

**EAST LIMESTONE ISLAND FIELD STATION
FIELD SEASON REPORT 2022**



Glaucous-winged Gull chick

Photo: Andrew Jacobs

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Laskeek Bay
CONSERVATION SOCIETY

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Summary

This was the Laskeek Bay Conservation Society's 33rd field season on East Limestone Island (ELI), Laskeek Bay, Haida Gwaii. The season ran from 6 May to 22 July 2022. This year we were able to reintroduce some elements of our field activities that had been restricted in 2020 and 2021, due to the COVID-19 pandemic. We were excited to welcome volunteers, educational groups, and tour groups back to ELI.

Ancient Murrelet (ANMU) chick departures were monitored using a wildlife camera system. Numbers continue to decline, with only 11 chicks departing through the Cabin Cove funnels this year. No raccoons were detected on the island via remote baited cameras throughout the season, although some possible raccoon scat was found on ELI and in the Skedans Islands. We have continued to monitor ANMU numbers through evening gathering ground counts and an Automated Recording Unit (ARU).

In collaboration with Canadian Wildlife Service (CWS) and researchers at the Czech University of Life Science Prague and the Czech Technical University in Prague, we continued the Smart Nest Box (SNBox) project in the Pigeon Guillemot (PIGU) nest boxes and expanded to eight nest boxes with cameras installed. 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.

A Glaucous-winged Gull nest count was conducted at just one colony this year, as we were unable to make it to the Lost Islands. Kingsway Rock had 53 active and 2 empty nests, very similar to 2021. Five near-shore sea surveys were completed, during which a total of 124 Marbled Murrelets were sighted, which was more than were observed in 2021, but still low compared to other years. Marine mammal sightings included 32 Humpback Whales, 11-12 Grey Whales, 1 Northern Elephant Seal, 56 Harbour Porpoises, 1 Fin Whale, 7 Minke Whales, and 13 sightings of groups of Orcas.

There were 18 active wildlife trees, four of which were newly identified in 2022. As usual, most of the wildlife trees were occupied by Red-breasted Sapsuckers (RBSA), but there were two used by Chestnut-backed Chickadees (CBCH), one by Hairy Woodpeckers (HAWO) and one by Tree Swallows (TRES). Common Ravens were nesting in one of the old nests on the island, which had last been used in 2019. They fledged four young shortly after the beginning of the field season. A pair of Bald Eagles was nesting on ELI, with one chick observed in the nest.

This was the fourth season since the initiation of our Restoration Project, which focusses on reducing the abundance of introduced Sitka Black-tailed Deer and observing the effects on the island ecosystem. 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 33 consecutive field seasons and during this period LBCS has developed diverse long-term monitoring and public education projects in Laskeek Bay, Haida Gwaii. Throughout our field season, 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.

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. 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.

Project Limestone

Project Limestone brings local elementary and high school students, to East Limestone Island to learn about natural history and participate in our research programs. As we emerge from some of the restrictions associated with the COVID-19 pandemic, we are working with local schools and teachers to reestablish our field trip program.

Volunteers

Volunteers play an important role in the operation of the LBCS field camp. They generally stay for one week, and help staff with research and 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.

During the 2022 field season, we had 24 volunteers, including three student interns, who contributed 226 volunteer days to projects on Limestone and in other areas of Laskeek Bay. Most volunteers stayed for one week, with the student interns each contributing 4 weeks. Seven volunteers had visited the island or volunteered on the island previously.

Twenty-two of our volunteers were from British Columbia this year (12 from Haida Gwaii), one from Ontario, and one from France.

Visitors

The LBCS visitor program provides an opportunity for tour groups to visit East Limestone Island and participate in an interpretive tour of the island with a staff member. While visitors walk across the island, they are introduced to the natural history of the area and to the monitoring and research projects that we conduct. We aim to bring about greater understanding of the natural world and increased awareness of local conservation issues through the visitor program.

Generally, visitor groups who stop on Limestone Island are taking part in ecotourism excursions into Gwaii Haanas. This year, Bluewater Adventures stopped by for a tour 5 times, with the Island Solitude on May 18, May 26 and June 28 and the Island Odyssey on June 16 and July 9.

Coast Mountain College in Prince Rupert brought 3 groups of students from the Applied Coastal Ecology program on May 17, 20 and 23. Each group was 10-11 students with two instructors. Two LBCS directors also stopped in to check on field operations, Carolyn Gibson by kayak and Jacques Morin by private motor vessel.

In total, there were 111 visitors to island throughout the field season.

Staff

LBCS staff this year were Rian Dickson, Lead Biologist/Camp Supervisor; Jesse Beaubier-Brulotte, Research Assistant; Matthew Peck, Alternate Biologist, and Judy Hilgemann, Executive Director. Past LBCS biologists Jake Pattison and Ainsley Brown made some cameo appearances to help cover the field season schedule.

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. After a two-year hiatus, we were grateful to have student interns back on the island. Lindsay Curle (BC Institute of Technology Ecological Restoration/Fish Wildlife and Recreation), Andrew Jacobs (University of Victoria, Biology), and Megan Scott (Simon Fraser University, Biology) each contributed four weeks during the field season. Megan stayed on for an additional week of data entry and report writing at the end of the field season. In total, the interns this season contributed 77 days of field and office work. Megan is back at SFU, working on a Directed Studies project to analyze some of the LBCS Black Oystercatcher data, Lindsay has been working for LBCS as a Social Media Intern and research assistant, and Andrew assisted LBCS science director Tony Gaston with seabird surveys off northern Vancouver Island.

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 continued our collaboration with the Canadian Wildlife Service (CWS) to study breeding ecology of Pigeon Guillemots. See the PIGU section for more details.

David Green, professor of Biological Sciences at Simon Fraser University, has been working with his graduate students to study Black Oystercatchers on the BC coast. For the past few years, they have been doing fieldwork in Haida Gwaii, primarily Skidegate and Masset inlets. In 2022, two Masters student came to Laskeek Bay to assist with our BLOY surveys and do some banding and prey sampling. See the Black Oystercatcher section below for more information.

