Ancient Murrelet

Synthliboramphus antiquus

Original[1] prepared by Anne Harfenist

Species Information

Taxonomy

The Ancient Murrelet belongs to the family Alcidae, the auks. It is the only one of four species in the genus *Synthliboramphus* to occur commonly and regularly in British Columbia (Gaston 1994a). Within the alcids, the Ancient Murrelet is most closely related to the Japanese Murrelet (*Synthliboramphus wumizusume*) found only near Japan; the other two *Synthliboramphus* murrelets are Craveri's (*S. craveri)* and Xantus' (*S. hypoleucus)* murrelets, which are found primarily near the Gulf of California and along the coast of California to Baja California, respectively (Gaston and Jones 1998). Two races of Ancient Murrelet have been described: *Synthliboramphus antiquus antiquus* and *S. antiquus microrhynchos* but Gaston and Jones (1998) call the validity of the latter race, found only on the Commander Islands, doubtful.

Description

The Ancient Murrelet is a relatively small auk with a wing length of ~14 cm and weighing about 200–250 g (Gaston 1994a). Males and females are similar in appearance: in adults the back, upper wings, and upper tail are moderate grey; the head is black; the belly is white; legs and feet are pale blue; and the short pointed bill is pinkish. In breeding plumage, Ancient Murrelets have a black bib that extends from the throat down to the upper breast and long white filamentous plumes along the sides of the crown which are the feature that give the bird the "ancient" look for which they are named (Gaston 1994a). The non-breeding plumage lacks the black bib and the plumes are reduced; this plumage is not maintained for very long and many birds seen in December are in breeding plumage (Gaston and Jones 1998). The plumage of immature Ancient Murrelets is similar to that of the winter adult with no plumes and a white throat (Gaston 1994a). Chicks are covered with down in a colour pattern similar to that of immature birds.

Distribution

The Ancient Murrelet spends most of its life at sea, coming to land only to breed.

Global

The range of the Ancient Murrelet describes an arc around the rim of the northern Pacific Ocean. Breeding colonies are found on offshore islands north from China in the western Pacific (35–62° N), across the Aleutian Islands and south through the Queen Charlotte Islands/Haida Gwaii in the eastern Pacific (52–60° N) (Gaston and Jones 1998). The at-sea distribution of the birds during the breeding season covers approximately the same geographic range. The wintering distribution includes the waters used during the breeding season, but extends into the Bering Sea in the north and along the eastern Pacific coast south to Baja California (Gaston and Jones 1998). In the eastern Pacific Ocean, Ancient Murrelets are probably most numerous in winter between 40 and 50° N (Gaston 1994a). The distribution of this species during the post-breeding season until the birds reach the wintering grounds is unknown.

British Columbia

Known Ancient Murrelet breeding colonies in British Columbia are confined to offshore islands in the Queen Charlotte Islands/Haida Gwaii (Rodway 1991). Approximately one-half of the birds nest at three large colonies off the northwest side of

1 Volume 1 account prepared by A. Derocher.

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Note: This map represents a broad view of the distribution of potential habitat used by this species. The map is based on current knowledge of the species' habitat preferences. This species may or may not occur in all areas indicated.

Graham Island and about 44% breed at 17 colonies off the east coast of Moresby Island; the remaining 7% nest at 10 small colonies off the northwest side of Moresby Island (Rodway et al. 1988, 1990, 1994). A single incubating adult was reported from the Moore Islands along the mainland coast in 1970 (Campbell et al. 1990), but a subsequent survey in 1988 did not find evidence of breeding at that site (Rodway and Lemon 1991). The presence of Ancient Murrelets in breeding plumage on the waters off northwestern Vancouver Island during the breeding season may indicate a small colony/colonies in that area but nesting has not been confirmed (Gaston 1994b). Birds are common and abundant on the waters near their colonies during the breeding season.

