

**EAST LIMESTONE ISLAND FIELD STATION
FIELD SEASON REPORT 2021**



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Laskeek Bay
CONSERVATION SOCIETY

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Summary

This was the Laskeek Bay Conservation Society's 32nd field season on East Limestone Island (ELI), Laskeek Bay, Haida Gwaii. The season began slightly later than usual, running from 11 May to 25 July (with a week off in the middle). Due to continued restrictions related to the COVID-19 pandemic, the season was similar to last year's in that the number of visitors and volunteers was limited, and Project Limestone did not take place. Rather than have two consistent field staff and weekly volunteers, we had three field staff and occasional volunteers. Volunteers came to Limestone three times throughout the season, to either help set up camp or keep programs running during Black Oystercatcher (BLOY) surveys. Most of our usual programs continued, though some in a reduced fashion.

Due to low chick departure numbers in the preceding seasons, Ancient Murrelet (ANMU) chicks were not captured this year. No raccoons were detected on the island via remote baited cameras throughout the season. We have continued to monitor ANMU numbers through evening gathering ground counts and an Automated Recording Unit (ARU), but for this year, our focus shifted away from ANMU data towards other species such as Pigeon Guillemots (PIGU).

In collaboration with Canadian Wildlife Service (CWS) and researchers at the Czech University of Life Science Prague and the Czech Technical University in Prague, Smart Nest Box (SNBox) systems were installed in the PIGU nestboxes at the start of the field season. This is the first use of the SNBox camera system to monitor a seabird species and it has allowed us to obtain high-quality video footage of PIGU incubating eggs and caring for their chicks. Additionally, one of the 15 geolocators that were attached to adult PIGUs in 2019 was retrieved this year.

Black Oystercatcher surveys were conducted in Laskeek Bay and Gwaii Haanas this year. In Gwaii Haanas, 92 active territories were documented, seven of which were discovered this year. Glaucous-winged Gull censuses were conducted at two colonies in Laskeek Bay and 180 active nests were found. Four near-shore sea surveys were completed, during which a total of 87 Marbled Murrelets were sighted, considerably fewer than in previous seasons. Marine mammal sightings included 56 Humpback Whales, 1 Grey Whale, 1 Northern Elephant Seal, 30 Harbour Porpoises and 13 sightings of groups of Orcas.

Eleven wildlife trees were occupied, including one by Hairy Woodpeckers (HAWO) and one by Northern Flickers (NOFL). Red-breasted Sapsucker (RBSA) sapwell trees were monitored again this season; 32 person hours were spent monitoring. A couple of interactions between RBSA and squirrels were observed, but there were no hummingbird sightings at the sapwells this year. A new Common Raven nest was found active near camp, but none of the known Bald Eagle nests appeared active this season and no new nests were located, despite concerted effort throughout the season.

This was the third season since the initiation of our Restoration Project, which focusses on reducing the abundance of introduced Sitka Black-tailed Deer. Various monitoring programs were continued: vegetation plots, songbird point counts, tree growth monitoring and invasive plant monitoring.

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Introduction

Laskeek Bay Conservation Society (LBCS) is a non-profit organization committed to increasing appreciation and understanding of the natural environment through biological research, interpretive programs, and public involvement in science. The field station at East Limestone Island has been in operation for 32 consecutive field seasons and over this period LBCS has developed diverse long-term monitoring and public education projects in Laskeek Bay, Haida Gwaii. Normally, volunteers assist researchers with data collection to study the abundance, distribution, and life history of the flora and fauna of Laskeek Bay.

This information helps us understand the fluctuations in marine and terrestrial ecosystems and gives a baseline against which we can describe changes in the future due to introduced species, marine pollution, global climate change, extreme weather events, and other threats to coastal ecosystems.

In 2021, due to the global pandemic of COVID-19, LBCS's field season operated for a shorter time period (ten weeks) and with a limited crew (both employees and volunteers).

Education and interpretation program

LBCS provides opportunities for public involvement in research and monitoring activities through Project Limestone (our school program), our volunteer program, and interpretive tours. Normally, students, volunteers, and visitors come to our field camp and participate in the projects that are occurring throughout the season. By bringing people to our camp and encouraging participation in research activities, we hope to increase public awareness of local conservation issues and increase public knowledge of the natural history of Haida Gwaii. Unfortunately, due to restrictions related to COVID-19, there were no on-island educational or interpretive programs offered in 2021.

Project Limestone

Project Limestone normally brings local elementary and high school students, to East Limestone Island to learn about natural history and participate in Ancient Murrelet research. This year, due to COVID-19 restrictions, there was no Project Limestone.

Volunteers

Volunteers typically play an important role in the operation of the LBCS field camp. They generally stay for one week, and help staff with research, monitoring projects, camp maintenance, and daily chores. Volunteer contributions of time and energy are essential and help ensure our ability to continue the long-term collection of data. LBCS provides a

unique opportunity for the general public to be involved in long-term research in a remote field camp.

This year, because of COVID-19, local volunteers only visited periodically throughout the field season: Saskia Peck and Christina Jewell helped set up camp during the first week of the season; the family of LBCS biologist Rian Dickson (Jon Brown, Hannah Dickson, Taya and Noa Dickson-Brown) volunteered during the first Gwaii Haanas BLOY survey; Ryan Barber came down for a day of technical trouble-shooting; and board member Ainsley Brown and her family (Barret, Isla, and Griffin Johnson) volunteered during the second BLOY survey.

Visitors

The LBCS visitor program normally provides an opportunity for private and commercial groups to visit East Limestone Island and participate in an interpretive tour. Unfortunately, due to restrictions related to COVID-19, there were no visitors to East Limestone Island.

Staff

LBCS staff this year were Rian Dickson, Lead Biologist (and Camp Supervisor for the first four weeks of the season); Todd Weisbrot, Camp Supervisor for the last 6 weeks of the season; Matthew Peck, Research Assistant and Research Program Leader; Natalie Weder, Field Assistant; and Judy Hilgemann, Executive Director. Jake Pattison and Douglas Black were contracted to assist with some field activities.

Student Interns

In 1998, LBCS began a program that provides students in biology or environmental studies with an opportunity to gain valuable hands-on field experience as an intern on East Limestone Island for a four to six-week period. This year, due to COVID-19 restrictions, there were no student interns.

Research and monitoring programs

Research Partnerships & Special Projects

LBCS assists other researchers and organizations with various projects in the Laskeek Bay area and other areas of Haida Gwaii. In Laskeek Bay this season, we collaborated with the Canadian Wildlife Service (CWS) to study breeding ecology of Pigeon Guillemots. See the PIGU section for more details. Also, working under a CWS contract, we collected Black Oystercatcher and Glaucous-winged Gull eggshells to be used for DNA analysis. These collections were made on our scheduled BLOY surveys as well as

on the GWGU colony census. BLOY and GWGU eggshells were also collected from several locations in Skidegate Inlet, with several volunteers assisting in those efforts.

