LASKEEK BAY RESEARCH

12

2002

Edited by
Tony Gaston

Laskeek Bay Conservation Society

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ANNUAL SCIENTIFIC REPORT, 2002

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ANTHONY J. GASTON

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Box 867, Queen Charlotte City, B.C. V0T 1S0, Canada

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LASKEEK BAY CONSERVATION SOCIETY

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

Sensitive biological research that is not harmful to wildlife or its natural habitat

Interpretation and educational opportunities for residents of and visitors to the Queen Charlotte Islands

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

Laskeek Bay Conservation Society
Box 867, Queen Charlotte City, British Columbia, Canada V0T 1S0
Phone/fax (250) 559-2345; E-mail <laskeek@island.net>

BACKGROUND

The goals and objectives of the Society are:

1. *To undertake and support research and long term monitoring of wildlife populations of the marine and terrestrial ecosystems of Haida Gwaii, especially the Laskeek Bay area.*

2. *To provide opportunities for non-scientists, especially students and local residents of Haida Gwaii, to participate as volunteers in our field season programs, and to offer training to impart necessary field research skills.*

3. *To promote better understanding of the marine and terrestrial ecosystems of Haida Gwaii, especially the Laskeek Bay area, by providing information to youth, local residents, and to the public in general in the form of publications, meetings and exhibits.*

4. *To promote the conservation of native species and to develop public awareness of the changes caused by introduced species to Haida Gwaii.*

5. *To support and assist other programs aimed at providing better knowledge, management and conservation of ecosystems on Haida Gwaii.*

INTRODUCTION

This year (2002) marked the 13th year of the Laskeek Bay Conservation Society's volunteer field programme at East Limestone Island, Haida Gwaii. Concentrating mainly within the Laskeek Bay area, the Society's programme includes biological monitoring and research, interpretation for visitors and learning opportunities for students and volunteers.

The scientific work of the Society is carried out in collaboration with researchers and management agencies having ongoing interest in the ecology and conservation of Haida Gwaii. The research programme is directed by a Science Advisory Committee that works closely with the Society's Board of Directors to develop research that is relevant to the conservation needs of Haida Gwaii and consistent with the goals of the society. Research activities include marine bird and marine mammal population monitoring, studies of intertidal invertebrates, plants and forest birds. In addition, the Society is a participant in the Research Group on Introduced Species, an umbrella organization devoted to studies of exotic species in Haida Gwaii and their impact on indigenous ecosystems. This research focuses especially on the impact of introduced mammals, including deer, raccoons and squirrels on the islands.

The overall aim of the Society's research programme is to provide long-term information on the biology and ecology of Haida Gwaii ecosystems. Ongoing monitoring, using simple, standard techniques that allow year-to-year comparisons to be made, and allowing the direct participation of volunteers, is the cornerstone of the Society's approach. By monitoring a variety of indicator species in the ocean, inter-tidal and terrestrial ecosystems, we can obtain an overall measure of their health. Because marine waters may be subject to cyclical or directional changes operating at the scale of decades, such observations become most valuable when they are tracked consistently over many years. Such long-term monitoring is becoming increasingly pertinent in the context of global climate change. In addition, the possibility of offshore oil developments in Hecate Strait makes the Society's long-term data on marine birds especially pertinent. In the event that such developments were to proceed, our information on population status and trends would be vital for monitoring both short-term and long-term impacts.

ACKNOWLEDGEMENTS

The Laskeek Bay Conservation Society is a non-profit volunteer-run organization, and could not operate without the generous support from a wide variety of groups and individuals. We gratefully acknowledge the contributions of all our supporters and apologize to any we may have inadvertently omitted from this list:

The society gratefully acknowledges the generous financial support provided by:

- Canadian Wildlife Service of Environment Canada (National Wildlife Research Centre, Ottawa)
- Ecoaction and Science Horizons Programs of Environment Canada
- Gwaii Trust Society
- W. Alton Jones Foundation
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- Forest Renewal BC
- South Moresby Forest Replacement Account
- Weyerhaeuser
- Canadian Nature Federation
- Haida Gwaii Museum
- Parks Canada
- Air Canada
- Habitat Conservation Trust
- Calgary Zoological Society
- British Columbia Gaming Commission

… as well as numerous other small business and private donors.

We also thank the following individuals or groups who gave generously to the Society in many different ways:

- Tony Gaston, Jean-Louis Martin and other members of the Science Advisory Committee for valuable advice and guidance through the field season.
- Graeme Ellis for providing us with a camera and film to document Orcas.
- Crew and guests of the vessels Island Roamer and Maple Leaf for generously supporting our project with their visits, purchase and donations.

- Nathalie Macfarlane at the Haida Gwaii Museum, for continuing to provide a venue to promote the Society's work.
- Barb Rowsell, RGIS coordinator, for generous help whenever required.
- All the artists who donated works for our successful "Art of Limestone" exhibit.
- LBCS directors for their time and effort in maintaining and developing funding, the field camp, and the scientific and educational projects.
- Kevin Borserio and all the students of Project Limestone, Gordon McMahon and the G.M. Dawson School, and Erin Sinclair and the Living and Learning School students.
- All of the volunteers who participated in the Limestone Island camp, purchased t-shirts, made donations, or helped out in town.

Finally, thanks goes to the owners, staff and crew of South Moresby Air Charters, s/v Anvil Cove, and m/v Tana Bay for their professional services in transporting gear and people from Queen Charlotte City to Limestone.

SCIENCE ADVISORY COMMITTEE, 2002

Dr. Anthony Gaston (Chair, marine bird specialist)
Canadian Wildlife Service, National Wildlife Research Centre, 100 Gamelin Blvd., Hull, Quebec K1A 0H3

Dr. Jean-Louis Martin (introduced species, terrestrial birds)
Centre National de Recherche Scientifique, CEPE, Route de Mende, BP 5051-34033, Montpellier-Cedex, France

Kathy Heise (marine mammals)
Department of Zoology, University of British Columbia, 6270 University Blvd., Vancouver, BC, V6T 1Z4

Dr. Tom Reimchen (Haida Gwai ecosystems, fish)
Dept. of Biology, University of Victoria, Victoria, BC, V8W 3N5

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EAST LIMESTONE ISLAND FIELD STATION: REPORT ON THE 2002 FIELD SEASON

Joanna Smith
Laskeek Bay Conservation Society, Box 867, Queen Charlotte City, BC, V0T 1S0

SUMMARY

This annual Field Season Report summarises the highlights of the Education and Science Programs of the Laskeek Bay Conservation Society. In 2002, we had 395 volunteer and visitor days during our 14-week season on Limestone Island. The camp opened from 29 March to 7 July and was supported by four staff, 27 volunteers and eight Directors. More than one-quarter of the volunteers had helped previously and at least half were from Haida Gwaii. Four school groups participated in Project Limestone and we enjoyed six visits from the sailing vessels *Island Roamer* and *Maple Leaf*. The Research Group on Introduced Species partnered with the Society for a songbird banding and genetics study that will examine the degree of isolation in resident songbirds on Haida Gwaii. Ancient Murrelets always fascinate and intrigue us and this year was no exception. Ancient Murrelet chick numbers were within the long-term average, 566 chicks from 9 May to 3 June, one of the shortest seasons to date. The peak night of departure was 21 May with 65 chicks, the highest number since 1993. Breeding Ancient Murrelets occupied 12 monitored burrows and eight of these families departed with chicks. Of the successful burrows, five left with two chicks and three left with one. Fewer adult Ancient Murrelets were caught than in recent years, with only 159 birds for the season. Black Oystercatcher nesting was also slow this year, with only two nests with chicks in July. The Lost Island gull colony declined to pre-1997 levels and the Kingsway Rock colony increased slightly. One Bald Eagle pair raised one chick near the Spring Valley plot. There were 19 nests, including three species, in wildlife trees. Unfortunately for the saw-whet owls, their nest tree from last year fell down. We had more than 100 sightings of marine mammals, including 49 humpback whales. And saving the big news to last, one of the Pigeon Guillemot nest boxes was used and it was by two different females no less! All in all, a really great season.

INTRODUCTION

What began as a discussion around a campfire on Reef Island in 1989 is now an active education and science program, more than halfway to its goal of 25 years. With pressures from introduced species, offshore oil exploration and now wind farms in the Hecate Strait, long-term monitoring projects like ours provide the scientific support to evaluate changes or effects. Our science program is comprised of more than a dozen projects and with each season, we are finding more firsts - a nine-year Red-breasted Sapsucker tree and a 17 year old Ancient Murrelet to name a few. The education program is an integral part of the science program, working in concert to gather data and provide a new experience for curious people. Residents and visitors to Haida Gwaii have an opportunity to investigate an old-growth forested island, explore the limestone shoreline and discuss what they have learned with scientists and other visitors.

EDUCATION PROGRAM

Project Limestone

This year marks the 12th season that local school groups have taken part in Project Limestone. This program is funded by the students, School District 50, Gwaii Trust and LBCS and offers a valuable, educational experience for both students and teachers from Haida Gwaii. Project Limestone is a great opportunity for young residents to learn more about the marine and terrestrial ecosystems of the islands and to experience biological research first-hand. School groups receive an afternoon natural history orientation and are introduced to the ongoing research projects carried out on East Limestone Island. At night, students and teachers return to assist with the Ancient Murrelet chick banding and learn to carefully retrieve chicks from funnels, help record weights, measurements and band numbers.

Four school groups participated in Project Limestone this year: Living and Learning School (Q.C. City), G.M. Dawson (Masset) and two groups from Queen Charlotte Secondary Kayak Club. Total number of Project Limestone days: 39 (30 students and 9 teachers).

Visitor Interpretation Program

Sailboat tour operators en route to Gwaii Haanas National Park Reserve often schedule a visit to East Limestone Island. Visitors are treated to the same experience as the Project Limestone participants with an afternoon tour and evening chick catching at North Cove. We are told that for many of the tour boat guests, visiting Limestone Island is the highlight of their trip to Haida Gwaii.

Both the *Maple Leaf* and *Island Roamer* came to Limestone Island in 2002, and a scheduled visit by Copper Sky was curtailed because of bad weather. The *Island Roamer* visited four times (17-18 and 26 May, 12 June) with 42 guests and nine crew members. The *Maple Leaf* visited twice (21 May and 1 June) bringing 14 guests and 9 crew members. Total number of tour group days: 74.

Volunteers

The volunteer program on Limestone Island offers a unique opportunity for people to assist with biological research in a remote field environment. This program, whereby people donate their time in exchange for learning about Haida Gwaii ecosystems, is vital to the success of the Society. This year, 27 people volunteered to help on Limestone, all from Canada – Haida Gwaii (17), rest of BC (4), Ontario (4) and Alberta (2). We had four volunteers age 12 or under, including one exceptionally enthusiastic student from Living & Learning, Cole Murdoch, who spent four extra days on Limestone after his trip with the Living & Learning School in 2001 and 2002.

The majority of volunteers helped for one week, but six people came for two weeks; the average length of stay in 2002 was nine days. Eight of the volunteers had been to Limestone before. Total number of volunteer days: 232.

Other visitors

The Reef Island-based Research Group on Introduced Species (RGIS) arrived in Laskeek Bay on 21 June. Limestone Island continues to serve as an important research site for RGIS because they monitor long-term vegetation plots and three deer exclosures. The initial Reef Island research crew of PhD student Steve Stockton (University of Ottawa), Joelle Fournier, Joelle's nephew Andreas Lutjen, post-Doc Theresa Burg and M.Sc. student Roger Bull stayed on Limestone for four days while we worked out the songbird banding schedule and starting setting up their camp for the next week.

Tony Gaston (Canadian Wildlife Service) arrived on 28 June with his undergraduate field course and five students from Ontario. The class came over to Limestone Island for a guided tour and to collect habitat data around the mist net lanes on Limestone. On 5 July, Dr. Vicki Friesen, Queen's University, and her 12-year old son Daniel joined the research crew on Reef Island to study songbird genetics (*see* Songbird Banding).

Other visitors to Limestone included divers from Haida Fisheries, onboard the *Haida Storm*, who were conducting a sea urchin survey in Laskeek Bay in early July. Total number of other visitor days: 50 (19 people).

Haida Gwaii Watchmen

To establish a closer relationship with our Haida neighbors, we visited Tanu and Hotspring Islands in early July. These visits were a good opportunity to meet the Watchmen and to extend an invitation to the Haida community to take part in our volunteer program; a number of the Watchmen were interested.

2002 Field Staff

The Limestone Island camp was open from 29 March to 7 July, 2002. Positions were: Joanna Smith (camp manager/senior biologist), Jen Rock (biologist/interpreter) and Charlotte Tarver (interpreter/naturalist). Volunteer banders: Mark Hipfner (Canadian Wildlife Service) and Keith Moore (LBCS). The science intern position was vacant this year.

RESEARCH AND MONITORING

Approximately half of the global population of Ancient Murrelets *Synthliboramphus antiquus* breed on Haida Gwaii and this species is listed as "of special concern" in Canada because of threats from introduced species. Although rats and raccoons continue to be a serious concern for Ancient Murrelets throughout most of the archipelago, Langara Island, on north coast, remains rat free after an intense eradication program. However, wind farms in the Hecate Strait are a new conservation issue to add to the discussion of offshore oil development and introduced species for their effects on species that use the Hecate Strait and offshore islands. Our long-term seabird monitoring programs allow us to develop a firm baseline against which we can evaluate future changes, anthropogenic or otherwise.

