systematic survey of Gwaii Haanas National Park Reserve in 2004, where survey stations were accessed by boat and located in protected inlets, passages and bays, and targeted adjacent terrestrial habitats, to ultimately determine range and density. Of the 59 stations surveyed (many of which were surveyed twice), Saw-whet Owls were found at 26 sites (Holschuh in prep.). The detection success was highest in the Gwaii Haanas survey. These three sets of surveys were done during spring when all males are highly vocal.

For the purposes of this document, population estimates were derived from measures of density and extrapolated to the amount of habitat available currently and ten years ago. Two population densities were calculated: (1) the density of active owl sites on Graham Island in a landscape altered by forestry activities using the 2002/2003 database, and (2) the density of active owl sites in a large tract of undisturbed habitat, in Gwaii Haanas. As these owls appear to be associated with mature and old forests, estimating the density of owls in a largely undisturbed landscape should provide a preliminary baseline estimate with which to compare densities in a changing landscape. Densities were calculated based on average distance to the closest neighbour. Raptors often have a uniform distribution across the landscape. The approximate spacing between territories can be taken as a surrogate to home range size. If the distance between the territory cores (areas the males are most consistently defending) is divided by two, a circular home range area could be calculated. By then dividing the calculated home range size into the amount of available habitat, the population size could be estimated. As the population estimate comes from the average spacing between individuals, the error in the population estimate was calculated from the standard error of the mean distance between individuals.

There are numerous limitations to this method. First, because the specific habitat needs of these owls are not fully understood, calculating home ranges, and then population size based on the amount of available habitat may lead to overestimating the

population size. Although the density measures may take factors such as fragmentation into account, other habitat features may also be limiting factors. Also, not all available habitat will necessarily be used by owls. Secondly, after estimating the number of sites across the landscape, this number is being multiplied by two. This is making an assumption of equal sex ratio, which has not been verified. Another limitation is that the population is being estimated based purely on habitat availability, and cannot take into account other possible factors, such as fecundity. Density estimates were extrapolated from data collected in different years, when annual variation in population size is not known. Ultimately, changes in the availability of habitat are being taken as surrogates to population change, when there are likely additional factors that are not yet understood (i.e. reproductive success changes over time due to the changing landscape). This could be leading to an overestimate in number of sites and individuals. Overall, the population sizes and trends have not been measured directly. Despite these weaknesses, this method is applying measured densities from survey data to changing habitat availability, thereby providing a reasonable estimate of abundance.

Abundance

Using the above estimates, the density of owls within Gwaii Haanas in contiguous old forest is significantly greater than the density in fragmented regenerating forest. Surveys in contiguous forests in Gwaii Haanas produced a mean of 2.18 $\pm$ 0.18 km between occupied sites, and therefore an approximate mean home range size of 3.52 $\pm$ 1.3 km^2. Dividing this figure into the 2,561 km^2 calculated for total unfragmented suitable forest (see Habitat) produces a total of 725 $\pm$ 200 territories in unfragmented landscapes. Conversely, in fragmented habitat, the average inter-neighbour spacing was 4.31 $\pm$ 0.71 km, producing a mean home range size estimate of 14.52 $\pm$ 11.1 km^2. Again, using the 2,927 km^2 of available habitat in fragmented landscapes, this translates into a total of 201 $\pm$ 90 territories in this habitat type. The combined total of 926 $\pm$ 290 territories is a best estimate for the number of possible breeding territories on Haida Gwaii, representing a possible adult population of 1,852 $\pm$ 580 adult owls.

Fluctuations and trends

There is very little information for either subspecies on population fluctuations and trends. Although there is some suggestion that populations cycle with food abundance in *A. a. acadicus* (Cannings 1993 and references therein), the more opportunistic and generalist nature of foraging in *A. a. brooksi* (Sealy 1999) seems to suggest some imperviousness to the fluctuations of single prey items. Nonetheless, repeated surveys of the same site between years showed that areas of concentrated activity in one year may have much lower activity in the next year (Holschuh, unpub. data).