LBCS was also contracted by Gwaii Haanas to map the Ancient Murrelet colony at SGang Gwaay. This colony was last surveyed in 1985 by a field crew from CWS. Since that time, infrastructure and activity on SGang Gwaay has increased, and an extreme wind event in 2018 caused some significant blowdown in the forested areas. A new archaeology project has also begun on SGang Gwaay this summer. In light of these developments, Gwaii Haanas staff wanted the ANMU colony re-surveyed to determine if things had changed since 1985. We found that ANMU are still breeding in the area around the Watchmen cabin and the boardwalk. However, it appears that the colony has also expanded to the southward (towards the village site) and may have increased in abundance. Signs of breeding activity, such as burrows, broken eggshells, and the remains of adult ANMU that were killed by predators, were found throughout the colony area.

In spring 2021, LBCS undertook a contract with BC Parks to update a beaver management plan for Kwiiid Suu Mayer Lake in Naikoon Provincial Park. This document has been submitted to BC Parks, with a three-year action plan. One recommendation of the plan was to attempt to protect and restore vegetation on the shoreline of Mayer Lake, particularly Pacific crab apple. LBCS is planning to work with BC Parks and the Council of the Haida Nation, with funding support from Gwaii Haanas (Youth Employment Skills Strategy) to select locations and build exclosures in January/February 2022.

Ancient Murrelets *Synthliboramphus antiquus*

In 2017, remote camera monitoring became one of the primary methods of monitoring for Ancient Murrelet (ANMU) chicks departing from East Limestone Island. In 2017 and 2018 the cameras were used throughout the ANMU season with manual monitoring being conducted every second night. Given the success of camera monitoring in 2017 and 2018, in 2019, manual monitoring was discontinued, and camera monitoring became the sole means of monitoring chick departure. This freed up staff and volunteers to undertake other activities. In 2020, camera monitoring was conducted on all funnels (Cabin Cove funnels 5,6,7 and 8). In 2021, it was decided to switch to monitoring ANMU chick departures on alternating years. This will allow staff and volunteers to focus on some of our other monitoring programs and research projects.

Chick Capture Trends

We plan to resume ANMU chick monitoring in 2022, using our camera system.

Other ANMU monitoring

Point counts

In past years (1990-2018), point counts were conducted in the colony area to monitor the activity of adult birds in the forest at night; five-minute counts were conducted in Cabin Cove at approximately 02:30 on some manual monitoring nights. In 2019, an automated recording unit (ARU) was set up in the same location where the point counts were conducted. This allows us to record ANMU, Cassin's Auklet and Fork-tailed Storm Petrel calls from 23:00 to 04:00, throughout the field season. Data are being archived for future analysis.

Gathering grounds

Ancient Murrelets enter and leave the breeding colony only at night. In late afternoon and evening the birds gather on the water in gathering grounds, where they wait until it is sufficiently dark before entering the colony. Both breeding and non-breeding birds are thought to gather in these areas and engage in important social interactions. The East Limestone Island gathering ground is located between Low Island and East Limestone Island. Between 12 May and 20 June, we conducted standardized 10-minute counts of birds on the gathering grounds (two counts of 5 minutes each). Gathering ground counts were completed on 29 evenings this season. They could not be completed on four nights due to poor weather conditions and were not done during 8-14 June, as all staff were in town for a one-week break. The highest count occurred on 6 June, with a total of 29 Ancient Murrelets observed. The maximum this year was lower than the maximum in 2020 (44 birds), 2019 (104 birds) and 2018 (51 birds), but greater than 2017 (22 birds). The average gathering ground count in 2021 was 7.4 (SD=8.1), similar to the 2020 average of 7.9 ± 12.7 Ancient Murrelets, and higher than 2019 (6.7 ± 15.6), 2018 (4.2 ± 10.0) and 2017 (4.6 ± 5.1). However, the three years prior to that had higher average counts (14.5 ± 15.7 in 2016, 30.3 ± 31.8 in 2015 and 20.7 ± 23.0 in 2014).

One of the highlights of 2021 was an incidental observation of the Reef Island ANMU gathering ground (between Low and Reef islands). We were on the water one calm morning in early June for BLOY surveys when we observed over 2000 ANMU on the water in this area, with lots of vocalizing and displays.

Summary: Population Trends

The breeding population of Ancient Murrelets on East Limestone Island has been declining over time. The number of departing chicks in funnels 5 and 6 declined by 56% between 2006 and 2009, likely due to the presence of raccoons in 2007 and 2009. Chick numbers increased slightly after 2009 and seemed to have stabilized in these two funnels, up until the 2015 season when there was a 67% decline in chick numbers from the previous year. The continued low number of chicks in 2016 (8% decline from 2015), 2017 (13% decline from 2015), 2018 (4% decline from 2015) and 2019 (0% decline from 2015) is concerning. In 2020, the number of chicks was lower than in 2019 and is a 32% decline from 2015. In 2015, it was speculated that the dramatic decline from 2014 to 2015 could have been a temporary poor breeding year due to high sea surface temperatures throughout the previous

winter. With six years of very low chick numbers, we are concerned that the combination of poor feeding conditions, changes in habitat on East Limestone Island due to blowdown, and sporadic raccoon predation in the past, have worked together to decrease recruitment of new breeders to the East Limestone Island colony, and we are now seeing the result as a rapidly declining population on this island. We will continue to monitor ANMU population trends using a combination of chick departure data, ARU recordings and gathering ground counts.

Black Oystercatchers *Haematopus bachmani*

Oystercatchers are large, conspicuous shorebirds that are easily studied because of the relative ease with which nesting sites can be located. Because they are entirely dependent on the intertidal ecosystem, these birds are also thought to be a good indicator species for the health of intertidal life. LBCS has been monitoring the breeding population of Black Oystercatchers in Laskeek Bay annually since 1992 (except for 2011).

LBCS conducted Black Oystercatcher surveys in Laskeek Bay and Gwaii Haanas this year, and the results from Laskeek Bay are summarized below. The results from Gwaii Haanas are detailed in the Gwaii Haanas Black Oystercatcher Survey report. We have been conducting extensive surveys of Black Oystercatchers in Gwaii Haanas for many years; in 2016 we switched to a cycle of conducting surveys in Gwaii Haanas every other year. However, the Gwaii Haanas BLOY surveyed was not completed in 2020, due to COVID-19 restrictions. With reduced restrictions in 2021, we were able to return to Gwaii Haanas for two BLOY surveys in 2021. Methodology for shoreline surveys and territory visits are detailed in the Gwaii Haanas Black Oystercatcher Survey reports and will not be repeated here. Survey maps of the Laskeek Bay area are produced by Gwaii Haanas and included as an appendix in the Gwaii Haanas reports.