Ancient Murrelets

Adult Banding

We used three knock-down nets from 1-12 April (before egg laying) and 20 May to 9 June (during chick departures) to catch adult Ancient Murrelets leaving the colony. We also looked for adults in monitored burrows after 30 days of incubation. All told, we opened the nets for 39.25 hours, over 20 nights, using the same approximate time of night as years prior (0330 to 0530 h in April and then 0130 to 0415 in May and June). Most of the time we only use one net each night but on 30 May we had 3 banders on the island so we opened both the Cabin and North Cove nets on the same night (North Cove after finishing chick banding at 0230 h).

A total of 190 birds were caught in 20 nights (79 new + 111 retrap), including nine birds in burrows and birds caught more than once. After multiple retraps are subtracted, the total drops to 159 (79 new and 80 retrap; Table 1). Before egg-laying, we caught 66 birds (23 new and 43 retrap) and we caught 93 adults (56 new and 37 retrap) post-laying (i.e. during chick departures).

Table 1
The number of Ancient Murrelets caught on East Limestone Island, 2002. Birds with brood patches 10-19mm are of unknown breeding status. Retraps* include only one capture per bird.

Timing	Capture method	Breeding status	New	Retrap*	Total birds
Pre-laying	Net	Breeder	23	43	66
Post-laying	Net	Breeder	12	23	35
	Net	Non-breeder	30	8	38
	Net	Unknown	8	3	11
	Burrow	Breeder	6	3	9
TOTAL			79	80	159

Of the 80 birds retrapped on Limestone Island, nine were banded as chicks, including seven breeders (banded 1990, 1991, 1995, 1997 and1998) and two non-breeders (banded 2000). The remaining 71 birds were banded as adults between 1989 and 2001. Two breeders were banded in 1989, which makes them 16 or 17 years old, the oldest Ancient Murrelets to date. Most of the remaining retrapped birds (59; 74%) were banded in 1996 or later, with 17 adult birds coming from 2000 (21%). Birds in burrows weighed 206.3 ± 9.9 g, breeders caught in nets 201.3 ± 16.2 g, and non-breeders 174.5 ± 14.3 g.

The catching efficiency of the nets varied. In April, we set up and opened the Spring Valley net first, then North Cove and Cabin. We banded eight nights each at Spring Valley and North Cove and only four nights at Cabin. However, Cabin was the big catcher this year, with 13.8 birds per night, or 6.5 birds per hour. The North Cove net was highly variable and one night we caught no birds but the net rated second for captures with 8.9 birds per night or 4.1 birds per hour. The Spring Valley had the lowest catching efficiency with 6.4 birds per night or 3.8 birds per hour, in part because the net would not completely open.

Chick banding

Several days of strong, north winds caused lots of difficulties when we were setting up the plastic funnels and we only just managed to get the plastic up by 7 May. The gates were closed from 7 May to 4 June, using the adjusted protocol from 2001: 2230 – 0230 until 21 May and then 2300 – 0230 to end of season . We used USFWS No. 3 stainless bands series 1313-96000 for the chicks and no plastic bands. The first chicks arrived on the night of 9-10 May and the last chicks left on 3-4 June. A total of 566 chicks were banded this year, with the peak night on 21 May with 65 chicks (Figure 1; Table 2). The duration of the chick departures, at 26 d, was the shortest recorded apart from 1992, when funnels were not set up until 12 May and chicks departed on the first night of trapping. Omitting 1990, the number of chicks caught on East Limestone Island in 2002 was within one standard deviation of the long-term average (Figure 2).

Figure 1
Nightly chick numbers on Limestone Island, 7 May to 4 June 2002.

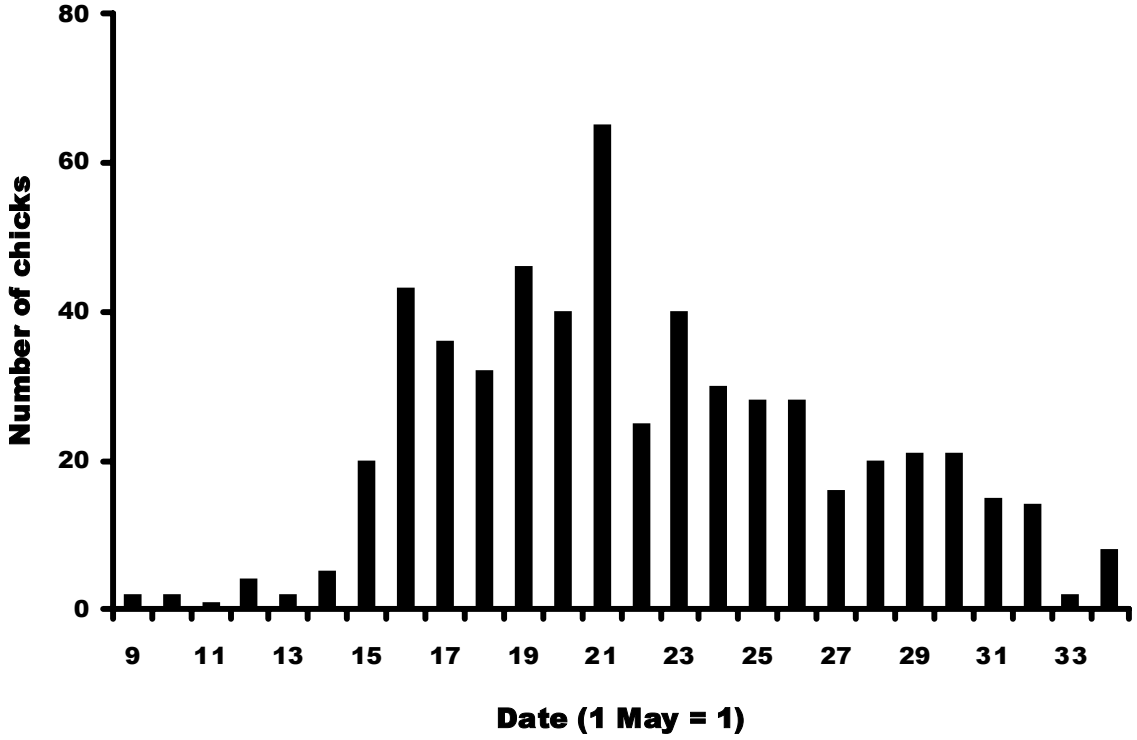
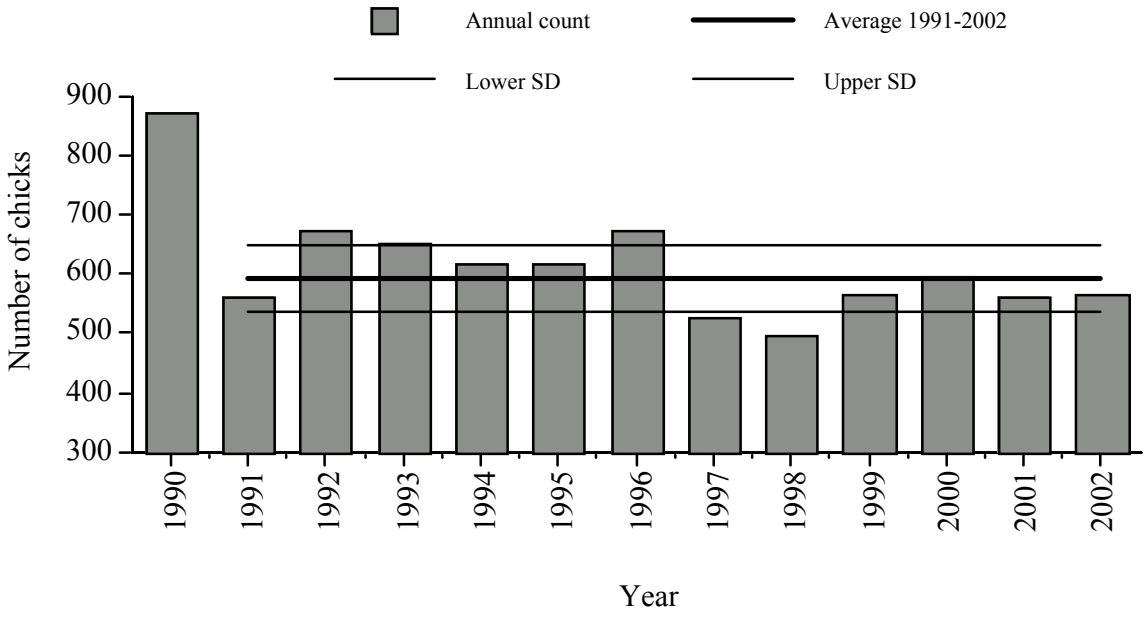


Table 2.
Summary of chick departures, peak nights and numbers on Limestone Island, 1990-2002.

YEAR	Opening night	First night	Last night	Peak night	Peak count	Total days	Total chicks
1990	12 May	12 May	15 Jun	22 May	65	35	873
1991	8 May	8 May	6 Jun	26 May	48	30	561
1992	12 May	12 May	3 Jun	22 May	84	23	674
1993	9 May	10 May	15 Jun	18 May	70	37	653
1994	7 May	7 May	8 Jun	22 May	52	33	618
1995	7 May	10 May	11 Jun	22 May	64	33	617
1996	10 May	11 May	9 Jun	19 May	48	29	588
1997	8 May	11 May	11 Jun	24 May	41	31	527
1998	7 May	11 May	22 Jun	20 May	55	43	495
1999	9 May	11 May	11 Jun	21 May	54	31	567
2000	11 May	11 May	11 Jun	20 May	62	31	595
2001	8 May	10 May	15 Jun	18 May	54	37	560
2002	7 May	9 May	3 Jun	21 May	65	26	566

Figure 2
Annual counts of Ancient Murrelet chicks in funnel on East Limestone Island 1990-2002. The solid line is the long-term mean, 1991-2001 and the dashed lines are one standard deviation from this mean



We banded an additional 10 chicks in burrows and 18 chicks outside of the funnels. Chicks weighed on average 31.9 ± 2.9 g in burrows, and 26.5 ± 2.2 g in funnels, illustrating a similar 20% weight loss to that reported by Tony Gaston on Reef Island in the 1980s (Gaston 1992). We found eight chicks with ticks this year, each having from 1-5 ticks per web. These chicks weighed 26.4 ± 1.7 g, not significantly different than chicks without ticks. Ticks were primarily on chicks that were departing from the eastern side of the island (Spring Valley and Cabin funnels, n=7). Ticks were detected on Ancient Murrelet chicks at Reef Island in 1999, but had not been seen previously at East Limestone Island.

Burrow monitoring

We checked Ancient Murrelet burrows for the first time on 7 April when one egg was found. Egg laying continued at a slow pace, with the last egg laid on 4 May (C-44). Our sample of burrows started off at 47 but we retired three burrows because they were either filled with spruce cone seeds or had collapsed (C-9, C-18 and S-23). Three half-days were dedicated to finding potential new burrows bringing the total sample to 52. In the end, 12 burrows were active and of these, only 8 pairs departed with chicks. There may have been 13 active burrows but one, C-98 on the Ridge Trail, was under the path and although it had lots of activity, we decided not to dig a hatch for fear the whole burrow would collapse.

Of the eight breeding pairs of Ancient Murrelets that left the colony with chicks, five had two chicks and three left with 1 chick (one had only one egg in the burrow, one was one chick and one cold egg and the last was one chick and one dead chick in the burrow). Four burrows were abandoned or deserted, three with two eggs and the other with one egg. The average weight of first eggs was 46.3 ± 3.9 g (N = 12).

An egg density index, based on weight/(L x B^2) suggested that deserted eggs in burrows with 2 eggs were incubated for 14, 23 and 28 days, and the burrow with the single egg was not incubated at all (C-69).

We continued to notice Sitka spruce cone stalks and seeds in the burrows. In 2002, we retired two burrows because of the large accumulation of seeds in the nest cup and are still unsure if it is only mice eating cones in the burrows and boxes, or if squirrels are also using the murrelet nest sites to cache seeds.

Ancient Murrelet families left the colony from monitored burrows from 25 May to 12 June. The last burrow, C-44, has been active for nine consecutive years, with two of last three years with the same adult (1313-87070). The same adults have been in C-75 and C-14 also for two of the last three years.

Gathering Ground

The usual evening counts of Ancient Murrelets on the gathering ground to the west of Low Island were made daily between 5 April - 27 June. The peak count was 226 on 29 April, almost a full month earlier than last year (2001: 328 on 23 May). Counts for the season were April: 3-226 (n=22, 62± 64), May: 1-157 (n=24; 43±42) and June: 4-129 (n=19; 49±51).

High winds, large swell and reduced visibility prevented us from counting birds on 17 evenings. April was unseasonably sunny and dry, with only a few days with high winds. The weather turned bad in May and we had several days with gale force winds. On 15 May we had a storm force sou'easter (>55 knots) with seas greater than 2.5m in Laskeek Bay! June was unusual in that we had almost a week of gale force winds in the last half of the month.

