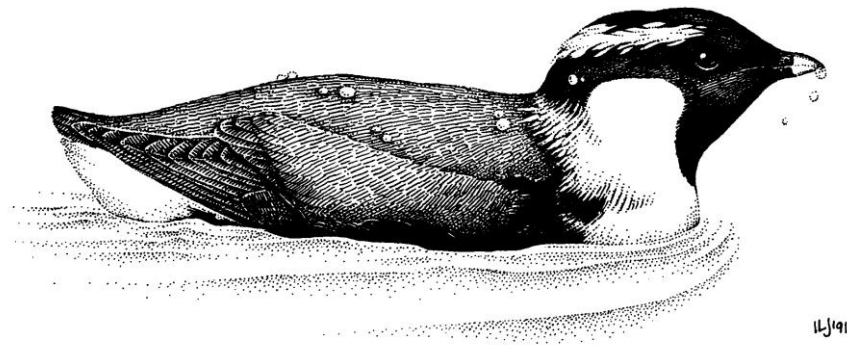


LIMESTONE ISLAND RESEARCH METHODS MANUAL



Laskeek Bay Conservation Society
Queen Charlotte City, BC

Version 5.0
September 2013

The Laskeek Bay Conservation Society is a volunteer based group based in the Queen Charlotte Islands. The Society is committed to increasing the appreciation and understanding of the natural environment through:

- *sensitive biological research that is not harmful to wildlife or its natural habitat*
- *interpretation and educational opportunities for residents of and visitor to the Queen Charlotte Islands*

Since 1990, the Society has operated a field research station at East Limestone Island and is carrying out a diverse long-term monitoring, research and interpretation programme in the surrounding islands and waters of Laskeek Bay. We actively involve volunteers from our island communities, many other locations in British Columbia, as well as from overseas.

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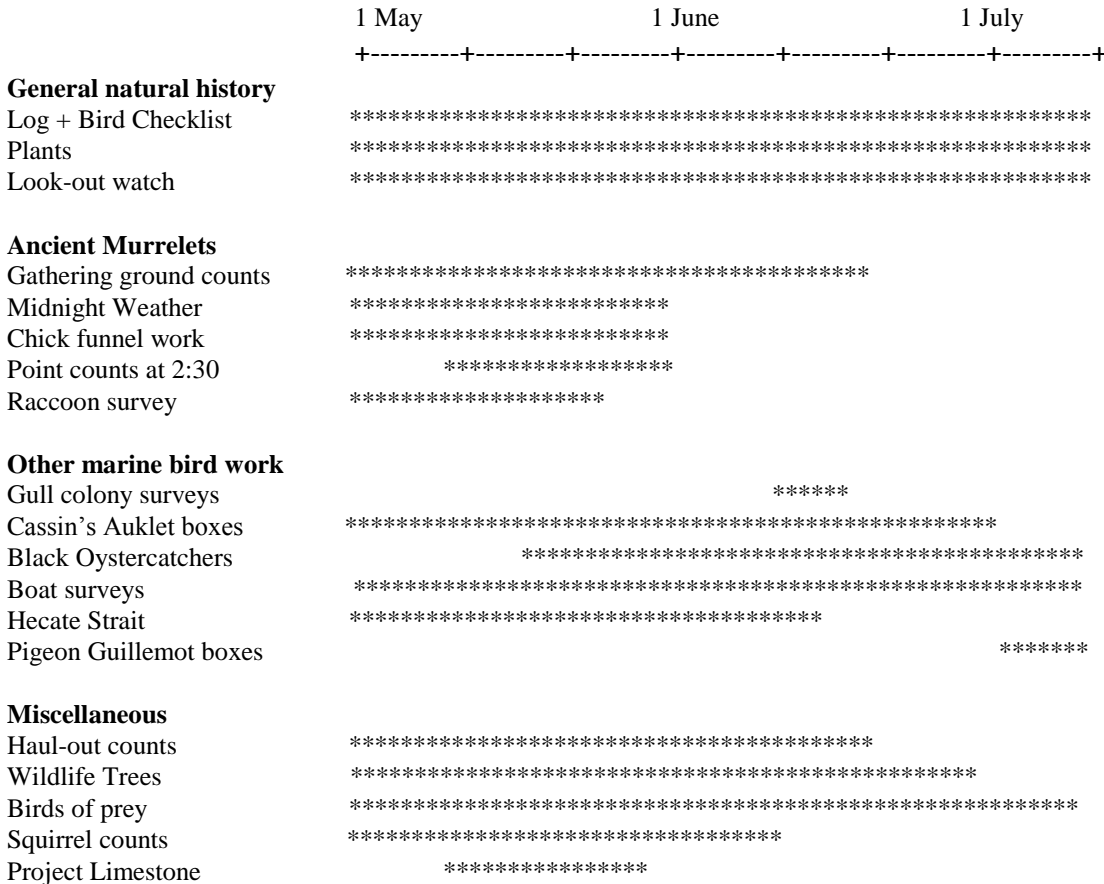
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SEASONAL TIMETABLE

MONTH	ANCIENT MURRELETS	MARINE	OTHER BIRDS	OTHER
MAY	Gathering ground counts Midnight Weather Chick funnel work Point counts at 2:30 Raccoon survey	Sea surveys Hecate Strait Haul-out counts Look-out watch	Bird Checklist Wildlife Trees Birds of prey BLOY GWGU CAAU	Camp Log Plants Squirrel counts Project Limestone
JUNE	Gathering ground counts Midnight Weather Chick funnel work Point counts at 2:30	Sea surveys Hecate Strait Haul-out counts Look-out watch	Bird Checklist Cavity nesters Birds of prey BLOY GWGU CAAU	Camp Log Plants Squirrel counts
JULY		Sea survey Haul-out counts Look-out watch	Bird Checklist Birds of prey BLOY GWGU CAAU PIGU nest boxes	Camp Log Plants Camp Inventory



GENERAL INSTRUCTIONS

- Record observations with as much information as possible, including date, location, time, observer(s) and weather.
- Record both the presence and absence of the desired variable or feature.
- Record observations as accurately as possible. Collect data in the same way that has been collected before, unless other directions given by Scientific Advisors.
- Enter data into computer often, double check, back-up on USB stick.
- All Ancient Murrelet, bird and marine mammal data are copied and sent to Tony Gaston (Environment Canada) digitally at the end of the field season.
- Copy squirrel data to Research Group on Introduced Species.
- All marine mammal data are copied and sent to BC Cetacean Sighting Network at Pacific Biological Station and copied to Kathy Heise (UBC).
- Send Field Season Summary to BC Breeding Birds Atlas and post to website.
- Send a copy of all data files, including a description of files (metadata) to Parks Canada for archiving on their server.

BINDERS

At least three binders are usually started each year to record data and observations for the season: 1) Camp Log 2) Ancient Murrelet and 3) Marine Data with the following suggested dividers: 1) Camp: Camp Correspondence (grocery lists, permits, instructions from the scientists and collaborators), Camp Log, Visitor Log, Volunteer Log, Birds of Prey, Deer, Plants. 2) Ancient Murrelets: ANMU Notes, Gathering Ground, Midnight Weather, Funnels. 3) Marine Data: Marine Mammal Sightings, Sea Surveys, Black Oystercatchers, Glaucous-winged Gulls.

Camp Log

Each year, start a new Camp Log beginning on the first day of camp. The Camp Log is a continuous record of the daily research activities (e.g. burrows, sea surveys) plus relevant natural history observations (e.g. birds, plants, insects, meteorological phenomena). Both staff and volunteers contribute their observations; even common events if written in a fresh way, may be included in the Annual LBCS Scientific Report. In addition to the Camp Log, more detailed species notes can be kept for Ancient Murrelets (ANMU Notes), plants (Plant Notes) and radio collar deer sightings.

Volunteer Log

This log is used to keep track of the names and contact information for each volunteer to Limestone Island. The total number of volunteers and volunteer days are tallied and reported in the LBCS Field Season Summary.

Visitor Log

The visitor log is used to summarize the visitors to Limestone Island. For example, tour boats (visitors + crew), school groups (Project Limestone: students + teachers), folks from Reef Island, as well as independent visitors. The total number of visitor-days are tallied at the end of the season and reported in the LBCS Field Season Summary.

ANCIENT MURRELETS

Scientific Advisor: Tony Gaston

Descriptions of Ancient Murrelet (*Synthliboramphus antiquus*) life history began in the late 1800s in Alaska. Early accounts lacked understanding of their unusual breeding strategy and precocial chick development. In British Columbia, Spencer Sealy studied the nesting and feeding ecology of the Ancient Murrelet in the 1970s. In 1984, Tony Gaston (Canadian Wildlife Service) and Ian Jones initiated and undertook a complex and detailed series of studies on Ancient Murrelet breeding and nesting ecology on Reef Island. After six years, most research on Reef Island came to a close and a camp was built on East Limestone Island in 1990, with the goal of a 25 long-term monitoring programme. East Limestone Island is the most northerly location for breeding Ancient Murrelets on the eastern side of Haida Gwaii and is approximately 40 km from Sandspit. The Ancient Murrelet colony occupies approx. 14 hectares, with ~500 nesting pairs (2006 colony census). Introduced raccoons occasionally arrive on the colony and kill adult Ancient Murrelets. A predator eradication program was developed with the then Ministry of Environment, Lands and Parks to remove raccoons from Limestone Island and the eastern shore of Louise Island to prevent their dispersal to the Limestone Islands. In recent years, the Society has done its own raccoon culls on ELI, WLI and Vertical Point. These are done in early March before the ANMU breeding season.

In Canada, Ancient Murrelets are listed as vulnerable by the Committee On the Status of Endangered Wildlife in Canada (COSEWIC) and will remain on the list until factors that threaten this population are removed (raccoons and rats). The global population is currently estimated at 1-2 million, with approximately 500,000 breeding on Haida Gwaii archipelago. Langara Island was the largest colony (ca 200,000 pairs) before introduced Norway rats (*Rattus norvegica*) caused serious and widespread declines colony. Today, the largest Ancient Murrelet colony is Frederick Island (58,000 pairs).

OBJECTIVES:

1. To examine inter-year variation in the breeding success, timing of breeding, chick and adult mass, median chick departure, recruitment, and survivorship of Ancient Murrelets (not all of this being done as of 2013).
2. To monitor Ancient Murrelet response to introduced predators.
3. To contribute to an educational and natural history interpretative program.

LIFE HISTORY

Sexes similar. Nocturnal. Colonial, burrow nester. Nine vocalisations, some quite melodic for an alcid. Female lays first egg early April and second 8 days later. Incubation starts with second egg and lasts 30-32 days. Precocial chicks leave with both parents 1-3 days after hatching. Average chick weight at hatching 25-33 g and average weight at departure 23-30g. Average weight of adults 200g (pre-breeders less). Adults and chicks eat plankton, invertebrates and fish (planktivorous and piscivorous). Bill depth is a useful

guide to sex: less than 6.9 mm is likely to be female and greater than 7.1 mm is probably male; 6.9 - 7.1 mm are of unknown sex.

CHICK TRAPPING

Chicks leaving the colony are guided to two banding stations by 4 plastic funnels. At the banding station, they are weighed and released. Funnels 5 and 6 have been in the same location since 1990.

North Cove was greatly impacted by blowdown in 2010/11 and it is no longer possible to monitor funnels 1-4 as before. Most of funnel 4 and a portion of funnel 3 are still intact, and are now monitored with Reconyx infrared cameras.

OBJECTIVES:

1. To examine inter-year variation in departure mass, timing of departure and numbers leaving (an estimate of breeding productivity).
2. To examine the relationship between departure date, departure time, and mass.

TIMING: 7 May to 11 June (approx.), stopping after second night when no chick is detected at any funnel.

FREQUENCY: Nightly, from 2230 - 0230 hrs until 20 May and then 2300 – 0230 hrs. On very dark, cloudy nights near the start of chick departures, it might be worth closing the funnels soon after 2200 h; some discretion can be exercised by staff.

MATERIALS

- Map of funnel locations (Fig. 1)
- Plastic sheeting for funnels + hundreds of skewers or sharp sticks
- Digital watch
- Chick banding bags: at least 4 per funnel
- Clothes pins (for closing funnel gates)
- Packing or duct tape (for repairing holes in plastic)
- 50g and 100g Pesola scales

SETTING UP FUNNELS

Set-up funnels about 3-4 May (usually takes 8 hours) and take down as soon as chicks are gone. The funnels are arranged to follow the natural contours of the land, diagonal to the slope, and direct chicks to banding stations near the shore. There are 4 funnel locations near the cabin: 5 and 7 south of cabin and 6 and 8 past the biffy. There are two partial funnels in North Cove: a small portion of funnel 3 near the banding shelter and most of funnel 4. North cove funnels are stored at the north cove banding shelter and the others are in the cache. There are permanent stakes for the funnels and plastic sheeting is labeled according to the fence number and side (e.g. “3 West” means Funnel 3, western side). The plastic should be replaced when it becomes too worn (holes, tears) for use.

Funnel plastic is 1m wide, 6-mil polyethylene sheets. To set-up the funnels, do the following:

- For each funnel, start at the gate and work towards the far end.
- Leave ~1 m of plastic on either side of the gate so that the ends can be overlapped or rolled together and secured with clothes pegs to make an enclosure.
- Arrange plastic so that fence height is about 60 cm. Leave 20-40 cm on the ground so that plastic can be weighed down with rocks or sticks to prevent chicks escaping and the plastic moving in the wind.
- Working from stake to stake, attach the plastic sheet to a stake with two skewers. Pull plastic snugly between stakes to prevent it from blowing about; anticipate strong (gale force) winds in May.
- Wherever possible, overlap adjoining sheets at a stake and use 3-skewers to secure the joint - chicks can squeeze through small holes.
- Place twigs, rocks and debris on the plastic laying on the ground. Do not use large logs, as chicks may wriggle under them and get trapped.
- To speed the passage of chicks along the funnel, clear obstructions like logs and brush away from the inside of funnel, near the plastic. This measure helps compensate for the extra distance and time that some chicks will have to make because of the funnels.
- Make sure that chicks won't get stuck in the funnel; chicks cannot grip the plastic.
- Every night when funnels are set, walk the fences to make sure they are still secure and intact. Always check funnels after a strong wind.
- When rolling up at the end of the season, brush away any debris and animals stuck to the plastic, otherwise they may rot over the winter.