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 (i.e., capturing) 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 more time to focus on some of our other monitoring programs and research projects. After a one-year hiatus, we set up the chick funnels in 2022.

Chick Capture Trends

The Cabin Cove total for 2022 was 11 chicks, including only chicks captured on camera during the time when we would normally be monitoring (22:30 to 02:30), to be consistent with previous years (Figure 1). The total including chicks that were photographed after 02:30 in the morning was 14.

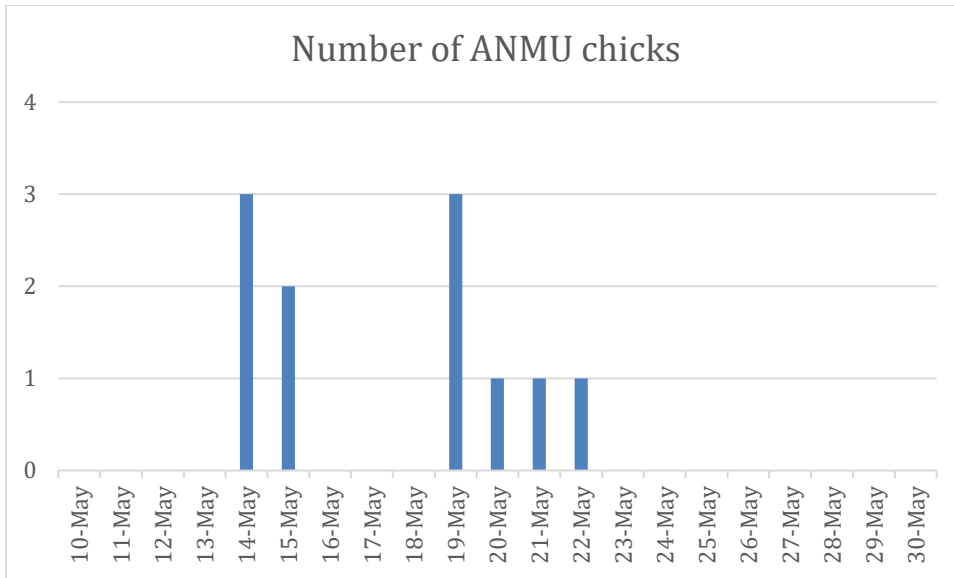


Figure 1. 2022 nightly chick records (funnels 5-8). Chicks photographed within the funnels before 02:30 are shown here. The date refers to when the monitoring night began, even if chicks were caught in the early morning of the next day.

The number of chicks recorded this season in funnels 5-8 continues to decline, compared to previous years, with 34 chicks recorded in 2019, 31 in 2020 and only 11 in 2022 (Table 1).

Table 1. Summary of chick departures, peak nights and totals for funnels 5 to 8 on East Limestone Island, 2006 to 2022. Chick numbers include only chicks captured or photographed within the funnels, and before 2:30 in the morning.

Year	First night with chicks	Peak night	Peak count	Last night with chicks	Total chicks
2006	10-May	21-May	24	30-May	197
2007	15-May	4-Jun	16	12-Jun	166
2008	12-May	14-May	13	3-Jun	125
2009	10-May	18-May	16	29-May	104
2010	8-May	21-May	19	2-June	121
2011	11-May	15-May	11	9-June	106
2012	12-May	17, 22-May	14	31-May	110
2013	13-May	21-May	15	1-June	136
2014	11-May	18, 19-May	15	2-June	110
2015	11-May	20-May	7	6-June	44
2016	18-May	25, 29-May	5	19-June	36
2017	16-May	20-May	5	10-June	28
2018	11-May	17-May	6	17-June	39
2019	11-May	19-May	6	11-June	34

2020	14-May	20, 21, 24, 25-May	4	3-June	31
2022	14-May	14, 19-May	3	22-May	11

Funnels 5 and 6

As of this season, funnels 5 and 6 have been monitored during a period of 33 years, and are the primary means of assessing the long-term population trend in the Cabin Cove colony area (Figure 2). Funnels 7 and 8 were installed in 2006, flanking funnels 5 and 6, to see if the colony area had shifted. This year there were more chicks in funnels 5 and 6 (10 chicks) than funnels 7 and 8 (1 chick), which is consistent with past trends, suggesting that the densest part of the remaining Cabin Cove colony is still being captured by funnels 5 and 6. As in past years, funnel 6 had much higher number of chicks (8) than funnel 5 (2 chicks). This year, the first chicks arrived in funnels 5 and 6 on 14 May and peak nights (3 chicks) occurred on 14 and 19 May (

Table 2).

