EAST LIMESTONE ISLAND FIELD STATION

FIELD SEASON REPORT 2016

SUMMARY

This was the Laskeek Bay Conservation Society's 27th field season on East Limestone Island, Laskeek Bay, Haida Gwaii. The season ran from 30 April to 22 July, bringing 33 volunteers and 2 student interns, and 114 visitors to the island, including 43 students and 8 teachers/chaperones who came with Project Limestone. Ancient Murrelet chick departures at Cabin Cove were very low again, similar to last year, and started much later than normal, on 18 May. A total of 36 chicks were manually captured or photographed within the funnels during the time-period when we would normally be monitoring (22:30 to 02:30). When chicks that were outside funnels and after 02:30 were added, a total of 42 chicks were observed in Cabin Cove. Thirteen chicks were recorded on camera in North Cove. Adult Ancient Murrelet activity seemed lower this season, especially in early May. No raccoons were detected on the island, during a shoreline survey conducted in February, or on remote baited cameras used throughout the field season. Black Oystercatcher surveys were conducted in both Gwaii Haanas and in Laskeek Bay, and 23 chicks were banded in Laskeek Bay. Glaucous-winged Gull censuses were conducted in colonies in Laskeek Bay and 288 active nests at 3 colonies were found. Pigeon Guillemot use of the 27 nest boxes at Lookout Point was high, but eggs were all abandoned early on in the breeding season. There were 6 Cassin's Auklet chicks that were measured and weighed in nestboxes; 3 died before fledging, and 3 chicks successfully fledged before 14 July. Three near-shore sea surveys were completed and Marbled Murrelet counts were similar to 2015. One Hecate Strait sea survey was completed. Marine mammal sightings were up from last season. They included 112 humpbacks, 9 minke whales, 7 harbour porpoises and 11 sightings of small groups of killer whales. Less common marine mammals sighted this year were 2 northern elephant seals and a pod of approximately 30 pacific white-sided dolphins. Twelve wildlife trees were active, containing 13 nests. A Common Raven nest, two Bald Eagle nests, and the Peregrine Falcon nest were active and produced young. Invasive plants were surveyed and removed from East Limestone, and surveyed on several other Laskeek Bay Islands. Marine debris was documented and removed from three beaches on Louise Island and one on East Limestone.

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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 27 consecutive field seasons and over this period LBCS has developed diverse long-term monitoring and public education projects in Laskeek Bay. Volunteers assist researchers with data collection in order to study the abundance, distribution, and life history of wildlife in 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 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 Laskeek Bay.

Project Limestone

Project Limestone brings local students to Limestone Island to learn about natural history and participate in Ancient Murrelet research. The students are led on an interpretive tour, which crosses the island and ends at Lookout Point. They learn about the natural history and geography of the area, and are introduced to the various projects that we run. They assist with the Ancient Murrelet monitoring work from 22:30 to 02:30. The students learn about Ancient Murrelet life history as they help to capture, weigh, and release chicks. Along with participating in Ancient Murrelet night work, the students have time to observe and learn about the birds and introduced species on Limestone Island, scan Laskeek Bay for marine mammals, and help check Cassin's Auklet nest boxes for activity.

This year 7 groups from 3 different schools camped on Louise Island opposite West Limestone Island, spent one night in the research camp on East Limestone Island, and returned to their camp the next morning. A total of 43 students from grades 7 to 12, and 8 teachers/ chaperones participated. The first student groups were from George M. Dawson (Masset), on 22 and 23 May. Two groups of students came from GidGalang Kuuyas Naay (Queen Charlotte) Secondary School, on 25 and 27 May, and three groups came from Tahayghen Elementary (Masset) on 31 May, and 1 and 2 June. Project Limestone began in 1991, and to date 752 students have visited the island as part of this program, some multiple times.

Volunteers

Volunteers play an important role in the operation of the field camp on Limestone Island. 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 to keep the field camp going and to continue long-term data collection. LBCS provides a unique opportunity for the general public to be involved in long-term research in a remote field camp.

This year we had 33 volunteers who contributed 244 volunteer days to projects on Limestone, in other areas of Laskeek Bay, and in Gwaii Haanas. Most volunteers stayed for one week, although three stayed for 2 weeks. Twelve volunteers had visited the island or volunteered on the island previously. Twenty-three volunteers were from British Columbia this year, 7 from Alberta, and 3 from Ontario. Fifteen were Haida Gwaii residents.

Visitors

The LBCS visitor program provides an opportunity for tour groups to visit 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. We did tours with 4 such tour groups who visited us on Limestone: Green Coast Kayaking on 24 May, *Island Roamer* on 27 May and 13 July, and *Passing Cloud* on 14 July. We also visited 2 groups aboard their sailboats to talk about our research: *Island Roamer* on 10 June and *Mapleleaf* on 26 June. We had visits from 3 other groups: A group of Northwest

Community College students who camped on Louise Island for a few days, and came for a tour on Limestone on 2 May; a film crew from Global BC (2 film crew and 2 Parks Canada staff) on 11 May; and 2 crew members from the *Haida Guardian*, working on Haida Fisheries surveys in the area. In total there were 63 visitors to the island throughout the field season, 114 including the school groups.

Staff

LBCS staff this year were Vivian Pattison, Lead Biologist/Camp Supervisor; James MacKinnon, Assistant Biologist/Interpreter; Lindsay Seegmiller, Executive Director; and Colleen Furhman, Field Season Coordinator. Jake Pattison joined the staff as supervisor for the first Gwaii Haanas Black Oystercatcher survey at the beginning of June.

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 Limestone for a four to six week period. This year we had two interns: Ruby Pyke and Terra Hauser. Ruby, a student from the University of British Columbia, contributed 4 weeks (3 June to 1 July) to projects on Limestone Island and in Laskeek Bay, including 5 days of oystercatcher surveys in Gwaii Haanas. Ruby also undertook a data analysis project on Cassin's Auklet chick growth, to gain credit for her internship through Simon Fraser University. Terra, a student at Quest University, was in the field for 4 weeks (24 June to 22 July), including 5 days of oystercatcher survey work in Gwaii Haanas. Terra also worked in the Queen Charlotte office for a week, assisting with data entry and report writing. In total the interns this season contributed 63 days to field and office work.

Research Partnerships & Special Projects

LBCS assists with other research and monitoring projects in Laskeek Bay and the surrounding area. In previous years we have assisted with Project BAMBI, a four-year study focused on understanding deer behaviour and how it changes in response to predation risk. The bulk of this project, an initiative of the Research Group on Introduced Species (RGIS), was completed two years ago. See section below on Introduced Species for information on how LBCS continues to support this project.

In early May, LBCS field staff and volunteers conducted surveys of Ancient Murrelet plots on Reef Island for the Canadian Wildlife Service (CWS). Two Ancient Murrelet burrow plots containing 25 burrows had been set up on the south-east side of the island in 2014. In 2014, adults from the burrows were banded with geolocators, small devices that track the location of the bird throughout the year. In 2015, a crew from CWS and LBCS successfully retrieved 9 geolocators through burrow checks in early May. In 2016, we returned to the plots and once more checked burrows for adults banded with geolocators. In the two visits to the burrows (4 and 14 May) we did not retrieve any additional geolocators.

In collaboration with BC Parks this season, we documented, collected, and removed marine debris from several beaches in Laskeek Bay. We conducted accumulation surveys, based on National Oceanic and Atmospheric Administration (NOAA) protocols, on three beaches on Louise Island, and on the Crow Valley beach on East Limestone.

RESEARCH AND MONITORING PROGRAMS

Ancient Murrelets *Synthliboramphus antiquus*

Chick capture work

The monitoring of chick-capture funnels 5-8 in Cabin Cove began on 7 May. Funnels were closed nightly to capture departing chicks from 22:30-02:30 for the period of 7-19 May and 23:00-02:30 after 19 May to compensate for increasing day length. Funnels were checked at regular 15 minute intervals and the date, time, location (funnel number) and mass for each departing chick was recorded. Funnel protocol is kept constant across years so that the number of chicks departing gives a consistent index of the overall breeding population. In the past, capture work has always ended after two consecutive nights with no chick captures in any of the funnels. In 2016, because the crew had to leave the island on 4 June to conduct a Gwaii Haanas oystercatcher survey, the last night of manual capture work was 2 June. Reconyx wildlife cameras were used to continue monitoring until 23 June. This date was used as the final date of monitoring because there had been many nights with zero chicks photographed.

In order to capture a sample of the same geographic area of the colony, the location of the funnels is constant year to year. Although the funnel location has not changed, the forest in the Cabin Cove area has changed dramatically in the last few years due to a large blowdown event in 2010/2011. There was significant blowdown in the area within funnels 5 and 7, while funnels 6 and 8 were much less affected. Due to instability in the remaining forest behind the cabins, trees continue to fall down each winter, and the north arm of funnel 5 is now slightly shorter due to the location of fallen trees.