Ancient Murrelets are rarely seen in British Columbia waters during late summer and early fall (Campbell et al. 1990). Wintering aggregations occur in the marine waters around Vancouver Island including Queen Charlotte Strait, Strait of Juan de Fuca, Haro Strait, and Active Pass (Campbell et al. 1990). Smaller numbers of Ancient Murrelets winter throughout coastal British Columbia, but the birds are rarely found in protected inland waters such as fjords and inlets.

Forest region and district[2]

Coast: Queen Charlotte Islands

Ecoprovinces and ecosections

Nesting:

COM: SKP, WQC

At-sea:

COM: DIE, HES, QCS, QCT, VIS

GED: JDF, SOG

NOP: JOS, NCF, OQC, QCC, SAP, TPR, VIC

Biogeoclimatic units (nesting)

CWH: vh2, wh1

Broad ecosystem units

CH, HS

2 Only forest districts with breeding habitats are listed.

Life History

Diet and foraging behaviour

Few data are available on the diet of the Ancient Murrelet. The diet appears to consist primarily of large zooplankton and small schooling fish; specific prey species and relative proportions in the diet vary across the range of the murrelet (e.g., Gaston 1994a) and among years (Sealy 1975; Vermeer et al. 1985). In one study conducted near Langara Island, the diet of adults was comprised primarily of euphausiids early in the breeding season: *Euphausia pacifica* in late March/early April and *Thysanoessa spinifera* in late April/May (Sealy 1975). In June, approximately half of the diet was juvenile sand lance (*Ammodytes hexapterus)* with euphausiids making up the other half. Juvenile shiner perch (*Cymatogaster aggregata)* and rockfishes (*Sebastes* spp.) were also consumed later in the breeding season (Sealy 1975). The diet of subadults was dominated by euphausiids (primarily *Thysanoessa spinifera)* and sand lance. Another study in the same area but in a different year found significant amounts of fishes in the diet of adults in May; in June the diet was almost exclusively larval and juvenile fish including ~25% rockfish as well as greenlings (*Hexagrammas* spp.) and flatfish (Pleuronectidae) (Vermeer et al. 1985). Young-of-the-year, presumably shortly after independence from their parents, forage almost entirely on sand lance (Sealy 1975; Gaston 1992).

The only information on the winter diet of Ancient Murrelets comes from birds off southeastern Vancouver Island (Gaston et al. 1993). Almost the entire diet was comprised of *Euphausia pacifica* throughout the winter except in November when significant amounts of juvenile herring (*Clupea harengus)* were eaten.

Ancient Murrelets forage in marine waters. They tend to forage over the continental shelf and slope; in British Columbia they forage most commonly over the shelf break and in areas where tidal upwellings force food close to the surface (Vermeer et al. 1985; Gaston 1994a). The main method of prey capture is pursuit diving to depths of 10–20 m; the birds use their wings to propel themselves under water (Gaston 1992). On occasion, murrelets also

feed at the surface (Gaston 1992). Ancient Murrelets usually forage in small groups and are found in either single species or mixed species feeding flocks (Gaston 1992; Gaston et al. 1993). Chicks are fed by their parents for more than a month after leaving the nesting colony (Litvinenko and Shibaev 1987).

Reproduction

The timing of breeding in Ancient Murrelets varies across the species' range: there is a 6-day delay for every 1° C decrease in mean April sea surface temperature near the colonies (Gaston 1992). Timing is not related to latitude, which suggests that food supply rather than day length is a critical factor (Gaston 1994a). The information presented below is for the Queen Charlotte Islands/Haida Gwaii, the only breeding area in British Columbia.

Ancient Murrelets are colonial burrow-nesters. The birds begin to visit their colonies in March and begin laying eggs 1–10 April (Gaston and Jones 1998). During the pre-laying period, the birds are seen in late afternoon on the waters around the nesting colonies and on land at night (Gaston 1992). Egg-laying at a colony occurs over about 45 days, but approximately one-half of all clutches are initiated within a single 6–10 day period (Gaston and Jones 1998). Dates of median clutch completion are 17 April–9 May (Gaston and Jones 1998). Almost all clutches consist of 2 eggs laid 6–10 days apart (Gaston 1994a). Adults begin incubation 1–2 days after the second egg is laid; the eggs may be neglected up to 7 days before incubation begins (Gaston 1994a). Only one clutch is produced per year.