Nest Boxes

Ancient Murrelet next boxes were checked during daily burrow rounds (5 April – 1 June). As burrows were used in the first year that they were installed on Reef Island, it was a bit of a surprise that the nest boxes on Limestone were not used in their second year, and there were very few overall visits. Spruce cones stalks and seeds were found in nine boxes.

Predation

Who is digging up the Ancient Murrelet burrows on Limestone Island? It is still a mystery but this year, we think it was river otters. Ten burrows were destroyed in 2002, most of them in the small Ancient Murrelet colony near the Look-out Point where an otter family has a play area and den within 200 m. Most of the diggings were found during late April - mid May, during the egg-laying and incubation period. Additional predation by birds of prey (eagles, falcons, hawks) was evident with Ancient Murrelet wings and feather piles throughout the colony, and occasionally beyond. Twice, headless carcasses were found.

Black Oystercatchers

Laskeek Bay has been nominated as an Important Bird Area on the basis of its population of Black Oystercatchers *Haematopus bachmani*. We surveyed all of the nest sites from mid May until 3 July, with additional nest checks made by Tony Gaston and Joelle Fournier from 8-10 July. In 2002, the final nest tally was 10 active nests, two with chicks and eight with eggs (three with two eggs, five with one egg). No chicks were banded this year because none were large enough by the time we left Laskeek Bay. Eight adult banded oystercatchers were re-sighted and combinations recorded (Table 3) although the aluminum numbered bands are already showing signs of wear.

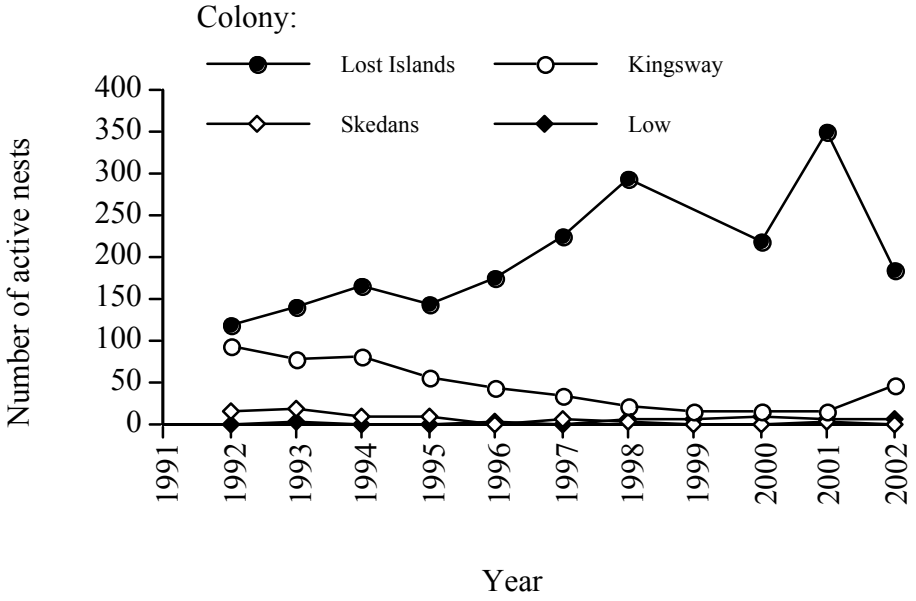
Table 3
Banded Black Oystercatchers in Laskeek Bay, 2002

Nest location (with Code)	Band combination (left – right leg)
Cumshewa Island (CUM-2)	Metal only (right)
Kingsway Rock (KNG-1)	White – metal
Limestone Island (ELI-2)	Aluminum – black/metal
Reef Island (REE-2)	White – brown/metal; black/metal – white
Skedans Islands (SKE-6)	White – metal; H2 (aluminum) – black/metal
Skedans Islands (SKE-10)	Metal only (right); white – black/metal
South Low (SLW-5)	Aluminum – black/metal
South Low (SLW-8)	White – white/metal

Glaucous-winged Gulls

At Kingsway Rock on 1 June we found many Glaucous-winged Gull *Larus glaucescens* nests with eggs, some with a full clutch (3 eggs): this is relatively early. Low Island was checked on 14 June (8 nests with eggs, 23 adults) and Kingsway Rock again on 20 June (48 nests with eggs, 109 adults). Then, strong winds prevented us from getting to the other colonies for a few weeks. At Lost Island on 2 July and there were fewer active nests than last year (184 nests with eggs, 121 empty, 920 adults); East Skedans Island was surveyed a few days later (3 nests with eggs, 16 adults) (Figure 3). Cumshewa Islet was checked on 3 July and no gulls or active nests were found, only one empty nest. The small gull colony on the south side of Reef Island was not counted this year.

Figure 3
Number of gull nests with eggs in Laskeek Bay, 1992-2002



Pigeon Guillemot Boxes

Ten boxes for Pigeon Guillemots *Cepphus columba* were put in place in 2001. They were checked on the day before closing camp for the season (6 July), when we found three eggs in Box 10, the one farthest out on the rocks at Look-out Point. Two of the eggs were the same, but the third was of a different colour and was about two-thirds of the way along the tunnel, towards the artificial nest cup. Clearly, two different females used the box.

Seabird Surveys by boat

We managed four nearshore/offshore surveys this year (20-23 April, 12 May, 8-9 June and 3 July), two short of our target. In addition, we traveled 9 km into the Hecate Strait twice to look for Shearwaters and other pelagic migrants (23 May and 19 June). Our boat ran very well this year, especially with the new bench and adjustments to the centre driving position, but the weather was generally too rough for surveys during most of May and June.

Marbled Murrelet counts are the primary reason we run the nearshore transects because this species continues to be red-listed in BC (Threatened), federally listed as endangered (Council on the Status of Endangered Wildlife In Canada) and internationally listed as vulnerable (Birdlife International). The total counts of murrelets for transects run continuously for 13 years and for all transects combined were, respectively: 20 April- 109 and 150; 12 May - 193 and 215; 8 June - 49 and 121; 3 July - 357 and 503. These counts were higher than those in 2001 (peak 165 on 23 June).

Eighteen species were seen on the nearshore/offshore transects: Common and Pacific Loon *Gavia immer* and *G. pacifica*, Horned Grebe *Podiceps auritus*, Double-crested and Pelagic Cormorant *Phacrocorax auritus* and *P. pelagicus*, Brant *Branta bernicla*, Bufflehead *Bucephala alveola*, Long-tailed Duck *Clangula hyemalis*, Black Oystercatcher, Glaucous-winged Gull, Black-legged Kittiwake *Rissa tridactyla*, Ancient Murrelet, Marbled Murrelet *Brachyrhynchus marmoratus*, Rhinoceros Auklet *Cerorhinca monocerata*, Pigeon Guillemot, Cassin's Auklet *Ptychoramphus aleuticus*, Bald Eagle *Haliaaetus albicilla* and Northwestern Crow *Corvus caurinus*. Notable by their absence were: Harlequin Duck *Histrionicus histrionicus*, White-winged and Black Scoters *Melanitta fusca* and *M. nigra*, Common Merganser *Merganser merganser* and Red-necked Grebe *Podiceps grisegena*.

Black-legged Kittiwakes were rarely seen in Laskeek Bay this year, in sharp contrast to the hundreds seen in 2001 on Kingsway Rock. Ten sub-adult kittiwakes were flocking with Glaucous-winged Gulls near Cumshewa Rocks on 3 July and Tony Gaston saw several between Skedans and Reef Islands in early July.

Eight species were seen on the two Hecate Strait surveys: Sooty Shearwater *Puffinus griseus*, Pink-footed Shearwater *Puffinus creatopus*, Glaucous-winged Gull, Pigeon Guillemot, Cassin's Auklet, Ancient Murrelet, Rhinoceros Auklet and Red-necked Phalarope *Phalaropus lobatus*. As in previous years, we were no more than 7 km beyond Reef Island when we intercepted hundreds of shearwaters cork-screwing southward just above the waves. We were unable to get very close to the stream of birds but are fairly certain that we saw Pink-footed among the Sooty Shearwaters. On 23 May, we were literally surrounded by humpback whales, with animals stretching from the horizon near the Skedans Islands, south past Low Island and offshore up to at least 18 km.

Correction to 2001 Report: The surveys referred to as 'offshore' in the 2001 Field Summary (p. 11) were Hecate Strait surveys. The 'nearshore' surveys included both the nearshore and offshore transects.

Marine Mammals

Nine species of marine mammals were seen in Laskeek Bay in 2002, including the sometimes-marine river otters (Table 4, Appendix 1). The pinnipeds were the most numerous group with 2577 Steller's sea lions *Eumetopias jubatus* and 316 harbour seals *Phoca vitulina* counted, although these totals merely reflect the frequency of visits to haul-out sites. Each year we consistently see the same core group of species (humpback whales, sea lions, killer whales, dolphins) while other species, like the Dall's porpoise, minke and fin whales, are irregular visitors to Laskeek Bay. Dall's porpoises were more frequent than usual in 2002.

Humpback whales were frequently spotted within 100 m of Limestone Island and spectacular displays of breaching, fin slapping and tail slapping occurred in the offshore waters, beyond Low Island. In Laskeek Bay, total numbers were lower than last year but reports from the sailboat tour operators indicated that these whales were numerous in Skincuttle Inlet and Juan Perez Sound, south of us.

On 5 July, students with Tony Gaston's Ontario Universities Field course were treated to a very spectacular display of breaching a by a pod of 9 Orcas, including two large males with tall fins. This group was seen first off East Limestone Island lookout, where they split up, with two animals, including one male, circling anticlockwise around

the island, while the rest dived and surfaced several minutes later close to South Low Island. About 1 h later the same group passed along the North shore of Reef Island within 100m of land and gave a continuous series of breaches, including roll-overs and back-flips, as well as a great deal of spy-hopping. Joelle Fournier thought it was the most spectacular display she had seen in many years of boating in Haida Gwaii waters. Between their appearance off East Limestone and their display at Reef Island, the group would have had time to make a kill at the nearby sea lion haul-out. This type of behaviour is sometimes seen after a successful kill (Graeme Ellis, pers. comm. to AJG).

Table 4
Total counts of marine mammals from marine surveys and sea-watches from East Limestone Island for four of last six years

Species (common name)	2002	2001	1998	1997
Dall's porpoise *Phocoenoides dalli*	29	0	0	9
N. elephant seal *Mirounga angustirostris*	0	2	0	2
Fin whale *Balaenoptera physalis*	0	4	0	0
Grey whale *Eschrichtius robustus*	2	0	0	6
Harbour porpoise *Phocoena phocoena*	21	19	25	21
Humpback whale *Megaptera novaeangliae*	49	140	6	2
Killer whale *Orcinus orca*	29	16	17	36
Minke whale *Balaenoptera acutorostrata*	0	0	3	8
Pacific white-sided dolphin *Lagenorhynchus obliquidens*	22	93	10	42
TOTALS	3060	2016	2875	1462

Wildlife Trees

In 2002, we checked 54 wildlife trees (WT) for cavity nesting species. By mid-June, 19 trees were being used, including three new trees (WT 85-87). Red-breasted Sapsuckers *Sphyrapicus ruber* nested in 16 trees, Chestnut-backed Chickadees *Poecile rufescens* in two, and one pair of Hairy Woodpeckers *Picoides villosus* nested in WT 64. Sapsucker chicks began called from 29 May - 19 June and fledged between 5 - 23 June.

WT 20 (in Spring Valley) was used for the ninth consecutive year by sapsuckers, making it the longest running sapsucker nest tree on Limestone Island. At WT 43 (in C-plot), a colour-banded sapsucker was seen four times, the same bird that was seen from 1996-98 (yellow/yellow – red/metal).

A tree that supported the first Northern Saw-whet Owl *Aegolius acadicus* nest on Limestone Island last year fell down over the winter. Of the 15m original snag, only 5.5 m remains standing. We were able to locate the nest hole among the bits lying on the ground and estimated that the nest had been at 9 m. The nest opening measured 74 x 77 mm and the actual cavity measured 18 cm wide by 30 cm tall. The snag had split open during the fall so we were able to examine the nest contents from last year. The nest cup contained two dull, white eggshell fragments and was lined with grass and small, dark feathers. In mid April, a fresh owl pellet was on top of the toppled snag fragment, directly above the old nest hole. An owl called from the forest above the cabin, near the junction of the main and north cove trails and on the north side in the forest, above funnel 3 and 4 but we were unable to locate a day roost site, or determine if there was a female owl was on the island.

Songbird Banding

In partnership with the Research Group on Introduced Species, a songbird banding and genetics study ran from 22 June - 15 July. The five mist-net stations used this year were East Limestone Island, West Skedans Island, Reef Island (2 sites) and Low Island; birds were not banded at Vertical Point (Louise Island). Each station had four banding sessions, generally from 0700 to 1200, with a two or four day rest between sessions. The Limestone Island staff ran the East Limestone and West Skedans mist-net stations for 7 of 8 scheduled sessions and the Reef banding staffran the other three stations and finished off the last session at West Skedans Island.

Morphometric data were collected from the birds (wing, bill and tarsus length, weight) plus age, plumage and breeding status; fat score and molt were not recorded. Blood was drawn from the brachial vein on the wing of a number of songbirds for a project initiated by Dr. Vicki Friesen and two of her students, Dr. Theresa Burg (a post-Doctoral fellow) and Roger Bull (an M.Sc. student) at Queens' University, Ontario. The blood samples will be used for DNA analyses to test whether resident songbirds on Haida Gwaii are distinct from their counterparts on the mainland coast. This will allow us to measure how much interchange there is between island and mainland populations - a question of great conservation interest.