This season the first chick to arrive in the Cabin Cove funnels was on the night of 18 May. The last chick to be manually captured and weighed was captured on the night of 2 June, and the last chick seen on the Reconyx cameras in Cabin Cove, before funnels were taken down for the season, was on the night of 19 June. Chicks began arriving much later than in past years. Over the course of 26 years of monitoring, the average night of first arrival is 11 May, with very little variation year-to-year. However, in 2016 the first chick to arrive was 1 week later than average. The highest number of chicks captured in one night was 5, on both 25 May and 29 May. A total of 31 chicks were manually captured in funnels 5 to 8; the total including chicks captured on camera during the time when we would normally be monitoring (22:30 to 02:30) is 36 (Figure 1), and the total including chicks that were seen outside the funnels or photographed after 2:30 in the morning is 42 (including 4 chicks seen outside funnels, near the cabins, and 2 chicks photographed after 2:30 in the morning). Chick monitoring continued until 23 June for a total of 47 nights of chick monitoring work (Table 1).

The number of chicks recorded this season in funnels 5-8 was similar to last year (36 this season compared to 44 in 2015). The decline in 2015 was the largest decline in a single year since we began monitoring. While previous sharp declines have always been associated with raccoon predation, there have not been any raccoons on East Limestone since 2009. Thus the low number of chicks leaving the Limestone colony in 2015 and 2016 is of significant concern. Also of concern this season was the apparent drop in adult Ancient Murrelet activity. In 2015, observations and point counts indicated that there were still many adult birds in the colony, while in 2016 general observations and point counts indicated much less activity in the colony most nights, and the gathering ground counts were also lower. The lack of adult birds in the colony was most apparent the week before chicks began leaving the colony on 18 May.

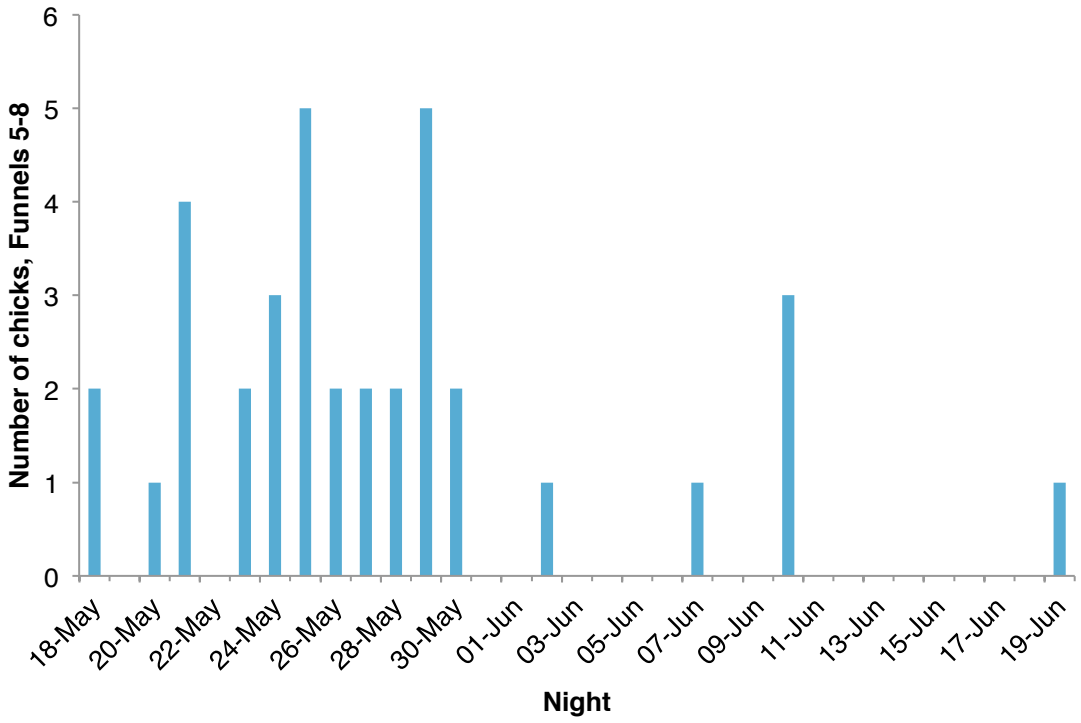

Figure 1. Nightly chick captures, Funnels 5-8, East Limestone Island, 18 May – 19 June 2016. Chicks after 3 June were photographed by Reconyx Infrared Cameras, and were not manually captured or weighed.

Table 1. Summary of chick departures, peak nights and totals for funnels 5 to 8 on East Limestone Island, 2006 to 2016. 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*	*Total days*	*Total chicks*
2006	10-May	21-May	24	30-May	21	197
2007	15-May	4-Jun	16	12-Jun	29	166
2008	12-May	14-May	13	3-Jun	23	125
2009	10-May	18-May	16	29-May	20	104
2010	8-May	21-May	19	2-June	26	121
2011	11-May	15-May	11	9-June	30	106
2012	12-May	17, 22-May	14	31-May	20	110
2013	13-May	21-May	15	1-June	20	136
2014	11-May	18, 19-May	15	2-June	23	110
2015	11-May	20-May	7	6-June	27	44
2016	18-May	25, 29-May	5	19-June[1]	32	36

[1]The final night of monitoring in 2016 was obtained using a different method from previous years, due to low chick numbers and use of cameras for monitoring. See text for details.

Cabin Cove Funnels 5 & 6

As of this season, funnels 5 and 6 have been monitored continuously for 27 years, and are the primary means of assessing the long-term population trend in the Cabin Cove colony area. 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 (23 chicks) than funnels 7 and 8 (13 chicks), which is consistent with past trends, suggesting that the densest part of the Cabin Cove colony is still being captured by funnels 5 and 6. A noticeable difference this season was a lack of chicks from funnel 5, until very late in the season. The only chicks in this funnel were 4 chicks that were photographed by the camera between 7 and 12 June.

A total of 23 chicks were captured this season in funnels 5 and 6 (including chicks photographed after manual monitoring ended, but not including chicks after 02:30). This number is similar to 2015, and again much lower than previous years (Figure 2). This year, the first chicks arrived in these funnels on 18 May and peak night (5 chicks) occurred on 25 May (Table 2).

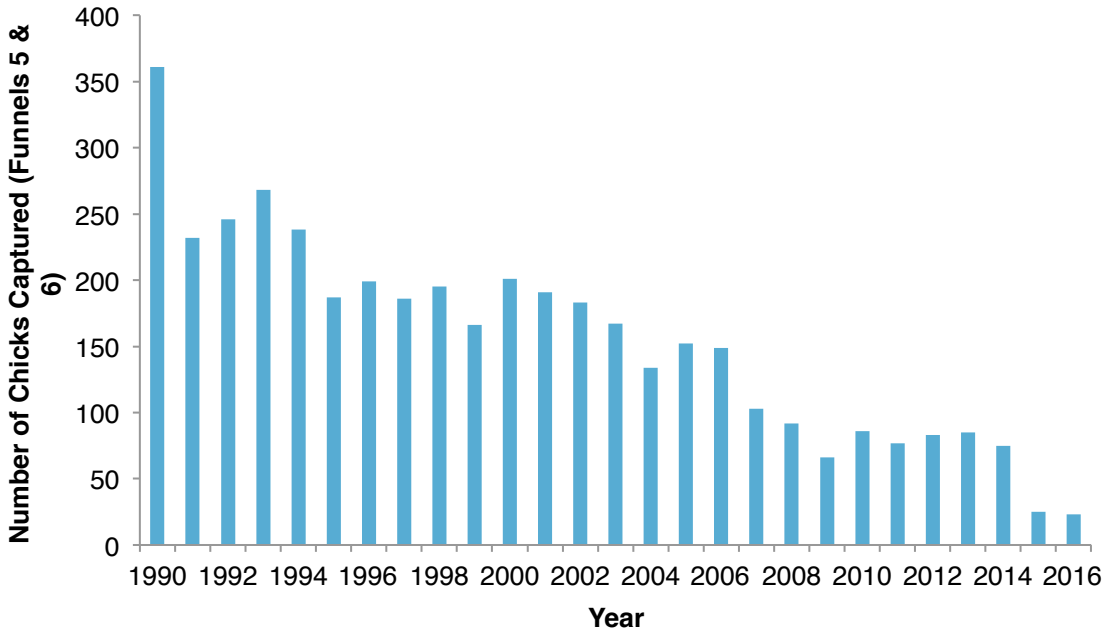

Figure 2. Total Ancient Murrelet chick captures at funnels 5 and 6, East Limestone Island, 1990-2016.

Table 2. Summary of chick departures, peak nights and totals from funnels 5 and 6 on East Limestone Island, 1990 to 2016.