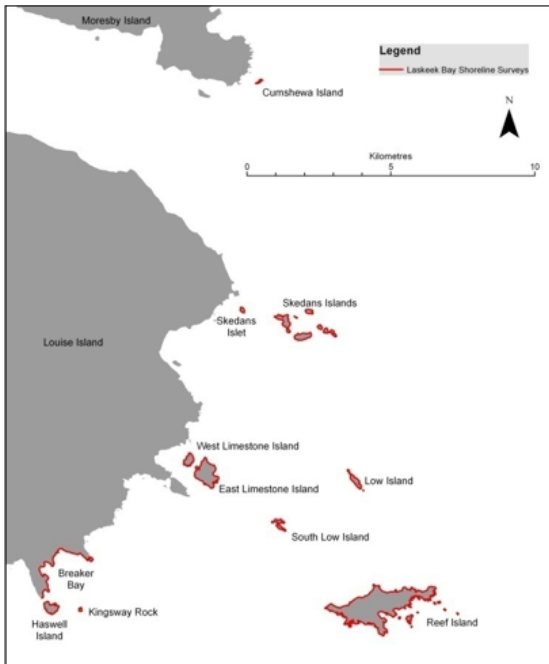


Figure 1. All shorelines outlined in red represent shoreline segments surveyed for Black Oystercatchers.

Site occupancy and reproductive success

Oystercatcher territories were visited in Laskeek Bay in late May/early June (25 May - 6 June) and again in early July (8 – 15 July). The islands that we survey every year are Cumshewa Island, East and West Limestone islands, Reef Island, Low and South Low islands, Skedans Islands (including the small islet in front of the village site), Kingsway Rock, Haswell Island, and a section of the Louise Island shoreline between Haswell Island and Nelson Point (Figure 1). We visited and searched on foot all territories occupied by breeding pairs in the last three survey years. Territories not active in the last three survey years were scanned during shoreline surveys, but not visited unless activity was observed. Shoreline surveys followed the same protocol developed for the Gwaii Haanas surveys and involved scanning shoreline areas from ~50 m offshore at 11 km/hr to search for new territories and for non-territorial birds. All islands were visited during the first and second survey. In the first survey, we weighed and measured eggs.

During survey 1, 32 of the 53 territories visited on foot were occupied with a territorial adult pair; 22 territories had warm eggs, one territory had a chick, and one territory was in the process of hatching when we visited, with one pipped egg and two fresh chicks. Thirteen of the Laskeek Bay territories were dormant, having been vacant for at least three consecutive years. During survey 2, 28 out of the 58 territories visited on foot were occupied; six territories had eggs (11 eggs total) and 22 territories had chicks (32 chicks total). We also surveyed the shoreline of islands to search for new territories and non-territorial birds (birds that are away from their territory or non-breeders). We found 4 new territories (included in the total of 58 territories visited on foot) in Laskeek Bay and had 17 non-territorial sightings of oystercatchers comprising 36 birds (some of which could be the same birds sighted multiple times).

Banding and re-sighted oystercatchers

Black Oystercatcher chicks are banded in most years in Laskeek Bay. When banding occurs, the chicks are banded with one metal band on the right leg that carries a unique number. Oystercatchers banded in the years before 2013 have a combination of colour-bands on the left and right leg that indicates the year of banding as well as the general location where the bird was banded. Metal bands are permanent, while the plastic bands may be lost over time. In 2013, we began banding chicks with field-readable alphanumeric (A-N) codes on plastic bands, instead of colour combinations, because the unique code allows identification of the individual bird from a distance. The A-N bands have white characters on a dark blue background. In 2017, we tried using a new type of A-N plastic band, because we noticed several very worn plastic bands from earlier years, on which the combination is now un-readable. In 2019, it was decided to discontinue using the A-N bands as the new bands selected in 2017 had already become mostly unreadable. In 2021, no chicks were banded.

All oystercatchers observed during the season were checked for bands, as this gives us information on their age and dispersal. Fifteen banded birds were seen in Laskeek Bay during the two 2021 surveys (Table 1). Banded individuals at breeding territories were assumed to be the same individuals on subsequent visits and repeated sightings are not included in the table. There were six birds with colour or alphanumeric bands that were re-sighted in Laskeek Bay this year. One BLOY with a metal band stayed very close to the scrape during the territory visit, allowing the last five numerals of the band number to be read (????-02617); this individual was likely banded as a chick in the Skedans Islands in July 2009 (1015-02617).

Table 1. Banded Black Oystercatchers re-sighted in Laskeek Bay in 2021.

Band Combination (Left – Right) ¹	Location Seen /Nest Site	Year Banded
UB-DG	REE-15	?
UB-R/M	Skedans Islands	2019
UB-UB/M	SKE-19	Unknown
UB-R/M	SKE-12	2019
UB-UB/M	SKE-17	Unknown
UB-UB/M	KNG-3	Unknown
UB-UB/M	Kingsway Rock	Unknown
UB-UB/M	ELI-4	Unknown
AN-R/M	LOW-2	?
UB-R/M	Low Island	2019
UB-UB/M (xxxx-02617?)	REE-17	2009?
UB-UB/M	REE-11	Unknown

UB-R/M	Near LOU-2	2019
UB-UB/M	SLW-8	Unknown
M-UB/M	Near SKE-6	Unknown

¹Band codes: UB = unbanded (birds can lose bands), M = metal, Or = orange, W = white, DG = Dark Green, R = Red, Bk = Black, Br = Brown, Y = Yellow, DB = dark blue, AN = Alpha numeric

Oystercatcher Chick Diet

Oystercatchers feed their chicks hard-shelled invertebrates, which they bring intact to the breeding territory. To quantify average diet composition fed to chicks, we collect a sample of fresh prey remains where they are present. In 2021, prey was collected from 20 unique territories in Laskeek Bay.

Limpets were the primary prey (74.1%), followed by mussels (16.1%), chitons (7.1%), and abalone (1.8%) (Figure 2). These four prey items made up 99.1% of the diet. These numbers are fairly consistent with what has been found in past years; in 2020 these four prey items made up 99.8% of the diet.

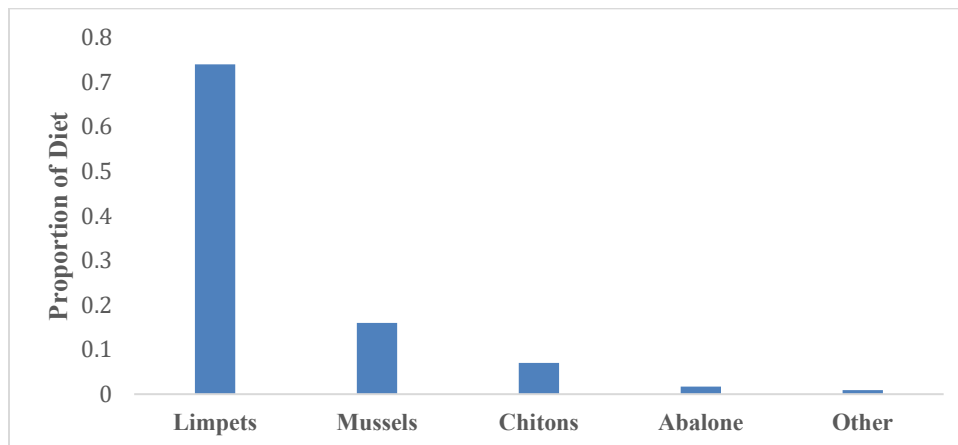


Figure 2. Black Oystercatcher chick diet from prey collections in Laskeek Bay, 2021.