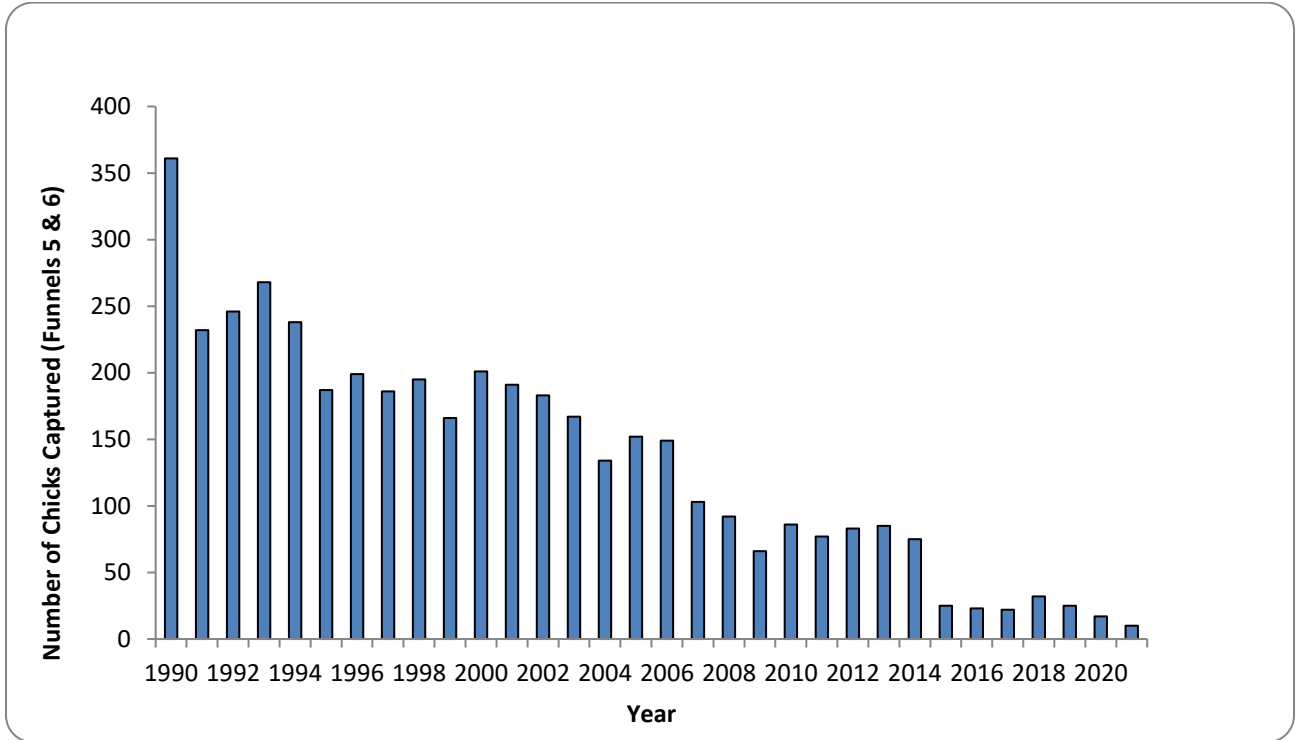


Figure 2. Total Ancient Murrelet chick captures at funnels 5 and 6, 1990-2017. These totals include only chicks captured within the funnels and before 02:30 in the morning.

Table 2. Summary of chick departures, peak nights and totals from funnels 5 and 6 on East Limestone Island, 1990 to 2017.

Year	First night with chicks	Peak night	Peak count	Last night with chicks	Total chicks
1990	13-May	20-May	28	15-Jun	361
1991	10-May	25-May	22	05-Jun	232
1992	14-May	22-May	29	02-Jun	246
1993	12-May	18-May	39	04-Jun	268
1994	08-May	20-May	29	06-Jun	238
1995	11-May	23-May	18	12-Jun	187
1996	11-May	18-May	17	07-Jun	199
1997	13-May	28-May	22	05-Jun	186
1998	11-May	20-May	23	20-Jun	195
1999	11-May	21-May	22	09-Jun	166
2000	11-May	21-May	22	06-Jun	201
2001	11-May	19-May	21	15-Jun	191
2002	09-May	21-May	33	01-Jun	183
2003	11-May	21-May	19	03-Jun	167
2004	08-May	16,17-May	15	01-Jun	134
2005	07-May	19, 23-May	12	05-Jun	152
2006	10-May	21-May	20	31-May	149
2007	15-May	04-Jun	16	12-Jun	103
2008	13-May	20,22,23-May	8	03-Jun	92
2009	12-May	18,19-May	10	29-May	66
2010	8-May	21-May	16	2-June	86
2011	11-May	21-May	9	9-June	77
2012	13-May	22-May	12	31-May	83
2013	13-May	22-May	11	1-June	85
2014	11-May	18-May	12	02-Jun	75
2015	11-May	17,24 - May	4	06-Jun	25
2016	18-May	25-May	5	19-Jun	23
2017	16-May	20-May	5	10-Jun	22
2018	10-May	16-May	6	11-Jun	24
2019	11-May	19-May	6	11-Jun	25
2020	16-May	20, 21-May	4	03-Jun	17
2022	14-May	14, 19-May	3	21-May	10

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 7 May and 4 July, we conducted standardized 10-minute counts of birds on the gathering grounds (two counts of 5 minutes each). Gathering ground counts were completed on 49 evenings this season. Counts were not completed on 10 days during this period (six due to weather and 4 due to staff availability). The highest count occurred on 20 May, with a total of 110 Ancient Murrelets observed, which is the highest maximum count observed since 2015. The average gathering ground count in 2022 was 15.8 (SD=23.2) which is also the highest average count since 2015 (30.3 ± 31.8).

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, and in 2022 is lower still. 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 additional years of very low and decreasing 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 in 2022. We have been conducting extensive surveys of Black Oystercatchers in Gwaii Haanas for many years as well, with surveys now occurring on a biennial schedule. Methodology for shoreline surveys and territory visits are detailed in the Gwaii Haanas Black Oystercatcher Survey report series 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.

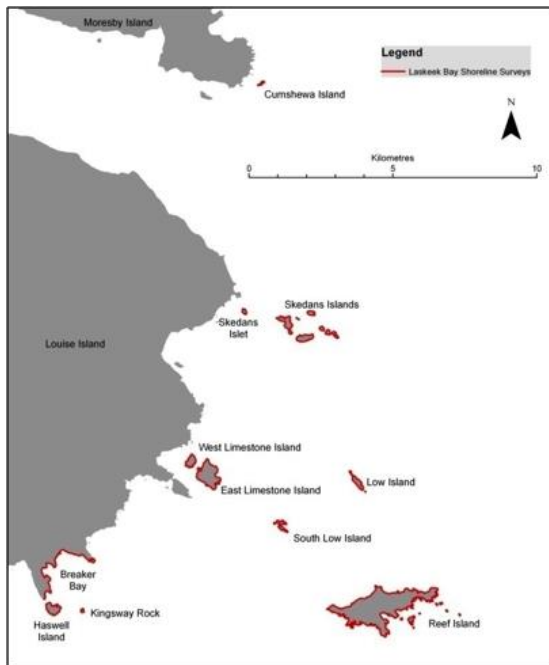


Figure 3. All shorelines outlined in red represent shoreline segments surveyed for Black Oystercatchers.