When the rates of decline in unfragmented habitat are taken into account, and the spacing of owls (density) is extrapolated to this changing landscape, a 9% decline in the population size of Saw-whet Owls over the past 10 years can be estimated. This is based on a harvest rate of old forests of about 3,000 ha per year (Figure 5), which translates into a loss of habitat for about 85 pairs of owls over 10 years. The loss over

the last 15 years, the presumed upper estimate for three generations, would be about 13%. Further, if the population is projected on the original base of available unfragmented habitat, it suggests there may once have been approximately 1,550 $\pm$ 420 territories, suggesting an approximately 40% decline in population since the start of large-scale forest harvest operations (which began about 1950, Gowgaia Institute data, A. Cober, pers. comm.). Overall, as the amount of unfragmented mature and old forest continues to be lost on Haida Gwaii, the number of owls can also be expected to continue declining. Further, the effects of other external factors, including the introduction of exotic species, are not well understood and are not factored into these calculations. Factors such as these are likely having an effect on the population also, suggesting that the above estimates are conservative. The collective effects of the limiting factors and threats described below will likely cause further decline of Haida Gwaii Saw-whet Owls.

Forest harvest is projected to continue at about 3,000 ha per year on the Queen Charlotte Islands, almost all occurring in old-growth forests (Alvin Cober, pers. comm.). This would translate into a decline of approximately 6% in the Saw-whet Owl population (57 pairs lost in a population of 926 pairs) over the next 10 years, or 9 % over 15 years (upper limit of estimate for three generations).

Rescue effect

As the *brooksi* subspecies of the Northern Saw-whet Owl is endemic to the Haida Gwaii archipelago, there is no rescue effect.

LIMITING FACTORS AND THREATS

Population

Current evidence suggests that the population density and abundance of Haida Gwaii Saw-whet Owls is low (CIH, unpubl. data). This subspecies is endemic, non-migratory, and the population range is limited to the Queen Charlotte Islands archipelago. Thus, if too great a population decline occurs, there are no ‘source’ populations to draw on that would compensate for such a decline (Harrison 1993).

Habitat loss

The breeding habitat of Saw-whet Owls appears to be associated with mature and old forest. Although the specific parameters of mature and old forest that the owls use are not well understood, it is likely that nesting opportunities are greatest in this forest type (Doyle, unpubl. data). As the Saw-whet Owls rely not only on snags, but also on primary cavity nesters to create suitable nest cavities, habitat loss for a suite of species will therefore also affect this owl population. Further, young stands of regenerating forest likely lack the features important to foraging during the breeding season (Cannings 1993, Fraser *et al*. 1993).

Introduction of exotic species

Haida Gwaii has experienced introductions of numerous species, some of which may directly threaten Saw-whet Owls. Raccoons and Red Squirrels (see interspecies interactions) are both effective nest predators, and European Starlings may harass owls and cause nest abandonment.

The introduction of Sitka Black-tailed Deer has decreased the diversity (species richness, turnover and total number of species) of understory vegetation in interior forest ecosystems (RGIS-FRBC 2001). This in turn is likely affecting the food availability of rodents, which appear to be an important prey item for Saw-whet Owls during the breeding season (Cannings 1993). As well, the owls may also be relying on various forest invertebrates for food during the breeding season, which are also known to decline with the high levels of deer browsing on Haida Gwaii (RGIS-FRBC 2001).

Road-kill

As many Haida Gwaii Saw-whet Owls apparently move to coastal areas for feeding during the fall and winter, owls are hit by vehicles at that time of year between Skidegate and Tlell, where the highway closely follows the coastline (Sealy 1999, S. Sealy pers. comm.).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Haida Gwaii Saw-whet Owl is a non-migratory, endemic subspecies, restricted to the Haida Gwaii archipelago. Many of the behaviours and other adaptations of this subspecies differ from the nominate subspecies, making these owls quite distinct from their continental counterpart.

The owls have significance to local Aboriginal people, as the Haida from Cumshewa are called St’awaas Xaaydgaay, meaning the Saw-whet Owl People (B. Wilson, pers. comm.).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Provincial listing: Blue listed; under consideration for future addition to the Identified Wildlife Management Strategy, a British Columbia strategy for managing rare and endangered species, which currently applies only to COSEWIC designated species under the categories of Special Concern, Threatened and Endangered.
Federal Protected from hunting, trafficking, or possession in Gwaii Haanas National Park Reserve under the Canada National Parks Act.
CITES: Appendix II
Global: G5T3

TECHNICAL SUMMARY

Aegolius acadicus brooksi
Northern Saw-whet Owl *brooksi* subspecies — Petite Nyctale de la sous-espèce *brooksi*
Range of Occurrence in Canada: BC