DATA COLLECTION AND RECORDING

Begin chick banding on 7 May and continue until the second night with no chicks at all funnels. Close the funnel gates from 2230 h (2300 after 20 May) to 0230 h.

- Check for chicks every 15 minutes.
- Catch chicks as they arrive, put in chick bags and take to a banding shelter. Do not mix up chicks from different funnels.
- Put only one chick in each bag.
- Weigh chicks on 50-60 g spring scale ($\pm 0.5g$).
- Release chicks at the beach in front of the cabin.
- To release a chick, turn off light and place the chick on the ground. Wait about 1 minute before turning the light back on.
- If a chick follows you after release, take the chick closer to the water and release again.
- Chicks caught outside a funnel but within the time protocol are recorded as "OUT" with reference to the closest funnel (e.g. 5-OUT)
- Chicks caught after 0230 are entered as "AFTER" with reference to the closest funnel (e.g. 5-AFTER)

- Transcribe data from notebooks to Chick Banding Record sheets.
- Record all chicks from each funnel on CHICKS TRAPPED IN FUNNELS
- Record all chicks banded on TOTAL CHICKS CAUGHT
- Enter data into a computer often, double check and back up.
- Continue nightly with funnels until the second night with zero chicks at all funnels.

North Cove: Since North Cove funnels will be monitored by camera, a Reconyx infrared camera is set at the mouth of each of the two funnels. Set the cameras at 10 pictures/trigger, no quiet period, hyper fire interval, trigger on, and high sensitivity. Download picture weekly and recharge batteries. Keep cameras set-up for duration of ANMU season.

GATHERING GROUND

The gathering grounds are the area on the ocean in front of the colonies. In Laskeek Bay, there are several large gathering grounds between Reef and Limestone Island. Each night, birds gather on the water before coming into the colony. In the early season, most birds are breeders and they are joined by non-breeders later in the season. We obtain an index of the number of birds flying over the gathering grounds by focusing a spotting scope in the same spot each night and counting the number of birds seen in flight within the field over a 10-min period. We only count birds in flight because birds on the water are often hard to see from Limestone Island.

OBJECTIVES:

1. To count Ancient Murrelets gathered on the water.
2. To help predict the number of birds that will be in the colony that night.

TIMING: beginning of camp until 20 June

FREQUENCY: Daily

MATERIALS

- spotting scope on tripod; magnification set on 25x
- stopwatch

DATA COLLECTION AND RECORDING

Begin counts 2 hours before sunset (± 45 min.). From the top of the beach in front of the cabin, train a spotting scope on the water in front of Low Island such that the Low Island light is at the top of the field of view (Fig. 4).

- Record the number of flying Ancient Murrelets in 10 minutes (or two 5-minute intervals).
- A bird that flies in, lands and takes off is counted each time it is in flight.
- Do not do gathering ground count if wind is greater than 25 knots (47 kph), sea state Beaufort 4, or visibility obscured by rain, fog or heat shimmer.
- If something disturbs or disrupts a count (e.g. a boat passing through the flock), stop the watch, wait for conditions to settle then start again.
- Train volunteers to differentiate between Ancient Murrelets, Pigeon Guillemots, Rhinoceros Auklets and Marbled Murrelets.
- New observers should carry out simultaneous counts with trained observers.
- Note wind speed and direction, sea state (Beaufort Scale) and visibility (clear horizon is 10 nautical miles from sea level).
- Record data on GATHERING GROUND COUNTS
- Record all other birds on the count and add to the BIRD CHECKLIST

POINT COUNTS

Beginning 21 May and continuing until the last night of funnel work, counts of calling birds are performed at the end of funnel work each night (2:30 am). A single five minute count is conducted from behind the main cabin at trail marker R-4 (beside the stump where megaphone sits). Over the five minute period the number of calls heard and the number of birds calling is recorded. All birds that are detected calling are included in the count apart from those suspected to be calling from the water.

PLAYBACKS

Because of continued ANMU declines in the colony in 2011 we began a restoration project aimed at increasing the recruitment of Ancient Murrelets to the breeding colony, while at the same time increasing efforts to keep raccoons off the island. In order to attract prospecting murrelets to the colony we used an approach referred to as “vocalization broadcasting as a means of social attraction”. We based our methods on work done by Heather Major on Langara Island in 2007 and 2008. This study used megaphones broadcasting Ancient Murrelet vocalizations to simulate a busy colony to attract prospecting birds. On Langara Island, Ancient Murrelet prospector activity increased by 271% over background levels during playback trials (Major & Jones 2011).

OBJECTIVES:

1. To attract potential breeders to the colony
2. To measure the effect of broadcasting vocalizations on prospecting activity in the colony area near the broadcast locations.

TIMING:**FREQUENCY:**

Play nightly between 0:00 and 2:30 from May 21 – May 31, except on nights with high winds or heavy rain as this decreased the effective range of the broadcast and prospecting activity is typically lower on these nights. Do not play on nights with school groups either as this detracts from their experience.

MATERIALS

2 TOA model ER2230 megaphones
 D-cell batteries to power megaphones
 2 Sony diskmen
 4 ANMU vocalization CDs (with two versions of all calls recorded at Langara Island in 2006).

DATA COLLECTION AND RECORDING

Place two megaphones in separate locations within the Ancient Murrelet colony and broadcast murrelet colony sounds during the part of the breeding season corresponding to chick departures and peak prospecting activity. Locations of megaphones are: Spring Valley (Station 1: N52.90889, W131.61024) and behind camp (Station 2: N52.90760, W131.61069). They are positioned 3-4 ft off the ground and pointed towards the ocean and up at a slight angle from the horizontal in order to project the sound into the forest canopy. The megaphones and CD players were kept at 75% volume. This is likely much louder than natural audio levels but ensures calls are audible over other ambient noise (e.g., wind and waves).

CASSIN'S AUKLETS

Scientific Advisor: Tony Gaston

Cassin's Auklets (*Ptychoramphus aleuticus*) are planktivorous marine birds that nest in burrows on forested or grassy islands and in natural crevices, usually very close to shore. British Columbia supports about 80% of the global population and Triangle Island is the largest colony in BC with ~500,000 breeding pairs. Cassin's Auklets are the most numerous breeding seabird in Haida Gwaii and most of the colonies are either on the southeast or northwest parts of the archipelago. Like Ancient Murrelets, this species has been negatively affected by introduced raccoons and rats; some colonies have been abandoned. There is a small Cassin's Auklet population on Limestone Island and natural

burrows are found on Cassin's Tower, at the Look-out, the East Coast Trail and the west side of the island.. Artificial nest boxes were installed at Look-out point and the East Coast Trail (North and South plots) in 2007. Chicks are fed in the burrow and consequently, occupied burrows have a strong odour from regurgitated plankton.

LIFE HISTORY

Sexes similar. Colonial, in burrows. Nocturnal. Planktivorous. One egg. Peak egg laying in late March to late April, chick hatching late April to late May, fledging early June to early July. Incubation 37-42 days and both parents share 24 hr shifts. Semi-precocial chick development. Chicks fed and brooded at night, but left alone during the day after they have gained the ability to thermoregulate at ~ 8 days old. Chick mass at hatching averages 20g; growth 4 grams per day with fledging mass 148-180g. In Haida Gwaii, seriously threatened by introduced raccoons. Langara Island population extirpated by introduced rats.

OBJECTIVES:

1. To monitor the Cassin's Auklet population on East Limestone Island.
2. To record timing of breeding.
3. To measure chick growth as an index of feeding conditions

TIMING: May - June

FREQUENCY: Every 3 days beginning in early May; after 22 May, each 5 days if chicks present.

MATERIALS

- Notebook and pencil
- Banding kit (No. 3B stainless bands, pliers, 50g and 300g spring scales, calipers, ruler)

DATA COLLECTION AND RECORDING

Burrows and boxes are located in the following places: Lookout Point, 25 boxes; East Coast Trail (north), 24 boxes (south), 17 boxes. To monitor Cassin's Auklets:

- Inspect numbered boxes and burrows in early May. Repair or remove any clearly non-usable. Carefully inventory any remaining intact boxes.
- Set-up knock-down sticks in the entrance and check at 3-day intervals throughout May. Record whether or not sticks are knocked down at each visit and re-set sticks.
- After 22 May, check boxes for signs of chicks or use. Check carefully for presence of other species (i.e. Storm-Petrels). An active burrow can often be found by sniffing the burrow or crevice entrance because they are generally very smelly.

- If an adult auklet is present do not disturb it. Quietly close the door and leave alone.
- If an auklet chick is present without an adult, band and weigh using the appropriate scale. Return and weigh chicks and measure wing cord length at 5 day intervals (to estimate growth rates). Using information collected from the periodic nest checks, estimate hatch or fledge date.
- Throughout the breeding season, note when Cassin's Auklets are heard calling at night in Bird Notes and the BIRD CHECKLIST .
- Record the status of each burrow and nest box in field notebook.

EVERY FOUR YEARS

Beginning in 2015 carry out a complete census of Cassin's Auklet burrows occupied by inspecting all likely coastal areas – places where there are rock crevices or tree roots close to the edge of some sort of cliff – probably just on the headlands between Cassin's Tower and the North Cove. To be done in early June – probably a 1-day job for 2-3 people.

Count number of natural burrows in each sector which appear to be occupied, judging from smooth burrow entrances, presence of droppings in the entrance and smell of rotten krill – very distinctive and quite different from musky petrel odor.

STORM-PETRELS

Scientific Advisor: Tony Gaston

A small, but unconfirmed number of Fork-tailed Storm-Petrels (*Oceanodroma furcata*) nest on Limestone Island. This small tubenose species nests in burrows primarily on small, forested islands. The global population for this species numbers several million although numbers nesting in Haida Gwaii are modest (ca. 54,000 pairs). Both Fork-tailed and Leach's Storm-petrels (*Oceanodroma leucorhoa*) species are pelagic and found in all waters of the archipelago in the spring and summer. Leach's Storm-petrels are not known to breed on Limestone Island.

LIFE HISTORY

For both species: Sexes similar. Pelagic. Diet of plankton and larval fish. Nest in burrows on islands. Semi-precocial chicks. One egg.

OBJECTIVE:

1. To record breeding attempts of storm-petrels on Limestone Island.

TIMING: late June – early July

FREQUENCY: visit potential breeding locations once or twice

DATA COLLECTION AND RECORDING

- Throughout the breeding season, record Fork-tailed and Leach's Storm-Petrels calls in the Daily Log and BIRD CHECKLIST.
- Check all Cassin's Auklet nest boxes and burrows for presence of storm-petrel chicks.

BLACK OYSTERCATCHERS

Scientific Advisors: Tony Gaston and Mark Hipfner

Black oystercatchers (*Haematopus bachmani*) are the dominant shorebird species in Laskeek Bay in summer. Pairs noisily defend nesting territories and lay their eggs in pebble-lined scrapes on gravelly or rocky shorelines. Laskeek Bay has about 30 pairs of oystercatchers nesting on all the islands. Haida Gwaii contains about 37% of the British Columbia population, which is about one third of the global population. Information on long-term population changes is limited and the research supported by LBCS is one of the few on-going studies to quantify Black Oystercatcher population trends. For this reason, it is a priority to make sure that all nest sites are visited each year and that efforts are made to band chicks. Trapping of adult birds has been done in earlier years and may be repeated.

LIFE HISTORY

Sexes similar, except that females have longer bills. Solitary nesters. Diurnal. Two or three egg clutch. Eggs laid in an open scrape, lined with small rocks and shells. Males have slightly thicker, redder bill than females. Chicks are fed within the nesting territory by both parents: begin to move away from nest after 2-3 days old but remain within territory boundaries. Parents and chicks feed on intertidal invertebrates, especially limpets, chitons and mussels. Adults are long-lived.

OBJECTIVES :

1. To completely census the population of territory-holding Black Oystercatchers in Laskeek Bay
2. To record the approximate timing of egg laying.
3. To estimate productivity.
4. To study chick philopatry and adult survival.

TIMING: late May - July

FREQUENCY: late May/early June, late June/early July; 2 days per check

MATERIALS

- Census/territory maps. (Fig. 6-10) and codes (Table 2)
- Binoculars (for reading leg bands)

- Chick Banding Kit (No. 5 stainless steel bands, large pliers, dark blue alpha-numeric plastic bands, vice-grips (for closing bands), needle-nose pliers (for fixing crossed bands), calipers (tarsus and bill measurements), wing ruler, banding bags)

DATA COLLECTION AND RECORDING

Each year, census all oystercatcher breeding territories in Laskeek Bay: Cumshewa Island, Skedans Islands and its islets, Low Island, South Low Island, East and West Limestone, Kingsway Rock, Reef and Lost Islands and their associated islets (see Figure 6-10). High tide and calm weather is best for surveys.

- Between 20-30 May, survey all offshore islands and islets, and map presence and absence of BLOY, indicating site-holding pairs. Look for new pairs. Use territory maps for guidance.
- At each site previously recorded, and at any new sites located, check the legs of the pair for bands and record the combinations if present. Make sure to record if you saw both legs and the bird was definitely unbanded (e.g. REE-2: all legs seen, no bands).
- In late May / Early June, visit all sites identified previously and check nests for eggs or chicks. This exercise is best done with lots of people to jump in and out of boat. Spend ~15 minutes watching pair from the boat to determine the location of the brood.
- Count, measure and weigh eggs and/or chicks.
- Record egg measurements on LBCS BLACK OYSTERCATCHER EGG DATA FORM.
- In late June/early July, visit all BLOY nests again. Weigh chicks and band them if they are at least 100g.
- Collect prey to inventory back at camp. Record number of chitons, limpets, mussels, abalone.
- Enter data onto LBCS BLACK OYSTERCATCHER TERRITORY VISIT FORM

Table 2
Nest codes and locations for Black Oystercatchers breeding in Laskeek Bay.