Site occupancy and reproductive success

Oystercatcher territories were visited in Laskeek Bay in June (1-25 June) and again in early July (2-7 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 3). 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.

Over the course of the two surveys, 76 territories were checked either on foot or from the boat. Of these, 43 territories were occupied with a territorial adult pair and 38 of those were active, with either eggs or chicks present. Seventeen of the Laskeek Bay territories were dormant in 2022, having been vacant for at least three consecutive years. 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 2 new territories (included in the total of 58 territories visited on foot) in Laskeek Bay and had 26 non-territorial sightings of oystercatchers comprising 67 birds (some of which could be the same birds sighted multiple times).

Banding and re-sighted oystercatchers

We collaborated with Hannah Roodenrijs and Jesse Kemp, graduate students working with David Green at Simon Fraser University, to capture and band Black Oystercatchers in Laskeek Bay. With their help, 17 adults and 12 chicks were banded. Of the adults, six had been previously banded as chicks years earlier (Table 3). Some of the old metal bands were so worn that the numbers were no longer completely legible. We do know that one female BLOY captured on Gooden Island in Skidegate Inlet in 2022 had been banded as chick on ELI in 1995, making her the oldest known Black Oystercatcher documented by any researchers. Two of the other BLOY that we re-captured are at least 22 years old and may be 28 years old. When attempting to identify metal bands that are partially legible, we are assuming that these individuals have been banded by LBCS in past years, rather than by other researchers.

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. The A-N bands used by the SFU BLOY team sit higher on the leg, which we hope will reduce wear and increase the longevity of the bands (Figure 4).



Figure 4. Black Oystercatcher with numbered metal band and plastic alphanumeric bands.

All oystercatchers observed during the season were checked for bands, as this gives us information on their age and dispersal. During the 2022 surveys, there were 30 re-sightings of banded BLOY, with 24 unique individuals (Table 3). Banded individuals at breeding territories were assumed to be the same individuals on subsequent visits and repeated sightings are not included in the table. Year of banding could be determined for some individuals from colour band combinations or by reading partial band numbers from photographs.

Table 3. Banded Black Oystercatchers re-captured or re-sighted in Laskeek Bay in 2022.

Method	Band Combination (Left – Right) ¹	Location Seen /Nest Site	Year Banded	Notes
Recapture	UB-UB/M ²	Gooden Island, Skidegate Inlet	1995	Metal band: 78535704
Recapture	UB-DG/M	REE-16	2017	Metal band: 1905-20168
Recapture	UB-UB/M ²	SKE-17	2007	Metal band: __15-06978
Recapture	UB-UB/M ²	SKE-15	2003	Metal band: __06-06025
Recapture	UB-UB/M ²	SKE-19	1994 or 2000	Metal band: __85-__048
Recapture	UB-UB/M ²	SLW-3	1994 or 2000	Metal band: __5-6__38
Recapture	UB-UB/M ²	REE-11	2001, 2003, or 2004	Metal band: __06-060__
Resight	AN-UB/M	CUM-7	Unknown	

Resight	UB-UB/M	SKE-15	Unknown	
Resight	UB-UB/M	SKE-19	Unknown	
Resight	UB-UB/M	SLW-3	Unknown	
Resight	W-M/R	SLW-5	2019	Red band has slid down over metal band
		SE side of Reef		
Resight	UB-UB/M	Island	Unknown	
Resight	UB-UB/M	REE-4	Unknown	
Resight	W-DG/M	REE-4	2017	Metal band: 1905-20__ __
Resight	UB-DG/M	REE-15	2017	
Resight	UB-UB/M	LOW-2	Unknown	
			Unknown	
Resight	B-R/M	LOW-4	(2017?)	
Resight	UB-UB/M	KNG-7	2006 or 2007	Metal band: __ __ __ - _0697
Resight	UB-UB/M	KNG-8	Unknown	
Resight	UB-UB/M	SKE-12	Unknown	
Resight	UB-R/M	SKE-14	2019	
Resight	UB-UB/M	SKE-17	Unknown	
Resight	UB-R/M	Wpt 312	2019	
Resight	UB-R/M	Wpt 320	2019	
Resight	UB-UB/M	LOW-1	Unknown	
Resight	W-Br/M	LOW-2	2016	White may be worn AN
Resight	W-GR/M	Wpy 327	2017	White may be worn AN
Resight	UB-UB/M	KNG	Unknown	Metal band: __ __ __ - __351
Resight	UB-UB/M	KNG	Unknown	Metal band: __ __0-51__ __
Resight	AN-G/M	REE	2017	Metal band: __05-2016__

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

²Originally banded with colour and/or alphanumeric bands, but these bands missing when recaptured.

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 2022, prey was collected from 16 unique territories in Laskeek Bay.

Limpets were the primary prey (80%), followed by mussels (8%), chitons (5%), and abalone (3%) (Figure 5). These four prey items made up 96% of the diet, along with smaller numbers of crabs, whelks, and isopods. These numbers are fairly consistent with what has been found in past years.