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* Area of Haida Gwaii.	10,000 km²
• *Specify trend in EO*	Stable
• *Are there extreme fluctuations in EO?*	No
• *Area of occupancy (AO) (km²)* Amount of suitable habitat for occupancy on Haida Gwaii, including both fragmented regenerating forest (occupied at low density) and old forest (occupied at higher density).	Approximately 5,488 km²
• *Specify trend in AO*	Decline; forest harvest creates unsuitable clearcut and dense forest habitat
• *Are there extreme fluctuations in AO?*	No
• *Number of known or inferred current locations*	Not applicable
• *Specify trend in #* • *Based on habitat loss through forest harvest*	Not applicable
• *Are there extreme fluctuations in number of locations?*	Not applicable
• *Specify trend in area, extent or quality of habitat*	Decline in quality and quantity of habitat
Population Information	
• *Generation time (average age of parents in the population)*	Age at sexual maturity 1 year. Average age of parents likely 2-5 years.
• *Number of mature individuals*	1,852 ± 580
• *Total population trend:*	Declining
• *% decline over the last/next 10 years or 3 generations.* Estimated based on rate of forest harvest throughout Haida Gwaii.	Last 15 years: 13% Next 15 years: 9%
• *Are there extreme fluctuations in number of mature individuals?*	Unknown
• *Is the total population severely fragmented?*	No
• *Specify trend in number of populations*	Only one population
• *Are there extreme fluctuations in number of populations?*	No, only one population
List populations with number of mature individuals in each: Not applicable	
Threats (actual or imminent threats to populations or habitats)	
Habitat loss: Nesting and foraging habitat declining due to forest harvest, which removes older forests with open structure and abundant nesting snags and produces dense forests which are clearly suboptimal for both foraging and nesting. **Introduced species:** Raccoons and Red Squirrels are possible nest predators, while European Starlings are aggressive competitors for nest cavities. The large-scale habitat alteration caused by foraging Sitka Black-tailed Deer may have reduced densities of small rodents and invertebrates, both of which are important food sources. **Road kill:** Birds are often hit by highway traffic between Skidegate and Tlell during the apparent movements to the shorelines during the fall.	

Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* No outside populations	
• *Is immigration known or possible?*	Not possible; no outside populations
• *Would immigrants be adapted to survive in Canada?*	Not applicable
• *Is there sufficient habitat for immigrants in Canada?*	Not applicable
• *Is rescue from outside populations likely?* **Quantitative Analysis**	No Not done
Current Status COSEWIC: Threatened (2006) British Columbia CDC: Blue-listed	

Status and Reasons for Designation

Status: Threatened	**Alpha-numeric code**: Met criteria for Endangered, C2a(ii) with its small population and projected habitat loss, but designated Threatened, C2a(ii) because of the presence of substantial protected areas.
Reasons for Designation: This is a distinct subspecies endemic to Canada, with a small world population (ca. 1,900 adults) restricted to the Queen Charlotte Islands. It is a forest specialist, preferring older forests with abundant nesting snags and an open understory in a landscape where such resources are continually becoming scarcer due to forest harvest.	
Applicability of Criteria **Criterion A**: (Declining Total Population): not applicable **Criterion B**: (Small Distribution, and Decline or Fluctuation): not applicable **Criterion C**: (Small Total Population Size and Decline): Met criteria C2a(ii) for Endangered with fewer than 2,500 breeding individuals, continuing habitat decline and all individuals in one population. **Criterion D**: (Very Small Population or Restricted Distribution): population too high **Criterion E**: (Quantitative Analysis): not done.	

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Carmen I. Holschuh has a B.Sc. in Wildlife Biology and an M.Sc. in Natural Resources and Environmental Studies from the University of Northern British Columbia. She is currently working as a wildlife biologist with Westland Resource Group Inc. Her research interests are largely surrounding the ecology, behaviour and evolution of species. She focused on the Haida Gwaii Saw-whet Owl for her postgraduate research, developing effective monitoring techniques for vocal, yet cryptic species such as these owls. Among her current projects, she is further examining the habitat needs and population of the Haida Gwaii Saw-whet Owls.

COLLECTIONS EXAMINED

Preserved specimens from the Royal British Columbia Museum (Victoria, British Columbia) were examined at an earlier date by Paul Levesque and Laurie Savard.