We captured 152 birds at the Limestone and West Skedans stations between 22 June and 6 July, 118 new and 34 retraps. Seventeen species were caught, 12 at each station. On East Limestone Island (ELI), Townsend's Warbler *Dendroica townsendi* was the most common species (25), followed by Golden-crowned Kinglet *Regulus satrapa* (14), Chestnut-backed Chickadee (12) and Hermit Thrush Catharus guttatus (6). On W. Skedans Island (WSK), Fox Sparrow *Passerella iliaca* was the most common (21), then Rufous Hummingbirds *Selasphorus rufus* (not banded, 17), Orange-crowned Warbler *Vermivora celata* (12), Swainson's Thrush *Catharus ustulatus* (11) and Hermit Thrush (5). All other species comprised less than five individuals: Brown Creeper Certhia americana (3 on ELI), Dark-eyed Junco *Junco hyemalis* (1 on ELI), Golden-crowned Kinglet (1 on WSK), Orange-crowned Warbler (4 on ELI), Pine Siskin *Carduelis pinus* (2 on ELI), Pacific-sloped Flycatcher *Empidonax difficilis* (1 on WSK), Red-breasted Sapsucker (2 on ELI), Red Crossbill *Loxia curvirostra* (1 on WSK), Song Sparrow *Melospiza melodia* (3 on WSK), Swainson's Thrush (1 on ELI), Townsend's Warbler (2 on WSK), Varied Thrush *Ixoreus naevius* (2 on ELI, 1 on WSK) and Winter Wren *Troglodytes troglodytes* (1 on ELI, 3 on WSK). One retrap from a previous year involved a movement between islands. A Winter Wren, banded as a juvenile bird at Vertical Point last year, was recaptured on West Skedans Island.

Joelle Fournier has been tracking a female Hermit Thrush that was banded on Limestone Island in 1998 and retrapped each year we have used the mist nets. We caught this bird in 2002, again with a brood patch, which makes four years of known breeding. We noticed that a banded Hermit Thrush had built a nest in the limestone wall beside the cabin, in the columbine bushes. We regularly watch this bird feeding directly in front of camp and wonder if it is this banded bird from 1998.

NATURAL HISTORY

Daily Bird Checklist

Our daily checklist of birds on Limestone Island and Laskeek Bay reached a high on 20 April with 38 birds (average was 25 birds per day). A total of 71 species were seen throughout the season with many species seen regularly each week. As in other years, the male Blue Grouse *Dendragapus obscurus* drummed almost daily from 6 April to 9 June, sometimes playing tag with the Northern Saw-whet Owl for continuous day and night calling on the east side of the island. Cassin's Auklets and Fork-tailed Storm-petrels *Oceanodroma furcata* were frequently heard in the middle of the night when we were awake for Ancient Murrelet chick or adult banding. Storm-petrels were probably breeding on the east side of the island, north of camp, and we would hear their 'laugh' as they circled the shoreline after midnight. A lone Red-necked Grebe was in the cabin cove when we opened camp on 29 March. We suspect that this same bird stayed for five weeks, occasionally joined by two other adult grebes. Three Common Snipes *Gallinago gallinago* were seen on East Limestone Island after two days of southeast gale force winds on 26 April. The snipes were on the ground in the interior of the island, one alone and two together. Wandering Tattlers *Heteroscelus incanus*, usually a reliable visitor to Limestone Island, did not appear this year. Instead, a small flock of Whimbrels *Numenius phaeopus* landed on our eastern shore on 7 May. The Black Oystercatchers called loudly when the Whimbrels landed near their nest and continued to alarm until the 'foreigners' left. The always-spectacular large flocks of Sooty Shearwaters flew within 50 m of Lookout Point on 28 May, a foggy, windy day. We generally see these birds in the Hecate Strait and only rarely are they this close to shore, but the dense fog may be the reason we saw hundreds of shearwaters so close to land.

Birds of Prey

Bald Eagles were the only bird of prey known to nest on Limestone Island in 2002. The eagle nest above the Spring Valley murrelet plot (BAEA-2) was active in early April and when we left camp on 7 July, a chick was large enough to be standing up in the nest. The eagle nest at Cassin's Tower all but fell down this year, although an eagle was seen sitting on the tree above the nest on several occasions. A search below this nest on Cassin's Tower in May brought the discovery of another Ancient Murrelet band in a regurgitated pellet but the bird was banded on Reef Island, not Limestone (1313-63528)!

All other eagle nests were checked during the season and were vacant (spring, Crow Valley, North cove). Painted tags (1 to 5) were nailed to all eagle trees except the active nest. Measurements were taken at nest trees this year to quantify the eagle nest sites: tree height and diameter, nest height, tree species, alive or dead, and presence of dead branches. A new nest (for us) may have been located along the southern ridge, west of the junction of the ridge trail out to Cassin's Tower. The suspected nest is in a very large live spruce (210 cm diameter) on a branch with lots of mistletoe. This last nest would bring the total number of eagle nests to 6 on Limestone Island.

Common Ravens *Corvus corax* frequently sat in the spruce trees near camp, vocalising and searching for unattended lunches on the beach. A quick visit to last year's raven nest tree in May turned up another Ancient Murrelet band, an adult banded on Limestone in 2000. This raven nest was not used in 2002 and we were unable to find their new nest, if in fact they nested this year. Charlotte Tarver remarked that the ravens were unusually quiet this year and some days, we hardly saw or heard them on the island. A Northwestern Crow pair nested under the trailing currant bushes below Cassin's Tower but we're not sure how successful it was. On 7 July, we found a dead fledgling below the nest when we put the new tag on the eagle nest tree.

There was no activity at the Peregrine Falcon *Falco peregrinus* eyrie on the south side of Limestone Island and indeed falcons were rarely heard or seen this year. Sharp-shinned Hawks were heard twice and Rob Cameron saw a Northern Harrier on Limestone Island.

Plants

Warm, dry weather in April, followed by rain in May and June created a lush and colourful array of flowers on Limestone Island. All plants in the deer exclosures were growing well, particularly the huckleberry and sword ferns. The rare plant locations were catalogued with GPS coordinates and occurrence was noted for all the plants inventoried in 1998. The cut-leafed anemone (*Anemone multifida*) and Richardson' geranium (*Geranium richardsonii*) continue to grow safely in three locations around the island. The few-flowered shooting star (*Dodacatheon pulchellum*) grows in seven cliff or wall locations and showy Jacob's ladder (*Polemonium pulcherrimum*) has still been found only near the boat cove. The marker for Menzies pipsissewa (*Chimaphila menziesii*) was accidentally removed in 1999 or 2000 and we have not found this plant again, blooming or otherwise.

Introduced Species

We surveyed the shores of Louise and the Limestone Islands twice for raccoons *Procyon lotor*. On 22 May, Charlotte and Jo found a raccoon on the eastern shore of Louise Island, very close to the large sandy beach with the old logging equipment. On 6 June, Jen Rock and Jo spotted a small raccoon on a beach facing West Limestone Island. Both surveys were done at low tide but the tidal height was not especially low (6.2' and 6.9' respectively), which may have influenced the results. No raccoons were spotted on either of the Limestone Islands, or at Vertical Point.

Mr. Yellow and Red, a collared Sitka black-tailed deer, was seen on Limestone Island from 11 April to 10 June. While he may wander the whole island, he spends a fair bit of time on the north and east sides and we spotted him 19 times. He is quite tame, feeding on spruce and grasses within 10 m of the cabin. A female deer and fawn were seen twice on the island and later a dead fawn was found in the interior of the island.

Other species

River otters were frequently spotted in Cabin Cove and on the shoreline of the island. The area near the Look-out Point was heavily used and there were many 'slides' up from the forested edge, crustacean bits and otter scat. Otters have also created a trail up from the water near where the spring drains to the beach by the cabin.

CONCLUSIONS

This year's research saw the completion of the research program of the Research Group on Introduced Species (RGIS), in which the Laskeek Bay Conservation Society was a partner. Monitoring of vegetation on Reef, Kunga and East Limestone islands will continue, probably at 2 year intervals. In addition, the Society hopes to extend part of the songbird banding programme initiated by RGIS. A conference and workshop dealing with the results of the RGIS studies, as well as other work on introduced species in Haida Gwaii, was held in Queen Charlotte City in October 2002. The proceedings of that conference will be published in 2003.

The Society's normal monitoring activities went well in 2002, despite some adverse weather. Breeding of Ancient Murrelets at East Limestone Island was typical of previous years, but the attendance of pre-breeding birds late in the season was lower than normal, reducing the number of adult birds captured by the flight nets. The paucity of pre-breeding birds visiting the colony, the apparently low success of Glaucous-winged Gulls breeding at Lost Islands, and the almost total failure of breeding by Black Oystercatchers, seemed to indicate a year of unusually low productivity for seabirds in the area.

Despite the evidence of poor conditions for seabirds in 2002, there were many sightings of large whales in Laskeek Bay, although not as many as in 2001. It appears that Humpback Whales have become more regular in Hecate Strait in spring than was true 20 years ago. A record count of Steller's Sea Lions at the Reef Island rocks suggests that the sea lion population also may be increasing in the area.

Appendix 1
Marine mammal observations in Laskeek Bay, 2002

Date	Time	Location	No.	Behaviour	SS,Wind
River otter					
06-May-02	1900	scampering up rock, Cabin Cove	1	running	-
17-May-02	1350	mist net lane near cabin	1	running from water	sun,no rain
18-May-02	1500	forest above Boat Cove, near crabapples	1	running to water	sun, no rain
20-May-02	1700	Rocks SW of boat cove	1	scampering up rocks	-
23-May-02	1835	path from cabin to tent#1	1	running	-
25-May-02	0830	front cabin, crossed steps	1	easing along	-
27-May-02	1700	N. Cove, slope between Fun1+2	1	carrying something in mouth	SE15-20
30-May-02	2050	Cabin Cove	1	eating,grunting on rocks	SE18,rough,10
16-Jun-02	1723	10m E Lookout Point	2	swimming	SS0, calm, VIS 6
25-Jun-02	1600	Cabin Cove	1	feeding and then came ashore	E 15, VIS 5
26-Jun-02	0630	Cabin Cove intertidal	2	playing	calm
26-Jun-02	0730	intertidal rocks in cabin cove	2	running to water	calm
Harbour seal					
01-Apr-02	1530	Cabin Cove	1	resting	SS2,NE5, 10 mile
02-Apr-02	1730	Cabin Cove	1	resting	SS1,NE5, 15 mile
02-Apr-02	1930	Cabin Cove	1	resting	SS1, NE5, 15 mile
04-Apr-02	1230	Cabin Cove	1	resting	SS1, NE5, 10 mile
05-Apr-02	1130	Cabin Cove	1	resting	SS2, SE10, 10 mile
06-Apr-02	1230	Cabin Cove	1	resting	SS3, S12, 10 mile
10-Apr-02	1530	Skedans Bay	1	surfing	SS1, S5, 15 mile
10-Apr-02	1545	Skedans Islands, middle	1	surfing	SS1, S5, 15 mile
20-Apr-02	1140	200mN of E side Reef	1	hanging at surface	NE5,SS2,15+
20-Apr-02	1229	Cumshewa Rocks		hauled-out	SS1,NE5, 15+
20-Apr-02	1240	Kingui Island		hauled-out	SS2,NE10+,15
22-Apr-02	2115	Boat Cove	1	resting	SS1,calm,15+
12-May-02	1440	Cumshewa Rocks	4	hauled-out	SS2,SE5,VIS 15

12-May-02	1442	Cumshewa Island	1	in water	SS2,SE8,VIS 15
12-May-02	1520	Skedans Bay	1	swimming	SS0,SE2,VIS 15
24-May-02	1530	Skedans Island, N	25	hauled-out,then water	SS0,SE5, 15
28-May-02	1430	Cabin Cove	1	-	S25,very rough,8
03-Jun-02	2100	100m W of ELI	1	-	SE15,SS3,5
04-Jun-02	0815	5m off rocks Cabin Cove	1	-	SW05,SS1,VIS 15
08-Jun-02	1122	2m off rocks, Cabin Cove	2	feeding	SS1, gentle,VIS 15
21-Jun-02	2315	Cabin Cove	1		calm, VIS 15
22-Jun-02	2150	Cabin Cove	1	swimming and looking about	SS1, calm, VIS 3
26-Jun-02	2115	Reef Island, boat cove	1	resting on kelp	SS0, calm, VIS >15
27-Jun-02	0650	Skedans Island, west	30	hauled out	calm, SS0, VIS 15
27-Jun-02	1400	Skedans Islands, middle	25	hauled out	calm, SE 15, VIS 15
02-Jul-02	1500	Lost Islands, hauled out		hauled out	
03-Jul-02	2115	Cabin Cove	1	traveling	SS1, calm, VIS 15
03-Jul-02	0955	Cumshewa Rocks	15	hauled out	SS2, calm, VIS 15
03-Jul-02	1030	Kingui Island	98	haul out	SS2, calm, VIS 15
03-Jul-02	1355	between S. Low and Skedans Is.	1	traveling Seast	SS0, calm, VIS 15
03-Jul-02	1420	W. Skedans Islet	35	hauled out	SS0, calm, VIS 15