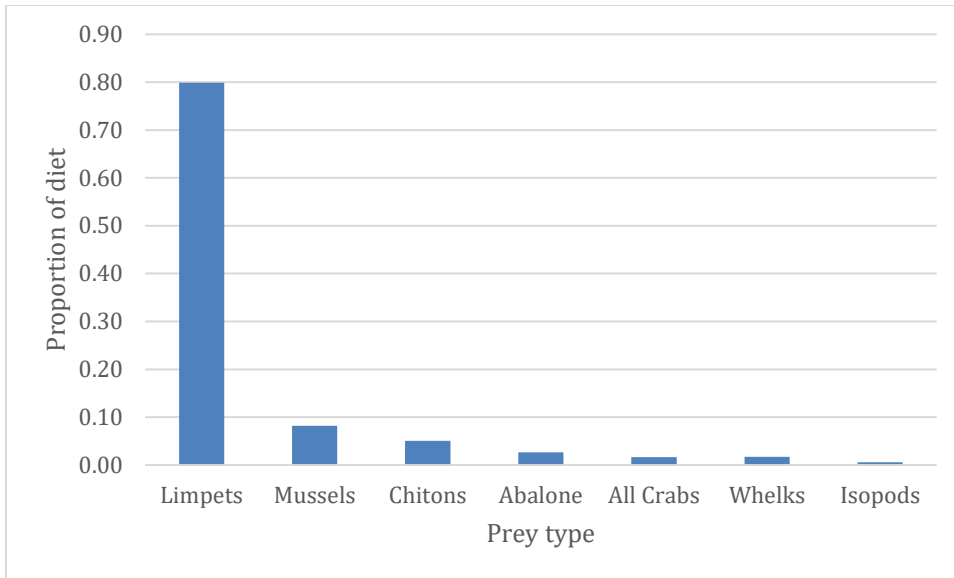


Figure 5. Black Oystercatcher chick diet from prey collections in Laskeek Bay, 2022.

Glaucous-winged Gulls *Larus glaucescens*

LBCS has been censusing gull colonies within Laskeek Bay since 1992 (Figure 6). This year, we visited the known colony locations on Kingsway Rock, Cumshewa Island, Reef Island, and Low Island but were unable to access the Lost Islands colony. 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 no nest was found. Kingsway Rock had 53 active nests on 21 June and 2 empty nests. Of these, 70% contained three eggs, while 20% had at least one chick hatched already. The total number of active nests at Kingsway Rock was slightly about the long-term average of 49 nests.

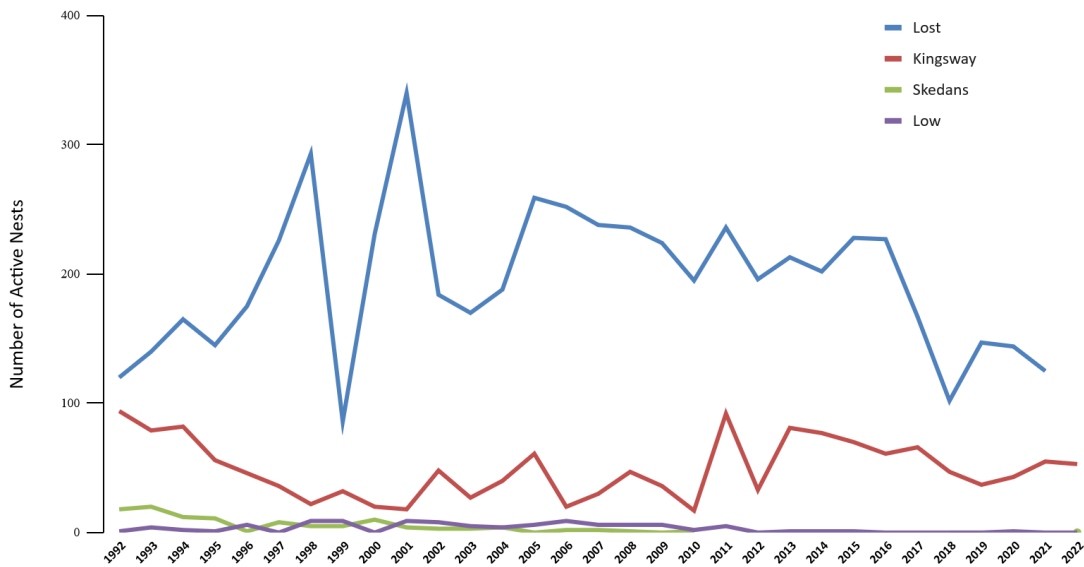


Figure 6. Glaucous-winged Gull nests containing eggs or chicks at four colonies in Laskeek Bay, 1992-2022.

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 next boxes in three areas on the cliffs at Lookout Point. Ten of these new nest boxes 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

Our 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 continued in 2022. We were able to add control units to five more nest boxes, so all ten of the camera boxes were ready for action. Based on the results from 2021, we made some modifications to the nest box setup, to improve camera angles and light exposure levels. We now have almost 30,000 short video clips of PIGU nesting behaviour, including prospecting, egg-laying, incubation, hatch and prey delivery to the chicks. The long process of watching these videos and recording the information is underway.

Pigeon Guillemot Survey

We counted PIGU throughout our study area, over a period from June 30 to July 5. We documented 1300 individuals, which should be considered an underestimate of the total populations, as many birds would have been foraging or attending eggs/chicks at the nesting burrows. During surveys in the 1980s, Rodway et al (1988) counted 848 PIGU in this same area.

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.

Nighttime observations by intrepid field staff and student interns indicate that there are likely more Fork-tailed Storm Petrels (FTSP) breeding on ELI than previously thought. Based on calls of adult FTSP coming to the colony at night and images captured on infrared wildlife cameras, we estimate there may be hundreds of FTSP visiting ELI.

An automatic recording unit (ARU) was used throughout the 2022 field season to record ANMU, FTSP and CAAU vocalizations. In the future, these recordings will be analyzed to determine activity levels.

Rhinoceros Auklets

Cerorhinca monocerata

During Black Oystercatcher surveys along the north coast of Reef Island on 5 July, some very large seabird burrows were detected from the boat. On 6 July a party landed and investigated the burrows. We counted just over 500 burrows of a size and in situations indicative of Rhinoceros Auklets. Two Rhinoceros Auklets were seen in burrows. No evidence of other auks was found in the area, although it had previously held small patches of Cassin's Auklet burrows in 1983. Most of the burrows looked active with many signs of digging and soil excavation. Rhinoceros Auklets were last confirmed nesting (eggs and eggshells found in burrows) on Reef Island in 1977, when 100 pairs were estimated nesting (73 burrows were counted) amongst Cassin's Auklet burrows in two areas on the south side of the island (Rodway et al. 2019).