Glaucous-winged Gulls *Larus glaucescens*

LBCS has been censusing gull colonies within Laskeek Bay since 1992 (Figure 3). This year, we visited the known colonies on Kingsway Rock, Low Island, Cumshewa Island, and Lost Islands. Observations from on the water at the Skedans Islands indicated that gulls were not nesting there, so it was not surveyed on foot. At each of the colonies visited, the number of active nests (those containing either eggs or chicks) was recorded, as well as the number of empty nests. No nests and very few gulls were seen on Cumshewa Island. Two gulls were occasionally seen on Low Island throughout the season, but unlike last year, no nest was found. Lost Islands, the largest colony in the area, had 125 active nests on 20 June, while Kingsway Rock had 55 nests on 20 June (total 180 active nests). The nests contained mainly eggs and occasionally young chicks: 1 egg (9% of nests), 2 eggs (22%), 3 eggs (61%), 2 chicks (1%), 3 chicks (3%), or a combination of both eggs and chicks (4%). The

total number of active nests counted this season (180), in these two colonies, was below the long-term average of 252.7 ± 55.5 (SD).

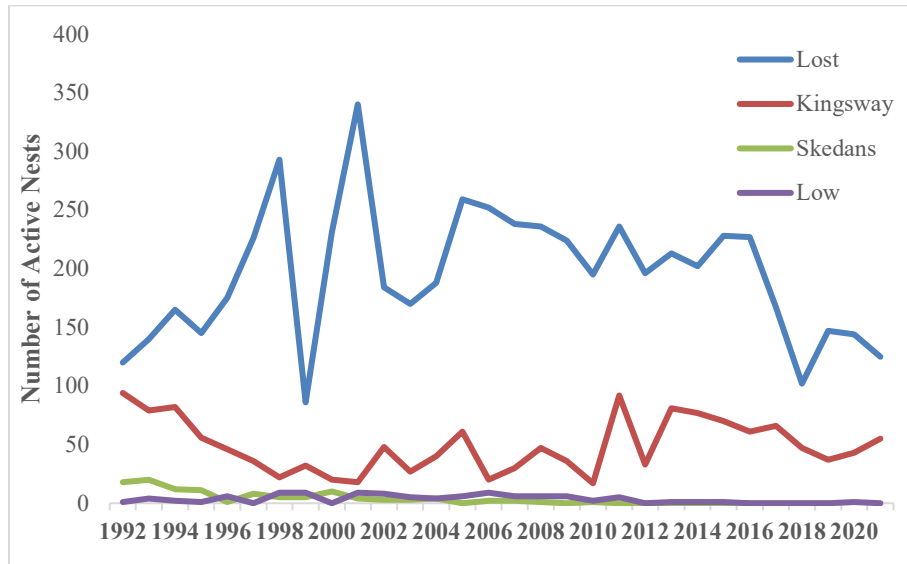


Figure 3. Glaucous-winged Gull nests containing eggs or chicks at four colonies in Laskeek Bay, 1992-2021

Pigeon Guillemots *Cepphus columba*

There are 30 Pigeon Guillemot (PIGU) nest boxes at Lookout Point on the east side of East Limestone Island. Ten boxes were initially installed in 2001 with another 18 boxes being added in 2010. In 2019, 10 new boxes with slightly different design were brought into the area. Eight of these boxes replaced old boxes in poor condition. In April 2021, many of the old boxes were replaced, retaining a total of 30 nestboxes in three areas on the cliffs at Lookout Point. Ten of these new nestboxes were equipped with cameras for a new monitoring project we have begun in collaboration with the Canadian Wildlife Service (CWS) and partners in the Czech Republic.

Pigeon Guillemot SNBox project

A pilot project was launched this year in collaboration with Greg McClelland at CWS and researchers at the Czech University of Life Science Prague and the Czech Technical University in Prague to monitor nesting PIGU via video cameras placed in nestboxes. PIGU, abundant sea birds who frequently use the nestboxes near Lookout Point, are ideal subjects for the project. The 10 camera boxes were equipped with two cameras each (one facing the tunnel entrance, the other facing the gravel nest area); five of these ten were further equipped with a control unit (which allowed the cameras to record and save footage). Using an infrared motion detector, the cameras are triggered to record 20-second videos when motion is detected in the tunnel (e.g. when a PIGU enters the nestbox). Footage of adult guillemots bringing prey back to their chicks, among other behaviours, can be obtained from this set up. In 2021, footage was collected from five nestboxes. The footage was downloaded throughout the season to monitor the activity of

each nestbox. If no activity was observed, the control units were moved to other nestboxes. There were still chicks in the nestboxes when the crew left camp on July 25, so the camera system was left in place and was retrieved at the end of August. We were able to obtain high-quality video and audio recordings of adult PIGU during prospecting, egg-laying and incubation. After the chicks hatched, we were able to record visits by adults bringing prey to their chicks and interactions between the chicks. Video footage will be analyzed by the CWS research team.

Pigeon Guillemot geolocator project

There is little information on where Pigeon Guillemots, breeding in Haida Gwaii, spend the winter. In 2019, LBCS began a collaboration with the Canadian Wildlife Service on research into the annual movement of Pigeon Guillemots. The CWS contracted us to attach 15 geolocator tags to adult guillemots in 2019 and then to retrieve them in the 2020 field season.

Geolocators (also known as GLS tags or geologgers) are miniature archival light level loggers used for tracking animals. They record the time of sunrise and sunset daily and from this information, the location of the animal each day can be determined. To retrieve the data, individuals must be recaptured, the tags removed, and the data archive downloaded. The accuracy of light level geolocation is appreciably less than provided by GPS tags and is usually assumed to have an error of about 150 km. However, it can be enough to provide useful timing and movement data, allowing the identification of important wintering and stopover areas. Geolocators are also smaller and cheaper than most other types of tracking devices.

The nest boxes, on Lookout Point, provide the PIGU with reliable nest sites that can be used, often by the same birds, year after year. They allow LBCS staff to recapture birds with minimal disturbance to remove the geolocators. In 2020, eight of the 15 geolocators placed on adult guillemots in 2019 were retrieved. In 2021, one more geolocator was retrieved; two other geolocators were seen on guillemots nesting at the nestboxes, but we were unable to retrieve them. Initial analysis of the geolocators retrieved in 2020 indicates that PIGU breeding at Limestone Island are non-migratory, spending the entire year around Haida Gwaii and the Hecate Strait (V. Pattison, pers. comm.). The geolocator retrieved this year has been sent to CWS – it will be interesting to see this individual's movements over two winters!

Pigeon Guillemot diet project

In 2016 we began opportunistically photographing Pigeon Guillemots with fish in their bills. Guillemots bring fish to their young carried externally, in the bill. The parents often sit on the water before they enter their nest sites to feed their chicks, which gives us a great opportunity to photograph the fish they are carrying (Figure 4). From these photographs we will be able to catalogue the type and size of fish that guillemots in Laskeek Bay are foraging on and may be able to track changes in the fish they are foraging on over time. A

preliminary analysis of some of these prey photos was done in 2020 and is available on our website at <https://www.laskeekbay.org/laskeek-bay-publications>. In 2021 most of the prey photographs were taken at the nestboxes near Lookout Point. Some photographs were also taken on the west side of East Limestone Island (near Boat Cove) and at the Skedans Islands.