ISLAND	OLD CODE	NEW CODE	ISLAND	OLD CODE	NEW CODE
East Limestone Island	A1	ELI- 1	South Low Island	A1	SLW-1
	A2	ELI- 2		A2	SLW-2
	A3	ELI- 3		A3	SLW-3
				A4	SLW-4
West Limestone Island	A1	WLI-1		A5	SLW-5
				A6	SLW-6
Reef Island	A1	REE-1	Low Island	A7	SLW-7
	A2	REE-2		A1	LOW-1
	A3	REE-3		A2	LOW-2
	A4	REE-4	Kingsway Rock		
	A5	REE-5		A1	KNG-1
	A6	REE-6		A2	KNG-2
	A7	REE-7		A3	KNG-3
Skedans Islands	A1	SKE-1	Lost Islands		
	A2	SKE-2		A1	LOS-1
	A3	SKE-3		A2	LOS-2
	A4	SKE-4		A3	LOS-3
	A5	SKE-5		A4	LOS-4
	A6	SKE-6		A5	LOS-5
	A7	SKE-7		A6	LOS-6
	A8	SKE-8		A7	LOS-7
	A9	SKE-9		A8	LOS-8
Cumshewa Island	A1	CUM-1		A9	LOS-9
	A2	CUM-2			
	A3	CUM-3			
	A4	CUM-4			

CHICK BANDING

- To locate chicks, first watch from a distance for 15-20 minutes to narrow down the potential search area.
- Finding chicks can be tricky! Chicks are well camouflaged. Look in all cracks and crevices. Chicks will hide in seaweed so step carefully.
- If you can't find a chick in 10 minutes, move away and hide again. Usually adults will rejoin chicks in about 10 minutes.
- Band chicks that are heavier than 100g. Chicks 15-20 days old are easiest to find because they don't run when approached.
- Band chicks: Right Leg (below the knee) = alpha-numeric band over No.5 stainless steel metal band. Left Leg (below the knee) = alpha-numeric band.
- Return chick to where you found it. Make sure it is well camouflaged.
- Record banding data on LBCS BLACK OYSTERCATCHER BANDING FORM
- For chicks 100g or more: band, weigh, measure wing chord length (elbow to tip of feathers), tarsus length (knee notch to heel), culmen (edge of feathers to tip).

GLAUCOUS-WINGED GULLS

Scientific Advisor: Tony Gaston

Glaucous-winged Gulls (*Larus glaucescens*) nest on un-forested islands or the cliffs of forested islands. They build nests from vegetation and lay up to three eggs as early as the end of May. They breed in four locations in Laskeek Bay, with the largest colony at the Lost Islands; the Kingsway Rock colony has declined with the rise in the Lost Islands colony. The overall breeding population of this species on Haida Gwaii is stable or increasing and over the entire BC coast, the population has grown by more than 300 percent in the last 60 years.

LIFE HISTORY

Sexes similar. Three-four years to maturity with annual, variable plumage. 3 egg clutch. Semi-precocial chicks. Colonial, surface nester. Breeds at 3-4 years old. In Haida Gwaii, eggs laid late May - late June; hatch late June - early July; fledge July - August. Surface feeders, scavengers and predators. Territorial and will attack foreign chicks that wander into their territory.

OBJECTIVE:

1. To record changes in Glaucous-winged Gull numbers in Laskeek Bay.

TIMING: June

FREQUENCY: 3-4 days of colony census around 10 June.

MATERIALS

- Notebook and pencil
- Maps (Fig. 11)

DATA COLLECTION AND RECORDING

Census Kingsway Rock, Cumshewa Rock, Reef Island and its islets, Skedans, Low and ^vLost Island colonies (Fig. 11). Visit one of the main gull colonies about 20 May to see if laying is underway. If laying has begun on 20 May (a normal year), visit all colonies beginning 10 June. Adjust census accordingly if laying is later.

- Before stepping on the colony, count the number of adult and juvenile gulls on land and in the air. Record the presence of Bald Eagles and other marine raptors
- Move steadily through the colony, count all nests and record their contents (empty, 1E, 2E, 3E, 1C2E, etc). Watch footing on steep areas, especially on the Skedans and Lost Islands.
- Look on all ledges and accessible islets because nests can be in the most unlikely places.

- Be careful not to step on any chicks that are hiding in the vegetation or chase an older, mobile chick into a neighboring gull's territory because it may get attacked by other adults.
- Look for banded adults and record presence and absence.
- Enter data onto GLAUCOUS-WINGED GULL CENSUS.

▽ Lost Islands are in the Gwaii Haanas National Park Reserve. Ensure current permit from Archipelago Management Board.

PIGEON GUILLEMOTS

Scientific Advisor: Tony Gaston

Pigeon Guillemots (*Cepphus columba*) nest in burrows and rock crevices on small remote islands. Pairs will nest in isolation but often form small colonies. They lay up to two eggs beginning mid-May. In 2001, ten nestboxes were placed at Lookout Point for monitoring and in 2010 18 more boxes were added. Most of the original boxes are used each year.

LIFE HISTORY

Sexes similar. Colonial crevice nester. Breeds at 3 years old. Two egg clutch. Peak egg laying mid-May to mid June, chick hatching mid June to mid July, incubation 26-32 days and parents share duties equally. Semi-precocial chicks. Chicks are brooded continuously until 3 days old, at intervals until 5-7 days old at which point they can thermoregulate. Mass at hatching about 44 g increasing between 10-20 g/d until asymptotic weight is reached between 30-40d. Chicks fledge around 38 days. Chicks are fed small fish and invertebrates by pursuit diving parents.

OBJECTIVES:

1. To monitor Pigeon Guillemot reproductive success on East Limestone Island.
2. To establish a known age population by banding chicks.

TIMING: end of season

MATERIALS:

- Notebook and pencil
- Banding kit (No.4 stainless bands, pliers, 50g and 300g spring scales, calipers)

DATA COLLECTION AND RECORDING

Twenty-eight boxes are located at Lookout Point. To monitor Pigeon Guillemot boxes:

- Inspect numbered boxes in early May to make sure hatches are in place. Re-mark numbers on boxes if fading.
- At the very end of the season (c. 5 July), check boxes for eggs and chicks
- If eggs are present, measure (length and breadth) and weigh each egg.

- If chicks are present, band and weigh using the appropriate scale. –measure WC + tarsus + culmen
- Record the status of each nest box on PIGEON GUILLEMOT NEST SUMMARY

TERRESTRIAL BIRDS

Scientific Advisor: Jean-Louis Martin and Tony Gaston

Many species of passerines, woodpeckers and raptors nest on Limestone Island and the other islands in Laskeek Bay. The combination of young and mature coniferous and deciduous trees, deciduous shrubs, rock walls and dead wood provide suitable nesting habitat for terrestrial birds. The abundance and distribution of flowering and fruiting shrubs have been negatively affected by introduced Sitka black-tailed deer, which limits both the foraging and nesting habitat for small passerines.

OBJECTIVE:

1. To record the presence, nesting activity and nest re-use of terrestrial birds on Limestone Island.
2. To study the effect of introduced deer on recruitment in songbird populations.
3. To use the long-term trends in terrestrial bird populations to monitor the impact of changes in the forest ecosystem.

TIMING: all season

FREQUENCY: Bird Checklist – daily; Cavity Nesters – early May – July; Raptors – May except falcons after 24 May

BIRD CHECKLIST

OBJECTIVE:

1. To record the presence of birds on Limestone Island and on the surrounding islands in Laskeek Bay.

TIMING: entire season

FREQUENCY: daily

DATA COLLECTION AND RECORDING

- Throughout the day, note species seen and heard on Limestone Island. Also, while out on the water or on other islands, note species seen or heard.

- At the end of the day, check off the species seen or heard in Laskeek Bay. Record the number seen for unusual species (not recorded daily). Sum the daily species total.
- Calculate average species numbers each month.
- Note maximum days for Field Season Summary.
- Record species on BIRD CHECKLIST

CAVITY NESTERS

Scientific Advisors: Keith Moore and Jo Smith

Seven species of cavity nesting birds nest on Limestone Island: Red-breasted Sapsuckers (*Sphyrapicus ruber*), Hairy Woodpeckers (*Dryocopus villosus*), Northern Flickers (*Colaptes auratus*), Brown Creepers (*Certhia familiaris*), Red-breasted Nuthach (*Sitta canadensis*) Chestnut-backed Chickadees (*Parus rufescens*) and Northern Saw-whet Owls (*Aegolius acadicus*). Red-breasted Sapsuckers are the most numerous cavity nesting species and some nest trees have been used for eight consecutive years. Sapsuckers are strong excavators and will make nests in both live and dead trees. Northern Flickers and Hairy Woodpeckers are moderate excavators and generally find dead trees for nesting. Nuthaches, creepers and chickadees are generally secondary cavity nesters, and creepers will also build nests under bark. A combination of nest monitoring and bird banding will advance our understanding of site fidelity and habitat use of cavity nesters on Limestone Island.

LIFE HISTORY

On East Limestone Island: excavating / nest building early April; incubation late April - early May; chicks late May; fledging early June.

OBJECTIVES:

1. To examine patterns of nest site use by cavity-nesting birds.
2. To study how changes in forest composition and the age and state of trees and snags can affect their suitability for cavity nesting birds

TIMING: early May - late June

FREQUENCY: Approximately every other day, or as work allows.

MATERIALS

- Notebook and pencil
- Map of wildlife trees (use most recent map)
- Watch

DATA COLLECTION AND RECORDING

Early May

- Survey wildlife trees that have been active in the last five years. (Noting whether an active tree from a previous year no longer exists e.g. fallen down or broken top).
- Watch trees quietly for 30 minutes or until activity is noted, whichever is longer. Early in the season, ‘activity’ is restricted to excavating and nest building behaviour whereas later, provisioning may be observed in addition begging chicks may be heard.
- Visit trees a minimum of three times to determine whether they are active. (Nests of Northern flickers and Hairy Woodpeckers need to be watched from 50-100m away if possible.)
- If a new nest is found, describe its position (height, aspect, physical features near it on tree that would help to locate it again) and map its location.

May – June:

Survey active nests for nestlings (chicks) at least every other day to record hatch and fledge dates.

- Once chicks at known active trees have hatched (chicks heard, adults delivering food), sweep through all of the previously active wildlife trees (active in the last five years to determine if there is any new activity since the initial survey. For ‘the sweep’ nests can be watched for 10 minute periods.
- For all new nest trees, record diameter (DBH), decay class and species of tree (reference: Wildlife Tree Classification Guide, Ministry of Forests)
- Record information on nest observation WILDLIFE TREE data sheets and forms. At the end of the season, make sure all trees have tags and that new trees are accurately mapped and described.

BIRDS OF PREY

Scientific Advisor: Tony Gaston and Jo Smith

Limestone Island's forests and cliffs support a small number of breeding eagles, falcons, ravens, owls and hawks (Table 3). Some of these birds rely heavily on Ancient Murrelets during the breeding season to feed themselves and their young. Eagle nests are located at or near the top of trees on the edge of the forest. The Peale's Peregrine Falcons nest in an eyrie on the south side of the island. The cliff is not accessible from the intertidal area or ridge trail; however, a blind was constructed in the early 1990s to view the eyrie without disturbing the birds. The diversity of nesting species can be as high as four in some years, although most years just one or two species have active nests. The first Northern Saw-whet Owl nest was found in 2001 in an abandoned Northern Flicker cavity near camp. There are few nest records on Haida Gwaii for any birds of prey except eagles and falcons.

OBJECTIVE:

1. To record the presence and absence of nesting birds of prey on Limestone Island

TIMING: entire season, except Peregrine Falcons after 24 May.

FREQUENCY: once per week

DATA COLLECTION AND RECORDING

Approach all nests quietly and wherever possible, stay at least 100 m from the nest during surveys.

- Locate all nests from previous years (Fig. 12) and record presence or absence of adults and breeding activity.
- Search for new nests.
- Record dates of occupation and other nesting behaviours (e.g. aerial displays, calling, prey deliveries).
- Visit Peregrine Falcon breeding locations by land **ONLY** after 24 May. Visits prior to this date may be made only by boat. Before the end of the season, try and determine how many young successfully hatched.
- Record nest activity on **BIRDS OF PREY NEST RECORDS**

Table 3
Birds of prey on East Limestone Island.

Common Name	Species Name	Provincial Status (1998)
Peale's Peregrine Falcon	<i>Falco peregrinus pealii</i>	BLUE
Northern Saw-whet Owl	<i>Aegolius acadicus brooksi</i>	BLUE
Bald Eagle	<i>Haliaeetus leucocephalus</i>	YELLOW
Sharp-shinned Hawk	<i>Accipiter striatus</i>	
Common Raven	<i>Corvus corax</i>	

SEA-SURVEYS

Scientific Advisor: Tony Gaston

At-sea surveys for marine birds and mammals provide long term trends on species distribution and abundance in this area of the Hecate Strait. Of particular interest is the number and location of Marbled Murrelets in Laskeek Bay. Few studies exist to examine at-sea trends for this forest-nesting seabird, and LBCS has the longest time series of marine counts in Haida Gwaii. The Hecate Strait surveys are also designed to provide a record of the abundance of pelagic birds such as shearwaters, fulmars and occasionally jaegers (skuas). In addition to marine birds, the biweekly transects record the number of marine mammals at known haul-outs in Laskeek Bay and the presence of aggregations of whales (such as humpback) that forage in nearby waters. Long-term marine survey data provide a baseline to measure change in the event of chronic or catastrophic oil spills or other disturbances to the marine environment.