Steller's sea lion

01-Apr-02	1400	100m E of ELI	1	traveling S	SS2,NE10, 10 mile
07-Apr-02	1800	400m E of ELI	1	going S	SS2, NE8, 15 mile
10-Apr-02	1550	Skedans haul-out	173	haul out	SS1,S5, 15 mile
10-Apr-02	1555	Reef Island haul-out	888	haul out	SS1,S5, 15 mile
14-Apr-02	0930	100m E of ELI	1	traveling S	NE15,SS3, 10 mile
20-Apr-02	1127	Reef Island haul-out	542	hauled-out	-
20-Apr-02	1215	Skedans haul-out	156	hauled-out	SS1,calm,15+
04-May-02	1045	15m from NW Nwest Pt of ELI	3	at surface still	NW10,SS2,15
12-May-02	1315	Reef Island haul-out	200	hauled-out	SS1,SE5,VIS 15
12-May-02	1421	Skedans haul-out	15	hauled-out	SS1,SE5,VIS 15
24-May-02	1300	Reef Island haul-out	590	resting	SS0,calm, 15
24-May-02	1520	Skedans Islands	1	hauled-out high on rock	SS0,SE5, 15

16-Jun-02	1326	Cabin Cove	1	fishing	SS0, calm, VIS 12
18-Jun-02	1130	Cabin Cove	1	swimming in kelp	SS0, calm, VIS 15
21-Jun-02	2300	100m E of ELI	1	traveling S	calm, VIS 15
25-Jun-02	1020	between ELI and WLI	2	swimming and looking about	SS0, calm, VIS 3
02-Jul-02	1830	Reef Island haul-out		hauled out	
03-Jul-02	0900	15m S of Low I.	1	swimming	SS2, calm, VIS 15
Pacific white-sided dolphin					
20-Apr-02	1148	1.5nm N of Reef Island	10	traveling S	SS2,NE5, 15+
20-May-02	2000	between Low + cabin cove	6	feeding	SS1,calm,15 mile
30-Jun-02	2200	200m N of Reef Island, in middle	6	traveling, bow-riding	SS2, calm, VIS 10
Harbour porpoise					
18-Apr-02	0915	200m East of Cabin Cove	1	traveling S	VAR light
19-Apr-02	1600	N of Low I, .5 way out	1	traveling S	VAR light,SS1, 15 mile
19-Apr-02	1730	400m E of ELI	2	traveling S	calm,calm, 15+
19-Apr-02	2015	100m E of ELI	2	traveling S	calm,0wind,15+
21-Apr-02	1930	250m east ELI	1	going N	SS2,NE10,15+
24-Apr-02	1330	200m East of Cabin Cove	1	going N,S,N	SS1,SE5,15+
07-May-02	1910	100m E of ELI	3	feeding	NS1,calm,15
22-May-02	2040	2nm SE of Cabin Cove	3	feeding	SS0,calm,15
13-Jun-02	2130	Cabin Cove	1	traveling N	SS0, calm, VIS 15
14-Jun-02	1334	500m West of Low Island	1	feeding	SS0, light, VIS 15
16-Jun-02	1326	Cabin Cove	2	fishing	SS0, calm, VIS 12
17-Jun-02	2125	Cabin Cove	2	traveling N	SS1, calm, VIS 15
03-Jul-02	1350	100m S of S. Low I.	1	traveling S	SS0, calm, VIS 15
Dall's porpoise					
01-May-02	1530	500m	25	-	-
12-May-02	1645	400m N of Kingsway Rock	3	swimming	SS1,SE5,VIS 15
16-Jun-02	1705	500m S of Lookout point	1	feeding	SS0, calm,VIS 6
Orca					
07-Apr-02	1230	west of low Island	5	traveling S	SS3, SE12, 15 mile

07-Apr-02	1315	100m E of ELI	3	traveling S	SS2, SE10, 15 mile
07-Apr-02	1430	E of Heming Head	9	traveling S	SS2, SE8, 15 mile
12-May-02	1310	Reef Island haul-out	3	hunting	SS1,SE5,VIS 15
05-Jul-02	1530	ELI - Louise - Reef	9	hunting? Traveling west and S	SS2, SW10, VIS15
Humpback whale					
19-Apr-02	2000	E of Heming Head	1	traveling east	calm,0wind,15+
05-May-02	1130	100m S of S.Low	3	traveling N	NW15,SS3-4,12+
18-May-02	1730	Louise Is.shore, N of ELI	2	feeding	SS2,SE10,VIS 13
19-May-02	0030	ELI shore, N and E	1	-	SS1,NE2, 0 VIS
19-May-02	0930	100m E of ELI	1	feeding off kelp	SS1,NE5,15 miles
19-May-02	1000	200m East of Cabin Cove	2	going N, feeding	SS1,NE5,15 mile
20-May-02	1300	200m East of Cabin Cove	1	feeding	SS1,NE5,10 mile
20-May-02	1315	200m East of Cabin Cove	2	feeding	SS1,NE5, 10 mile 12
21-May-02	0030	ELI shore, N and E	2	feeding	SS0,calm,dark
22-May-02	2030	offshore N of Low, 10 miles	2	tail + fin slaps	SS0,calm, 15
23-May-02	0050	50m N of ELI	-	feeding	SS0,calm, 15
23-May-02	0600	200m East of Cabin Cove	1	feeding	SS0,calm,15
23-May-02	2045	3nm NE of Cabin Cove, off Low I.	2	feeding	SS0,calm,15
24-May-02	1400	2mELow-reef+skedans	10	feeding	SS0,SE5, 15
25-May-02	1130	1 nm N of ELI, towards Skedans Is.	1	feeding	SS3,SE15,15
25-May-02	1930	S+E Low Is. 1 mile	1	blow	SE15,SS4,10
07-Jun-02	0600	at edge of kelp off Cabin Cove	1	traveling S, blow	NW 5, SSO, VIS 15
07-Jun-02	1830	50m East of Cabin Cove	1	traveling S, blow	NE 07, SS1, VIS 15
07-Jun-02	2115	offshore, N of Low 1 mile	1	blowing	SS1, calm, VIS 15
09-Jun-02	1140	Kingui Island	1	feeding	SS0, calm, VIS 15
21-Jun-02	1100	1nm E of ELI	1	traveling S	SS3, SE 10-15, VIS 15

21-Jun-02	1600	200m East of Cabin Cove	1	diving and feeding	SS3, SE 10-15, VIS 15
25-Jun-02	0920	50m west ELI, at boat cove	1	swimming and blowing	SS0, calm, VIS 3
25-Jun-02	1100	S of Skedans village	1	swimming and blowing	SS0, E 15, VIS 3
27-Jun-02	0645	Skedans Island, N	1	feeding	calm, SS0, VIS 15
29-Jun-02	1720	100m E of ELI	1	close to shore, swimming	SS4, S20, VIS 5
30-Jun-02	0920	100m E of ELI	1	resting	SS2, calm, VIS 15
01-Jul-02	2100	100m E of ELI	1	feeding, traveling N	SS2, S10, VIS 10
03-Jul-02	1030	100m E of ELI	1	traveling S	
03-Jul-02	0940	250m N of Skedans Is.	1	traveling N	SS2, calm, VIS 15
04-Jul-02	0930	100m S of Vertical Pt campsite, Louise I.	2	feeding	SS1, calm, VIS 15
04-Jul-02	2105	50m E of ELI (cabin cove)	1	feeding	SS2, calm, VIS 15
Grey whale					
14-Apr-02	1615	1.75 nm East of Cabin Cove	2	traveling N	VAR12,SS4, 15 mile

NORTHERN SAW-WHET OWL NEST ON EAST LIMESTONE ISLAND

Charlotte Tarver
Laskeek Bay Conservation Society, Box 867, Queen Charlotte City, BC, V0T 1S0

The nest

A Northern Saw-whet Owl *Aegolius acadicus brooksi* nest found on East Limestone Island on 27 June 2001 is the first documented record of a nest site for this non-migratory sub-species restricted to the Haida Gwaii archipelago (S. Sealy and Rolf Krahe, personal communication). Although common throughout its range, there may be only a few records of potential nest sites of *A. a. brooksi* on Haida Gwaii (Campbell et al. 1990).

The nest was in a Sitka spruce *Picea sitchensis* snag, classified as Category 5 under the British Columbia Wildlife Tree Classification System (no bark, decayed heartwood, dead for at least 15 years). The tree was situated alongside a well-traveled trail, next to a small creek and was on the edge of the shore, 15 m from a small cabin. The snag, Wildlife Tree 1 (WT 1) measured 15 m high with a diameter of 130 cm. The nest entrance was 9 m above ground and the hole was 78 mm tall by 74 mm wide. The cavity extended back 18 cm and was 30 cm deep. The cavity was used by Northern Flickers *Colaptes auratus* in 1992.

In 2001, saw-whet calls were first heard on 5 May, (about one month later than recorded in previous years) and continued nightly until 15 June. The owl roosted in a tree near the top of Spring Valley, and emitted a constant "advertising" call (see Cannings 1993) from dusk to dawn. These calls were clearly audible from North Cove and in the cabin area.

From 2 - 15 June, an owl would frequent the area near the cabin, calling from trees to the south, west, and north sides of the cabin. During the week of 8 to 15 June, on three occasions, we saw a Saw-whet Owl sitting on a small spruce (20 cm diameter) at dusk directly in front of the cabin, only 3 m from the door. The owl would sit on a branch (3.5 m high.) quietly and not appear disturbed by our presence. On several occasions between 15 and 29 June, an owl flew into the cabin area and headed towards WT 1. On the evening of 27 June, an owl flew towards WT 1 and landed below the old Northern Flicker nest cavity (J. Fournier, personal communication). From that date until camp closure on 27 July, WT 1 was observed daily.

Behavior and activities after June 27

Once we determined the location of the nest, we made daily observations of the nest site, recording activities in the evenings and during the day. We observed a male owl coming to the nest with prey, a female calling from within the nest, chicks calling, both adults on the tree, the feeding of a female and chicks, and heard three distinct calls: a visiting call, a female response and a chick begging call.

When the male came into the nest area, he would make a "visiting" call as he approached. A female within the nest would give a "response" call (soft tsst, tsst, tsst). The male then would fly to WT 1, often with prey, briefly stick his head inside the cavity, then immediately fly off. On 2 July, the male landed on the nest tree with prey in his talons (possibly a deer mouse) and we heard young chicks peeping inside the cavity. On 3 July, a female was looking out of the nest hole at 2100 h. The next day, the female left the nest at 2230 h, whilst the male was calling nearby. On 7 July, an owl (probably female) left the nest cavity during the late afternoon and flew away into the forest. The next day, 8 July, an owl stuck its head out of the nest, flew out and sat on a nearby tree then returned into the nest hole at 1700 h.

Both male and female owls seemed undisturbed by human presence, as evidenced by several observations of the female watching people walk by, or when the male would perch on the tree in front of the cabin or sit in the regenerated Spruce trees surrounding the nest tree. A chick stuck its head out of the nest on 20 and 21 July. We noticed that whenever the male would sit in the regenerated spruce trees in the early

evenings, Hermit Thrush and Winter Wrens would give alarm calls and on 14 July, Winter Wrens were dive-bombing the unfazed owl sitting on a small spruce near the nest site.

Camp closed on 27 July with the chick(s) still remaining in the nest cavity. On 1 August, I returned to Limestone for a short visit, checked the nest and did not hear, or see any owls, eggshells or pellets in the area around the nest tree.