Year	1st night with chicks	Peak night	Peak count	Last night	Total days	Total chicks
1990	13-May	20-May	28	15-Jun	34	361
1991	10-May	25-May	22	05-Jun	27	232
1992	14-May	22-May	29	02-Jun	20	246
1993	12-May	18-May	39	04-Jun	24	268
1994	08-May	20-May	29	06-Jun	30	238
1995	11-May	23-May	18	12-Jun	33	187
1996	11-May	18-May	17	07-Jun	28	199
1997	13-May	28-May	22	05-Jun	24	186
1998	11-May	20-May	23	20-Jun	41	195
1999	11-May	21-May	22	09-Jun	30	166
2000	11-May	21-May	22	06-Jun	27	201
2001	11-May	19-May	21	15-Jun	36	191
2002	09-May	21-May	33	01-Jun	24	183
2003	11-May	21-May	19	03-Jun	24	167
2004	08-May	16,17-May	15	01-Jun	25	134
2005	07-May	19, 23-May	12	05-Jun	30	152
2006	10-May	21-May	20	31-May	22	149
2007	15-May	04-Jun	16	12-Jun	29	103
2008	13-May	20,22,23-May	8	03-Jun	22	92
2009	12-May	18,19-May	10	29-May	20	66
2010	8-May	21-May	16	2-June	25	86
2011	11-May	21-May	9	9-June	30	77
2012	13-May	22-May	12	31-May	19	83
2013	13-May	22-May	11	1-June	20	85
2014	11-May	18-May	12	02-Jun	23	75
2015	11-May	17,24 - May	4	06-Jun	27	25
2016	18-May	25-May	5	19-Jun[1]	32	23
Average ± SD	11-May ± 2.3 days	21-May ± 3.7 days	18 ± 8.5 chicks	6-Jun ± 5.8 days	27 ± 5.4 days	154 ± 79 chicks

[1]The final night of monitoring in 2016 was obtained using a different method from previous years, due to low chick numbers and use of cameras for monitoring. See text for details.

Camera Monitoring

North Cove Funnels

North Cove funnels 1-4 were heavily impacted by the blowdown events of 2010/2011. Only funnel 4 and a small portion of funnel 3 remained intact. This year we monitored only funnel 4, using an infrared motion activated camera (Reconyx HC600). The camera was set at the mouth of the funnel on 6 May and left in place until 26 June. A wooden chute, designed to direct the chicks towards the camera and slow them down, was installed at the funnel mouth in front of the camera

(Figure 3). A total of 13 chicks were recorded between the night of 23 May and 24 June with peak departure of 5 chicks on 3 June. The total number is similar to 2015 (11 chicks) and 2014 (13 chicks), but departure dates are much later. The past 3 years have been much lower than 2013 (41 chicks), the first year that a camera was used for the full Ancient Murrelet departure period at funnel 4.

Figure 3. Camera and chute setup at North Cove funnel 4.

Cabin Cove Funnels

An additional 3 Reconyx infrared cameras were set up at funnels 5, 6, and 7 (PC900 at funnels 5 and 6, HC600 at funnel 7). They were set up in a similar manner to the funnel 4 camera, although funnel 7 did not have the wooden chute: instead the plastic was extended around the camera to direct the chicks towards the camera (Figure 4). These cameras are used in conjunction with manual trapping; the chicks pass by the cameras, we then catch them in the funnels and by comparing the number of chicks recorded manually to the number photographed, we can calculate the proportion of chicks that the camera is not able to photograph. We can then assess the accuracy of using only cameras for monitoring chick departure numbers at funnels, as we are doing presently in North Cove. This year, there were no chicks captured in funnel 5 during the manual capture period (7 May to 2 June), so we cannot use this camera for comparison. At funnel 6, 100% of the 18 chicks that passed by the camera before 2 June were captured on camera. At funnel 7, 73 % of the chicks that passed by the camera were photographed (sample size 11). The lower number photographed in funnel 7 could be due to the different setup, which could be modified next season to ideally reduce the number of chicks that pass the camera without being photographed.

In the future we will consider using the cameras for more of the Ancient Murrelet chick monitoring. Cameras are useful because they can monitor throughout the night; we normally end monitoring each night at 02:30, but with cameras we can continue to capture photos of the chicks that depart later in the night, giving a better estimate of colony size and chick departure times.. This year, the cameras caught 3 chicks departing the colony later than 02:30, 1 in funnel 4 at 3:02, 1 in funnel 5 at 3:18, and 1 in funnel 6 at 06:11.

Cameras can also be used when staff are unable to manually monitor, for example, while away from the island during the Gwaii Haanas BLOY survey, and later in June, when we must discontinue manual nighttime monitoring by staff because of the need to complete other projects during the day. This season, after manual monitoring was ended on 2 June, the camera at funnel 5

caught photos of 4 chicks (the only chicks to come through funnel 5). The camera at funnel 6 captured photos of 2 chicks after 2 June. Five of these chicks were added into the season total, as they left the colony before 02:30, and would therefore have been captured manually if we had been monitoring (Tables 1 and 2).

We will likely continue to use cameras for Ancient Murrelet chick monitoring in the future, but some limitations of camera monitoring must be understood. Settings must be kept consistent and on the fastest possible settings, in order to capture photos a fast-moving chicks. During photo analysis, it can be difficult to determine if the camera was triggered by a chick. For example, this season there was 1 photo which may have been a chick, but also could have been an adult murrelet, and there was another photo that was likely a chick but was only a photo of a very small portion of the bird. It can also be very challenging to determine the number of chicks if there are two chicks that arrive at the camera at, or close to, the same time.

Figure 4. Camera setup at two of the Cabin Cove funnels: Funnel 6 (left), which wooden chute, and Funnel 7 (right) with no wooden chute.

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 areas called 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 Limestone Island gathering ground is located between Low Island and Limestone Island. Between 3 May and 20 June we conducted standardized 10-minute counts of birds on the gathering grounds. The highest count occurred on 21 May, with a total of 70 birds observed. The highest count of birds last year and the year before were both much higher, with 120 birds counted both years. Average counts (±SD) were lower this season, at 14.5 ± 15.7, compared to 30.3 ± 31.8 (2015) and 20.7± 23.0 (2014).

Point counts

We conducted point counts 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 each night for the period of 21 May to 2 June. The maximum number of birds counted was 19, producing 79 calls, on 29 May. The mean number of birds counted this year (±SD) was 8.2 ± 5.1, and the mean number of calls was 58 ± 39.5. This is lower than 2015 (11.9 ± 7.1 birds, 63.7 ± 35.4 calls), but is similar to 2014 (7 ± 5 birds, 37.7 ± 25.4 calls). This is surprising, because this season at times it seemed that there were many fewer adult birds in the colony compared to previous years. The lack of adult birds calling and flying in the colony was most apparent in the week before point counts began, so it is possible we missed the change between years because of the start date of point counts.

Band Recoveries & Recaptures
Recapture of adult birds on Limestone ended in 2003. However, we still opportunistically inspect adult birds for bands, if for some reason we have to handle them (for example, removing a bird that is trapped in a funnel). No adult birds were inspected for bands this year. We also scan feather piles, raven pellets and other predation remains looking for bands, but no bands were recovered this year.

Predation transects
In previous years we checked for predation remains along 5 fixed, 20m wide transects. These transects were heavily impacted by blow-down and have not been monitored since 2011. See the 'Raccoons' section below for a description of the use of cameras to detect the presence of raccoons.

Population Trends & Social Attraction
The breeding population of Ancient Murrelets has been declining over time (Fig 2). 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. The last census of the colony was completed in 2006 and estimated 509 ± 132 breeding pairs compared to the estimate of 1273 ± 254 in 1995. Chick numbers had increased slightly since 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 (Fig 2). The continued low number of chicks in 2016 (8% decline from 2015) is concerning. Last year we 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, but with continued low numbers this season we are concerned that the combination of poor feeding conditions, changes in habitat on Limestone Island due to blowdown, and sporadic raccoon predation in the past, have worked together to decrease recruitment of new breeders to the Limestone Island colony, and we are now seeing the result as a rapidly declining population.

The number of chicks exiting the colony in the North Cove funnel 4 area has declined dramatically since it was last manually monitored in 2010, suggesting breeding birds are moving elsewhere, possibly due to the extreme blowdown that took place in North Cove. In 2013, the second year after the blowdown, chick numbers, based on photo monitoring, had only declined by ~20% since 2010, but in the last 3 years, the number has stabilized at approximately 75 % lower than 2010.

Due to the population decline, a social attraction project was initiated in 2011 to attempt to bring Ancient Murrelets back to the Limestone colony. From 2011 to 2015, sounds of Ancient Murrelets calling in the colony, recorded on Langara Island, were broadcast from two megaphones located behind the cabin and on the East Coast trail. Prior to the 2016 field season, we decided to pause the social attraction project until we have thoroughly reviewed all aspects of the project, and until we have decided whether this is the most appropriate restoration technique to use on Limestone Island.