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 Cumsheewa Island and south to Haswell Island. Five near-shore surveys were completed this year: 19 May, 30 May, 13 June, 25 June, and 16 July. On these surveys, we counted a total of 24 species: American Crow, Ancient Murrelet, Bald Eagle, Black Oystercatcher, Brandt's Cormorant, Cassin's Auklet, Common Loon, Common Merganser, Common Murre, Greater Scaup, Glaucous-winged Gull, Harlequin Duck, Long-tailed Duck, Marbled Murrelet, Northern Shoveler, Pacific Loon, Pelagic Cormorant, Peregrine Falcon, Pigeon Guillemot, Rhinoceros Auklet, Sooty Shearwater, Red-necked Phalarope, Western Sandpiper, and White-winged Scoter. Of these species, Glaucous-winged Gulls, Marbled Murrelets, Pelagic Cormorants, Pigeon Guillemots, and Rhinoceros Auklets were seen on every survey while Brandt's Cormorant, Common Loon, Common Merganser, Long-tailed Duck, Northern Shoveler, Peregrine Falcon, Red-necked Phalarope, Sooty Shearwater, and Western Sandpiper were observed on just one of the survey dates.

The highest Marbled Murrelet count was during the survey on 30 May, when we recorded 54. During the other surveys we counted a total of 70 more Marbled Murrelets: 14 on 19 May, 33 on 13 June, 21 on 25 June and 2 on 16 July. The low number recorded on 19 May may be partially due to technical difficulties with the voice recorder used to record data during the survey, as some recordings were unclear. The 2022 counts are slightly higher than the counts from the four surveys in 2021 (45 [plus 15 off transect], 16, 0, 11; 19 May to 20 July) but are generally 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).

Marine mammals observed during the at-sea nearshore surveys included Harbour Seal (*Phoca vitulina*), Steller Sea Lion (*Eumetopias jubatus*), Humpback Whale (*Megaptera novaeangliae*), Grey Whale (*Eschrichtius robustus*), Harbour Porpoise (*Phocoena phocoena*), Killer Whale (*Orcinus orca*), Minke Whale (*Balaenoptera acutorostrata*), and Northern Elephant Seal (*Mirounga angustirostris*).

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 2022.

Marine Mammals

We kept a daily record of all marine mammal sightings, with the exception of Harbour Seals and Steller Sea Lions. Harbour Seals and Steller Sea Lions are counted at specific haul-outs during sea surveys 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 scans and counts 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 each year, when the ANMU gathering ground count ends. The results of this season's total sightings are summarized in Table 4.

In 2018, an attempt to standardize sea watch times was made; sea watches were scheduled three times per week, from 0700-0800. 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. In 2022, we conducted 31 hour-long sea watch observations; of these about half occurred around 0700-0800 while the remainder were at various times throughout the day.

Table 4. Total marine mammal sightings from sea surveys, sea watches, and incidental sightings, 2011-2022†. Data since 2014 includes sightings during the 5-minute evening count. Numbers do not necessarily reflect total number of individuals, as some individuals may be counted on multiple sightings.

Common name	Scientific name	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Northern elephant seal	<i>Mirounga angustirostris</i>	1	1	0	0	0	0	2	0	0	0	0	0
California sea lion	<i>Zalophus californianus</i>	0	1	0	1	0	0	0	0	4	0	0	1
Humpback whale	<i>Megaptera novaeangliae</i>	32	56	15	122	36	22	112	13	347	12	14	193
Fin whale	<i>Balaenoptera physalis</i>	1	0	0	0	0	0	0	0	0	0	0	0
Grey whale	<i>Eschrichtius robustus</i>	11-12	1	3	5	1	2	3	0	0	1	1	1
Minke whale	<i>Balaenoptera acutorostrata</i>	7	0	0	2	2	2	9	4	3	6	2	1
Killer whale	<i>Orcinus orca</i>	43	75-80	8	36	36	45-60	47	50	26	16	13	49
Harbour porpoise	<i>Phocoena phocoena</i>	55-58	30	11	16	27	14-15	7	13	31	7	4	19
Dall's porpoise	<i>Phocoenoides dalli</i>	1	0	0	0	0	0	0	0	0	0	0	8

Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	0	0	15	0	13	0	30	0	0	0	0	0
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†Harbour seal *Phoca vitulina* and Steller’s sea lion *Eumetopias jubatus* sightings are not reported here.

Humpback Whales

The number of Humpback whale sightings in Laskeek Bay was a bit lower in 2022 than in the previous year. The number of Humpbacks sighted during our field season is quite variable, with an average of 81 sightings/field season over the past 12 years. As is often the case, most sightings occurred in May and early June, which just a few sighting in the second half of June and through July. We have begun to upload our Humpback whale photos to Happywhale.com, a global database of marine mammal sightings. AI algorithms are used to identify species and match photos of individuals. Two of the Humpbacks that we photographed in 2022 were matched to known individuals, one previously seen in Alaska and one on the west coast of Vancouver Island.

Orca

There were 13 sightings of Killer Whales in Laskeek Bay this season; most of the whales seen were in small pods of 2-4, although one was a lone male. There were a couple of pods that were seen on multiple occasions, while others were sighted just once during the season. 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 and shared with other researchers.

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, Cumshewa 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 285 individuals at Reef (19 May) and 90 at Skedans (19 May).

Other marine mammals

We spotted a Northern Elephant Seal (1 individual) in 2022, which makes two years in a row for that species. Our count of 11-12 individual Grey Whales is the highest number seen in the past decade; these were likely all unique individuals, as they appeared to be migrating through Laskeek Bay. There were 3 separate groups, with at least two mother-calf pairs. We saw more Minke whales this year than we typically do, and one Fin whale which is uncommon for Laskeek Bay, although they are seen more frequently further south in Gwaii Haanas and Hecate Strait. We had over 50 sightings of Harbour Porpoises in 2022,

which is much higher than usual. All in all, it was a pretty busy season for marine mammals!

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 194 wildlife trees have been identified over the past 33 field seasons.