Incubation lasts for approximately 1 month and is shared equally between parents, with incubation shifts of 2–4 days (Sealy 1976; Gaston 1992). The precocial chicks hatch within 12 hours of each other and weigh an average of 31 g one day post-hatching (Gaston 1992). The chicks are not fed in the burrows and leave the colony at night by running to join their parents at sea about 2–3 days after hatching. Median dates of chick departure differ significantly among colonies and years: in the 1990s, the earliest median date was recorded at Reef Island in 1995 and Limestone Island in 1996 (21 May) and the latest at Frederick Island in 1997 (3 June; Gaston and Harfenist 1998). The timing of departures was 8–11 days later off the northwest coast of Graham Island than off the east coast of Moresby Island; the difference is too large to be accounted for solely by variation in sea surface temperature around the archipelago (Gaston and Harfenist 1998).

Family groups swim quickly away from the breeding colony and are rarely seen inshore (Sealy 1975; Gaston 1992). Both parents feed their chicks at sea for at least a month until they are fully grown (Litvinenko and Shibaev 1987). *Synthliboramphus* is the only genus of seabirds in which the young are raised entirely at sea (Gaston 1994a).

Non-breeding birds visit breeding colonies at night; numbers peak during the second half of the incubation period (Gaston 1992). There is little activity by either breeders or non-breeders at the colonies by the end of June off eastern Moresby and early July off western Graham (Gaston 1992, 1994a).

The age at first breeding in Ancient Murrelets is 3–4 years (Gaston and Jones 1998). On Reef Island the age structure of the population at the beginning of the breeding season was 30% first-year birds, 29% non-breeding second- and third-year birds, and 41% breeding birds (Gaston 1994a). Mean annual survival of adults at Reef Island was estimated at 77% (Gaston 1990). Survival is relatively low for an alcid, but reproductive success is relatively high: almost all pairs lay a two-egg clutch and reproductive success up to the time that the chicks leave the colony is 1.44–1.69 chicks per laying pair (Vermeer and Lemon 1986; Rodway et al. 1988; Gaston 1994a). Most reproductive failure is caused by desertion of the eggs before incubation begins (Gaston and Jones 1998).

Site fidelity

Two types of site fidelity are considered for colonially nesting seabirds: fidelity to natal colony and fidelity to nest site. There is little information about fidelity of Ancient Murrelet to their natal colony as few birds banded as chicks have been recovered. Prospecting pre-breeders visit colonies close to their natal colonies and some recruitment to

a non-natal colony has been observed (Gaston and Lemon 1996). Fidelity to nest site is difficult to determine as the birds nest in burrows and disturbance at their nests can cause desertion, but limited data suggest that there is some site fidelity at the burrow level. Burrows in which a pair bred successfully are more likely to be occupied in the following year than burrows in which eggs were deserted (Gaston 1992). Murrelets that have abandoned a burrow rarely return to that burrow (Gaston 1992).

Home range

Not applicable.

Movements and dispersal

The post-breeding season movements of Ancient Murrelets are largely unknown. Family groups immediately disperse from the waters around the breeding colony once the chicks have joined their parents at sea; within 6–8 hours of departure, family parties traveled an average of 13 km from the colony (Duncan and Gaston 1990). In British Columbia, Ancient Murrelet families from colonies off the east side of Moresby Island remained in offshore waters of Hecate Strait for several weeks (Duncan and Gaston 1990). Small numbers of birds have also been observed in offshore waters off Barkley Sound following the breeding season (Vermeer et al. 1987). During late summer and early fall, Ancient Murrelets are rarely seen in British Columbia's waters or elsewhere along coastal North America and their movements during this season are unknown (Campbell et al. 1990; Gaston 1994a). The birds reappear farther south at their wintering grounds in inshore waters around Vancouver Island by mid-October and off California by November (Campbell et al. 1990; Gaston 1994a). However, a small number of Ancient Murrelets move northward to winter in the Bering Sea and others winter throughout the breeding range (Gaston 1994a). Adults return to the marine waters adjacent to their colonies by March (Gaston 1992).