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Appendix 1
Field notes for the activity of the first Northern Saw-whet Owl nest on East Limestone Island, 2001

5 May, 22.00 - Calling throughout night from Spring Valley area
7-31 May, 22.00 - "Advertising call" continuous dusk to dawn
7 June – 23 July, Various hours - Calling, visuals and nesting activity in area of cabin
12 June, 21.00 - Adult on spruce tree branch (3.5 m ht.) in front of cabin (3m from door), flew to tree on north side of cabin (2.7 m from cabin)
13 June, 21.00 - Adult on spruce tree branch in front of cabin
16 June, 20.30 - Adult on spruce tree branch in front of cabin
20 June, 21.00 - Adult flying to and from cabin area, some 'visiting' calls
22 June, 21.15 - Adult heard calling near cabin
26 June, 2200 - Adult flying to and from North side of WT 1
27 June, 2130 - Female looking out from nest hole on WT 1 (north side) male flew in 3 times, entered hole, prey in talons; gave "visiting" calls as it approached nest area
2 July, 21.45 - Male flew into nest cavity with prey, loud peeping of young inside nest hole, exited and perched on tree with head inside, then flew off
3 July, 21.00 - Female looking out of nest hole
4 July, 22.15 - Male calling softly and gently (visiting call) from regenerating spruce on west side of WT 1; female left nest at 22.30
5 July, 17.45 - Male "visiting" call from tree behind cabin, flew onto nest tree with prey, other bird inside took prey
7 July, 21.00 - Adult left nest cavity, flew away to SW of cabin
8 July, 17.00 - Female exited nest, than sat on close by tree, then re-entered cavity
12 July, 16.30 - Female stuck head out of hole and watched JF walk by on trail
13 July, 14.00 - Male left nest (after feeding?), flew over regeneration area, Winter Wren in regeneration, excited, loud alarm calls; 21.00 - Male in spruce in front of cabin, flew to WT 1 w/prey in talons, head into cavity, then flew to nearby small tree in regeneration area, perched there for 7 minutes, Winter Wren alarm calling and pestered owl by flying at it
14 July, 2100 - Male perched in spruce in front of cabin with prey, flew to nest hole, then into regenerating spruce and perched on branch overhanging trail at 3m ht., looking at observers and ignoring 2 Winter Wrens "buzzing" him
15 July, 20.30 - Adult and chick calling from within cavity
15 July, 22.30 - Adult "visiting" call as approached nest with prey, flew in to tree, then departed
17 July, 15.30 - Adult at WT 1, then perched in regeneration with Winter Wren and Hermit Thrush alarm calls and diving on owl
18 July, 14.30 - Adult feeding chick(s) within nest cavity
19 July, 21.00 - Chick looking out of nest hole
20 July, 15.00 - Chick looking out of nest hole; 20.30 - Adult feeding young in nest hole

21 July, 13.00 - Chick looking out of nest hole
22 July 22, 14.00 - Chick looking out of nest hole
23 July 23, 11.00 - Adult brought prey to nest and fed chick(s); 11.15 - Adult brought prey to nest and fed chick(s) (possibly second adult?); 20.00 - Chick looking out of nest hole
24 July 24, 15.00 - Chick looking out of nest hole; 22.30 - Adult gave “visiting” call and flew to nest tree with prey, observed feeding chick, chick peeping loudly.

RARE PLANTS ON EAST LIMESTONE ISLAND: A FOUR-YEAR UPDATE

Joanna L. Smith[1]
Laskeek Bay Conservation Society, Box 867, Queen Charlotte, BC V0T 1S0

With its distinctive limestone bedrock, East Limestone Island is home to many interesting plants. In 1998, a vascular plant checklist was published for East Limestone Island, with an emphasis on the occurrence of rare or uncommon species (Smith and Buttler 1999). Most of the rare plants occur in small numbers (< 20 individuals) on cliffs, overhangs, or rock faces that are inaccessible to the introduced Sitka black-tailed deer. The Laskeek Bay Conservation Society tracks the persistence of rare plants to assess the long-term effects of the black-tailed deer and maintain a floral record for the island.

To update the previous inventory and to record the specific locations of the rare plants for future surveys, known sites were visited in June- July 2002 and plants were noted as present or absent. At each site, the exact coordinates (using GPS) were recorded (Figure 1, Table 1). All but three rare plants inventoried in 1998 were still present in 2002 (Table 2). The three species not found, Rattlesnake plantain, *Goodyera oblongifolia* (site M), Menzies' pipsissewa, *Chimaphila menziesii* (site N), and broad-petalled gentian, *Gentiana platypetala* (site K), grow in areas more accessible to deer than the other rare species (i.e. interior forest and open rock). A second effort to locate rattlesnake plantain on Limestone Island was also unsuccessful (S. Stockton, pers. comm). The introduced wall lettuce, *Lactuca muralis*, still occurs on Limestone Island but it is not yet widespread. And finally, a new location for Richardson's geranium, *Geranium richardsonii*, was found on the northwest tip of the island (site F).

Two species of plants on Limestone island, the cut-leafed anemone, *Anemone multifida*, and Richardson's geranium are restricted in Haida Gwaii to this location (Calder and Taylor 1968). Many other species have a limited distribution in the archipelago. The long-term protection of these habitats is important and a regular inventory of these species will aid in tracking short-term changes in their populations.

ACKNOWLEDGMENTS

Many thanks to Charlotte Tarver, Jenny Rock, Rod Gee and Theresa Burg for helping with the plant inventory and mapping (29 June and 7 July 2002).

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[1] Current address: School of Aquatic and Fishery Sciences, University of Washington, Box 355020, Seattle, WA 98195

Figure 1.
Locations of rare plants on Limestone Island 2002 (see Table 1). Map is not to scale.

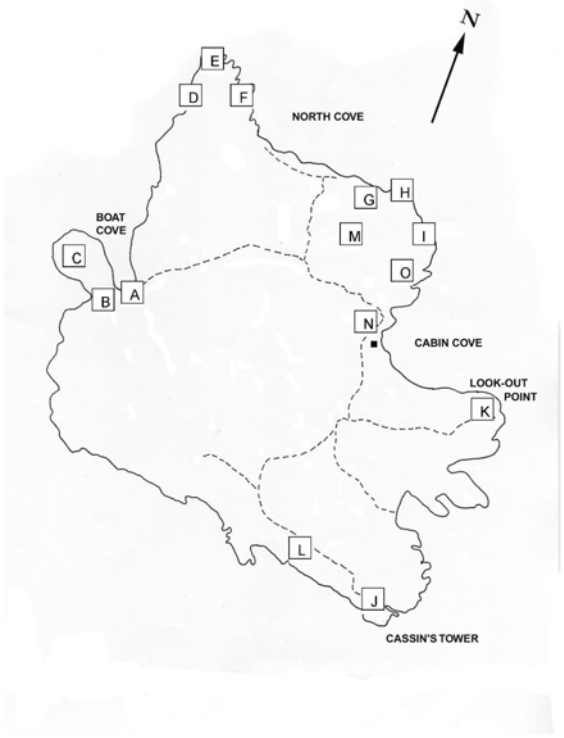

Table 1.
Locations of rare plants on East Limestone Island (see Fig. 1)

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

Table 2
Updated inventory of rare plants on Limestone Island 2002 (see Smith and Buttler 1999).

Site	Species	Common name	Present
A,B,F	*Anemone multifida*	cut-leafed anemone	v
A-C,K	*Aquilegia formosa*	red columbine	v
A	*Chaemecyparis nootkatensis*	yellow cedar	v
A	*Polemonium pulcherrimum*	showy Jacob's ladder	v
B,D,E	*Amelanchier alnifolia*	Saskatoon berry	v
B,D,E,G,K	*Dodecatheon pulchellum*	few-flowered shooting star	v
B,G,K	*Fritillaria camschatcensis*	northern rice root	v
B	*Lactuca muralis*	wall lettuce (introduced)	v
C,I,J	*Castilleja unalaschcensis*	Unalaskan paintbrush	v
D-E	*Fragaria chiloensis*	coastal strawberry	v
D-E	*Rosa nutkana*	Nootka rose	v
E,F,I	*Rumex crispus*	curled dock	v
F,H,I	*Geranium richardsonii*	Richardson's geranium	v
H	*Minuartia tenella*	slender sandwort	v
J-L	*Prunella vulgaris*	self heal	v
J	*Rosa nutkana*	Nootka rose	v
J	*Sisyrinchium littorale*	shore blue-eyed grass	v
K	*Gentiana platypetala*	Broad-petalled gentian	X
M	*Goodyera oblongifolia*	rattlesnake plantain	X
N, O	*Chimaphila menziesii*	Menzies' pipsissewa	X

LICHENS OF EAST LIMESTONE ISLAND: THE FIRST CHECKLIST

Robert Cameron
Nova Scotia Dept. of Environment and Labour, Protected Areas Branch, PO Box 697, Halifax, NS B3J 2T8

and
Joanna L. Smith[1]
Laskeek Bay Conservation Society, Box 867, Queen Charlotte, BC V0T 1S0

ABSTRACT

The Limestone Islands, Haida Gwaii (Queen Charlotte Islands), support a rich plant community owing to their unique geology and geographic location. Lichens are an integral and ecologically important component of old-growth forests, and some of the species are uncommon. In this paper, we describe the lichen flora of East Limestone Island and provide a preliminary checklist. We identified 45 species, mostly foliose and fruticose lichens; we did not attempt to document all encrusting species. Nearly 80% of the species were found in forest. Nine species were categorised as rare on the island, with some classified elsewhere as "ancient forest" species. This study is the first step towards an inventory of lichens on Limestone Island and we encourage others to add to the checklist.

INTRODUCTION AND METHODS

The Queen Charlotte Islands archipelago is home to many species of rare plants, including several endemics (Calder and Taylor 1968). The presence of limestone on East Limestone Island, as elsewhere on Haida Gwaii, suggests the likely occurrence of rare plants, (Roemer and Ogilvie 1983). In 1997, East Limestone Island was surveyed for vascular plants, especially less abundant taxa (Smith and Buttler 1998) and several species of lichens were collected and identified. However, no attempt was made to document all lichen species on the Island.

East Limestone Island is part of the North American temperate rain forest where there is abundant air moisture for lichen growth. In addition, the Pacific Ocean provides plants with airborne nutrients from salt spray. Limestone Island's distinctive geology and geographic position, with minimal human disturbance and virtually no sources of pollution, suggests a high lichen diversity. Some lichen species only occur, or are abundant on, basic substrates such as limestone (Brodo *et al*. 2001) and like most vascular plants, many lichens are sensitive to pH.

Some species of lichens will grow on a variety of substrates, but most are found on specific surfaces or habitats. As such, lichens can be categorized based on the substrate where they grow (i.e., corticolous [on bark], lignicolous [on wood], saxicolous [on rock] and terricolous [on soil]).

The purpose of this study was to develop a checklist of lichens on East Limestone Island (52˚ 55' N 131_36' W) and assess each species for relative abundance. Extensive documentation, collection and identification of lichens on the Island was done by R. Cameron in the spring of 2001 and 2002. A rarity assessment for each species was based on

[1] Current address: School of Aquatic and Fishery Sciences, University of Washington,Box 355020, Seattle, WA 98195

methods outlined by Smith and Buttler (1998). Species were characterised by growth form, substrate, geographic affinity and habitat (from Brodo *et al.* 2001, Goward *et al.* 1994, Goward 1999). All fruticose [shrub or club-shaped] and foliose [leaf-shaped] species found were identified. Some crustose species were identified, but no attempt was made to document all crustose species. Nomenclature for the species list follows Goward *et al.* (1994) and Goward (1999).

RESULTS AND DISCUSSION

We identified 45 species of lichen on East Limestone Island in 2001 and 2002 (Table 1). Of these, 19 were fruticose and 18 were foliose growth forms. Most lichens occurred in forest (80% or 36 species), with 14 species occurring most often, or exclusively, in coniferous forests. Twenty-three species occurred in either deciduous or coniferous forests and no lichens were considered to be exclusively deciduous forest species.

Substrate

In terms of substrate category, the greatest number of species occurred on bark (69% or 30 species). Almost half of these species are known to occur on coniferous trees, the dominant tree type on Limestone Island. The remaining corticolous species (16) are usually found on either deciduous or coniferous trees, and in this study grew mostly on coniferous trees. Only one species that was found, *Ramalina menziesii*, occurs most often on deciduous trees (Goward 1999), however this species occurs frequently on conifers on Haida Gwaii (J. Pojar, pers.comm.).

We found four species that were classified as strictly lignicolous [on wood]. *Xylographa abietina* was found growing on well dried, hardened wood, while *Icmadophila ericetorum* and *Cladonia umbricola* were on very moist, well-rotted wood (*see* Brodo *et al.* 2001). *Calicium abietinum* grew on a dry, standing dead western redcedar (*Thuja plicata*) on East Limestone Island, but this species can be found on a variety of substrates (Goward 1999). The other lignicolous species occurred on dead wood but were not restricted to this substrate.

Three saxicolous taxa [on rock] were identified on Limestone Island: *Parmelia saxatilis*, *Pilophorus acicularis* and *Leparia* spp. *P. saxatilis* was found growing on rocks but can occasionally be found on bark or wood (Brodo et al. 2001). *Leparia* spp. will grow on a variety of substrates, depending on the species: on East Limestone Island, they were found on rock, wood and bark. *Pilophorus acicularis* was found almost entirely on rocks in open areas, which is typical for this species (Goward 1999).

Nine terricolous [on soil] taxa were identified: four species of *Peltigera* and five species of *Cladonia. Peltigera*s grew in forested habitats and elsewhere occurs mostly in humid forests on damp moss, soil or tree bases (Hale 1979). Most *Cladonia* species, with the exception of *C. umbricola*, are found in a variety of soil types from dry soil to damp moss (Hale 1979).

Biogeography

East Limestone Island supports coastal temperate rain forest and phytogeographic affinities of lichens found there largely reflect these conditions. About one third of the species identified in this study have a western, coastal distribution while another third are distributed more or less across North America. Ten species (22%) have general coastal affinities, found either on the west or east coast of North America. Only two species, *Cladonia bellidiflora* and *Usnea subfloridana*, have a boreal distribution (Brodo *et al.* 2001).

Rarity

Judging the abundance of lichens can be problematic. For some species, identification is fairly obvious and relative abundance can be determined with as much accuracy as vascular plants. However, other species cannot be distinguished except by careful examination or chemical tests. Therefore determining more than one occurrence for some species is either an educated guess or extremely time consuming. This needs to be considered when examining our rarity assignments.