Black Oystercatchers *Haematopus bachmani*

Background
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 system, these birds are also thought to be a good indicator species for this ecosystem. LBCS has

been monitoring the breeding population of Black Oystercatchers in Laskeek Bay annually since 1992 (except in 2011).

LBCS conducted Black Oystercatcher surveys in both Laskeek Bay and in Gwaii Haanas in 2016. The Laskeek Bay survey is summarized below. For details on the two surveys within Gwaii Haanas, please consult the separate report entitled "2016 Black Oystercatcher survey in Gwaii Haanas". Methodology for shoreline surveys and territory visits followed the methods outlined in the Gwaii Haanas report. Survey maps of the Laskeek Bay area are produced by Gwaii Haanas and included as an appendix in the Gwaii Haanas report.

Site occupancy and reproductive success
Oystercatcher territories were visited in Laskeek Bay in mid-June and again in July. 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 on foot. Shoreline surveys followed the same protocol developed for the Gwaii Haanas surveys and involved scanning shoreline areas from ~50m offshore at 11 km/hr (2500rpm) to search for new territories. All territories were visited and all shoreline segments were completed during the first survey except for Cumshewa Island. During the second survey, we prioritized visiting territories that had active nests (eggs or chicks) during survey 1, so that we could maximize time spent banding chicks. During survey 2, we did not complete shoreline surveys, but visited active territories on the Lost Islands (included in Gwaii Haanas report, therefore not reported here), Reef, Kingsway Rock, South Low, Low, Skedans Islands and Islet, East and West Limestone, and Cumshewa Island.

Of the 62 territories visited, 39 were occupied by an alarmed adult pair. Of these, 28 were active, that is, there were warm eggs or live chicks present on at least one visit. Three new territories were found this year. During the first survey (conducted on 11-18 June), we found 44 eggs and 16 chicks, and during the second survey (9-14 July) we found 8 eggs and 25 chicks (keeping in mind that we only visited the territories that had been active during the first survey).

Banding and re-sighted oystercatchers
All birds 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 tend to 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. In 2016, we banded 23 chicks. Most chicks were banded with a single A-N band on the left leg, but two chicks were too small, so we only put the metal band on the right leg. We also had observed a very worn A-N band, that we could no longer read, so part way through the banding we decided to band chicks with a single colour band above the metal band on the right leg as a year identifier. Seven chicks from 2016 were banded with an A-N band on the left leg, and brown over metal on the right leg.

All oystercatchers seen during the course of the season were checked for bands as this gives us information on the age and dispersal of these birds. There were 16 banded individuals sighted in Laskeek Bay (Table 3) and 8 individuals sighted in Gwaii Haanas (Table 4). We were able to identify several banded birds in Laskeek Bay by photographing the metal band and reading the number from the photos. A bird banded with white on both the left and right legs which had been breeding at territory LOS-13 was sighted and photographed at a new territory, LOS-14. It had been banded as a chick in 2009, at territory LOS-2. One of the pair at REE-4 with only a metal

band was photographed and had been banded in 2009 as a chick, at territory SKE-3. A bird with an aluminum band on the left leg was seen again this year at SKE-14. The metal band number was read, and we determined that this was the bird that had been breeding at SKE-6 for many years. In fact, it had been banded as a breeding adult at SKE-6 in 2001, and only moved to SKE-14 in 2015. Most oystercatchers only begin to breed at 4 years of age (although a 3-year-old was observed breeding in Gwaii Haanas this year) which suggests that this bird is at least 18 years old, and likely older. This would make this bird older than any published ages of Black Oystercatchers (Andres and Falxa, 1995). One of the pair breeding at REE-11 is distinctive because its metal band was mistakenly put on the left leg. The only bird in our banding records with a metal band on the left leg was banded in 2004 at Dog Island. This bird has been consistently breeding at REE-11 for many years.

In 2016, 3 individuals with alphanumeric bands were sighted during the Gwaii Haanas surveys; A0, banded at territory REE-13 in 2014 and E4, banded at territory REE-12 in 2014. A6, banded at territory REE-10 in 2013, was seen paired up at an active territory with 2 eggs (400-2-1 on Alder Island). One individual with A-N bands was sighted in Laskeek Bay, on the rocks at the east end of Reef Island. Unfortunately, the bands were too worn to be able to read the combination. We were able to see an "E", but the number was not visible. Based on the letter, we know this bird was banded as a chick in 2014, but we do not know the specific territory where it was banded.

Table 3. Banded Black Oystercatchers re-sighted in Laskeek Bay in 2016.

Band combination (Left - Right)[1]	**Location seen / Nest site**	**Year Banded**	**Banded as Adult or Chick**
UB-UB/M	LOW-1	Unknown	Unknown
UB-UB/M	SKE-16	Unknown	Unknown
W-UB/M	Skedans Islands	Unknown	Chick
UB-UB/M	REE-6	Unknown	Unknown
UB-UB/M	REE-4	2009[2]	Chick
UB/M-UB	REE-11	2004[3]	Chick[3]
UB-UB/M	REE-11	Unknown	Unknown
UB-UB/M	REE-1	Unknown	Unknown
UB-UB/M	KNG-3	Unknown	Unknown
UB-Y/M[4]	KNG-4	Unknown	Chick
Al-UB/M	SKE-14	2001	Adult
UB-UB/M	SKE-17	Unknown	Unknown
W-UB/M	ELI-4	Unknown	Chick
E?-E?/M[5]	Reef Island	2014	Chick
UB-UB/M	SLW-8	Unknown	Unknown
UB-UB/M	SKE-10	Unknown	Unknown

[1]Band codes: UB = unbanded (birds can lose bands), M = metal, W = white, Y = Yellow, E# = alphanumeric combination, white characters on dark blue plastic band
[2] Age determined from band number read from photo
[3] Only 1 BLOY in records with metal band on left leg, was banded as chick in 2004
[4] Field notes were unclear if the yellow band was on the left of right leg, therefore year banded is unknown

Table 4. Banded Black Oystercatchers re-sighted in Gwaii Haanas, 2016.

Band combo (Left -Rt)[1]	Location seen / Nest site	Year Banded	Banded as Adult or Chick
UB-DB/M	560-3-1	2006	Chick
A6-A6/M	400-2-1	2013	Chick
UB-DB/M	535-1-3	2006	Chick
A0-UB/M	Kunga	2014	Chick
W-UB/M	Kunga	Unknown	Chick
UB-UB/M	LOS-7	Unknown	Unknown
W-W/M	LOS-14	2009	Chick
E4-E4/M	Murchison	2014	Chick

[1]Band codes: UB = unbanded (birds can lose bands), M = metal, DB = dark blue, W = white, A# and E# = alphanumeric combination, white characters on dark blue plastic bands.

Oystercatcher Chick Diet

Oystercatchers feed their chicks hard-shelled invertebrates which they bring intact to the breeding territory. In order to quantify average diet composition fed to chicks, we collect a sample of fresh prey remains where they are present. In 2016, prey was collected from 20 unique territories in Laskeek Bay, and collected twice from 4 territories, for a total of 24 prey samples. Limpets were the primary prey (60.5%), followed by mussels (28%), and chitons (7.4%; Figure 5). These three prey items made up 96% of the diet, consistent with what has been found in past years. In Gwaii Haanas, prey remains were collected from 24 territories, where diet composition was similar to that of Laskeek Bay (Figure 5). An interesting deviation from the past few years is the quantity of abalone in the diet of oystercatchers in Gwaii Haanas: abalone make up 6.5 % of total prey in Gwaii Haanas, compared to the more typical 1.5 % in Laskeek Bay.

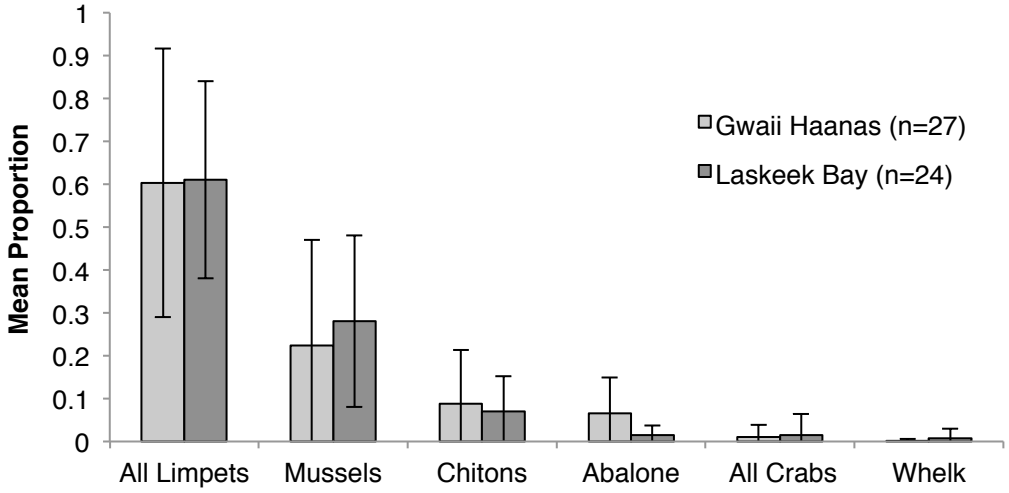

Figure 5. Black Oystercatcher chick diet from prey collections in Laskeek Bay and Gwaii Haanas 2016. Error bars are ±SD.