Ancient Murrelets are occasionally recorded from sites in the Interior of British Columbia; these are presumed to be windblown from the Coast (Campbell et al. 1990; Gaston 1994a).

Habitat

Structural stage

7: old forest

Important habitats and habitat features

Nesting

Ancient Murrelets require islands without alien mammalian predators. Colony areas and adjacent shorelines must also be free of most human disturbances. Ancient Murrelets require nearby marine areas with no lights or gill net fishery.

In British Columbia, Ancient Murrelet colonies are located on forested islands offshore from the main islands in the Queen Charlotte Islands/Haida Gwaii archipelago. Almost all Ancient Murrelets nest in burrows dug into the ground beneath mature Sitka spruce or western hemlock on seaward slopes or flat areas (Vermeer et al. 1984; Gaston 1992). On Frederick Island, nesting was densest on mossy slopes lacking understorey beneath hemlocks: 79%, 19%, and 2% of burrows were under western hemlock, Sitka spruce, or western redcedar, respectively (Vermeer et al. 1984). On Reef Island, most burrows are under >50% canopy cover (Gaston 1992). Most burrow entrances are found at the base of trees, stumps, or fallen logs; infrequently the birds nest in rock crevices or natural cavities in rotten logs (Vermeer and Lemon 1986; Gaston 1994a). Burrow tunnels are up to 2 m long (Vermeer and Lemon 1986; Gaston 1992). Ancient Murrelets excavate their own burrows or use burrows excavated by other individuals in previous years.

Most Ancient Murrelet burrows are located within 300 m of the ocean, but may be found up to 450 m from shore (Rodway et al. 1988, 1990, 1994). On Reef Island, peak burrow density was about 100 m from shore and densities were highest on slopes >30° (Gaston 1992). However, the birds also nest densely on flatter islands (Rodway et al. 1988, 1990, 1994). A summary of habitat plot data from colonies throughout the Queen Charlotte Islands/Haida Gwaii indicates that almost half of the plots had burrow densities below 0.33/m^2 (G.W. Kaiser, unpubl. data).

Marine

During the breeding season, Ancient Murrelets are found primarily over the continental shelf and slope in waters with sea surface temperature between 4° and 20° C (Gaston 1994a). Highest densities are found near the shelf break (Vermeer et al. 1985); less frequently the birds are found in inshore waters (Gaston 1992). The waters adjacent to breeding colonies are used as gathering grounds in early evening and near dawn, but the birds are not usually seen near their colonies for most of the day. Important marine habitat features during late summer/early fall are unknown. In winter Ancient Murrelets are found over the continental shelf and slope in British Columbia, where aggregations of birds are found in areas of tidal upwelling that concentrates prey (Morgan et al. 1991; Gaston et al. 1993).

Conservation and Management

Status

The Ancient Murrelet is on the provincial *Blue List* in British Columbia. In Canada, it is considered a species of *Special Concern* (COSEWIC 2002).

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

AK	BC	CA	OR	WA	Canada	Global
S4	S2S3B, S4N	S?	SZN	S3S4N	N3	G4

Trends

Population trends

The Canadian breeding population of Ancient Murrelets is approximately 256 000 pairs, all of which nest on the Queen Charlotte Islands/Haida Gwaii (Vermeer et al. 1997). Although population estimates in British Columbia are fairly accurate, estimates for much of the range are poor with only presence/absence data available from some sites and rough approximations of colony size at others (Springer et al. 1993). A best guess is that the B.C. population represents about one half of the world population (Gaston 1994a).