Seven species were rated as rare for East Limestone Island (Table 1). *Peltigera degenii* was rare on East Limestone Island and is also considered a rare forest species by Brodo et al. (2001). None of the species that we found to be

rare on East Limestone Island are classified as rare in the province (Goward 1996) or Canada (Goward et al.1998). In the inland rainforests of British Columbia, several of the species we found are considered "ancient forest" species and are relatively uncommon in B.C. (Goward 1994, Selva 1994, Rose 1976). Included in this group are *Calicium abietinum, Hypogymnia tubulosa, Lobaria oregana, Lobaria pulmonaria, Ramalina thrausta, Sphaerophorus globosus* and *Usnea longissima.* However, Goward (1999) and Goward et al. (1994) suggest that *Lobaria oregana, Ramalina thrausta, Sphaerophorus globosus* and *Usnea longissima* are common on Canada's west coast.

ACKNOWLEDGMENTS

We thank Mary Morris, Josina Davis and Dr. Irwin (Ernie) Brodo (Canadian Museum of Nature) for their assistance in finding, collecting and identifying lichens on Limestone Island during 1997-2000. We also thank Jim Pojar for reviewing this paper and providing many helpful comments. This checklist was undertaken with the assistance of the Laskeek Bay Conservation Society research and volunteer program and we thank the Directors for supporting this project.

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Table 1.
Preliminary checklist of lichens of East Limestone Island with abundance rating, growth form, substrate, phytogeographic affinities and habitat.

SPECIES	ABUNDANCE	GROWTH FORM	SUBSTRATE	PHYTO-GEOGRAPHY	HABITAT
Alectoria sarmentosa ssp. sarmentosa	4. common	Fruticose	on bark	coastal	conifer forest
Bryoria capillaris	1. rare	Fruticose	on bark	North American	conifer forest
Buellia punctata	4. common	Crustose	on bark	North America	forest
Calicium abietinum	1. rare	Fruticose/crustose	on wood	North America	forest
Chrysothrix candelaris	3. occasional	Crustose	on bark	North America	conifer forest
Cladonia bellidiflora	3. occasional	Fruticose	on soil	boreal	open/forest
Cladonia furcata	3. occasional	Fruticose	on soil	coastal	open/forest
Cladonia macilenta	3. occasional	Fruticose	on soil	North America	open/forest
Cladonia squamosa	1. rare	Fruticose	on soil	North America	forest
Cladonia umbricola	3. occasional	Fruticose	on wood	west coastal	forest
Hypogymnia apinnata	1.rare	Foliose	on bark	west coastal	conifer forest
Hypogymnia enteromorpha	4. common	Foliose	on bark	west coastal	conifer forest
Hypogymnia tubulosa	1.rare	Foliose	on bark	coastal	conifer forest
Icmadophila ericetorum	3. occasional	Crustose	on wood	North America	forest
Lepraria spp.	4. common	Crustose	on bark/ on rock	North America	forest
Lobaria oregana	4. common	Foliose	on bark	west coastal	conifer forest
Lobaria pulmonaria	4. common	Foliose	on bark	coastal	forest
Mycoblastus sanguinarius	2. uncommon	Crustose	on bark	North America	conifer forest
Parmelia hygrophila	2. uncommon	Foliose	on bark	west coastal	forest
Parmelia saxatilis	4. common	Foliose	saxicolous	North America	open/forest
Parmelia squarrosa	3. occasional	Foliose	on bark	coastal	forest
Parmelia sulcata	4. common	Foliose	on bark	North America	forest
Peltigera britannica	1. rare	Foliose	on soil	west coastal	forest
Peltigera degenii	1. rare	Foliose	on soil	North America	forest
Peltigera membranacea	3. occassional	Foliose	on soil	coastal	open/forest
Peltigera neopolydactyla	5. abundant	Foliose	on soil	North America	conifer forest
Pilophorus acicularis	1. rare	Fruticose	on rock	west coastal	open
Platismatia glauca	4. common	Foliose	on bark	North America	conifer forest
Platismatia herrei	3. occasional	Foliose	on bark	west coastal	conifer forest
Platismatia lacunosa	2. uncommon	Foliose	on bark	west coastal	forest
Platismatia norvegica	5. abundant	Foliose	on bark	coastal	forest

Pseudocyphellaria anomala	2. uncommon	Foliose	on bark	west coastal	forest
Pseudocyphellaria anthraspis	2. uncommon	Foliose	on bark	west coastal	forest
Ramalina dilacerata	4. common	Fruticose	on bark	North America	forest
Ramalina farinacea	4. common	Fruticose	on bark	coastal	forest
Ramalina menziesii	1. rare	Fruticose	on bark	west coastal	forest
Ramalina roesleri	2. uncommon	Fruticose	on bark	coastal	forest
Ramalina thrausta	5. abundant	Fruticose	on bark	North America	conifer forest
Sphaerophorus globosus	2. uncommon	Fruticose	on bark	North America	conifer forest
Usnea chaetophora	4. common	Fruticose	on bark	west coastal	conifer forest
Usnea longissima	3. occasional	Fruticose	on bark	coastal	forest
Usnea madeirensis	3. occasional	Fruticose	on bark	west coastal	forest
Usnea subfloridana	3. occasional	Fruticose	on bark	boreal	forest
Usnea wirthii	3. occasional	Fruticose	on bark	west coastal	forest
Xylographa abietina	2. uncommon	Crustose	on wood	North America	open/forest

BREEDING RECORDS OF BIRDS OF PREY ON EAST LIMESTONE ISLAND SINCE 1990

Joanna L. Smith[1]
Laskeek Bay Conservation Society, Box 867, Queen Charlotte, BC V0T 1S0

ABSTRACT

The nesting activity of eagles, falcons, ravens and owls has been studied on Limestone Island since 1990. Annual surveys have recorded nest activities, locations and species occurrences. In 2002, all known nest trees were measured and previous breeding records compiled. A total of 10 nests from five species have been located on the island, with nesting density as high as 1pair per 12 ha in some years. As many as four species have nested successfully in one year. All nests (except falcons) were built in Sitka spruce trees and most were either adjacent to or within the Ancient Murrelet colony. There are five bald eagles nests on the island, and at least one was active in all but three years. Peregrine Falcons were known to nest on the island for seven years, producing at least one chick in all active years. The concentration of Ancient Murrelets breeding on the island provide a predictable food supply for these birds and may explain the diversity and density of their nests.

INTRODUCTION

Birds of prey are conspicuous members of the bird community in Haida Gwaii (Queen Charlotte Islands). Several species, like falcons and eagles, rely heavily on seabirds, for example Ancient Murrelets *Synthliboramphus antiquus*, during their breeding season (Nelson 1990, Vermeer et al 1984, Gaston 1992). Nesting records of predatory birds have been collected in many parts of Haida Gwaii, including a long-term study of Peale's Peregrine Falcon *Falco peregrinus pealei* on Langara Island (Nelson and Myres 1976) and a comprehensive report of marine raptors nesting within the entire archipelago (see Harfenist et al. 2002). On East Limestone Island, the Laskeek Bay Conservation Society has recorded breeding records of eagles, falcons, owls and ravens since 1990.

Bald eagles *Haliaeetus leucocephalus* are a common resident of Haida Gwaii and populations are relatively dense (Campbell et al 1990). Eagles generally nest near the ocean, often building very large structures. Nests can be up to 6 m across and weigh as much as 1 tonne. Although much less common than eagles, the concentration of Peale's Peregrine Falcons in the province is highest in Haida Gwaii (Campbell et al 1990). Ancient Murrelets dominate their diet during the breeding season and adult carcasses can be seen on the ledges outside their eyries (C. French, pers. comm.). British Columbia has 75% of the population of this coastal sub-species and because poaching is a conservation concern for all falcons, specific nesting locations are generally not published (Harfenist et al 2002).

[1] Present address: School of Aquatic and Fishery Sciences, University of Washington, Box 355020, Seattle, WA 98103, josmith@u.washington.edu

Less common than both falcons and eagles, Northern Saw-whet Owls *Aegolius acadicus brooksi* are an uncommon resident of Haida Gwaii. There are as many as five breeding records for this species (Campbell et al 1990), including one for Limestone Island (Tarver 2002). Adult Saw-whet Owls are small (~ 100g) and feed on invertebrates, small mammals and birds, including Ancient Murrelet chicks. Owing to their secretive and nocturnal habit, courtship and territorial calling is often the only indication of their presence.

Finally, Common Ravens *Corvus corax* are a common resident of Haida Gwaii. Their diet includes both Ancient Murrelets and marine invertebrates. There are currently only eight published nest records for Haida Gwaii (Campbell et al 1997).

The purpose of this paper was to compile and summarise the nesting records of eagles, falcons, owls and ravens on Limestone Island since 1990.

METHODS

East Limestone Island is a 48 ha island in Laskeek Bay, supporting approximately 1,200 breeding pairs of Ancient Murrelets. Most of the island is forested with mature Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*) and red alder (*Alnus rubra*). This forest is typical of other late succession old growth stands, with gaps forming primarily from windthrow and decay.

Beginning in 1990, staff and volunteers of Laskeek Bay Conservation Society recorded the presence and absence of avian predators of Ancient Murrelets on East Limestone Island. Up to three methods were used to note the activity of these birds: checks of known, or suspected, nest trees; completion of daily bird checklists; and annual island-wide nest searches. The nest summaries presented here were compiled from annual Field Season Reports (1990-2002), Science Reports (1990-2001), and natural history notes recorded by staff and volunteers on the island. All nest trees were measured in 2002 for tree height, diameter and if visible from the ground, nest height.

RESULTS

In all years, at least one, and at most four, bird-of-prey species have nested on Limestone Island (Table 1). Bald eagles were the most common breeder (nesting in all seasons except 1996-1998) followed by falcons, ravens and saw-whet owls. Sharp-shinned Hawks *Accipiter striatus*, which prey mainly on small songbirds, have also nested four times on Limestone Island. All species except Sharp-shinned Hawks were observed on the island each year, regardless of nest confirmation.

In 2002, there were five eagle nests on Limestone Island, possibly six (Figure 1). On average, each eagle nest was used 3 times in 13 years (range 1-5) with an average of 1 active nest per year (range 0-2) (Table 2). All nests were built in Sitka spruce trees with an average height of 30.7 m (range 16-45m) and diameter at breast height of 143 cm (range 95-223 cm) (Table 3). Average nest height was 24.5 m (range 8-36 m). Nests were built at the top (n=2), middle (n=2) or two-thirds of the way up (n=1) dead and live trees. Four nests were more than 10 m from the forested edge and one nest was in a tree on a tall, rock outcrop on an exposed southeast shore. A sixth nest may be in a large tree (227 cm diameter and ca. 40 m high) near an unmarked trail. Dense mistletoe obscures a view of the trunk but birds behaved and vocalised in patterns typical of other active Bald Eagle nests on the island (J. Smith pers. obs).

Table 1
Birds-of-prey nesting on East Limestone Island 1990-2002.
Legend: A-adults seen/heard on nest, no chicks observed, Ac-adults and chicks seen/heard at nest, Y-adults present on island, blank-no data.

Year	Bald Eagle	Peregrine Falcon	Northern Saw-whet Owl	Common Raven	Sharp-shinned Hawk
1990	A	Ac		Ac	
1991	A	Ac	Y	Y	
1992	A	Y	Y	Ac	
1993	Ac	Ac	Y	A	
1994	Ac, Ac	Ac	Y	Ac	
1995	Ac, Ac	Y	Y	Y	
1996	Y	Ac	Y	Y	
1997	Y	Ac	Y	Y	Ac
1998	Y	Ac	Y	Y	Ac
1999	Ac, A	Y	Y	Y	A
2000	Ac	Y	Y	Y	Y
2001	Ac	Y	A	Ac	A?
2002	Ac	Y	Y	Y	Y

Table 2
Bald Eagle (BAEA) nest activity 1990-2002.
Legend: A-adults seen/heard on nest, no chicks observed, Ac-adults and chicks seen/heard at nest (with number of chicks), X-nest not active and blank-no data available.

	Nest number (with species code)					
Year	BAEA-1	BAEA-2	BAEA-3	BAEA-4	BAEA-5	Summary
1990	A					A
1991	A					A
1992	A					A
1993	Ac -1					Ac -1
1994	Ac -1		Ac -1			Ac -1, Ac -1
1995	X		Ac -1	Ac -1		Ac -1, Ac -1
1996	X		X	X		X
1997	X		X	X		X
1998	X			X		X
1999	X	A	Ac -1	X		Ac -1, A
2000	X	X	X	X	Ac -1	Ac -1
2001	X	X	X	X	Ac -1	Ac -1
2002	X	Ac -1	X	X	X	Ac -1

Table 3
Nest descriptions, East Limestone Island; all trees are Sitka spruce unless indicated.

Tree No.	First active	Location of nest tree	Tree status	DBH (cm)	Tree Ht (m)	Nest Ht (m)
BEA-1	1990	Spring Valley; top of the spring, west of camp	dead	171.9	36.2	36.2
BAEA-2	1999	North of S-plot; WT 78	dead	121.6	31.4	31.4
BAEA-3	1994	Crow Valley; southwest of WT 52	dead	223	45.2	27.2
BAEA-4	1995	North shore, ~ 10m from shore, best seen from water	live	95	25	20
BAEA-5	2000	Cassin's Tower; on top of tower	live	101.5	15.8	7.9
BAEA-6	2002?	South ridge; west of WT 61, WT 19	live	227.9	40 (est.)	-
CORA-1	1992	Along main trail, 48 m south from stake 430 m	live	223	45.2	27.2
CORA-2	1990	150 m along trail from Boat Cove to Alder Bluffs	live	-	40 (est.)	20 (est.)
SSHA-1	1997	Along main trail, north of trail near stake 380 m	Unknown	-	-	-
NSOW-1	2001	Wildlife tree 1, ~10 m NE of cabin	dead	130	15.1	7.9

Peregrine Falcons have nested on Limestone Island for half of the last thirteen years (Table 1) and each time, produced chicks. Falcons were seen or heard each year both on Limestone and Louise Island, but nesting was not always confirmed.