This year we found a total of 18 active trees, containing nests of four different species (Table 5). Four new trees were identified. Fourteen nests were occupied by Red-breasted Sapsuckers (RBSA), two by Chestnut-backed Chickadees (CBCH), one by Hairy Woodpeckers (HAWO), and one by Tree Swallows (TRES).

Table 5. 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)
109	RBSA	Ss	11-Jun	14-Jun
136	RBSA	Ss	11-Jun	18-Jun
149	CBCH	Ss	6-Jun	8-Jun
166	RBSA	Ss	11-Jun	14-Jun
169	CBCH	Ss	11-Jun	14-Jun
170	TRES	Ss	13-Jul	16-Jul
176	RBSA	Ss	12-Jun	14-Jun
178	RBSA	Ss	18-Jun	22-Jun
181	RBSA	Ss	12-Jun	14-Jun
182	RBSA	Hw	10-Jun	14-Jun
183	HAWO	Ss	31-May	4-Jun
184	RBSA	Hw	11-Jun	14-Jun
186	RBSA	Ss	15-Jun	18-Jun
188	RBSA	Hw	11-Jun	14-Jun
191	RBSA	Ss	8-Jun	11-Jun
192	RBSA	Ss	18-Jun	22-Jun
193	RBSA	Ss	14-Jun	18-Jun

194 RBSA Ss 14-Jun 18-Jun
¹RBSA = Red-breasted Sapsucker, HAWO = Hairy Woodpecker, CBCH = Chestnut-backed Chickadee, TRES = Tree Swallow.
²Ss = Sitka spruce, Hw = 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 2022, few of the previous identified sapwell trees were active and only two new sapwell trees were located. Staff and volunteer time was prioritized for other projects. Red squirrels were observed feeding at sapwells again this year, and sometimes scare or chase away RBSA that are present at the sapwells.

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).

In 2022, there was a pair of Bald Eagles using nest BAEA-10, which is near the northwestern shoreline of ELI, on the edge of the blowdown. This nest was first identified in 2015 and was active in 2017. There was one chick observed in the nest this year, first seen on 11 June and still in the nest at the end of the field season on 18 July.

Peregrine Falcons (PEFA) were much more present on ELI during 2022 than they were in 2021, but we did not observe chicks and could not confirm that they nested this year. Two adults were often seen in the vicinity of the eyrie and alarm calls were regularly heard by the field crew. This nest site was continuously used from 2016 to 2019, was vacant during 2020 and 2021, and in 2022 appeared to be occupied but without chicks.

Common Ravens have nested and fledged young on ELI every year since 2006 (during 1991-2005 our records are not as consistent, but they did nest during some of those years). We do not know if the same pair has been on ELI for the past 16 years or if the individuals have changed during that time. There have been nine different nest trees located over the years. In 2022, there was a pair nesting in CORA-3, a beautiful big Sitka Spruce. This nest tree was active in 2013-2017, 2019 and then again, this year. The nest was confirmed active on 14 May with 4 large chicks. In most years, there are 2 or 3 chicks; we have only recorded a brood of 4 once before. When the nest was visited on the morning of 16 May, all four

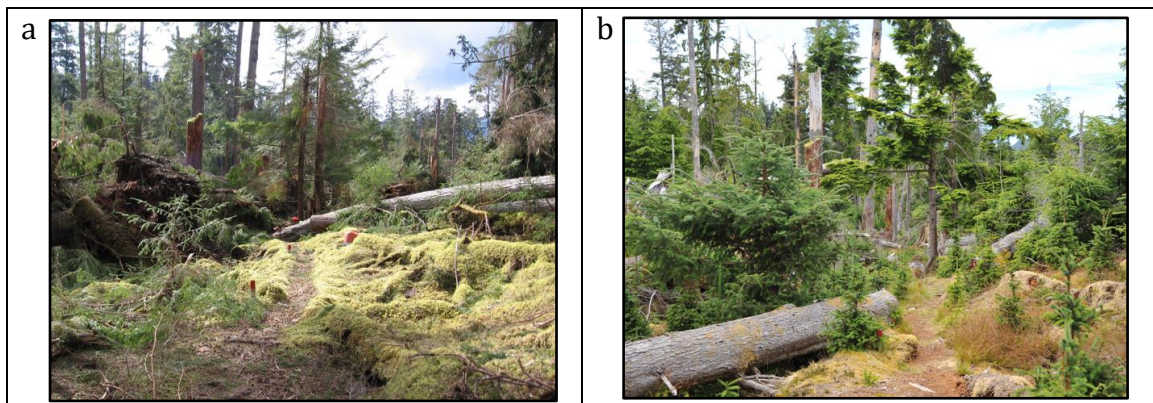
chicks were still in the nest but by the afternoon of the same day, two of the chicks had left the nest, and on 18 May, all the young ravens had left the nest. We continued to see them on ELI throughout the rest of the field season.

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 82 species over 76 days, with 25 June 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, Pacific Loon, Pelagic Cormorant, Glaucous-winged Gull, Red-breasted Sapsucker, Hairy Woodpecker, Pacific-slope Flycatcher, Hermit Thrush, and Pacific Wren. Many less frequently observed species were recorded this year as well, such as Red-throated Loon, Red-necked Phalarope, Short-billed Gull (formerly Mew Gull), Black-legged Kittiwake, Leach’s Storm-petrel, Tufted Puffin, and even one Horned Puffin! There were a few species, such as Northern Flicker, Belted Kingfisher, Sharp-shinned Hawk, and Whimbrel which were seen much more frequently in 2021 than 2022.

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 7). 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.