Figure 4. Pigeon Guillemots with prey items

Cassin's Auklets and Fork-tailed Storm Petrels

Ptychoramphus aleuticus and *Oceanodroma furcata*

Small populations of Cassin's Auklets (CAAU) and storm petrels breed on East Limestone Island. Like Ancient Murrelets, these species are burrow nesters and are only active above ground at night. Breeding activity on the island has fluctuated over the years, which is partly attributed to predation by introduced raccoons.

CAAU nestbox checks were not conducted in 2021. We are planning to resume this project in 2022 and switch to alternating years for this monitoring (as with ANMU chick departures).

The ARU was used throughout the 2021 field season to record ANMU, FTSP and CAAU vocalizations. In the future, these recordings will be analyzed to determine activity levels.

Sea Surveys

Boat surveys are conducted throughout the season to monitor the distribution and abundance of marine birds and mammals encountered along pre-determined 100 m wide strip-transects in Laskeek Bay. The objective of these surveys is to develop a strong baseline dataset for marine wildlife in the Laskeek Bay area as well as to specifically monitor the abundance and distribution of Marbled Murrelets (*Brachyramphus marmoratus*), a forest canopy nesting seabird that is provincially Red-listed and designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada

(COSEWIC). These surveys have been conducted since 1991 and represent a very important Marbled Murrelet dataset within the province.

Near-shore surveys

Near-shore surveys cover the inshore waters as far north as Cumshewa Island and south to Haswell Island. Four near-shore surveys were completed this year: 19 May, 18 June, 9 July, and 20 July. On these surveys, we counted 17 species: Ancient Murrelet, Black Oystercatcher, Common Loon, Glaucous-winged Gull, Harlequin Duck, Black-legged Kittiwake, Long-tailed Duck, Mallard, Marbled Murrelet, Pacific Loon, Pelagic Cormorant, Pigeon Guillemot, Rhinoceros Auklet, gull species (likely Short-billed Gull [Mew Gull was renamed in 2021 when it was split from the Common Gull]), Red-necked Phalarope, Whimbrel, and White-winged Scoter.

The highest Marbled Murrelet count was during the 19 May survey, when we recorded 45 (plus 15 off transect). During the other surveys we counted a total of 27 Marbled Murrelets: 16 on 18 June, 0 on 9 July, and 11 on 20 July. These numbers are lower than those recorded on four 2020 surveys (92, 41, 34, and 50; 8 May to 23 June) and five 2019 surveys (120, 111, 131, 274 and 45; 6 May to 24 June). The decreased sightings this year may be partly due to fact that the surveys were conducted later in the season than usual.

Hecate Strait surveys

This survey takes us due east from Reef Island into Hecate Strait, and then back towards the Skedans Islands. It allows us to record species that tend to stay farther from shore. No Hecate surveys were conducted in 2021.

Marine Mammals

We kept a daily record of all marine mammal sightings, with the exception of Harbour Seals (*Phoca vitulina*) and Steller's Sea Lions (*Eumetopias jubatus*). Harbour Seals and Steller's Sea Lions are counted at specific haul-outs during sea surveys in order to keep an index of population trends.

Along with recording incidental sightings, we do standardized surveys of marine mammals during sea watches from Lookout Point, during at-sea surveys, and by doing a 5-minute scan and count of marine mammals from Cabin Cove each evening approximately two hours before sunset. The evening 5-minute count was initiated in 2014, and ends on 20 June, when the ANMU gathering ground count ends. The results of this season's total sightings are summarized in Table 2.

In 2018, an attempt to standardize sea watch times was made; sea watches were scheduled three times per week, from 07:00-08:00. In addition to these three scheduled sea watch sessions, another one or two were completed opportunistically, depending on other field activities. This schedule was kept in 2019, but in 2020 and 2021 was less rigorously followed, due to time constraints and reduced volunteer involvement.

Table 2. Total counts of marine mammals from sea surveys, sea watches, and incidental sightings, 2011-2021†. Data since 2014 includes sightings during the 5-minute evening count. Numbers do not necessarily reflect number of individuals, as individuals may be re

Common name	Scientific name	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Northern elephant seal	<i>Mirounga angustirostris</i>	1	0	0	0	0	2	0	0	0	0	0
California sea lion	<i>Zalophus californianus</i>	1	0	1	0	0	0	0	4	0	0	1
Humpback whale	<i>Megaptera novaeangliae</i>	56	15	122	36	22	112	13	347	12	14	193
Fin whale	<i>Balaenoptera physalis</i>	0	0	0	0	0	0	0	0	0	0	0
Grey whale	<i>Eschrichtius robustus</i>	1	3	5	1	2	3	0	0	1	1	1
Minke whale	<i>Balaenoptera acutorostrata</i>	0	0	2	2	2	9	4	3	6	2	1
Killer whale	<i>Orcinus orca</i>	75-80	8	36	36	45-60	47	50	26	16	13	49
Harbour porpoise	<i>Phocoena phocoena</i>	30	11	16	27	14-15	7	13	31	7	4	19
Dall's porpoise	<i>Phocoenoides dalli</i>	0	0	0	0	0	0	0	0	0	0	8
Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	0	15	0	13	0	30	0	0	0	0	0

†Harbour seal *Phoca vitulina* and Steller's sea lion *Eumetopias jubatus* sightings are not reported here.

Humpback Whales

There were more Humpback whale sightings in Laskeek Bay this year than in 2020, although fewer sightings than in 2019. The majority of Humpback sightings occurred earlier in the season (May and June). No Humpbacks were spotted in late June and early July, although two sightings occurred on July 15th and 21st.

Orca

There were 14 sightings of Killer Whales in Laskeek Bay this season; most of the whales seen were in pods of 5 to 6, although one was a lone male. Nine of the sightings were likely of the same pod, which was observed in Laskeek Bay from July 6th to 15th. We were able to take ID photographs during most of these encounters. Our ID photographs are sent to the Killer Whale database at the Pacific Biological Station in Nanaimo.

Steller's Sea Lions

There are several sea lion haul-outs in Laskeek Bay. The largest of these is on islets off the east end of Reef Island. There are also smaller winter haul-outs on the Skedans Islands, Cumsheewa Rocks, and Helmet Island. We regularly count the number of individuals on

the Reef and Skedans haul-outs. The maximum number counted this season was 377 individuals at Reef (18 June) and 123 at Skedans (19 May).

Other species

Other less-common marine mammal species that were sighted this season: Northern Elephant Seal (1 individual) and Grey Whale (1 individual).

Wildlife Trees

The Society has been monitoring cavity-nesting birds on East Limestone Island since 1990. Wildlife trees (dead standing snags) were monitored opportunistically from 1990-1994, and since 1995 there has been a systematic effort each year to cover the island thoroughly, looking for active trees. Through this monitoring program, LBCS has amassed a long-term data set on tree use across many years, showing the importance of these trees as habitat for cavity nesting species. A total of 190 wildlife trees have been identified over the past 32 field seasons.