OBJECTIVES:

1. To measure the abundance and distribution of marine birds and mammals.
2. To monitor inter-annual changes in Marbled Murrelet at-sea populations.
3. To record inter-annual changes in sea-surface temperature (SST) in Laskeek Bay.

TIMING: May, June and July

FREQUENCY: beginning early May, survey transects once per two-week period, with no less than 10 days between surveys.

MATERIALS

- Thermometer on a string
- Binoculars
- Map of transects (Fig. 13)
- Handheld tape recorder with tape
- Bird book (optional)
- GPS unit with spare batteries

DATA COLLECTION AND RECORDING

Sea-surveys are done under calm, or near calm conditions. The entire survey is ca. 55 nm and takes approximately 5 hours, not including breaks. Check the weather forecast and outlook 24 h before a proposed survey and note barometric pressure changes - if it is rapidly falling, postpone a survey.

In 2009 we began using the GPS to measure distance along the transect, as opposed to stopwatch time as was used in the past. Set trip odometer to zero at the beginning of each transect (doesn't matter which way transect is being run) and simply record distance at which birds are seen. Record start and end time for each transect.

Note: for Hecate survey we need a second GPS with waypoints for the boat driver to navigate with.

NEARSHORE AND OFFSHORE

- Transects are conducted from a boat running at a speed that just allows the boat to plane.
- We use a continuous, strip transect method where the strip is 100 m wide (50m either side of boat). Transects along the shore are done at a distance of 200m from the high tide mark. It is best to start early in the day to get as much of the survey done as possible before the wind picks up. Definitely aim to start no later than 0900 h.
- At the beginning of each survey, record into the tape recorder the following data: date, time, observers names, wind speed and direction, sea state (swell height and waves), visibility (15nm to horizon), cloud cover (0-100 %) and any other relevant weather.
- At the beginning of each transect, record: the transect number, record SST at locations indicated on the map, time of day, and any changes in wind/weather. Use GPS to measure distance along transect from start. Record this distance for each observation.
- For each bird or flock seen within the transect, note the time, species and how many (see below for Marbled Murrelets). Note whether on water or in flight. Birds that take off from the water are recorded as "on water." All birds seen or heard are noted on the BIRD CHECKLIST.
- Record all sightings of shearwaters and kittiwakes at any time during the season. Immature kittiwakes have dark 'W' across wings. Record Adult: Immature ratio for BLKI.
- Record any interesting bird/mammal sightings beyond 100 m as "off transect".
- Transcribe data from tape soon after survey so that it is still fresh in your mind and problems or questions can be resolved. Record observations on data sheet 'Laskeek Bay Boat Surveys for all Sea Birds'. Transcribe into Excel spreadsheet as well.

Marbled Murrelets. Record individual group sizes, that is, pairs of birds or small groups instead of a total number seen. Marbled Murrelet at-sea ecology is analysed sometimes with respect to group size, e.g. pairs probably are breeders, small groups could be failed breeders, prospectors or non-breeders.

Sea lions and seals. All pinnipeds are recorded and counted at haul-outs: Reef Island and its islets, Skedans Islands, Cumshewa Rocks, Cumshewa Head, Kingui Island and South Low Island. Low tide is often the best time to count Harbour Seals since at other times they usually in the water. Approach no closer than 200 m to a haul-out and if animals begin to move towards the water, move further back.

Due to the long-term nature of this data set, it is very important that all transects are done for each survey. If transects are missed for any reason, complete them as soon as possible, ideally, the next day.

HECATE STRAIT

Attempt Hecate Strait pelagic bird surveys only during calm conditions otherwise you will miss many birds. From the cabin, view the sea beyond Reef Island with a spotting scope. If the horizon is uneven and wavy, the swell is too large to run the survey. Determine the direction of the swell before beginning and drive the farthest offshore leg (NE - SE) running with the swell. Record if a leg is driven at something other than planing speed. Weather offshore is unpredictable and swell can be too large to travel at a constant speed, even with calm winds.

- In a tape recorder, note the presence of all pelagic birds, especially shearwaters (Sooty Shearwaters common but look for Pink-footed Shearwaters and Buller's Shearwaters), Black-legged Kittiwakes, skuas, phalaropes, albatrosses, etc. Record all sightings of shearwaters and kittiwakes at any time during the season.
- Make one trip in April, two in May and June, and one in July. Use established coordinates and make trips into Hecate Strait early in the morning - just after dawn (early morning is best for birds and weather, later in day is OK if not possible. May is the best time for migrants - do at least two surveys during this month.
- Similar to nearshore surveys, run trips at least 10 days apart.
- Use the GPS unit to run a fixed pattern. Use normal transect method, including the recording of the exact position of any special aggregations. If you see lots of birds making a passage (e.g. Sooty Shearwaters and loons), stop for 5-10 minutes and count the birds. Record these numbers separately from the transect counts.

Waypoints (2002):

REEF	52° 52.70' N; 131° 29.45' W
SE	52° 52.70' N; 131° 21.20' W
NE	52° 57.70' N; 131° 21.20' W
SKEDANS	52° 57.15' N; 131° 33.05' W
CABIN	52° 54.47' N; 131° 36.59' W
LOW I.	52° 54.75' N; 131° 32.40' W

MARINE MAMMALS

Scientific Advisor: Kathy Heise and Graeme Ellis

Throughout the entire season, watch for marine mammals in Laskeek Bay. Record all sightings and where possible, take photos to help marine mammal researchers identify individuals and groups. The BC Cetacean Sightings network is a repository for all marine mammal records in BC and in 2002, LBCS partnered with this organisation. We also receive assistance from the Pacific Biological Station in Nanaimo to identify orcas. Photo-identification is used to record the presence of an animal and our efforts to photograph orcas have helped marine mammal biologists establish movement patterns and family groups of orcas in Haida Gwaii and Alaska.

SEA WATCHES**OBJECTIVES:**

1. To record the presence of marine mammals in Laskeek Bay
2. To count sea lions and seals at haul-outs on Skedans and South Low Islands

TIMING: Daily

FREQUENCY: Daily from cabin and 2-3 times per week from Lookout point. Seasonal goal is 30 hours of sea watches.

MATERIALS

- Binoculars
- Spotting Scope on tripod
- Marine mammal profile sheet
- Bird Book
- Notebook and timer
- Hand-held VHF radio

DATA COLLECTION AND RECORDING

From the cabin, watch for marine mammals on the water. As much as possible, try to spend 10-15 minutes a day, 4 times a day, scanning the horizon. In the past, a large proportion of the total marine mammal sightings have been from the cabin. Dedicated sea watches are done from the Lookout point when winds and seas are light to moderate (up to 20 knots and sea state 3-4)

- For each sea watch, record time of day, observers, wind direction and speed, visibility, sea state, glare and cloud cover.
- At Look-out Point, divide area to be watched among observers (2-3 people best) (Fig. 14).
- Suggested method with 2-3 people is to scan, with binoculars, to the edge of the islands for 10 minutes then move to another sector. Repeat for 30-60 minutes.
- Record marine mammal species seen or if none seen.
- On a clear day, count the sea lions hauled out on Skedans Island and seals on South Low Island.
- Sea watches are a minimum of 30 minutes.
- Record logged time at Lookout, species and number of animals seen, visibility, and wind on MARINE MAMMAL LOG.
- For Orcas, complete Vancouver Aquarium Killer Whale Encounter Summary and send with digital photos.
- Record bird species on the BIRD CHECKLIST

CETACEAN ENCOUNTERS

Scientific Advisors: Kathy Heise and Graeme Ellis

OBJECTIVES:

1. To record the presence of whales and dolphins in Laskeek Bay.
2. To identify individual animals to record movements.
3. To acquire information on the feeding ecology of Pacific White-sided Dolphins.
4. To determine size of groups and age structure and of whales and dolphins in Laskeek Bay.

MATERIALS:

- Any SLR camera with a 200 or 300 mm lens (set camera to shutter priority, 1250-1600 if good light; 1000 if dim).

PHOTO-IDENTIFICATION

- Approach the animals cautiously and maintain a constant speed. Maintain constant speed, that is, try not to vary propeller vibration too much.
- If necessary, talk to any other boats in the area to let them know what you are doing.
- Once sufficient photos have been taken, leave the animals alone.
- Take clear, square-on, full-frame photos of the left side of all animals' dorsal fins and saddle patches. It is really important to photograph all the animals present so systematically work through the entire group, taking at least one photo of each individual.

AFTER TAKING PHOTOS

- Save all pictures in photo data base and name file as SPECIES_YYY-MO-DA_Photographer_Location (ie. KW_2013-07-04_JPattison_JuanPerez).
- Fill in a Vancouver Aquarium's "Encounter Summary" sheet, and send sheet and DVD with photos to Graeme Ellis at the end of the field season to the Pacific Biological Station, Fisheries and Oceans Canada, 3190 Hammond Rd, Nanaimo, B.C. V9R 5K6. (250) 756-7245.
- Send entire spreadsheet to Graeme and Kathy Heise at the end of the season.

Killer whales: When killer whales are seen from land, leave someone with a handheld radio to watch the pod, while others go to the boat. Take pictures if you can (see above). Pictures of whales and dolphins can be very useful for recording the use of an area by cetaceans. Biggs' et al. (1987) book, Killer Whales of British Columbia, also has information on how to take pictures of killer whale identification.

Pacific White-sided Dolphins. These are very challenging animals to take pictures of but it is useful to record the time, date and location of all encounters. Kathy Heise is interested in the breeding status of dolphins so if you see particularly small animals within a group, or a pair of animals that consistently surface next to each other, record this information.

Humpback Whales. Individual identification is possible from the pattern on the tail. If possible, take a photo of underside of tail fluke as the animal dives; humpbacks often flick their tale before a deep dive.

Gray Whales. Take pictures of left flank of animal.

SEA LION AND SEAL COUNTS

Monitor each 10 days.

During all nearshore sea surveys, and whenever you are able to from the boat, count the sea lions and harbour seals hauled-out on the rocks of islands in Laskeek Bay. The most common sea lions are Steller's Sea Lions but also look for California Sea Lions (steep forehead, quintessential sea lion bark). Usually, sea lions are on the Skedans Islands until mid-May, then they move over to the islets at the eastern end of Reef Island later in the spring.

- All sea lions and seals are recorded and counted at haul-outs: Reef Island islets, Skedans Islands, Cumshewa Rocks, Cumshewa Head, Kingui Island, South Low Island.
- Low tide is often the best time to count Harbour Seals since at other times they are often in the water.
- Approach no closer than 200m to a haul-out but if animals start to jump in the water, move back farther.
- Look for branded animals and report this information to Graeme Ellis at Pacific Biological Station. Also look for animals that may have caught their head in fishing netting.
- Record data on Haul-out counts on MARINE MAMMAL LOG.

PLANT INVENTORY

Scientific Advisor: Tony Gaston and Jo Smith.

Limestone Island supports a unique assemblage of plants because of the limestone bedrock. Several plants occur on Limestone Island that are either not found elsewhere on the islands, or are uncommon. Most rare and uncommon plants are located on deer-free refugia (e.g. cliffs, overhangs). Over time, several plants have been introduced to Limestone Island and while some species are not especially harmful, others like wall lettuce (*Lactuca muralis*) are described by some as noxious weeds and it is important that their occurrence on the island is tracked. If populations of introduced plants start to spread, control programs should be considered to protect the native diversity.

OBJECTIVES:

1. To inventory and map the occurrence of plants on the island.
2. To track rare plants and introduced species.

TIMING: entire season, emphasis late May - July

FREQUENCY: opportunistic, with 2-3 days in late June - early July

MATERIALS:

- Notebook and pencil
- Archived map of rare plant locations (Fig. 15)
- Field Guide (e.g. Pojar and Mackinnon)
- Hand lens (10x)

DATA COLLECTION AND RECORDING

- Throughout the season, record the presence /absence of species, and dates of flowering of major plant species (herbs, shrubs, trees)
- Each year, make notes on the abundance and distribution of introduced species
- In late May- early June, travel around the edge of the island and search the known locations of rare plants (Table 4 and 5). Record blooming dates, number of individuals and any signs of browsing.
- Every five years (First survey: 1997) complete a thorough inventory of all plants on the island, paying particular attention to uncommon and introduced species.

Table 4
Rare and introduced species to track on East Limestone Island.