Glaucous-winged Gulls *Larus glaucescens*

Since 1992, LBCS has been censusing gull colonies within Laskeek Bay (Figure 6). This year, we visited the known colonies on Kingsway Rock, Low Island, and Lost Islands. No gulls were seen by boat at the Skedans Islands or at Cumshewa Island, therefore these areas were not searched on foot. Six gulls, and at least 3 nests, were observed on Reef Island by boat during the BLOY survey. 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. Lost Island, the largest colony in the area, had a total of 227 active nests (28 June), followed by Kingsway Rock with 61 nests (20 June). Although some pairs of gulls were seen at Low Island, no active nests were found. In total we counted 288 active nests on these three colonies. 74.2 % of nests contained only eggs: 1 egg (2.7% of nests), 2 eggs (13.4%), or 3 eggs (58.1 %). 23.7 % of nests contained only chicks or a combination of chicks and eggs, with most (9.3%) containing 3 chicks. The total number of active nests counted this season (288) was above the long-term average (±SD) of 265.6 ± 50.0.

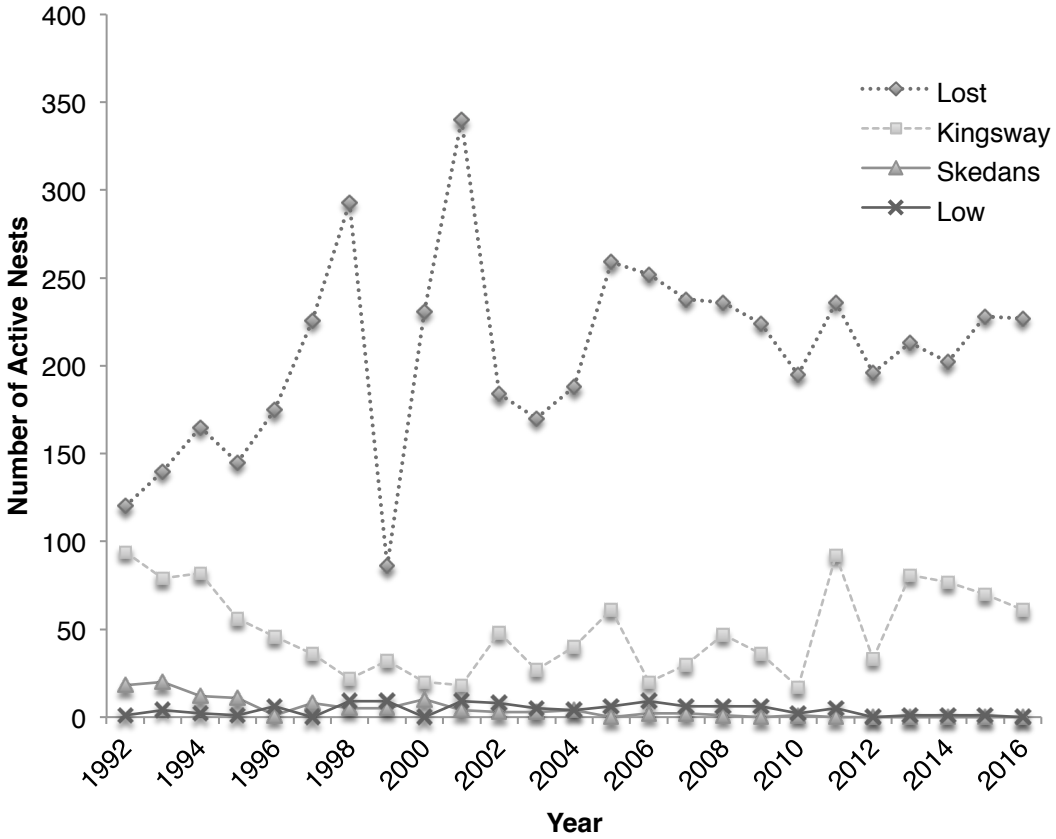

Figure 6. Glaucous-winged Gull nests containing eggs or chicks at four colonies in Laskeek Bay, 1992-2016.

Pigeon Guillemots *Cepphus columba*

There are 27 Pigeon Guillemot nest boxes at Lookout Point. Boxes #1-10 were installed in 2001 and boxes #11-28 in 2010. Nest box #3 went missing during the winter of 2013.

Boxes were checked at the end of the field season (12 July), to determine if they contained eggs or chicks. Of the 27 boxes 20 contained 1 or 2 eggs. This is the highest occupancy in all the boxes since the new boxes were added in 2010: 74 % occupied this year, compared to the previous high of 63% in 2014, and a low of 41 % in 2015 (Figure 7). Unfortunately, all eggs appeared to have been abandoned early on during incubation. The reason that the eggs were abandoned is unknown. When abandoned eggs were discovered in these same boxes last year, we speculated that egg abandonment could be caused by overheating of the boxes due to the exceptionally warm weather in the spring of 2015. To reduce the temperatures in the boxes this season, we added shades to most of the boxes that did not previously have shades.

To determine if the temperatures in the boxes vary greatly from natural rock cavities, we placed temperature loggers in several shaded boxes, unshaded boxes, and in natural rock crevices (Table 5). Preliminary analysis of the temperature data shows that the unshaded boxes had the highest maximum temperatures (31.7 and 26.7 °C), and the natural crevices had the lowest maximum temperatures (22.3, 18.9 and 15.6 °C), as we expected. Crevice 1 seemed to be an active nest site, based on the presence of guano in the entrance and on the temperature logger, and is therefore the most useful for comparison. The highest temperature in Crevice 1 was 22.3 °C, similar to the maximum temperatures in shaded nestboxes (24.5 and 25.5 °C). It seems that shading the boxes does help keep maximum temperatures lower, and reduces the fluctuations in temperatures. Because the temperatures in Crevice 1 (a natural nest site) were similar to the shaded nestboxes, we do not believe that overheating was the cause of abandoned eggs and chicks in 2015. The fact that eggs were again abandoned in 2016, although we did not experience unusually warm weather, is another indicator that temperatures were not the cause of abandonment.

Another possible reason the boxes were abandoned is due to predation, most likely an avian predator such as eagle, raven, or falcon. Based on the timing of abandonment in 2015 and in 2016, a predator could have discovered the nesting birds in the boxes part way through the breeding season in 2015, scared the breeding birds away, and caused the abandonment of partially developed eggs as well as hatching eggs and several chicks. This could explain why, in 2016, all eggs were abandoned early in development; the predator already knew about the boxes and began predating the adults early in the breeding season. In 2017 we will attempt to determine whether predation is causing the abandonment of eggs in the nestboxes at Lookout Point, and if we cannot determine the cause we will block the boxes so they cannot be used.

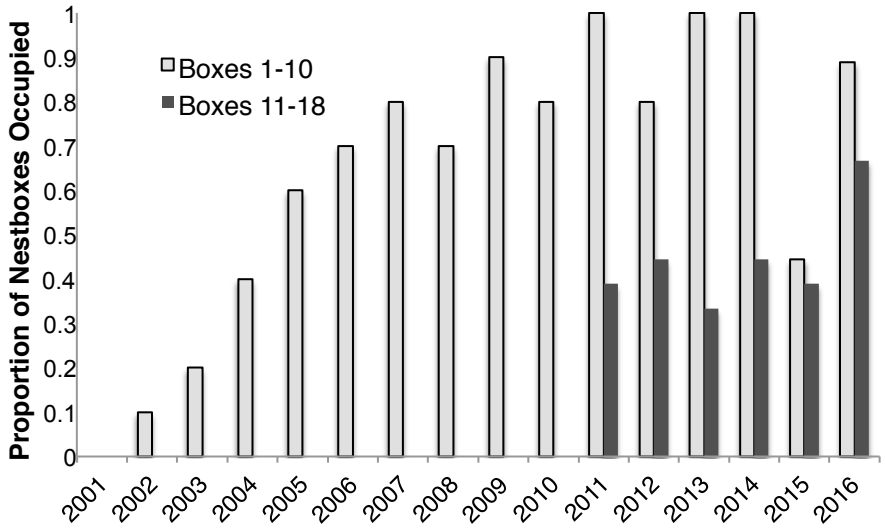

Figure 7. Nestbox use between 2001 and 2016 by Pigeon Guillemots at Lookout Point on East Limestone Island. Although there was evidence of breeding in nestboxes in 2015 and 2016, all eggs and chicks seemed to be abandoned.