This year we found a total of 11 active trees, containing nests of three different species. Four new trees were identified. Nine nests were occupied by Red-breasted Sapsuckers (RBSA), one by Northern Flickers (NOFL; Figure 5), and one by Hairy Woodpeckers (HAWO; Table 3).



Figure 5. Northern Flicker adult feeding nestling on East Limestone Island

The number of Red-breasted sapsucker nests (9) was similar to numbers over the past decade, but less than in some earlier years when up to 22 active sapsucker trees were found.

Table 3. Wildlife tree activity on East Limestone Island in 2021. Minimum fledge date is the last day activity was observed at the nest, maximum fledge date is the first day that no activity was observed in a half-hour continuous watch of the nest.

Tree #	Cavity Nester ¹	Tree Species ²	Fledge Date (earliest)	Fledge date (latest)
51	RBSA	Hemlock	16-Jun	19-Jun
109	RBSA	Spruce	23-May	24-Jun
157	RBSA	Spruce	23-May	19-Jun
176	RBSA	Spruce	22-May	24-Jun
181	RBSA	Spruce	7-Jun	22-Jun
182	RBSA	Hemlock	22-May	19-Jun
184	RBSA	Hemlock	29-May	19-Jun
187	HAWO	Hemlock	29-May	7-Jun
188	NOFL	Hemlock	25-Jun	26-Jun
189	RBSA	Spruce	19-May	01-Jun
190	RBSA	Spruce	29-May	Unknown

¹RBSA = Red-breasted Sapsucker, NOFL = Northern Flicker, HAWO = Hairy Woodpecker, CBCH = Chestnut-backed Chickadee.

²Spruce = Sitka spruce, Hemlock = Western hemlock.

Sapwell Monitoring

In 2019, we began to monitor Red-breasted Sapsucker sapwells. Sapwells were found opportunistically while the staff and volunteers travelled around the island during other projects, mainly the wildlife tree monitoring program. While monitoring wildlife trees, we noted where the sapsuckers went after leaving the nest and often found a sapwell tree in the area where the bird had flown. It was then marked with flagging tape and mapped.

In 2021, fourteen active sapwell trees were monitored; 11 that were active in 2020, as well as three newly identified trees: all were Western Hemlocks. A total of 32 person-hours were spent monitoring sapwell trees. During these sessions, many visits by sapsuckers were documented. There were six sightings of squirrels feeding at the sapwells, and two interactions between squirrels and sapsuckers. Unlike last season, no Rufous Hummingbirds were observed using sapwells this year.

Raptors and Corvids

Every season, as with cavity-nesting birds, we make a concerted effort to keep track of other nesting birds on East Limestone Island, including Bald Eagles, Peregrine Falcons,

Common Ravens, and American Crows (formerly designated Northwestern Crows, the subspecies was lumped with the more widespread American Crow, as of 2020).

This year we had no confirmed active Bald Eagle (BAEA) nests, although eagles were frequently observed on North Cove Trail near BAEA-7, on Ridge trail near BAEA-6 and BAEA-8, and on Lookout Point. However, despite rigorous observations there was no nesting activity noted. Additionally, the most reliable BAEA nest (BAEA-5) blew down sometime during the past winter and has not been rebuilt. A nest was built at this location in 2000 but was blown down in 2002-2005 before being re-built in 2006. Overall, the BAEA-5 tree has hosted an active nest in 11 years during 2000-2020.

Nesting Peregrine Falcons (PEFA) were also absent from the island this year. At the beginning of the field season there were a few sightings of PEFA around Lookout Point and Cabin Cove that gave hope to the possibility of having a nesting pair of PEFA on East Limestone, but sightings quickly decreased and there were only sporadic instances of any PEFA signs on the south cliffs near the old nesting site. PEFA have nested on East Limestone Island discontinuously since research began in 1990. Despite continuous use at the nest site from 2016 to 2019, during 2020 and 2021 the site has been vacant.

The one Common Raven (CORA) nest on ELI this year initially caused a bit of confusion due to its proximity to camp. When the field crew arrived on May 11th, it was assumed that the ravens had already fledged because there was clearly a young raven making a ruckus near camp. It was only later noticed that the young raven was not actually a fledgling, but that the new nest site was located a short distance away from camp at the start of Main Trail, making it the 6th CORA nest site on East Limestone Island.

This year also brought the exciting possibility of a Sharp-shinned Hawk (SSHA) nest on ELI. The nest was never located but a pair of SSHA were reliably observed deep in Crow Valley near CORA-4 and were engaging in territorial behavior such as dive-bombing and alarm when researchers were nearby. There were also consistent signs of use such as numerous feather piles, a very well used plucking post, and concentrated areas of feces or “whitewash”. Since 1990, there have only been two other years in which SSHA were thought to have nested on East Limestone Island.

Daily Bird Checklist

Throughout the field season, we keep a daily record of all bird species seen or heard within Laskeek Bay. We recorded a total of 62 species over 65 days, with May 13th as the biggest day having 41 species recorded in one day! Throughout our monitoring, many species were recorded almost every day, for example: Common Raven, Black Oystercatcher, Bald Eagle, Pigeon Guillemot, Red-breasted Sapsucker, Pacific-slope Flycatcher, Hermit Thrush, and Pacific Wren. Many less frequently observed species were recorded this year as well, such as Red-necked Phalarope, Lesser Yellowlegs, Western Sandpiper, Tufted Puffin, and Sabine’s Gull.

Blowdown

Since 2011, when winter winds blew down a significant portion of the forest on East Limestone Island, we have been monitoring the regeneration of the forest in these blowdown areas by taking photos from the same locations each year (Figure 6). We have established 6 photo points, mostly in the north and central part of the island but also including one directly behind the camp in Cabin Cove.