Common Name	Species name	Status on ELI	Location(s)
Richardson's geranium	<i>Geranium richardsonii</i>	Rare	eastern shore & lookout
Showy Jacob's ladder	<i>Polemonium pulcherrimum</i>	Rare	Boat & Anemone Cove
cut-leaf anemone	<i>Anemone multifida</i>	Rare	Boat & Anemone Cove
Menzie's pipsissewa	<i>Chimaphila menziesii</i>	Rare	near cabin & SH1
rattlesnake plantain	<i>Goodyera oblongifolia</i>	Rare	one location - forest plot 3
shore blue-eyed grass	<i>Sisyrinchium littorale</i>	Rare	south shore & Cassin's tower
slender sandwort	<i>Minuartia tenella</i>	Rare	one location - NE shore
Canada thistle	<i>Cirsium arvense</i>	Introduced	widespread; edge of forest
bull thistle	<i>Cirsium vulgare</i>	Introduced	edge of forest
wall lettuce	<i>Lactuca muralis</i>	Introduced	cave cove, SH7
Tufted saxifrage	<i>Saxifraga cespitosa</i>	Rare	Boat cove – south side of rock
Dandelion	<i>Taraxacom officianale</i>	Introduced	Edge of forest

Table 5
Locations of rare plants on East Limestone Island (see Fig. 14)

Site	Latitude (N)	Longitude (W)	± m	Description
A	52° 54.521'	131° 37.025'		Boat Cove
B	52° 54.510'	131° 37.086'	17	Anemone Cove
C	52° 54.523'	131° 37.109'	13	NW point Anemone Cove
D	52° 54.739'	131° 36.907'		Almost to N tip of ELI
E	52° 54.743'	131° 36.885'	8	N tip, just east of tip
F	52° 54.742'	131° 36.831'		SH3, NE side of N tip
G	52° 54.616'	131° 36.625'	28	N shore, past F1 to east
H	52° 54.650'	131° 36.551'	25	NE shore, at curve of ELI
I	52° 54.564'	131° 36.50'		E shore, rock ramp before cabin
J	52° 54.237'	131° 36.613'		Cassin's tower area, south slope
K	52° 54'	131° 36'		Look-out Point
L	52° 54'	131° 36'		South ridge, along shoreline
M	52° 54'	131° 36'		Interior Plot 3 (RGIS)
N	52° 54'	131° 36'		Near cabin, 3m NW of front door
O	52° 54'	131° 36'		Shoreline Plot 1 (RGIS)
P	52° 54'.569	131° 37'.053		Boat cove – south side of rock

INTRODUCED SPECIES

Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), raccoons (*Procyon lotor*) and red squirrels (*Tamiasciurus hudsonicus*) are introduced species that are sometimes or always found on Limestone Island. Squirrels are year round residents and generally inhabit the interior forest of the island. There are no known breeding records for squirrels on the island but the population is firmly established and a threat to the reproductive success of native songbird species. Deer are seasonal residents on Limestone Island and each year, one to several fawns are observed with females. Several deer were captured and radio-collared and these animals are easily recognised and their presence on the island recorded. Raccoons are year round residents on nearby Louise Island and are occasionally observed on Limestone Island. Raccoons are a very serious threat to burrow nesting seabirds and their presence on Louise Island is cause for concern because these animals are able to swim the short distance across the water to Limestone Island. Annual surveys for raccoons on the Limestone Island and the eastern shore of Louise Island are essential to monitor population numbers and their movements. An agreement exists between LBCS and the Ministry of Water, Land and Air Protection (was Ministry of Environment, Lands and Parks) to remove animals on Louise and Limestone Island to protect Ancient Murrelets.

RACCOONS

Scientific Advisor: Tony Gaston

OBJECTIVE:

1. To determine whether raccoons are present on the Limestone Islands and the eastern shore of Louise Island.

TIMING: middle to end of Ancient Murrelet breeding season.

FREQUENCY: three times

MATERIALS

- 10,000 candlelight power spotlight
- waterproof notebook
- watch
- VHF radio and boat kit

DATA COLLECTION AND RECORDING

- From 15 May to end of the Ancient Murrelet breeding season, conduct 2-3 spotlight surveys during a very low tide from the boat.
- Select survey nights that have low tides between 0200 and 0500 h. Preferred weather conditions are calm winds, no swell or chop and no rain or drizzle. It is difficult to view the shoreline with the spotlight in rain or fog.
- If low tide does not coincide with darkness, surveys at dawn or dusk without a spotlight on a very low tide are preferred to high tide surveys at night with a spotlight because animals are most visible feeding in the intertidal.
- Surveys can be easily done after chick banding and take about 2 hours.
- One person drives the boat and the other holds the spotlight on the shoreline. Drive at a constant speed as close to shore as possible and scan the intertidal for animals. Raccoon eyes are brighter and more orange than deer's
- If any raccoons are seen on Louise Island, note the time, number of animals, body condition and location. Sketch a map of the location and write a brief, 1-page description of the survey (date, time start-end, tide height, moon, precipitation). Send this to town (mail or e-mail).
- If raccoons are seen on Limestone Island, immediately contact the LBCS office. Complete a detailed description of their location, number of animals, body condition and time of sighting.
- As early as possible in the season, walk the perimeter of both Limestone Islands looking for raccoon scat. Raccoons generally defecate in the same location each time (a latrine). River otter scat will undoubtedly be found along the intertidal area, but it will be different from raccoons because it is a) smaller b) has shells

- and fish scales and c) will be scattered in many locations. Raccoon scat is generally larger and you should find many in the same location. Raccoons eat a lot of crustaceans and other intertidal organisms. They will have some fish scales but it is not the most common item in the scat, unlike river otter's. Both raccoons and otters could have bird feathers in their scat.
- On Ancient Murrelet colonies, look for headless Murrelet carcasses. Raccoons will bite the head off of Murrelets and leave the rest of the carcass behind. Also, look for burrows that have been excavated. River otters and raccoons will both dig up burrows but otters will generally not take eggs. Look for hairs and paw prints in the disturbed soil to make a positive ID of the predator. (Raccoon hair will not kink when bent; unlike deer hair which will kink because it is hollow).

SQUIRRELS

Scientific Advisor: Jean- Louis Martin

Red squirrels were intentionally introduced to Limestone Island by the BC Forest Service ca. 1950 to collect Sitka spruce cones for nursery stocks. Squirrels eat cones and seeds, as well as songbird eggs.

OBJECTIVE:

1. To monitor the squirrel cycles. In the past, this was an essential element in the nest predation study and in the future it will be correlated with spruce cone production.
2. To document spatial variation of squirrel abundance in relation to abundance of mature spruce in the habitat, making it possible to quantify variation in the predation pressure by squirrels on song bird populations over space and time.

TIMING: Camp start-up to 10 June

FREQUENCY: Approximately every four days

MATERIALS

- Notebook and pencil
- Watch

DATA COLLECTION AND RECORDING

- Duration of count at each station is exactly 1 minute (use a stopwatch).
- Station radius is 20 m and locations (Table 6).
- At each station, stop and record the number of squirrels heard or seen within the 20 m radius, as well as those outside 20 m radius.

- Record squirrels as IN, OUT or BETWEEN (stations). IN refers to squirrels within 20 m radius, OUT is beyond and BETWEEN is squirrels seen / heard when walking between stations outside of 1 minute counts.
- Proceed quietly along the trail at a steady pace throughout the survey. Be quiet. Listen carefully for squirrels since their chatter can be mistaken for a bird.
- It doesn't matter what order the trails are surveyed, two groups can split the survey.
- Record the time finished and weather, if it changed.
- Complete 10 surveys evenly spaced between 21 April and 10 June, approximately every 4 days. Can do additional surveys until end of field season.
- Conduct surveys on days without precipitation or high winds.

Table 6
Squirrel stations on East Limestone Island.

TRAIL	STATIONS	NO.	CANOPY
Main Trail (to Boat Cove)	each 50m (0-500 m inclusive)	11	Ss, Hw, Cw
Ridge Trail	R26, R37, R47, R54, R63, R72, R82, R92, R101, R107, R113, R119	12	Cw, Alder
Crow Valley	CV11, CV23, CV35	3	Ss, Hw
Lookout Trail	L6, L11, L17, L22, L28	5	Alder, Cw, Ss

Ss - Sitka spruce Hw - western hemlock Cw - western redcedar

DEER

Scientific Advisors: Jean- Louis Martin

OBJECTIVE:

1. To monitor deer on Limestone Island.

TIMING: all season

FREQUENCY: when deer seen

MATERIALS:

- notebook

DATA COLLECTION AND RECORDING

- Record the location and date of any and all radio-tagged deer on Limestone Island.
- Note whether the deer has a collar and record number if it has numbered ear tags.
- Record the presence of antlers and general body condition at least once per season.

VEGETATION SAMPLING

Scientific Advisors: Jean-Louis Martin and Tony Gaston

Deer exclosures were established in 1998 on Limestone Island (and other locations in Haida Gwaii) as part of a long-term monitoring project to examine the effects of deer on native plants. The exclosures are 20 x 20 m in size and were placed in areas outside of the Ancient Murrelet habitat that were generally representative of the island ecosystem. Plants in the exclosures are sampled by staff and students of the Research Group on Introduced Species.

In addition to enclosures, RGIS established long-term monitoring plots in the interior and forested edge of Limestone Island (Fig. 5). These plots are used to monitor the changes in the plant community in two distinct habitat types. Long-term plots like the ones on Limestone Island were established on other islands in Laskeek Bay and within the Haida Gwaii archipelago.

BLOWDOWN RECOVERY MONITORING

Advisor: Keith Moore

In the winter of 2010/2011 severe windstorms caused major blowdown and significantly changed the forest environment on East Limestone Island, along with Reef Island, the Skedans Islands, Vertical Point and many other locations.

On East Limestone, the blowdown was extensive along the Main Trail, in the North Cove area and the hill slope above Cabin Cove. In total, an area of 16.1 ha (35.4 % of the total area of East Limestone Island) was moderately or heavily blown down. This affected 7.0 ha (44%) of the area mapped in 1983 as ancient murrelet colony.¹ The location of the blowdown on East Limestone is shown in the map in Figure 16.

In the summer of 2011, photos of the blowdown were taken at locations along the main trail, above the cabin in Cabin Cove and in North Cove. In 2013, 6 of these photos were selected to provide the best, and most accessible reference Photo Points for repeating these photos in successive years to monitor forest succession. The exact locations of these Photo Points were located and marked in the field. The locations are recorded in Table 7. Two photos are taken from Photo Point 6. These Photo Points serve as a reference to monitor forest succession and the future of the few remaining trees within the blowdown area, as time passes and the forest recovers.

OBJECTIVES:

To monitor and document forest succession following the 2010/2011 blowdown by repeat photography from established photo points.

¹ Determination of the area of blowdown determined by Kelly Runyon based on GPS points and map of blowdown provided by Soizic Le-Saout and Thibault. Area of ELI determined as 45.5 ha by Kelly from contour map.

TIMING: At least once every two years, preferably every year.

MATERIALS:

- Laminated photos from 2011 and subsequent years.
- Digital camera

DATA COLLECTION AND RECORDING

- Locate each of the 6 Photo Points
- Using the laminated reference photos to identify identifiable trees, stumps, etc and take photos of the same landscape as taken in earlier years.
- Adjust camera focal length (zoom) to take photos as close to the 2011 photos as possible.
- Store digital photos with photo point # and the year in the file name of the photo
- Print and label photos by photopoint # and year, for use in succeeding years.

Table 7. Photo Point Locations

Photo point	Location	Photo direction	GPS
1	Main Trail 175	NW	N 52 54 529 E 131 36 715
2	Main Trail 310	SW	N 52 54 536 E 131 36 824
3	Main Trail 320	NE	N 52 54 536 E 131 36 828
4	Main Trail 420	NE	N 52 54 515 E 131 36 891
5	Ridge Trail 2	SW	N 52 54 464 E 131 36 628
6a	North Cove Trail 15	W	N 52 54 605 E 131 36 698
6b	North Cove Trail 15	SW	N 52 54 605 E 131 36 698

FIELD SEASON SUMMARY

At the end of the season, summarize all areas covered in this manual including the absence of a particular species or event if it generally occurs. Consult Field Summaries from previous years for guidance.

ACKNOWLEDGEMENTS

This manual began with field and research notes provided by AJG and Keith Moore. The protocol for the Ancient Murrelet burrow monitoring was developed from studies by AJG on Reef Island prior to the formation of LBCS. Jean-Louis Martin contributed the research protocols for the introduced species (squirrels and deer). Many people provided helpful comments on earlier versions of this manual including Keith Moore, Charlotte Tarver, Janet Gray, Joëlle Fournier, Jen Rock, Joanna Smith and Chris Lindberg.

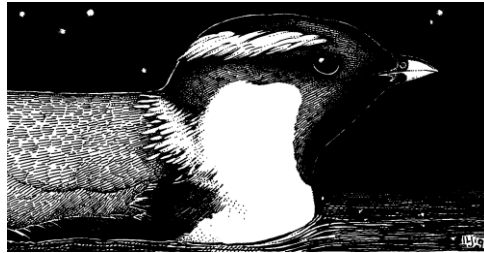


Figure 1. Net and funnel locations, Limestone Island.