Table 5. Preliminary results from temperature loggers placed in Pigeon Guillemot nestboxes and in natural rock crevices, 2016. Crevice 1 seemed to be an active PIGU nest site, based on presence of guano on the temperature logger, while Crevice 2 and 3 were sites deemed to be potential nest sites, but had no evidence of activity.

Location	Description	Max temp (°C)	Min temp (°C)	Mean temp (°C)	Standard Deviation (°C)
Box 16	No shade	31.7	6.7	15.2	4.8
Box 25	No shade	26.7	7.1	14.1	3.4
Box 4	Old, shaded	24.5	8.2	13.9	2.8
Box 12	New shade added	25.5	8.1	14.4	2.8
Box 28	New shade added	24.7	7.9	14.1	2.8
Crevice 1	Lower Lookout Point, near boxes 11-28.	22.3	9.7	15.8	2.4
Crevice 2	Lookout Point, near box 6	18.9	9.3	13.8	1.9
Crevice 3	Anemone Cove, west side of ELI, very shaded	15.6	9.4	12.2	1.2

Cassin's Auklets and Fork-tailed Storm Petrels

Ptychoramphus aleuticus and *Oceanodroma furcata*

Small populations of Cassin's Auklets and storm petrels breed on Limestone Island. Like Ancient Murrelets, these species are nocturnal burrow nesters and are only active in the colony at night.

Breeding activity on the island has fluctuated over the years, which is partly attributed to predation by introduced raccoons. In previous seasons we monitored several locations on the island for breeding activity and noted increasing activity in recent years. In 2015 we completed a natural burrow census on Limestone Island and found 101 Cassin's Auklet burrows that appeared to be active. Most burrows were located on Cassin's Tower, at Lookout Point, and at the East Coast nestbox plots, although there were lower densities of burrows interspersed between these locations. The next complete burrow census will be carried out in 2019 to monitor long-term Cassin's Auklet activity on East Limestone.

Cassin's Auklet nestboxes were monitored again this year at both Lookout Point and at the East Coast plots. Knock-down sticks were placed at the entrances of all nest boxes early in the season and were checked every 4-5 days. A total of 41 nest boxes were monitored at the East Coast plots (North and South), and 24 at Lookout Point. In late May, nestboxes with multiple consecutive records of knockdown activity were checked for chicks. In late May, 7 boxes were occupied: 6 with auklets and one with an incubating Ancient Murrelet. This was the same box that contained murrelet eggshells last year. It was checked again on 10 June and 2 hatched murrelet egg shells were found again. Unfortunately, by late June 3 auklet chicks in boxes had died, all at the East Coast plot. Three chicks successfully fledged, all before 14 July. One chick was banded before it fledged. We set Reconyx wildlife cameras up at several of the boxes, and therefore know the exact date when 2 chicks fledged. The chick in box 4, East Coast South Plot, left in the early morning of 7 July, after 03:42, while the chick in box 6, Lookout Point, left on 14 July after 02:30.

The amount of Fork-tailed storm-petrel activity this season seemed higher than the past few years, based on observations during nighttime murrelet monitoring. The number of days the species was recorded in the daily bird checklist was similar to the last few years (40 days), but this measure is dependent on how often we are awake at night, and could depend on how long the Ancient Murrelet monitoring season is. This year and last year, storm-petrels were heard frequently at night during the murrelet season, and many were very close to the cabin and in the forest behind ANMU chick funnel 7. In the recent past they were noted mostly in the areas northeast of funnel 6 and near Lookout Point.

Sea Surveys

Boat surveys are conducted throughout the season to monitor the distribution and abundance of marine birds and mammals encountered along pre-determined 100m wide strip-transects in Laskeek Bay. The objective of these surveys is to develop a strong baseline data-set 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. Three near-shore surveys were undertaken this year; 15/16 May (complete), 30 May (several transects not completed due to poor weather), and 27 June (complete). On these surveys we counted 16 species: Bald Eagle, North-western Crow, Tree Swallow, Marbled Murrelet, Pigeon Guillemot, Ancient Murrelet, Rhinoceros Auklet, White-winged Scoter, Surf Scoter, Harlequin Duck, Pelagic Cormorant, Common Loon, Pacific Loon, Glaucous-winged Gull, Black Oystercatcher, and Red-necked Grebe.

The highest Marbled Murrelet count was during the 27 June survey, when we recorded a total of 87. During the survey on 15/16 May we counted 65 Marbled Murrelets, and during the survey on 30 May we counted 53 (although during this survey we did not complete several of the shoreline transects, which usually have a high number of Marbled Murrelets). These numbers are similar last years numbers (41, 91, and 95 in three surveys), and are higher than 2014 (26 and 43 in two surveys). The last three years have all been much lower than 2013, when all counts were above 100 birds (in 4 surveys, counts of 115, 175, 101, and 125).

Hecate Strait surveys

This survey takes us approximately five nautical miles into Hecate Strait, and allows us to record species that tend to stay farther from shore. We completed one Hecate Strait surveys this year, on 28 May. On this survey we counted 9 Species: Sooty Shearwater, Cassin's Auklet, Rhinoceros Auklet, Common Murre, Ancient Murrelet, Glaucous-winged Gull, Pacific Loon, Pigeon Guillemot, and Red-necked Phalarope.

Marine Mammals

We kept a daily record of all marine mammal sightings, with the exception of harbour seals (*Phoca vitulina*). Harbour seals and Steller's sea lions (*Eumetopias jubatus*) are counted at specific haulouts 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. The results of this season's total sightings are summarized in Table 6.

Table 6. Total counts of marine mammals from sea surveys, sea watches, and incidental sightings, 2006-2016†. Data since 2014 include sightings during the 5-minute evening count. Numbers do not necessarily reflect number of individuals, as individuals may be recorded more than once.

Common name	Scientific name	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Northern elephant seal	*Mirounga angustirostris*	2	0	0	0	0	0	0	0	0	0	0
California sea Lion	*Zalophus californianus*	0	0	4	0	0	1	1	0	0	4	0
Humpback whale	*Megaptera novaeangliae*	112	13	347	12	14	193	86	102	261	203	91
Fin whale	*Balaenoptera physalis*	0	0	0	0	0	0	0	0	0	0	0
Minke whale	*Balaenoptera acutorostrata*	9	4	3	6	2	1	0	0	1	3	1
Grey whale	*Eschrichtius robustus*	3	0	0	1	1	1	0	0	0	0	1
Killer whale	*Orcinus orca*	47	50	26	16	13	49	11	14	18	26	4
Harbour porpoise	*Phocoena phocoena*	7	13	31	7	4	19	0	10	0	1	4
Dall's porpoise	*Phocoenoides dalli*	0	0	0	0	0	8	0	0	0	0	0
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	30	0	0	0	0	0	46	334	0	81	365

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

Humpback whales
Compared to last season, there were many humpback sightings this year in Laskeek Bay, but we did not observe large groups of humpbacks as have been seen some years. For example, in 2014, it was not uncommon to count 40 whales during 1 sea watch. Many of the sightings this year, especially later in the season when most whales have moved farther north, were likely sightings of the same few whales.

Killer whales
There were 11 sightings of killer whales in Laskeek Bay this season. We were able to take ID photographs during four of these encounters. Our ID photographs are sent to the killer whale database at the Pacific Biological Station in Nanaimo. Two groups were seen twice each in the same day; both groups were seen first close to Skedans Village and the Skedans Islands, and then later in the day were seen near Cumshewa Island and Kingui Island. One of these groups included 2 large bulls, and was therefore distinctive. From photos, we were able to determine that one bull was most likely T150, and the other T020 or T087. A group that included 2 large bulls was seen on a different day as well, and was probably the same group. On another day, we followed a group that include 1 female with a small calf, and two other medium-sized whales, from Kingsway Rock to Vertical Point. As well as taking ID photos, we put a hydrophone in the water several times and were able to record the whales vocalizing.

Steller's sea lions
There are several sea lion haulouts in Laskeek Bay. The largest of these is on the east end of Reef Island. There are also smaller haulouts on the Skedans Islands, Cumshewa Rocks, and Helmet Island. We regularly count the number of individuals on the Reef and Skedans haulouts. The maximum number counted this season was 420 individuals at Reef (13 June) and 4 at Skedans Islands (15 May). Occasionally we sight branded sea lions that have been individually marked by researchers in the United States, but this season no branded sea lions were sighted. We did observe one large sea lion at the Reef haulout with something wrapped around and digging into its neck, possibly rope or rubber. Although sometimes sighted at the haulouts with the Steller's sea lions, no California sea lions were seen this year.