Ancient Murrelet populations have declined throughout the species' range due to depredation at the colonies by introduced mammals including rats, raccoons, and foxes (Bailey and Kaiser 1993). Some colonies, such as those on Lucy and Cox islands, have been extirpated by introduced predators (Gaston 1994b). The Aleutian Island population may have declined by 80% (Springer et al. 1993). Trend information is not available for the western Pacific populations, but breeding populations there have probably declined due to introduced predators; some small unprotected colonies in Japan, Korea, and China may be in danger of extirpation (Springer et al. 1993; Gaston 1994a). On the Queen Charlotte Islands/Haida Gwaii, all estimates from colonies without introduced predators indicate that breeding populations have increased by 0.2–9.5% annually since 1980 (Lemon and Gaston 1999). However, populations at those colonies with introduced predators have decreased at an annual rate of 1–23%. The total breeding population in the archipelago has declined by an estimated 50% in the last few decades (Gaston 1992). On Langara Island, the population declined from a historical level of about 200 000 pairs (Gaston 1992) to <15 000 pairs in 1993 (Harfenist 1994). Introduced rats are believed to be largely responsible for the decline; mortality caused by commercial gill net fisheries was also a contributor (Bertram 1995). Rats were eradicated from Langara Island in 1995 (Kaiser et al. 1997), but the Ancient Murrelet population had not shown evidence of recovery 5 years later (Drever 2000). Population declines or extirpations have also been attributed to rats at Kunghit, Lyell, Cox, Lucy, Murchison, and Bischof islands (Harfenist and Kaiser 1997). Introduced raccoons are believed responsible for declines on Limestone, Saunders, and Helgesen islands: the breeding population on Helgesen Island declined by over 80% over a 7-year period when 8–12 raccoons were present (Gaston and Masselink 1997).

Habitat trends

The presence of introduced mammalian predators on present, former, and potential colony islands has rendered those islands unsuitable for nesting Ancient Murrelets. With the exception of the presence of introduced species, potential suitable nesting habitat in British Columbia is likely relatively stable as the forests on colony islands have not been altered by industrial activities or urban development since the creation of Gwaii Haanas National Park Reserve/Haida Heritage Site. On Langara Island, a sports fishing lodge was constructed on an area historically used for nesting by Ancient Murrelets. On a regional level, there is no evidence that the availability of suitable breeding habitat limits the breeding population: some colony islands have large areas of unused suitable habitat (Gaston 1994b).

It is difficult to estimate the availability of suitable marine habitat for Ancient Murrelets. Suitable marine habitat adjacent to colonies may have increased with the decline in the commercial gill net fishery.

Threats

Population threats

Introduced mammalian predators pose the most serious immediate threat to nesting Ancient Murrelets in British Columbia (e.g., Gaston 1994b). Rats and raccoons have killed hundreds of thousands of adults and chicks (see "Population trends" above). At least one-half of the Ancient Murrelet colonies in the Queen Charlotte Islands/Haida Gwaii are vulnerable to invasion by raccoons (Lemon and Gaston 1999). Rats are less likely to swim between islands but may reach new colonies on commercial or pleasure boats or ship wrecks.

Other significant threats are contaminants, exploitation of ocean resources, human recreation, and climate change (e.g., Vermeer et al. 1997). Oil pollution is the main contaminant threat to Ancient Murrelets: effect of oil on seabirds is well documented (e.g., Burger and Fry 1993). Ancient Murrelet carcasses comprised 2.4% of the birds washed up on Vancouver Island following the Nestucca oil spill (Rodway et al. 1989), but was one of most common species killed in oil spills in the Sea of Japan (Kazama 1971). Mortality from large episodic spills receive most of the attention, but impacts from chronic low-level pollution from ship operations such as bilge-flushing or leaking tanks may be more of a threat (Burger et al. 1997). Levels of organochlorine contaminants found in Ancient Murrelets nesting in British Columbia are probably below levels likely to seriously affect populations (Elliott et al. 1997).