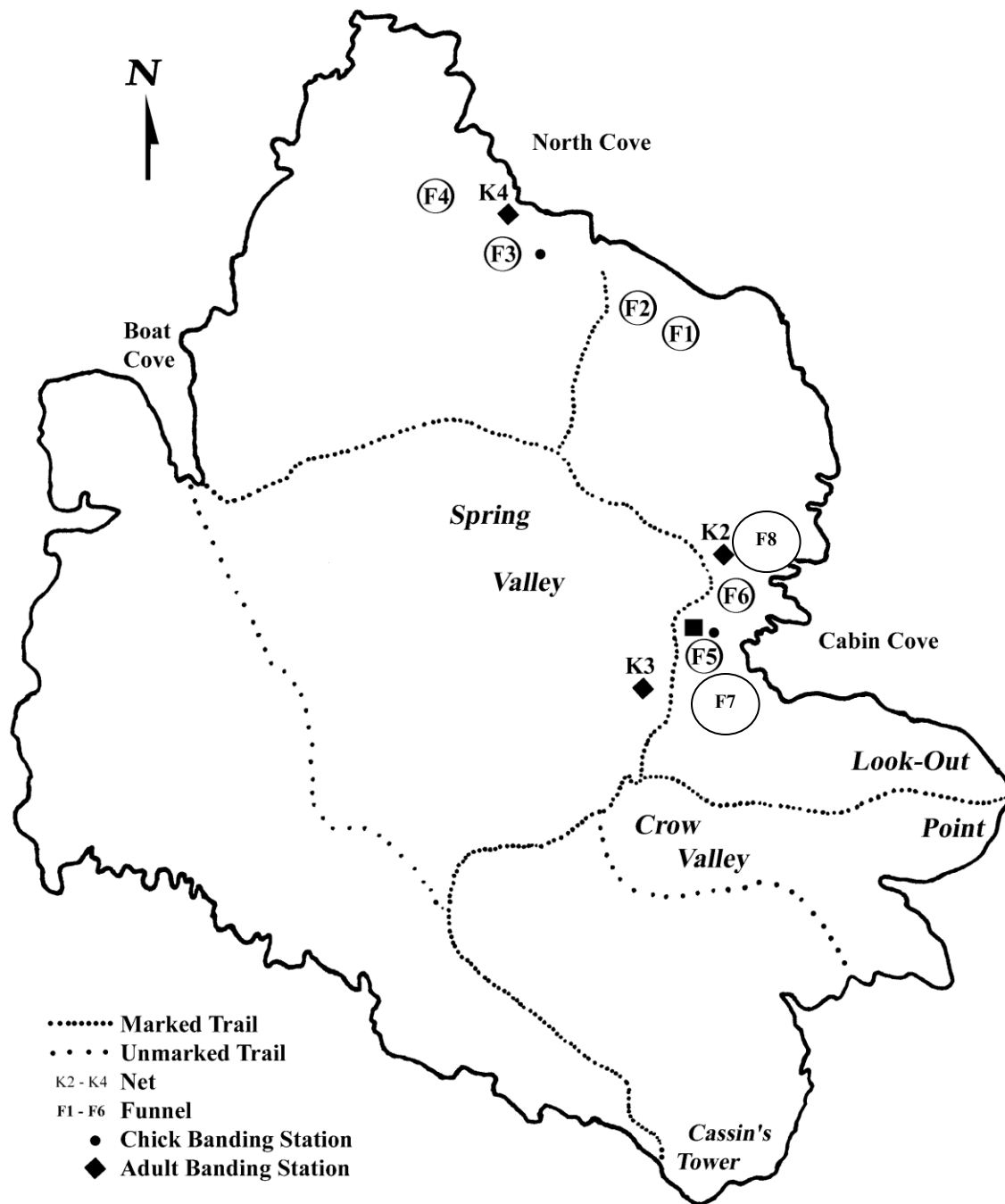
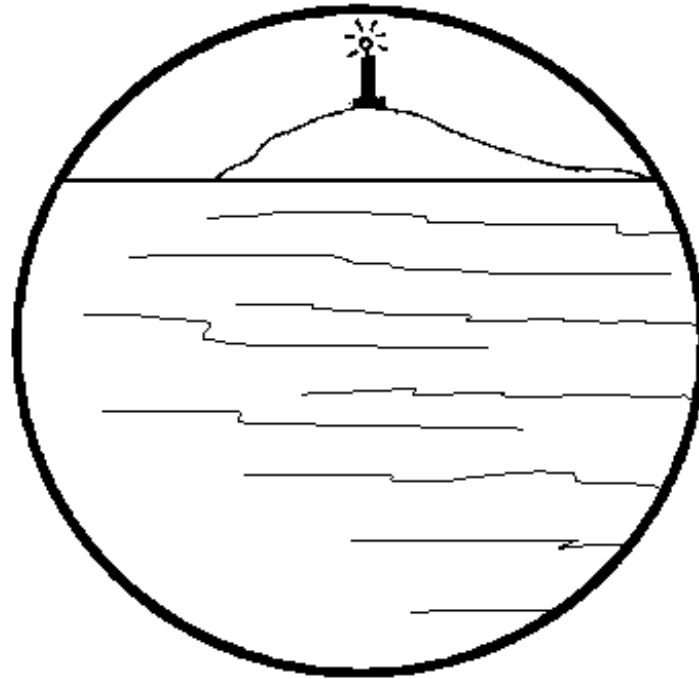


Figure 2. Gathering ground count set-up



Low Island
(Looking to the East)

Figure 3. Black Oystercatcher nests in Laskeek Bay

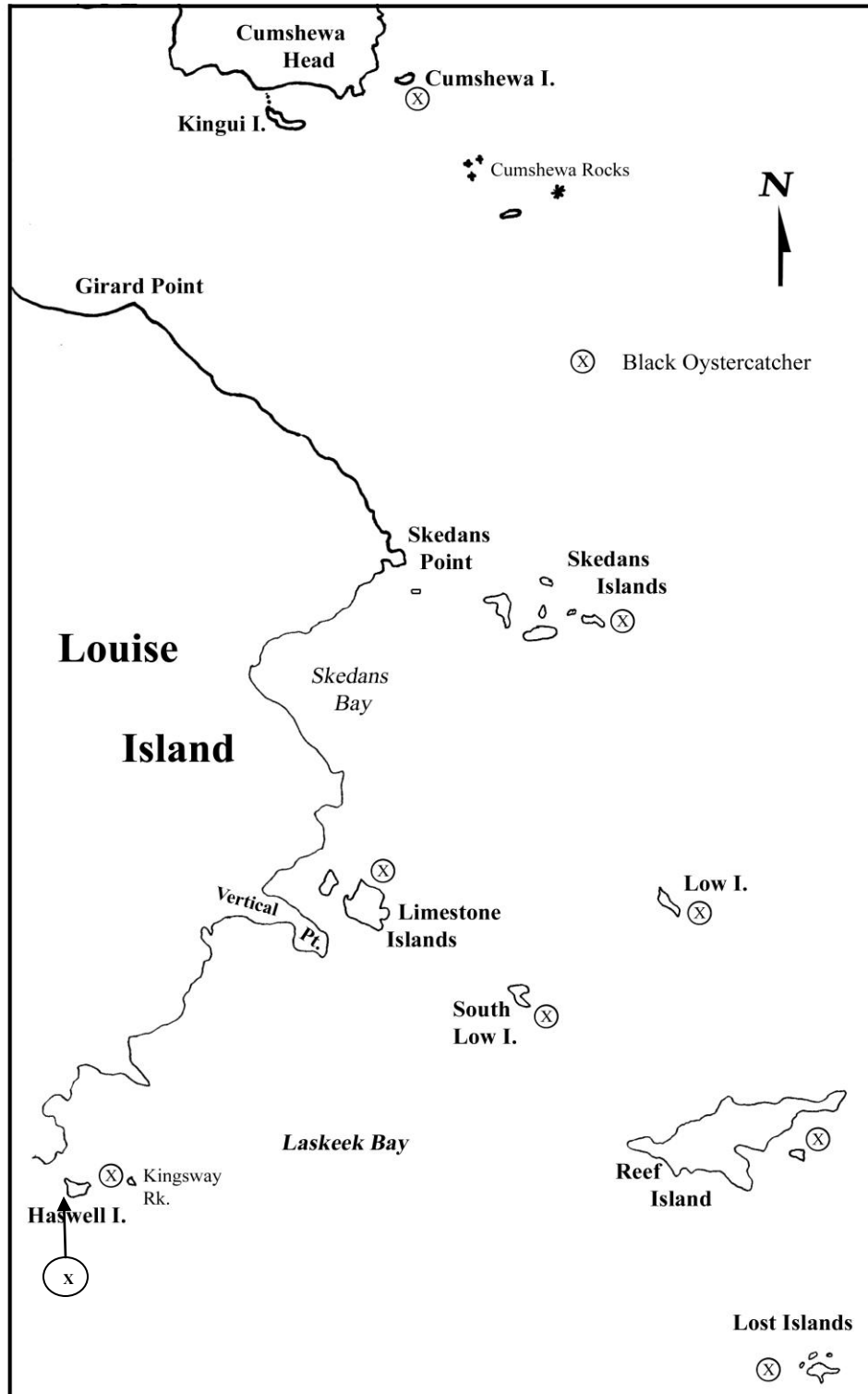


Figure 4. Black Oystercatcher nests on the Limestone Islands

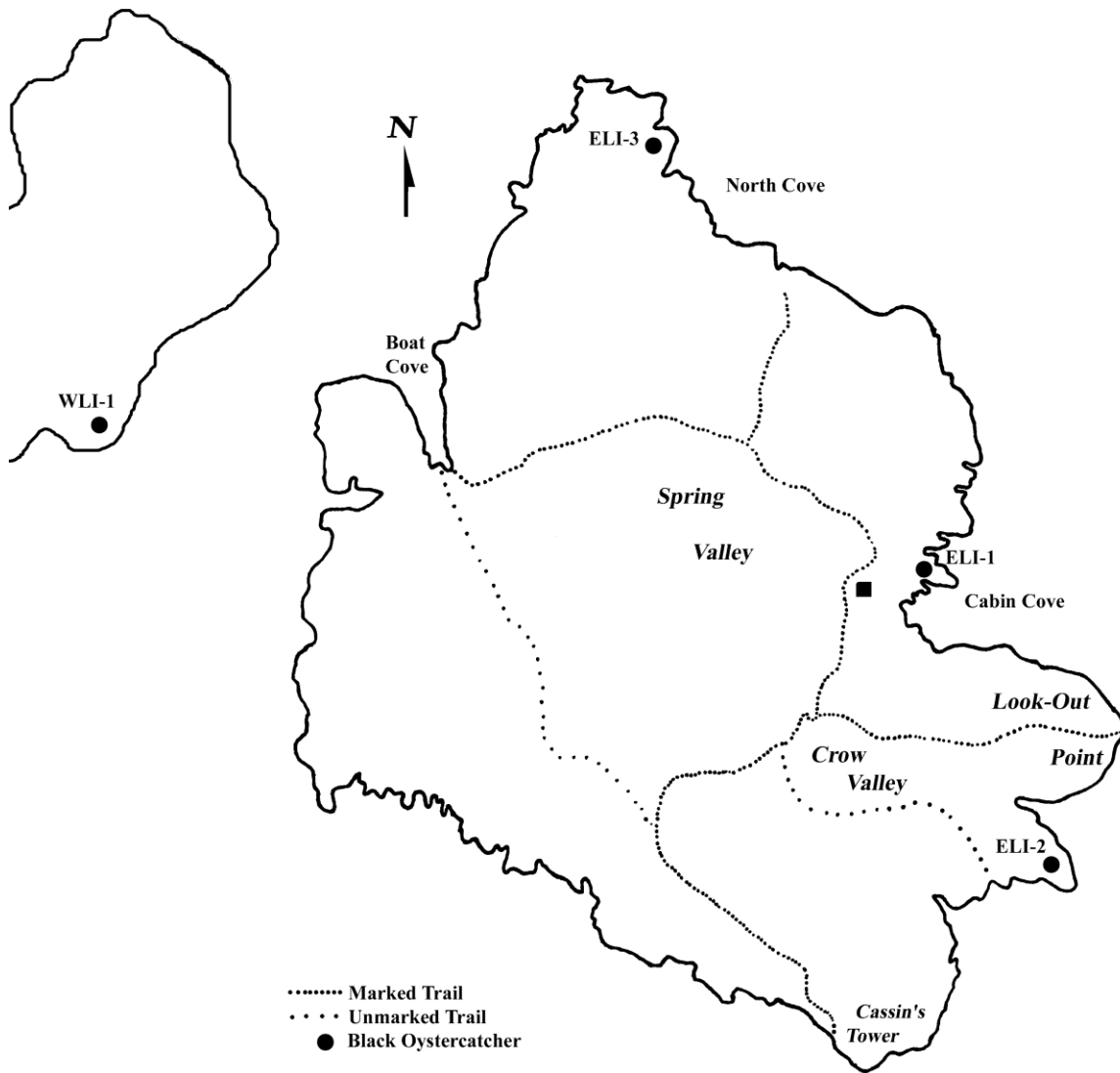


Figure 5. Black Oystercatcher nests on the Reef and Lost Islands

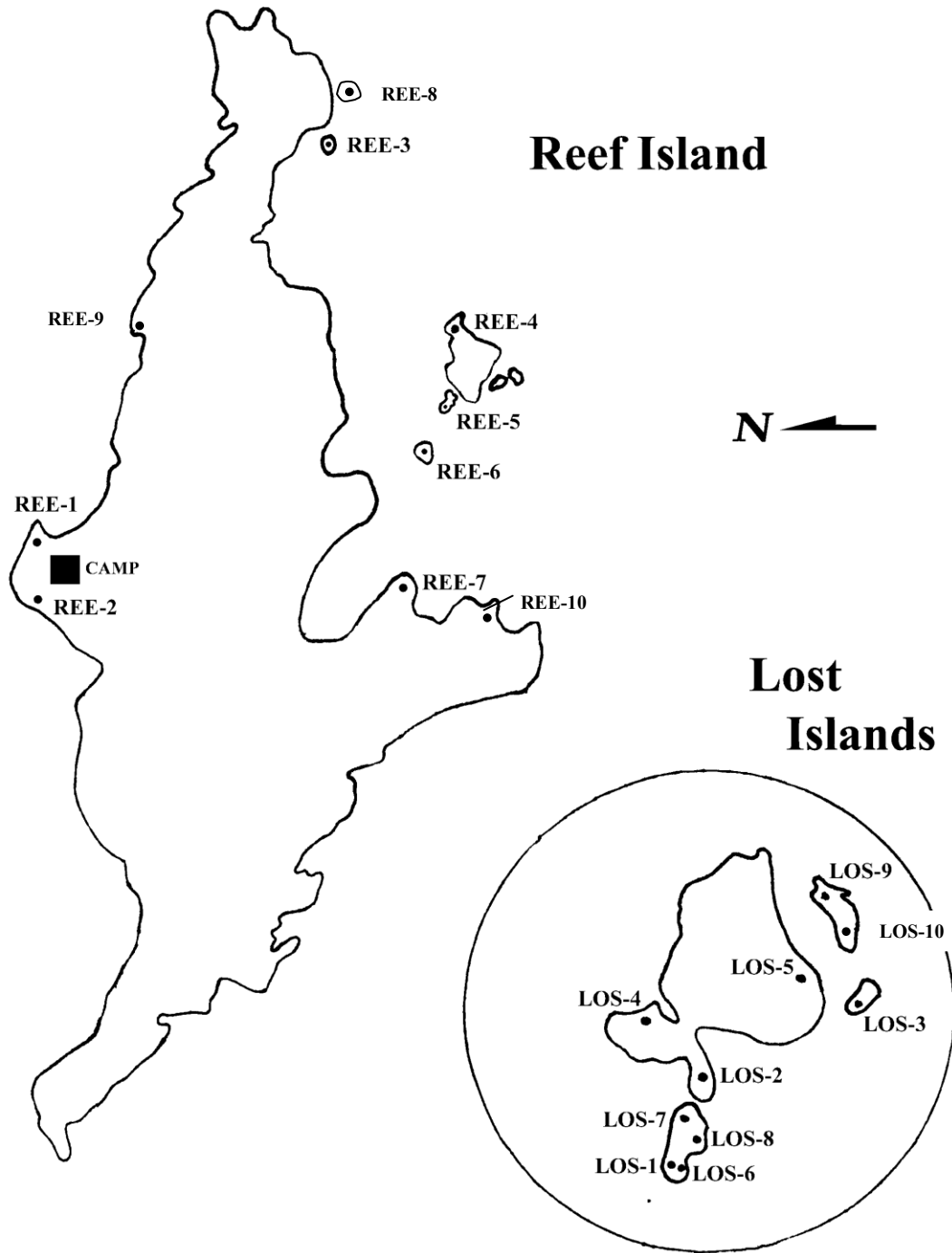


Figure 6. Black Oystercatcher nests on South Low, Low Islands, Kingsway and Louise Island.