Other species
Five other less-common marine mammal species were sighted this season: minke whales (9 sightings), harbour porpoises (5 sightings), grey whales (2 sightings), pacific white-sided dolphins (1 sighting), and northern elephant seals (2 sightings). Although several minke whales and harbour porpoises are usually sighted each year, grey whales have usually only been seen one at a time, and this season we saw two together, diving in front of Cabin Cove and bringing their tail flukes out of the water. Dolphins have not been sighted since 2010; the group seen this year was travelling into Hecate Strait, south of Reef Island. We tried to listen with the hydrophone, and were unable to record them, although we did hear several squeaky noises which were most likely dolphin vocalizations. The two elephant seals were different individuals; one was seen in the water in Boat Cove on 1 May, and was a male. The other was a smaller individual, a female or a young male, hauled out and moulting on a beach on the south side of Kunga Island, observed on 8 June. This might be the first record of a hauled-out elephant seal in the Laskeek Bay area; there are only two other published haul-out sightings on Haida Gwaii, on northwest Moresby Island, and Rose Spit (Ford, 2014).

Wildlife Trees

LBCS has been monitoring cavity nesting birds on Limestone Island since 1990. Wildlife trees (dead standing snags used by cavity nesting birds) 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 163 wildlife trees have been identified over the past 27 field seasons.

This year we found a total of 12 active trees, containing 13 nests of 4 different species. Five new trees were identified. Nine nests were occupied by Red-breasted Sapsuckers (RBSA), one by Chestnut-backed Chickadees, two by Hairy Woodpeckers, and one by Northern Flickers (Table 7). Consistent with last year, a Northern Flicker pair and a Red-breasted Sapsucker pair were found nesting in separate cavities in the same tree (Tree #154), which is the same tree these two species were nesting in together last year. Flickers have nested every year since the blowdown event of 2010/2011, but prior to that were very infrequent. This could indicate a preference for the more open forest, or could indicate an increase in food supply (insects). Notably absent this season were Red-breasted Nuthatches, which have been nesting on the island every year since 2012. No nests were found, and they were only heard one or two times during the whole season. Wildlife tree #109 is the oldest active tree currently (first active in 2006), and has been active each year since 2011 with a Red-breasted Sapsucker nest. The number of Red-breasted sapsucker nests (9) is consistent with recent years, but less than in some previous years when up to 22 active RBSA trees were found.

Table 7. Wildlife tree activity on East Limestone Island in 2016. 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	Fledge Date (min)	Fledge date (max)
109	RBSA	Ss	17-Jun-16	19-Jun-16
118	RBSA	Ss	12-Jun-16	17-Jun-16
149	RBSA	Ss	14-Jun-16	17-Jun-16
150	RBSA	Hw	19-Jun-16	20-Jun-16
153	HAWO	Ss	12-Jun-16	14-Jun-16
154	RBSA	Ss	22-Jun-16	23-Jun-16
154	NOFL	Ss	20-Jun-16	22-Jun-16
156	RBSA	Ss	14-Jun-16	17-Jun-16
159	RBSA	Hw	12-Jun-16	14-Jun-16
160	RBSA	Hw	2-Jun-16	10-Jun-16
161	HAWO	Ss	31-May-16	12-Jun-16
162	RBSA	Ss	21-Jun-16	Unknown[2]
163	CBCH	Ss	6-Jul-16	10-Jul-16

[1]RBSA = Red-breasted Sapsucker, NOFL = Northern Flicker, RBNU = Red-breasted Nuthatch, HAWO = Hairy Woodpecker, CBCH = Chestnut-backed Chickadee, Ss = Sitka spruce, Hw = Western hemlock.
[2]Notes were missing for maximum fledge date

Invasive Plants

Invasive plants are plants that have been introduced to an area from elsewhere, and that 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 Limestone

Island include bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), prickly sow-thistle (*Sonchus asper*), and wall lettuce (*Lactuca muralis*). Marsh cudweed (*Gnaphalium uliginosum*) was first detected on the island in 2013 near Cassin's Tower, and is now spreading to other parts of the island.

During the 2016 season, an effort was made to document invasive plants on various islands in Laskeek Bay, and to remove invasives from East Limestone Island. This year's project built on the initial invasive plant work done in 2009/2010 (See report "A study of invasive alien plant distribution in Laskeek Bay", Laskeek Bay Research #16). Surveys were undertaken along selected portions of shorelines of the Skedans Islands, Low Island, South Low Island, Kingsway Rock, East Limestone, Reef and Louis Islands (Figure 8). Survey sections were chosen based on accessibility; much of the island shoreline in Laskeek Bay is comprised of cliffs and we would be unable to survey it on foot.

In 2014 and 2015 staff and volunteers had pulled out several large patches of bull thistle and removed as many easily accessible thistles as possible along trails. In 2016, the two species of thistles, wall lettuce and marsh cudweed were removed from as many accessible places as possible on East Limestone. They were disposed of by burning. After three seasons of removal, there seems to be a reduction in the number of thistles on the island, and with continued removal in the future we hope to provide more habitat for the native and rare plant species that grow on East Limestone Island.

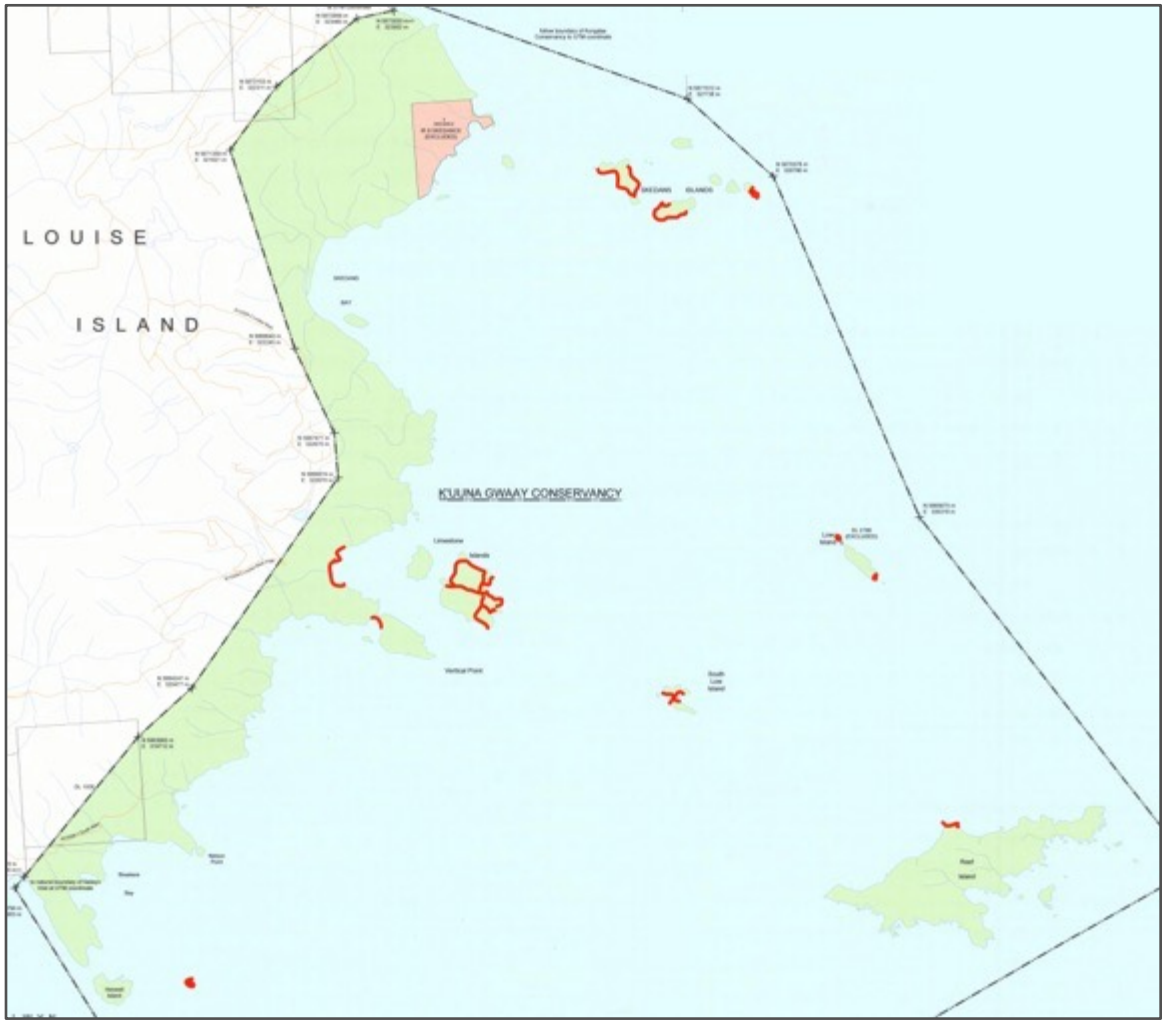

Figure 8. Laskeek Bay/ Kuuna Gwaay Conservancy invasive plant surveys in 2016. Shorelines and trails surveyed are shown in red. If found, invasive plants were documented in these areas. They were only removed from East Limestone Island.