The main issues of concern related to exploitation of ocean resources are bird/fisheries interactions and oil and gas development. The most serious threat to this species from the commercial fishery is that of bycatch in fishing nets. Significant numbers of Ancient Murrelets drowned in nets during gill net fisheries off Langara Island (Bertram 1995). Collisions with wires and ropes by birds attracted to lights on the boats caused additional mortality. Commercial and recreational overfishing of Ancient Murrelet prey species such as rockfish and herring may lead to a decrease in the availability of juvenile stages of these species for the birds (Vermeer et al. 1997). Oil and gas development in the oceans around the Queen Charlotte Islands/Haida Gwaii has the potential to increase mortality of Ancient Murrelets caused by oil or metal contamination as well as that caused by collisions around lights (Montevecchi et al. 1999). Wind turbines, such as those recently proposed for a site off Rose Spit, may also present a risk to migrating birds.

The activities of tourists involved in recreational boating or camping can damage the birds' habitat (see following section) or injure or kill to adults and chicks. The main risk is from campfires built on shorelines near colony sites. The birds are attracted to lights and will fly or run into fires; this was the main hunting technique used by the Haida (Ellis 1991). Lights around recreational boats or campsites will also disorient the birds.

Climate change has been indirectly linked to changes in seabird populations via alterations of their prey species' ecology (e.g., Anderson and Piatt

1999). Although there have been no studies of effects of climate change on Ancient Murrelets, warm marine waters during an El Niño event have been linked to a reduction in reproductive success in this species (Gaston and Smith 2001).

In the past Ancient Murrelet adults and eggs formed a significant part of the diet of Haida (Ellis 1991), but at present there is little threat to the breeding populations from human harvesting.

Habitat threats

The main threats to habitat are visitor activities that damage burrows and habitat destruction at sites from which the birds have been eradicated by introduced predators. On Langara Island, a sports fishing lodge was recently built on a former colony area, precluding full recovery of the Ancient Murrelet population on that island following the removal of the predators (Kaiser et al. 1997). In addition, development or activities that significantly alter the shoreline such as mariculture or recreational sites are a threat to the suitability of nesting habitat because chicks and adults require a relatively unobstructed route between their burrows and the ocean.

Forest harvesting at breeding colonies can be a significant threat; however, almost all of the currently active Ancient Murrelet breeding colony sites in British Columbia are protected or proposed for protection (i.e., WHAs).

Marine habitats adjacent to colonies and important feeding areas are threatened by oil pollution, oil and gas development, log sorts, and mariculture operations. The marine habitat can be rendered temporarily unsuitable for Ancient Murrelets by the presence of a commercial fishing fleet or a nearby sports fishing lodge.

Legal Protection and Habitat Conservation

The Ancient Murrelet, its nests, and eggs are protected in Canada and the United States from hunting and collecting under the *Migratory Birds Convention Act*. In British Columbia, it is protected from killing, or wounding, taking, and transporting under the *Wildlife Act*. However, Ancient Murrelets were traditionally an important food source for members of the Haida Nation and Haida can still legally hunt the birds for subsistence purposes.

In British Columbia, 16 of the 31 active nesting colonies are within Gwaii Haanas National Park Reserve/Haida Heritage Site and are protected under the *Canada National Parks Act.* Two additional colonies are within a B.C. Provincial Wildlife Management Area and covered under the *Wildlife Act.* One colony is within an ecological reserve and protected under the *Ecological Reserves Act.* The remaining 12 colonies have been designated as wildlife habitat areas under the *Forest Range and Practices Act*. Two colony islands (Lucy and Cox islands) from which Ancient Murrelets were eradicated by rats are on provincial Crown land.

Marine protected areas for the conservation of Ancient Murrelets can be created under the *Canada Wildlife Act,* although none have been designated to date. The *Canada National Marine Conservation Areas Act* came into force in June 2002. This act provides authority for the establishment of marine conservation areas. Marine bird bycatch in fisheries is covered under the *Fisheries Act.*

Identified Wildlife Provisions

Sustainable resource management and planning recommendations

The establishment of WHAs may not be adequate to address the threats faced by Ancient Murrelets. The link between terrestrial nesting habitats and adjacent and nearby terrestrial and marine habitats should be considered.