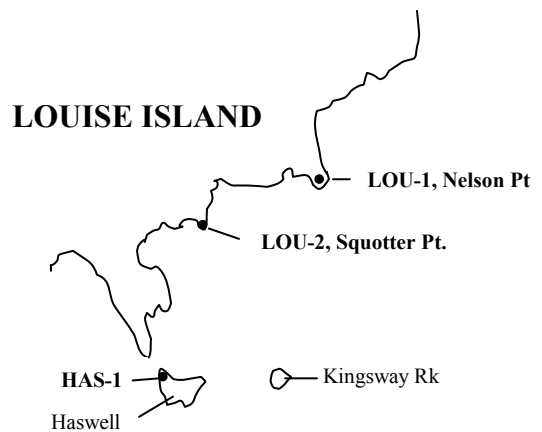
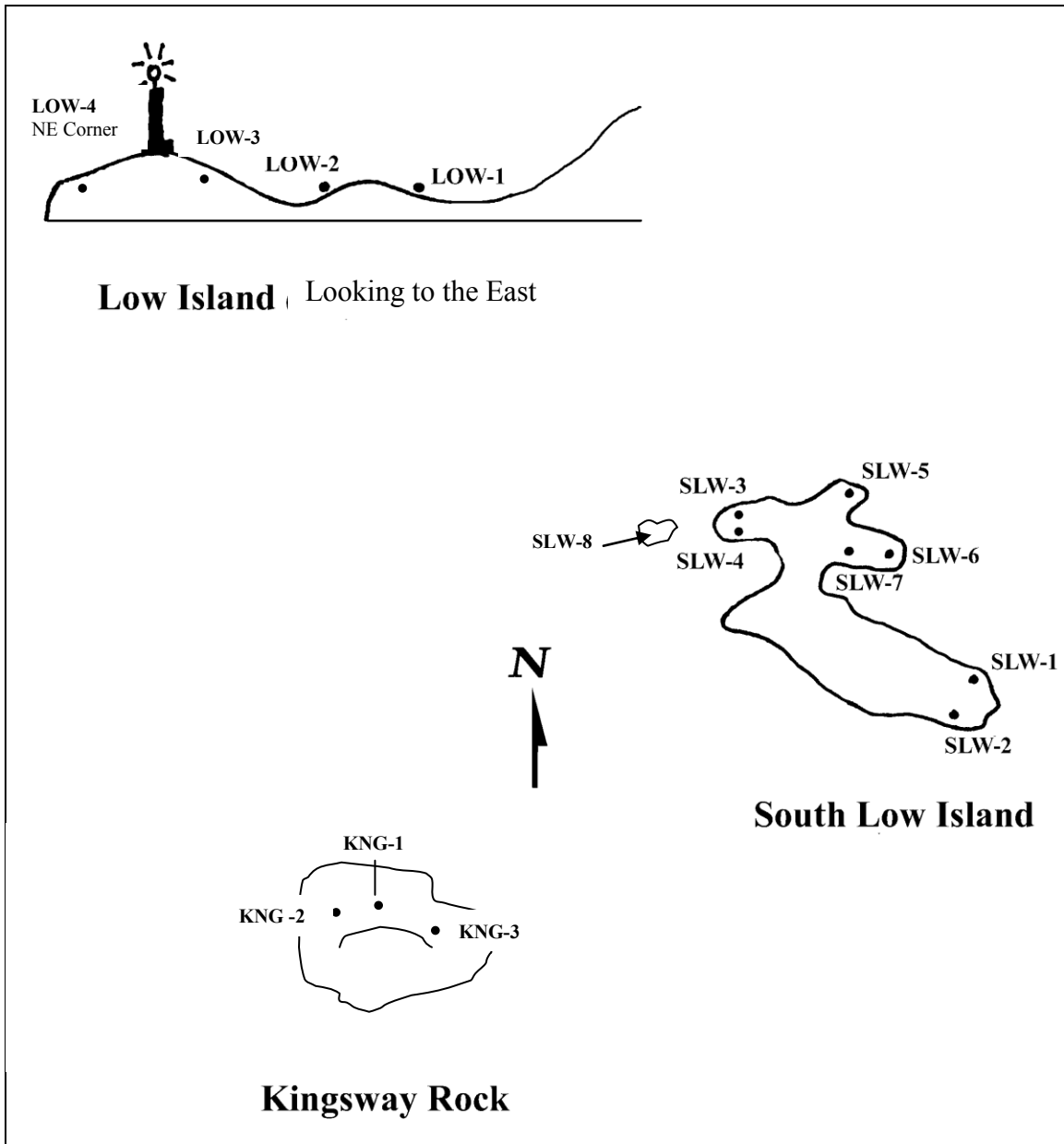