NATURAL HISTORY

Daily Bird Checklist

Throughout the field season, we keep a daily record of all bird species seen or heard within Laskeek Bay. The peak number of species was 35 on 28 May. There were a total of 68 species recorded over 78 days. Many species were recorded almost every day, for example: Common Raven, Northwestern Crow, Black Oystercatcher, Bald Eagle, Pelagic Cormorant, Glaucous-wing Gull, Pigeon Guillemot, Hairy Woodpecker, Pacific-slope Flycatcher, Hermit Thrush, and Pacific Wren. Many less frequently observed terrestrial species were recorded this year as well, such as Red-tailed Hawk, Barn and Tree swallows, and Sooty Grouse. Migratory duck species including White-winged and Surf Scoters, American Widgeon, Northern Pintail, and Scaups were observed, and shorebirds such as the Black Turnstone, Western, Least, Pectoral, Rock, and Spotted Sandpipers, and Wandering Tattler were also sighted. Some notable sightings were of a Western Grebe in the bay at Cabin Cove, many sightings of Red-necked grebes in this location and others,

a flock of approximately 245 immature California Gulls at the Lost Islands and another sighting of many California Gulls in the mouth of Cumshewa Inlet, and several sightings on East Limestone Island of a pair of Tree Swallows. As in the past few years, there was one observation of a Wilson's Warbler in early May, a few sighting of Whimbrels on East Limestone, and a few sightings of Red-necked Phalaropes during boat trips.

Raptors and Corvids

As with cavity nesting birds, we make a concerted effort through the season to keep track of other nesting birds on Limestone Island, including Bald Eagles, Peregrine Falcons, Common Ravens and Northwestern Crows.

This year we had 2 active Bald Eagle nests on East Limestone Island: one at Cassin's Tower (BAEA-5) with one chick, last seen still in the nest on 16 July; and one at the north-east point (BAEA-7), with at least 1 chick observed on the edge of the nest with an adult on 19 July.

We checked the Peregrine Falcon nest on the south cliffs on 29 May, and observed 1 downy chick and 1 unhatched egg. Peregrine Falcons have nested on Limestone Island discontinuously since research began in 1990. During the first 9 years (1990-1998), an active nest was observed in all years except 1992. During the next 8 years (1998-2006) there was no nesting activity observed. For the next 7 years (2007-2013) there was an active nest every year, generally with 2-3 young observed. In 2014 and 2015, there were abandoned eggs observed in the nest, but no young. The nest has always been on the south cliffs, although the position has shifted somewhat between years.

As in past years, one pair of Common Ravens nested on the island. The nest was in the newest nest site (CORA-3) that has been used since 2013. Three chicks were observed in the nest in early May, and were seen fledged and flying around the island by 26 May.

Plants

There are relatively few wildflowers and berry bushes left on 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. Throughout the season we keep a record of the dates on which particular species are first observed in bloom. For example, this year we recorded sightings of blooming northern rice-root (*Fritillaria camschatcensis occidentalis*), salal (*Gaultheria shallon*), monkey flower (*Mimulus guttatus*), and red columbine (*Aquilegia formosa*); these species tend to be common in areas with no deer, but are only seen on inaccessible cliff locations on Limestone Island.

A number of rare plants are present on Limestone Island due to the unique limestone geology that is uncommon on the rest of Haida Gwaii. These plants are showy Jacob's ladder (*Polemonium pulcherrimum*), Richardson's geranium (*Geranium richardsonii*), and cut-leafed anemone (*Anemome multifida*). Showy Jacob's ladder and cut-leafed anemone were found to be blooming in early May, on the cliffs in Boat Cove. This seems to be earlier than in past seasons. Northern starflower (*Trientalis artica*) was again seen blooming in North Cove by the banding shed. The 2014 discovery of northern starflower was the first record of this flower in Laskeek Bay. A field locoweed (*Oxytropis campestris*) plant was observed again this season in the same location as in the past, although it was not seen blooming. Field locoweed was first discovered on Limestone in 2013, and at that time the most recent report of this plant on Haida Gwaii was in 1980, from the alpine on Mount Moresby (from eFlora BC website).

Introduced Species

Sitka Black-tailed Deer *Odocoileus hemionus*

Deer were intentionally introduced to Haida Gwaii in 1878 and in several years 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 in the Research Group on Introduced Species (RGIS, www.rgisbc.com), which has carried out extensive research on this topic in Laskeek Bay as well as on the rest of Haida Gwaii.

RGIS has recently finished a four-year program, project BAMBI (Behavioral Adjustments to Mitigate Biodiversity loss). This study 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 infrared and motion activated cameras were used to remotely track deer on Limestone and Reef Islands. On Limestone, 12 cameras were set up around the island between 23 February and 30 April. Eleven of the cameras were moved to Reef Island in early May and retrieved in late July. The pictures were sent to RGIS for analysis.

Although project BAMBI is over, we continue to record deer sightings on Limestone Island for RGIS. The date/time, location, tag colour/number, and sex were recorded along with any behavioural notes. This year, deer with ear tags numbered 1, 4, 6, 11, 21, and 29/9 were sighted.

On Limestone Island, there are now two deer exclosures, one remaining since the blow-down in 2010 and a new one which was built on 22 March of 2015. The older deer 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 new 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 already quite apparent, with many small huckleberry bushes, wildflowers, and healthy spruce 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.

Raccoons *Procyon lotor*

Raccoons were introduced in the early 1940s to provide local trappers with a source of employment (Gaston *et al*. 2008). Raccoons (as well as rats) 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 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 Limestone since 2009.

Due to the large raccoon population on Louise Island it seems likely that raccoons will continue to disperse to Limestone in future years. It is therefore very important to continue undertaking spring surveys for raccoons to eliminate them from the colony before birds begin breeding in early April. By the time field camp opens in early May, a raccoon could have already had a considerable impact on the colony.

This year, cameras were set up and surveys took place early in the season. On 23 Feb, a crew set up four infrared cameras baited with cans of sardines. They were set up in Boat Cove, Cabin Cove, North Cove and Crow Valley. Anemone Cove and Boat Cove are likely spots where raccoons crossing to Limestone from Vertical Point could be intercepted, and Cabin Cove is within the known Ancient Murrelet colony. The cameras were in place continuously until the staff arrived to begin nighttime Ancient Murrelet work on 30 April. No raccoons were photographed. On 22 February, a crew conducted a nighttime spotlight survey of the shoreline of East Limestone, West Limestone and the adjacent shoreline of Louise Island. During this approximately three-hour survey, no raccoons were sighted on East or West Limestone. On Louise Island, 6 raccoons were sighted and 5 were killed.

Monitoring for raccoons continued throughout the field season, with two or more cameras that were baited and checked regularly. Boat Cove was monitored continuously from 23 February until 20 July, North Cove from 23 February to 30 April and from 26 June to 20 July, Crow Valley 23 February to 3 June and 24 June to 20 July, and Cabin Cove 23 February to 30 April. Based on experiments with baited cameras in locations where raccoons are present, they are attracted to the baited cameras for an extended period of time. However, we did not record any photographs of raccoons at the wildlife cameras so we are almost certain they were not present on East Limestone this season.

In collaboration in Bird Studies Canada, we also placed 4 baited cameras on other islands in Laskeek Bay: West Limestone, South Low, Kingsway Rock and the most western Skedans Island. No raccoons were photographed on any of these cameras.

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 Limestone directly at this time. Squirrels are now well established on Limestone and are known to be a nest predator on various songbird species (see www.rgisbc.com).

Since 2007, we have been conducting squirrel surveys on Limestone 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. Ten squirrel surveys were completed this season, and numbers of squirrels seemed to be lower than in the past few years.

CONCLUSION

This season was our 27th 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. 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 have again experienced another major decline in chick numbers in the Cabin Cove area (from 110 chicks in 2014 to 44 chicks in 2015, and now 36 in 2016). 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 and remove raccoons from the area as our main restoration initiative. We will also continue to research the possibilities of other restoration, such as social attraction techniques that have been shown to be effective in other colonies, to assist the recovery of the Limestone Island colony.

The lessons that we learn from our research on Limestone Island are of great importance when considering the prospects of other colonies threatened by introduced raccoons and rats as they continue to disperse throughout the many islands of Haida Gwaii. LBCS hopes to continue to implement and incorporate island restoration techniques in future field seasons, such as invasive plant control, raccoon monitoring, and social attraction. We are participating in the development of a bio-security plan to address some of the ongoing issues of introduced species. We are also beginning to discover the possible impacts of changes in climate as warmer oceans change the patterns of marine species. We hope that continuing our core long-term monitoring programs will help to document and understand these broader scale changes.

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