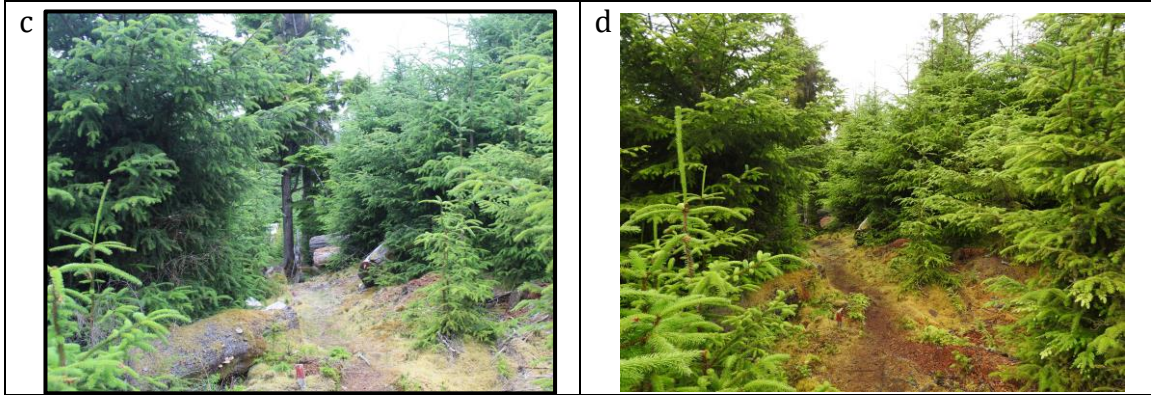


Figure 7. Photos taken looking west along the main trail, in (a) 2011, the first field season after the blowdown events, (b) five years later in 2016, (c) ten years later in 2021, and (d) in 2022.

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.



Figure 8. Richardson's Geranium (*Geranium richardsonii*) blooming on East Limestone Island, with Yarrow (*Achillea millefolium*) in the background.

Several plant species are present on East Limestone Island due to the unique limestone geology that is uncommon on the rest of Haida Gwaii. For example, showy Jacob's ladder (*Polemonium pulcherrimum*), Richardson's geranium (*Geranium richardsonii*), and cut-leafed anemone (*Anemome multifida*) are uncommon west of the Coast Mountains but are all found on East Limestone Island. In 2022, showy Jacob's ladder and cut-leafed anemone

were found to be blooming, on the cliffs in Boat and Anemone Cove, while Richardson’s Geranium was blooming on the cliffs along the southern shore of the island (Figure 8). Another rare plant was discovered along the shoreline north of Boat Cove in 2021, but was not definitively identified, as it was eaten before it bloomed (likely due to grazing deer). In 2022, we located three plants and were able to obtain photographs of the inflorescence (Figure 9). After consulting with Andy MacKinnon, James Pojar, and Hans Roemer, the species was confirmed as *Platanthera ephemerantha* (white-lip rein orchid). It is Blue-listed (Special Concern) in BC and fairly uncommon throughout the province. We had no previous records of it on ELI, and it is not listed in *Vascular Plants of Haida Gwaii* (Mike Cheney et al., 2007), *Plants of the Pacific Northwest Coast* (Pojar and MacKinnon 2016), or *Plants of Northern British Columbia* (MacKinnon et al. 2016). It is typically found in dry conifer forest or Garry Oak woodland, so we were quite surprised to find it growing in our wet, hypermaritime coastal Western Hemlock forest zone!



Figure 9. *Platanthera ephemerantha* (White-lip rein orchid) growing on East Limestone Island in 2022 (left, entire plant; right, close-up of blossoms).

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 11 vegetation plot areas (see above) 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 2022 field season, four sets of point counts were conducted in each vegetation plot. Each set of point counts was completed in one to three-day period, typically between 0600-1000. Dates for the point counts were 16-18 May, 28-29 May, 15-16 June, and 29 June. Twenty-three species of forest birds were recorded, with some of the most common species being: Golden-crowned Kinglet, Hermit Thrush, Orange-crowned Warbler, Pacific-slope Flycatcher, Red-breasted Sapsucker, and Townsend's Warbler.

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, some of the saplings (particularly the cedar!) that we are tracking disappear (likely eaten by deer). When this happens, we choose a nearby individual of the same species to begin monitoring, so that we continue to have 10 of each species. In 2022, also began measuring tree saplings of these species within two of our deer exclosures, so we have a sample of 10 of each species that are protected from deer browsing and we will be able to compare their growth rates to those outside the exclosures.

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 continued to record the abundance and richness of invasive plants on these plots in 2022.

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). As 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 were also set up on Reef Island, but since 2020 we have been deploying cameras just on ELI. This year on East Limestone Island, 9 deer monitoring cameras were set up around the island between 6 March 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 are recorded along with any behavioral notes. In 2022, we did not see any tagged deer (one was seen in 2021).

In early March 2022, a small crew, including a Youth Intern funded by the Gwaii Haanas YESS program, travelled to ELI to build two new deer exclosures. We now have four deer exclosures on ELI: one that was built several years prior to the 2010-2011 blow-down event, one built in March 2015, and two built in March 2022. 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 second 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 will continue to monitor differences in vegetation inside and outside of the exclosures. We are also noticing that a consequence of the blowdown is the creation of many small refugia for plants on top of upturned roots.

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 2022. Cameras were set up on 6 March in Boat Cove, North Cove and Crow Valley. They were checked on early May, with no sign of raccoon presence. The North Cove camera was taken down on 8 May, but cameras were kept in Crow Valley and Boat Cove and taken down after the field season ended (in early August). In early July, some possible raccoon scat was observed in the Skedans Islands and on the north shore of ELI. It can be challenging to distinguish between River Otter and raccoon scat, so raccoon presence was not confirmed. A camera was reset in North Cove on 5 July, and cameras were placed on East Skedans Island and Skedans Islet. These were left in position until 5 August. Memory cards were checked regularly throughout the season, and bait replenished as required. No raccoon activity was detected by camera during the 2022 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. Nine squirrel surveys were completed in the 2022 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 2022, marine debris was collected opportunistically, but systematic surveys were not completed.

Conclusion

This season was our 33rd 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. We were delighted to be able to welcome volunteers and student interns back to our field camp in 2022! We also had college students and ecotourism charter groups visit for tours. We are working on getting a revamped Project Limestone up and running for local schools in 2023.

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 11 chicks in 2022). 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.

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 analyses 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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Haawa ~ Haw'aa