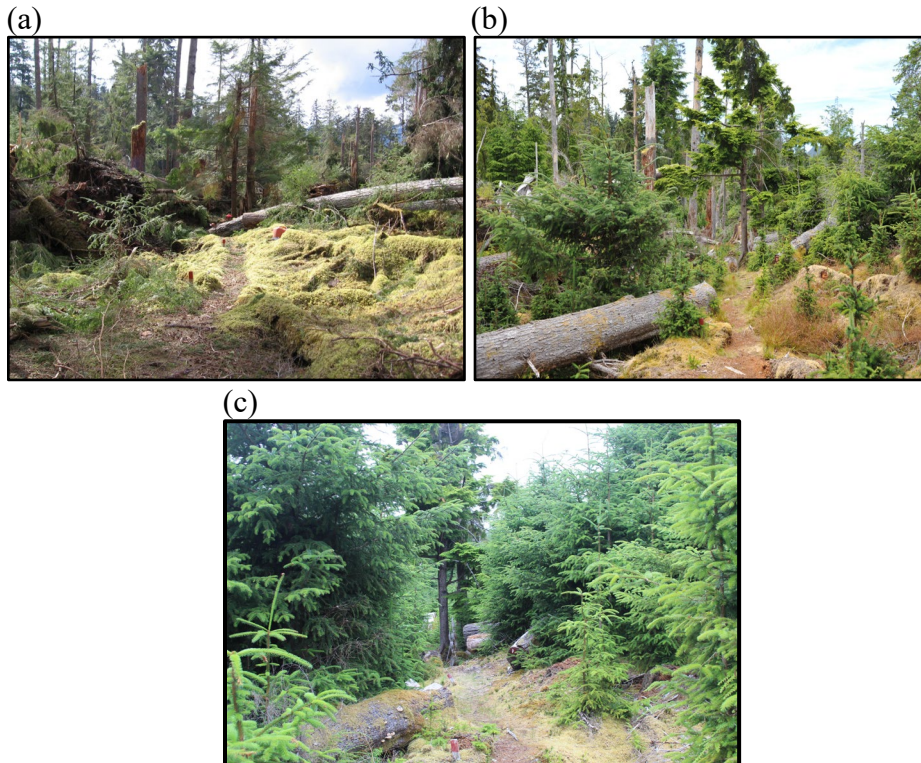


Figure 6. Photos taken looking west along the main trail, in (a) 2011, the first field season after the blowdown events, (b) five years later in 2016 and (c) this year, 2021.

Rare Plants and Vascular Plant Blooming Records

There are relatively few wildflowers and berry bushes left on East Limestone Island as a result of heavy browsing by introduced deer. Most flowering plants are now found restricted to cliff areas where the deer cannot reach them or the top of uprooted tree stumps, above the deer's grazing height.

A number of rare plants are present on East Limestone Island due to the unique limestone geology that is uncommon on the rest of Haida Gwaii: showy Jacob's ladder (*Polemonium pulcherrimum*), Richardson's geranium (*Geranium richardsonii*), and cut-leafed anemone (*Anemome multifida*). In 2021, showy Jacob's ladder and cut-leafed anemone were found to be blooming, on the cliffs in Boat and Anemone Cove. Another rare plant has been discovered this year on the shoreline north of Boat Cove; although it was not observed

blooming (likely due to grazing deer), photos have led botanists Mackinnon, Pojar, and Roemer to conclude it is very likely *Piperia (Platanthera) ephemerantha* (white flower rein-orchid). It is considered rare and threatened in BC, and vulnerable across its range from Alaska to Mexico. We had no previous records of it on Limestone, and it is not included in *Vascular Plants of Haida Gwaii* (Mike Cheney et al., 2007), demonstrating its rare status.

Every field season we keep a record of the dates on which all vascular plant species are first observed in bloom. For example, this year we recorded sightings of blooming Villous Cinquefoil (*Potentilla villosa*), Summer Coralroot (*Corallorhiza maculata*), Nootka Rose (*Rosa nutkana*) and Red Columbine (*Aquilegia formosa*), among other species.

CONSERVATION

Restoration Project

In 2019, LBCS began a restoration project that will help East Limestone Island return to a state approaching a pre-deer era (based on what is seen on deer-free islands). A central plank in this plan is to encourage regular deer hunting on East Limestone Island, with the hope that this will substantially lower deer browsing pressure. Once regular deer hunting on the island has been established, we should be able to document the return of the native vegetation on East Limestone Island, creating an increase in biodiversity and a more resilient ecosystem.

The main aspects of the monitoring program were implemented in the 2019 field season prior to the commencement of the regular hunting of deer on East Limestone Island.

This Restoration Project has created an effective monitoring program for native vegetation, the browsing effects of deer, and songbird richness and abundance, as well as a monitoring program for the distribution and density of invasive alien plants.

Vegetation Plots

East Limestone Island contains habitat suitable for many types of grasses, forbs, ferns, shrubs and trees. This vegetation has changed over time due to the presence of the invasive Sitka Black-tailed Deer. In order to capture change in the vegetation structure as hunting pressure is established and deer numbers decrease, we have begun to record every plant species present, as well as estimate abundance and cover in 11 vegetation plots around the island; vegetation plots are located strategically in different areas of the island: Sitka Spruce/Western Hemlock forest (2 plots), Shoreline (4 plots–N, S, E, W), Alder forest East (1 plot), Alder forest South (1 plot), Cedar forest (1 plot) and blowdown (2 plots). The plots have a 10-meter radius (large plot) with a subplot (using the same center point as the large plot) of 3.6 m. The large plot will be used to measure species richness and the subplot used to estimate abundance and cover. The information will be recorded annually for as long as the project continues.

Songbird Point Counts

Many species of songbirds are found on East Limestone Island with different species occupying various habitats. The introduction of deer has negatively affected the abundance and distribution of flowering plants, limiting both foraging and nesting habitats for many songbirds. This has most likely led to lower levels of both songbird richness and abundance. We are now conducting point counts in all of the vegetation plot areas to record the presence, location and abundance of various species of songbirds on the island, in order to monitor change in songbird distribution and abundance as deer hunting becomes a regular event.

In the 2021 field season, three point counts were conducted in each vegetation plot. Each set of point counts was either completed in one day or finished over a two-day period. This year's methods differed slightly in that counts were done throughout the day, rather than early morning. Dates for the point counts were 20-21 May, 01 June, and 16 June.

Tree Growth

Sitka Black-tailed Deer have a marked effect on tree growth on East Limestone Island, the result being that it can take much longer for a tree on ELI to escape the browsing limit of the deer when compared to a place where deer are less abundant. In order to monitor and record the growth rate of trees that are within the browsing limit (<1.5m) of the deer, in 2019 ten saplings of three common tree species (Sitka Spruce, Western Hemlock, Western Red Cedar) on ELI that were <1.5m in height, were selected. The total height of the sapling and the longest lateral branch were measured and these measurements will be recorded annually. Unfortunately, sometime between the 2020 measurements and the 2021 measurements, four saplings (one Sitka Spruce and three Western Red Cedar) had disappeared, likely eaten by deer. Other saplings of the same species were identified, measured and used as replacements for those that were no longer present. Measurements were taken on all the remaining saplings.

Invasive Plant Monitoring

Invasive plants are plants that have been introduced to an area from elsewhere and have the ability to reproduce rapidly. They often quickly take over habitat that would otherwise be available to native plant species. Invasive plants that have become established on East Limestone Island include Bull Thistle (*Cirsium vulgare*), Canada Thistle (*Cirsium arvense*), Prickly Sow-thistle (*Sonchus asper*), Wall Lettuce (*Lactuca muralis*) and Marsh Cudweed (*Gnaphalium uliginosum*).

After a three-year invasive plant removal project on ELI, it was found that the effort exerted did not provide the desired rewards. During the removal program, a number of plots were selected for invasive removal. Of these plots, ten were selected to be monitored without further removal (with some exceptions: seed heads of *Cirsium* species

were, at times, clipped). The ten plots that were selected had the most consistent records and contained the most common invasive plants on ELI. We recorded the abundance and richness of invasive plants on these plots in 2021.