- Provide unobstructed access to the open ocean for adults and chicks departing the colony (i.e., no development such as log sorts, fishing lodges, mariculture operations, or recreation sites on shore, in intertidal areas or nearshore areas, or along opposite shores of non-colony islands).
- Provide undisturbed access to marine foraging grounds for adults during the breeding season.
- Discourage commercial and sports fishing activities in adjacent marine waters or in key foraging areas during the breeding season.

- ❖ Provide uncontaminated marine waters around colonies and foraging areas: to prevent exposure to chronic oil pollution from commercial or recreational boats, no mooring buoys in inshore areas around colonies.
- ❖ Provide colony and near-colony habitats free of light pollution.
- ❖ Maintain integrity of marine habitats of prey species.
- ❖ Restrict recreational use and access to colony sites (see "Additional Management Considerations").

Wildlife habitat area

Goal

Protect and maintain integrity of breeding colonies.

Feature

Establish WHAs at all extant and extirpated breeding colonies not already within national parks, national park reserves, ecological reserves, or wildlife management areas. Where Ancient Murrelet nesting colonies have been negatively impacted by introduced predators, WHAs should be established on former colony sites once the threat has been removed to allow the re-establishment of the colony and the recovery of the population.

Size

Generally between 5 and 50 ha but will vary with size and shape of nesting area.

Design

Ancient Murrelets nest around the periphery of islands and adults and chicks need unhindered access to the ocean. WHAs should include all areas with active nesting and the adjacent shoreline areas plus 200 m to maintain the quality and isolated nature of the forest and forest floor. In some cases, it may be necessary to include more area (possibly entire island) to ensure the integrity of a WHA is maintained (i.e., when active nesting occurs around the entire or significant proportion of an island and the only access for development would impact the colony such as impacting the integrity of the forest or forest floor).

General wildlife measures

Goals

1. Protect breeding colonies from development and disturbance.
2. Prevent mortality and disturbance of breeding birds and young on and adjacent to nesting areas.
3. Maintain important habitat features (i.e., intact forest structure and forest floor).
4. Prevent the introduction of non-native species.

Measures

Access

- Do not develop roads or access structures and restrict access to qualified biologists for monitoring populations.

Harvesting and silviculture

- Do not harvest or salvage timber. Do not allow development of any form in WHA or adjacent inshore waters.

Pesticides

- Do not use pesticides.

Recreation

- Do not develop recreation sites, trails, or structures.

Additional Management Considerations

Under the results based code (RBC), colonies can be protected from forest practices (including restrictions on establishing Ministry of Forests recreational facilities); however, it is not the mandate of the RBC to regulate recreational activities. Recreational activity at these colonies is considered a serious threat to this species. The following recommendations should be considered at colony sites.

Restrict access and do not allow recreational activities on colony islands.

Do not allow sports fishing lodges adjacent to colonies or on nearby shorelines.

Avoid activities involving lights or fires on nearby shorelines or in inshore waters around colonies.

Educate public on how to avoid disturbing nesting colonies. Clearly mark on marine and recreation maps with a notation that human access is prohibited at WHAs and other sites protected for these species.

Remove introduced species from colony islands. Ensure that non-endemic plants and animals are not introduced to colony islands. If necessary, reintroduce Ancient Murrelets to islands where colonies have been extirpated once introduced predators have been eradicated.

Information Needs

1. Population trend data have wide confidence intervals. Methodologies should be used to produce more precise population estimates and trends should be monitored.
2. The species' marine habitat is not well described. Important feeding areas should be determined.
3. Methods of eradicating introduced predators should be refined and those of attracting Ancient Murrelets back to areas from which they have been eradicated should be tested.

Cross References

Cassin's Auklet, Keen's Long-eared Myotis,"Queen Charlotte" Northern Saw-whet Owl, "Queen Charlotte" Hairy Woodpecker

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