Figure 7. Black Oystercatcher nests on Skedans Islands and Cumshewa Head

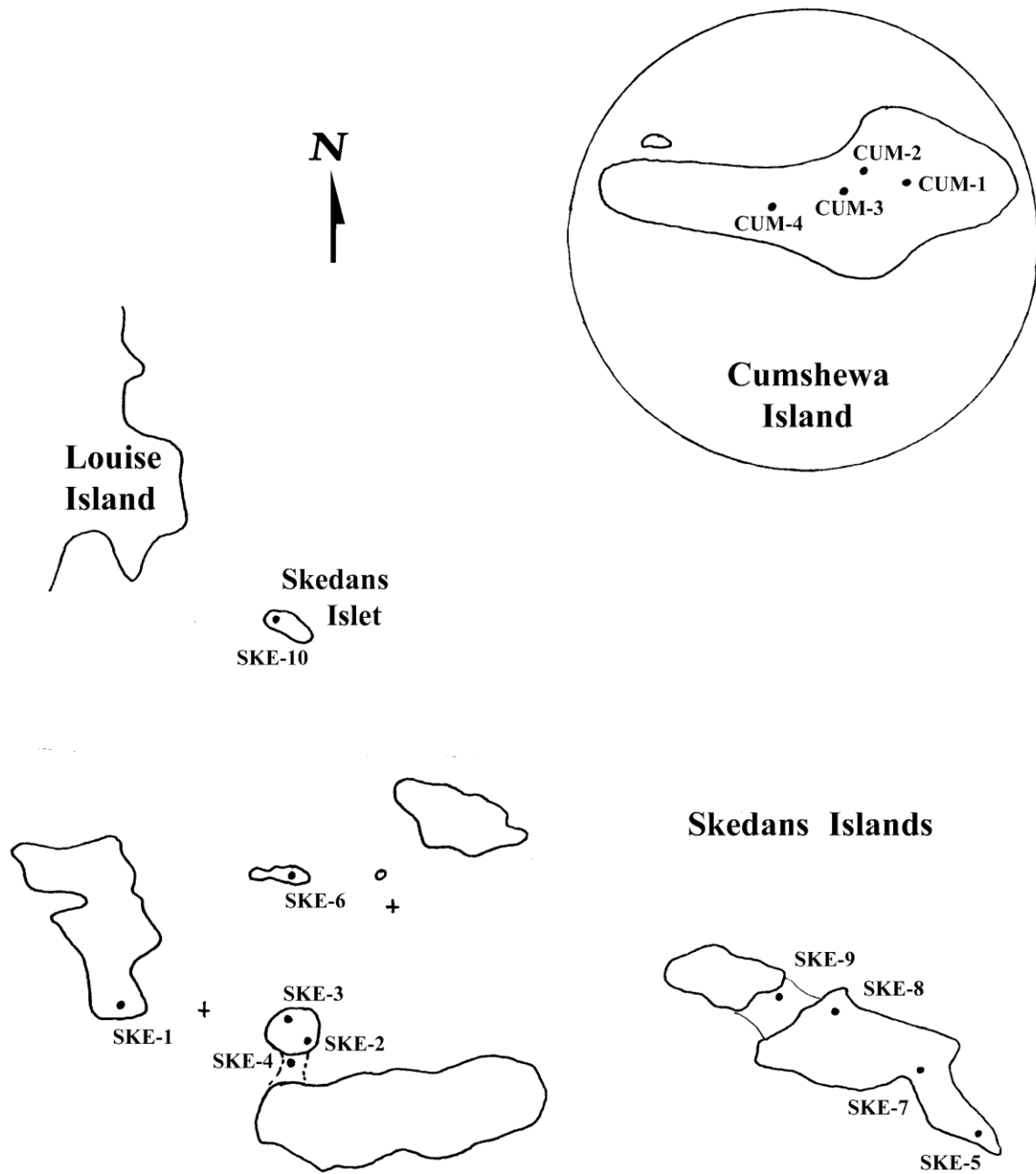


Figure 8. Glaucous-winged Gull nests in Laskeek Bay

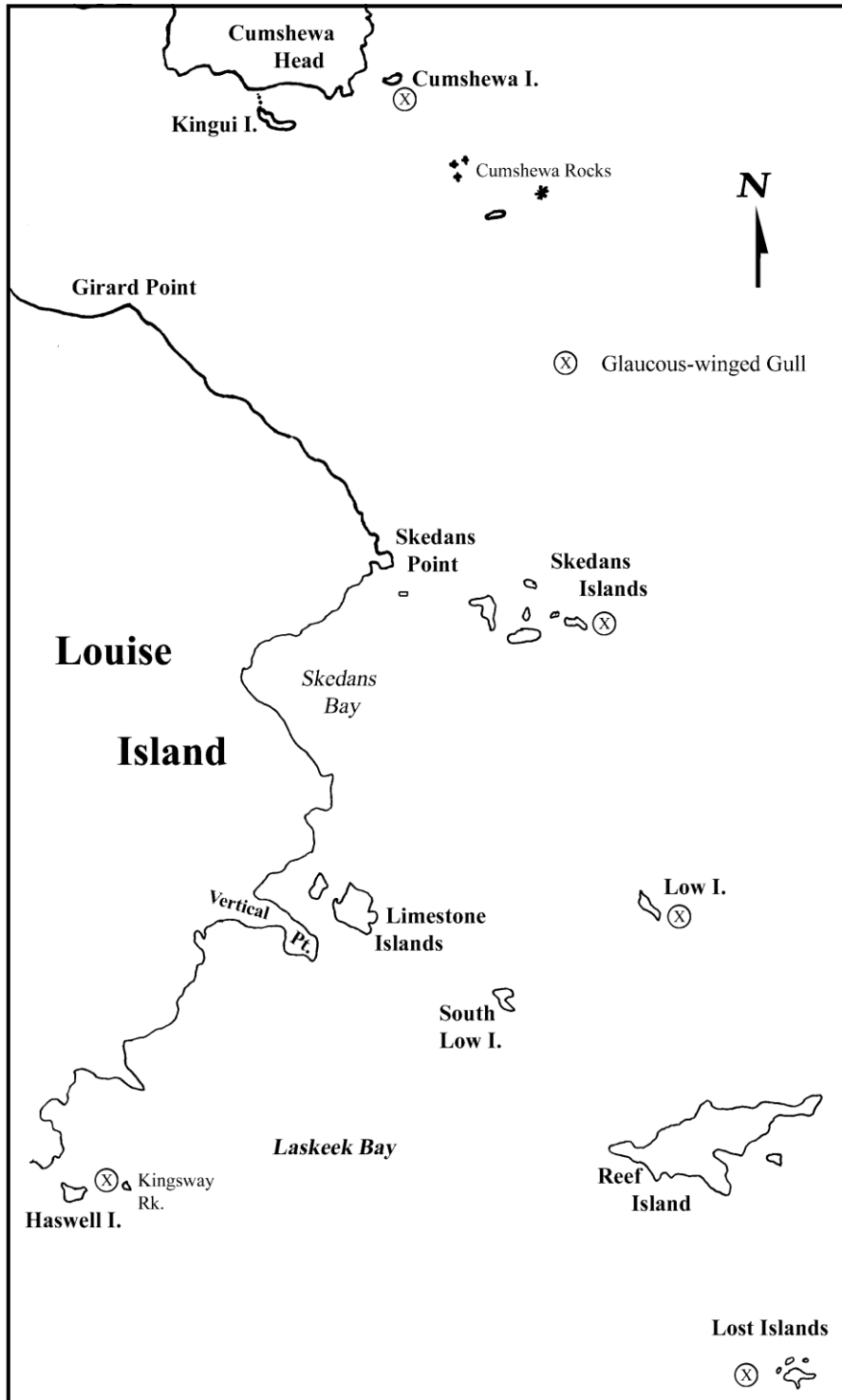


Figure 9. Birds of prey nest locations – **UPDATE RAVENS**

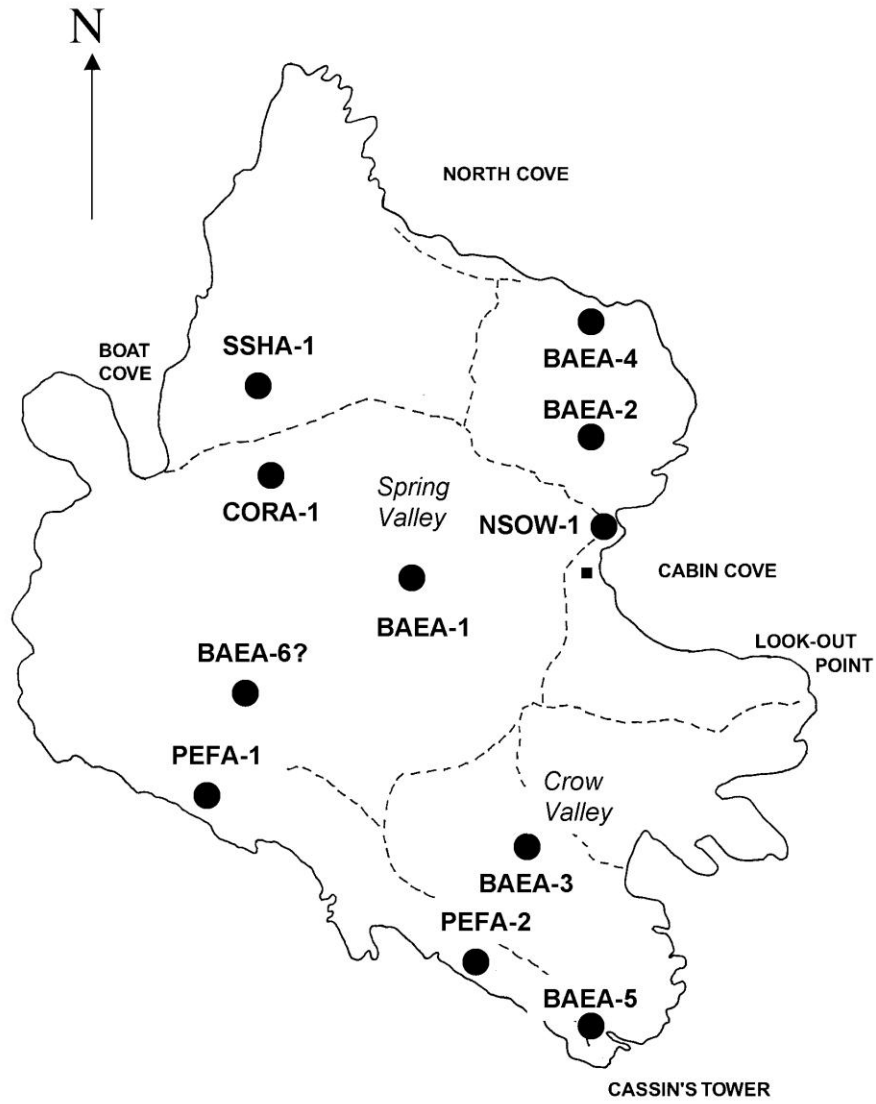


Figure 10. Transects for sea surveys in Laskeek Bay

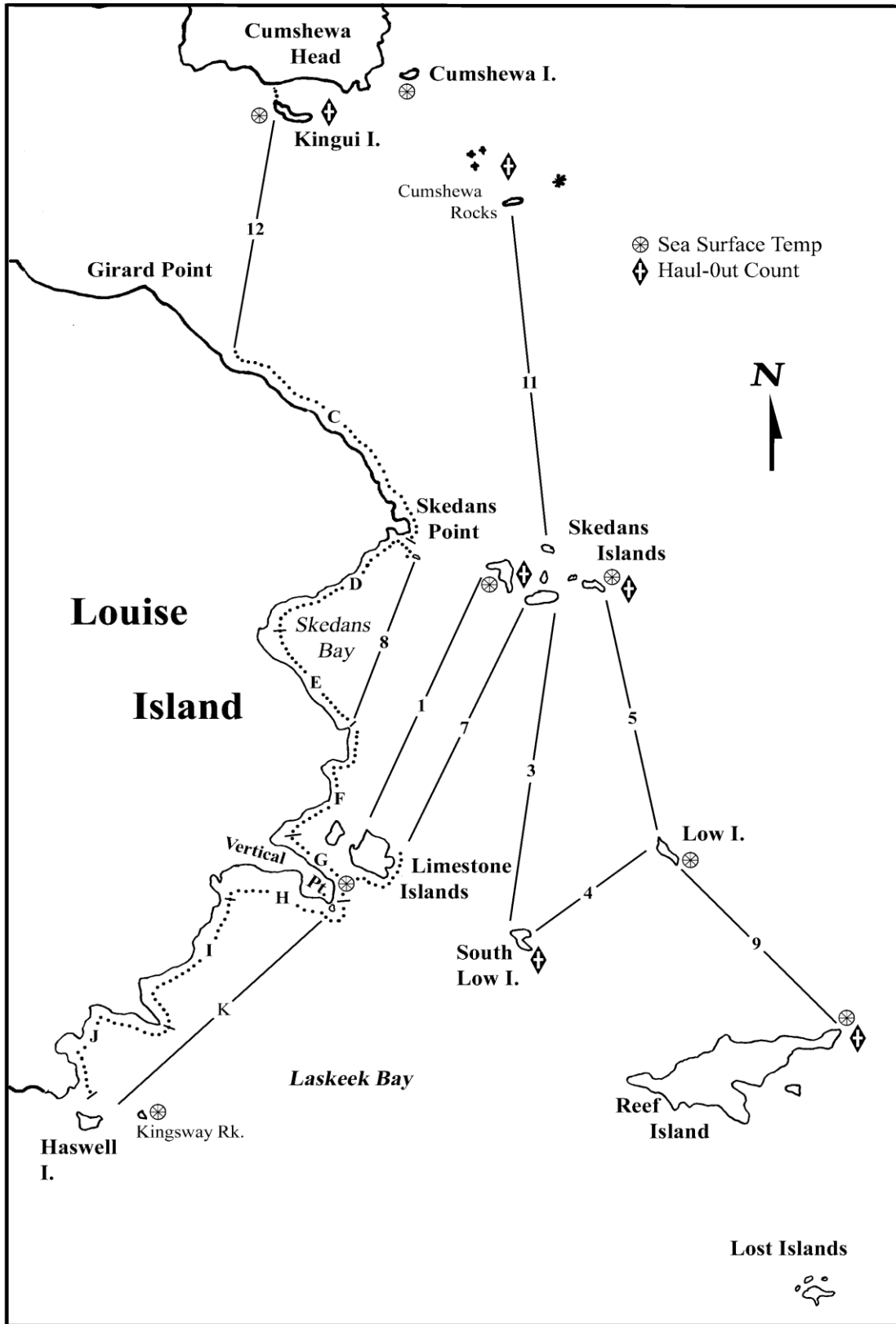


Figure 11. Sea watch from Look-out Point

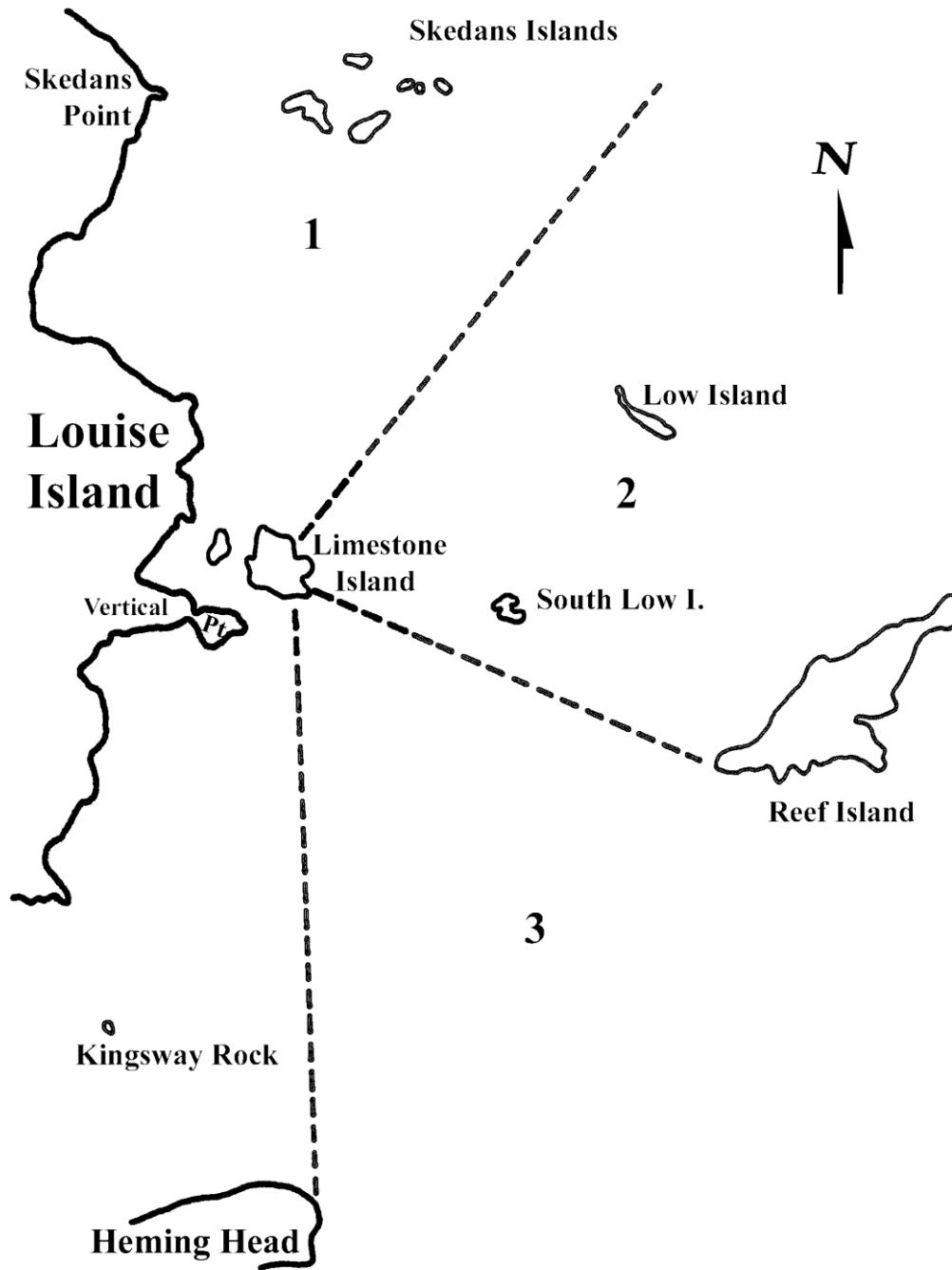


Figure 12. Locations of rare plants

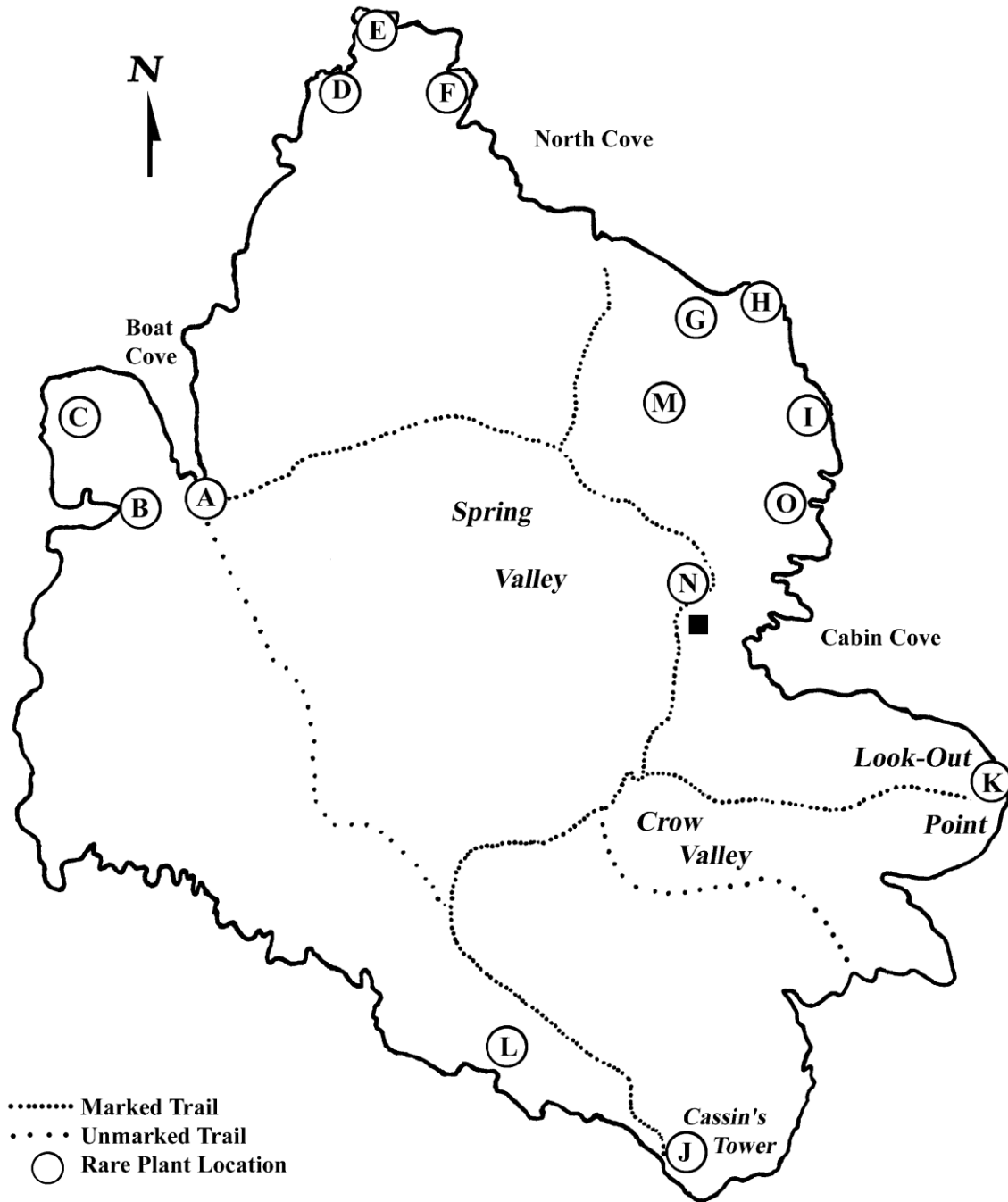


Figure 13. Map of Blowdown Area Impacting Seabird Habitat