Introduced Mammals

Sitka Black-tailed Deer *Odocoileus hemionus*

Deer were intentionally introduced to Haida Gwaii in 1878, and on several occasions between 1911 and 1925, to provide game meat for local people (Gaston *et al.* 2008). Because they have no major predators on the islands, the deer population has reached very high density and has dramatically impacted plant communities, particularly in the forest understory. LBCS is a partner with the Research Group on Introduced Species (RGIS), which has carried out extensive research on this topic in Laskeek Bay as well as on the rest of Haida Gwaii.

RGIS has completed a four-year program, project BAMBI (Behavioral Adjustments to Mitigate Biodiversity loss), a study that looked at how the deer of Haida Gwaii have adapted to life in the absence of predators, and the role that fearless behaviour plays in helping deer maintain high densities on islands with severely browsed understories. This season, thermal motion-activated cameras were used to remotely track deer on East Limestone Island. In past years cameras would also be set-up on Reef Island, but due to the limited ELI field season resulting from COVID-19 restrictions, no cameras were set-up there in 2020 or 2021. This year on East Limestone Island, 12 cameras were set up around the island between 21 May and 19 July. The pictures were sent to RGIS for analysis.

Although project BAMBI is over, we continue to record sightings of tagged deer on East Limestone Island for RGIS. The date/time, location, tag colour/number, and sex were recorded along with any behavioral notes. This year, the only deer sighted with ear tags was number 5. This deer is now eleven years old; it was captured and tagged in July 2011 as a yearling buck.

On East Limestone Island, there are now two deer exclosures, one that was built several years prior to the blow-down in 2010 and another one was built in March of 2015. The older exclosure, having survived the blowdown with only minor damage, contains vegetation that was established prior to the blowdown. This exclosure did not receive any further damage in the last winter and it is full of shrubs, saplings, and ferns, continuing to highlight the contrast between browsed and unbrowsed areas. The understory vegetation (huckleberry, salal, ferns, and young trees) inside this exclosure is almost entirely absent from areas that deer can access. The newer exclosure is close to the main trail, in the blowdown at the centre of the island. The difference in growth within this exclosure to the area adjacent is also quite apparent, with many huckleberry bushes, wildflowers, and healthy spruce, hemlock and cedar saplings growing within the exclosure. We are also

noticing that a consequence of the blowdown is the creation of many small refugia for plants on top of upturned roots. We have selected locations for two new deer exclosures to be built during the fall/winter of 2021/2022.

Raccoons *Procyon lotor*

Raccoons were introduced in the early 1940s to provide local trappers with a source of employment (Gaston *et al.* 2008). Raccoons are one of the largest threats to ground and burrow nesting seabirds on Haida Gwaii. With few defenses against mammalian predators, birds such as Ancient Murrelets, Cassin's Auklets and Fork-tailed Storm Petrels are very vulnerable to raccoon predation and typically experience rapid declines where these predators become established in colonies.

Raccoon predation is an ongoing concern on East Limestone Island and drops in Ancient Murrelet numbers have been closely correlated with raccoon presence. During 1990 and 1991 there was considerable raccoon presence on the island and very high rates of predation. Based on predation rates observed during earlier visits to the island, it is reasonable to assume high levels of predation for the period of 1983-1989 as well (see LBCS Science Report #3 for further discussion). Raccoons were removed from the colony in 1992 and predation rates dropped dramatically. Raccoons were again present in 1993, 1994 and were suspected in 1995 and 2001. More recently a raccoon was removed from the island in 2007, and raccoon presence was confirmed again in 2009. No raccoons have been confirmed present on East Limestone since 2009.

Due to logistical constraints, we were unable to survey for raccoons in February or March of 2021. Cameras were set up on 2 April in Boat Cove, Cabin Cove, North Cove and Crow Valley. They were checked on 12 April, with no sign of raccoon presence. The North Cove and Cabin Cove cameras were taken down on 14 May, but cameras were kept in Crow Valley and Boat Cove throughout the season, until 19 July. The memory cards were checked regularly, and bait replenished as required. No raccoon activity was detected during the 2021 field season.

Red Squirrels *Sciurus vulgaris*

Squirrels were introduced to Haida Gwaii in 1950 to aid in cone gathering for the forest industry (Gaston *et al.* 2008). Squirrels may have been introduced to East Limestone Island directly at this time. Squirrels are now well established on East Limestone Island and are known to be a nest predator on various songbird species (Martin and Joron 2003).

Since 2007, we have been conducting squirrel surveys on East Limestone Island to measure the annual abundance of squirrels. Over time we hope to describe population cycles of this introduced species and gain a better understanding of the consequences of squirrel presence. Eleven squirrel surveys were completed in the 2021 season.

Marine Debris Removal

In 2016, we began documenting, collecting, and removing marine debris from several beaches in Laskeek Bay. In 2019, two beaches were selected to become long-term monitoring sites: the south beach on Reef Island and the Crow Valley beach on East Limestone Island. The type of survey conducted is an accumulation survey, which is based on National Oceanic and Atmospheric Administration (NOAA) protocols. In 2021, marine debris was collected opportunistically, but systematic surveys were not completed.

CONCLUSION

This season was our 32nd year of research, monitoring, and environmental education in Laskeek Bay. Since 1990, LBCS has focused on developing baselines and long-term data sets for the marine and terrestrial ecosystems of Laskeek Bay, as well as providing volunteers, students and visitors the chance to visit our research camp. Unfortunately, in 2021, no visitors or students could visit the island and only a few volunteers were possible. Despite these circumstances, the field season was a success – long-term monitoring programs were maintained and new projects are being developed. The society remains dedicated to long-term monitoring and engaging the public in addressing local conservation issues.

Between the years 2006-2009 we documented a very serious decline in Ancient Murrelet numbers on East Limestone Island. Since 2015, we again experienced another major decline in chick numbers in the Cabin Cove area (from 110 chicks in 2014 to 31 chicks in 2020). What brought on this change is not clear: changes in sea surface temperatures which in turn modify food sources, loss of habitat or degradation of habitat in the remaining forest due to blowdown, and increased predation are all plausible explanations. Since raccoons are detrimental to Ancient Murrelet colonies, we will continue to monitor for raccoon activity on the island. In 2019, we decided to discontinue manual monitoring and move to complete automation of ANMU monitoring. This has allowed us to be less invasive with the ANMU, as well as giving us the ability to direct more person hours to other projects. In 2021, we decided to begin monitoring ANMU chick departures on alternating years. If ANMU numbers increase, then we will re-visit that decision.

Invasive plants and animals are degrading the various habitats on ELI. These same problems are evident on many islands in the Haida Gwaii Archipelago. The restoration plan begun in 2019 will help to give us a better understanding of these effects and how controlling the deer population can effect change, as well as hopefully, a return to what the island would have been like in pre-deer era. In 2021, some change was observed in the vegetation but several more years will have to pass before we will have collected enough data to sufficiently confirm any change that may be occurring.

The lessons that we learn from our research on East Limestone Island are of great importance. In every monitoring program LBCS conducts we are collecting quantifiable data that will allow us, and others, to conduct analysis that will produce information that can inform managers, researchers and the general public. We hope that continuing our core long-term monitoring programs will help to document and understand broader scale changes.

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