Common Ravens were present and active on the island during all years but nests were only confirmed or reported four times (Table 1). Ancient Murrelet remains, including severed wings, bones, eggshell fragments and stainless steel bands, helped identify one Common Raven nest tree – a large Sitka spruce, 223 diameter and 45 m high (Table 3). A nest was not visible from the ground but was considered active and successful when fledglings were seen at, or near, the nest tree in 1994 and 2001.

Northern Saw-whet Owls have called after dusk each year except 2002 when a nest was found. LBCS staff member Joelle Fournier found a nest in a Sitka spruce snag (Wildlife Tree 1), about 15 m from the cabin (*see* Tarver 2002). The owls used an abandoned Northern Flicker (*Colaptes auratus*) nest cavity in a Sitke spruce snag. The snag broke during the winter of 2001-02 and an intact nest cup was found the next spring.

Finally, Sharp-shinned Hawks were known to nest on Limestone Island at least four times in the last six years (Table 1). The first confirmed sign of nesting was in 1997 when two adult hawks displayed breeding behaviours for several months (e.g. repeated calling from one area, frequent flying into and out of same area, adults with prey) and two fledglings were later observed near the nest site in July. Adults, and occasionally juvenile, Sharp-shinned hawks were active in the same area of the island for the next three years. The nest tree was estimated to be about 75 m north of the 380 m stake on the main trail.

DISCUSSION

In the Gulf Islands, and other locations in British Columbia, eagles nest close to the shoreline, presumably because this places them close to a food supply (Vermeer et al 1987, Harfenist et al 2002). Throughout their range, Bald Eagles also nest in tall trees, that are structurally sound, to support the weight of their large nest, provide good visibility and ease of take-off and landing, All of the eagle nest trees on Limestone Island were either alive or in early stages of decay (bark > 50%). Most nests were in the forest interior, at the top of tall trees, and not at the extreme edge or shoreline. The only nest tree on the shoreline lasted two years before falling apart. This nest was built on the southeast corner of the island and exposed to frequent southeast gales.

All raptor and owl species that nested on Limestone Island (and depend upon Ancient Murrelets for food) nested within or very close to, the murrelet colony. There are 1,200 breeding pairs of Ancient Murrelets on East Limestone Island and an additional 5,000 pairs on nearby Reef Island (Rodway et al 1988). Reef Island has the same diversity of avian predators as Limestone Island , with up to four of these species recorded breeding in one year during the 1980s (Gaston 1992). Additional nesting and roosting sites also occur on other islands within Laskeek Bay - Bald Eagles nest on Low, South Low, Louise and Skedans Islands, and Peregrine Falcons are known to nest on both Louise Island and Reef Island.

Given the secretive nature of some species, nest attempts on Limestone Island may be unobserved. Some species, like saw-whet owls, occupy small nest holes and do not typically return to the same nest site each year. Their nesting activities are more inconspicuous than other species, like eagles, that occupy large nests year after year. Saw-whet owls do not have long-term pair bonds or well-formed territories, adding to the difficulty of detecting nesting activities. Northern saw-whet owls use old Northern Flicker or Hairy Woodpecker (*Picoides villosus*) cavities, as well as natural cavities. Neither of these woodpecker species are particularly abundant on Limestone Island (Smith 2002), however Red-breasted Sapsucker (*Syphyrapicus ruber*) nest holes are more common and might be big enough for saw-whet owls. Gaston (1992) found Ancient Murrelet chicks to be part of their diet on Reef Island so it is not surprising that saw-whet owls nested near the edge of the most dense part of the colony (557 burrows/ha, Rodway et al 1988). The nest was near the research cabin and an enhanced population of deer mice (*Perimyscus maniculatus*), which could be an additional source of food for adults or nestlings; pellets need to be analysed to confirm whether saw-whet owls consume deer mice on Limestone Island.

The observed diversity and density of avian predators at East Limestone Island is somewhat higher than might be expected for an island of 48 ha. Nearby Reef Island, about 5 times as large, usually supports 2 breeding pairs of ravens, 1-2 pairs of peregrines, 2-3 active eagle nests and sometimes one pair of Sharp-shinned Hawks and one or more pairs of Saw-whet Owls in a given year (A.J. Gaston, pers. comm.). Although the entire raptor and owl community of East Limestone Island does not breed every year, prey populations support up to four species to successfully breed; the existence of a breeding population of 1,200 pairs of Ancient Murrelets may partly explain this concentration. Ancient Murrelets have evolved several strategies to avoid predators (e.g. burrow nesting, nocturnal habit) and likewise, avian predators have evolved hunting mechanisms to capture prey (e.g. crepuscular foraging). The continuous record of nesting success and species occurrence will increase our understanding of the long-term use of raptor nest sites in Haida Gwaii and the structure of this avian predator-prey relationship in Laskeek Bay.

ACKNOWLEDGEMENTS

Colin French, Charlotte Tarver, Keith Moore and Tony Gaston all helped to clarify and complete the nesting records of the birds of prey. I thank Colin French and Tony Gaston for their comments on earlier versions of this paper. Anne Harfenist provided the inspiration for this summary and I appreciate her interest and help in its preparation.

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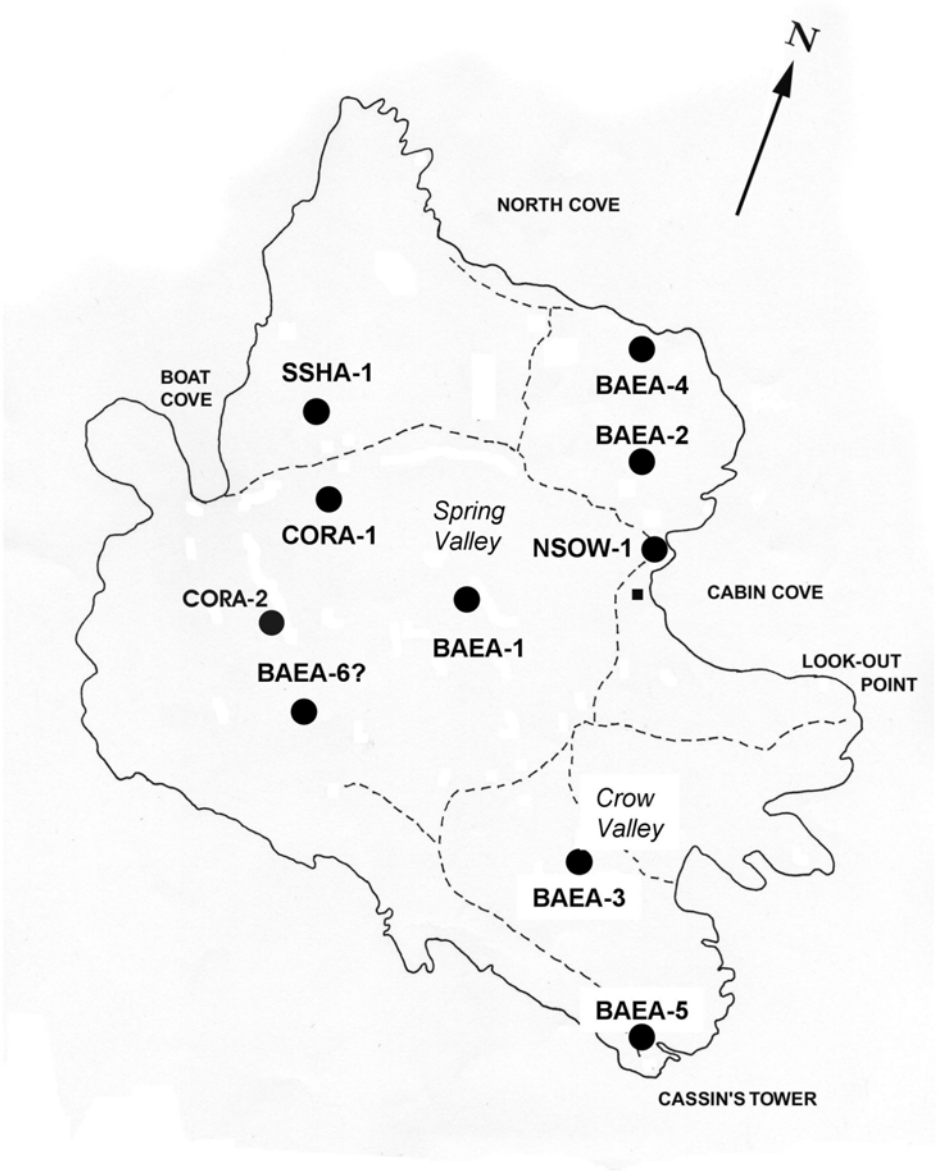
Figure 1
Nesting locations of birds of prey on East Limestone Island since 1990.



ANCIENT MURRELET CHICK DEPARTURES AT EAST LIMESTONE ISLAND, 1990-2001

Anthony J. Gaston
CWS/NWRC 100 Gamelin Blvd., Hull, Quebec, K1O 0H3, Canada

ABSTRACT

Ancient Murrelet chicks have been trapped as they left the colony at East Limestone Island every night throughout the departure period in every year since 1990. Between 508-812 chicks were trapped each year. This unusually large and complete set of data allows us make firm generalizations about variation in timing of breeding, time of departure from the nest site and mass at colony departure. In comparison with other seabirds, Ancient Murrelets appear to be a remarkably consistent in their timing of breeding, with median dates of departure varying by only six days over the 12 years of the study. Chick mass at departure has varied among years, with mass being lowest in the year following the El Nino event of 1997-98. Overall, there has been a trend towards lower departure weights in recent years. Within years, mass tends to decrease with date and increase with time of night. However, even when combined, year, date and time account for only a small fraction of total variation. These effects could only have been detected with the large and consistent data set provided by the Laskeek Bay Conservation Society monitoring programme.

INTRODUCTION

The unique breeding biology of the Ancient Murrelet, where chicks leave the nest site at 2-3 d old and make their way to the sea alone, makes it possible to trap large numbers of chicks in a uniform manner from year to year. This is achieved by erecting low plastic fences that guide departing chicks to capture stations near the shore, where they are weighed, banded and then released quickly at the adjacent beach. At East Limestone Island, the Laskeek Bay Conservation Society used this technique to capture, band and weigh 7714 departing chicks during the breeding seasons of 1990-2001. Timing of chick departures and their mass during departure have been commented on in previous LBCS reports. Here, I summarize information to 2001 on chick departure mass, time of day and date.

METHODS

Each year in early May plastic fences approximately 0.5 m high are erected at selected sites, kept constant from year to year. The fences cut obliquely across the likely route of departing chicks and lead them to

catching stations near the shore at North Cove (Funnels 1-4), Cabin (Funnel 5) and Spring Valley (Funnel 6). The lower end of each guide funnel is left open at all times except when the funnels are being monitored, which takes place from 8 May onwards until the first night in June on which no chicks are trapped. Monitoring is carried out nightly from 22.30 - 02.30 h, although towards the end of the season monitoring may not begin until 23.00, or even 23.30 h, at the discretion of the field crew, especially if it is a clear evening. Observations at Reef Island, based on >7000 chick departures, showed that >90% of chicks departed before 02.30 (AJG, unpublished). In some years catching extended beyond 02.30, up to 30 min after the last chick was captured. However, inter-year comparisons were based on captures up to 02.30 only.

On capture, chicks were placed in a cloth bag, weighed on a 50 g Pesola spring balance, banded with a US Fish and Wildlife Service stainless steel band on the right leg and then released close to the sea in a situation where the chick could run easily to the water. In some cases the chicks were released directly onto the water. No more than 10 m elapsed between capture and release. One of the Pesola balances used in 1990 was later found to be faulty, so the mean mass of chicks for 1990 cannot be compared with means measured in other years.

RESULTS

Variation in numbers

Numbers of chicks captured annually varied from 526 in 1998 to 869 in 1990. Based on captures up to 02.30 only, there was a sharp drop (-36%) between 1990 (812) and 1991 (520), which was followed by a partial recovery in 1992 (658) and then a gradual decline to 1998 (508). Since then numbers have been more or less stable at 560 - 600/yr (Table 1). Looking at individual funnels, numbers fell most sharply at funnels 5 and 6 (Spring Valley and Cabin) although numbers in both funnels have been stable since 1995 (Figure 1). No time trend is evident for the North Cove funnels except for the drop between 1990 and 1991, which happened everywhere.

Dates of departure

Chicks were captured between 8 May - 23 June. Overall, 90% departed between 14 May - 6 June and 50% between 19 - 28 May (Figure 2). Median departure dates were between 18 - 23 May and the dates on which maximum numbers departed fell between 17 - 27 May. Mean departure dates were slightly later than median dates (by 4 d, on average) because the distribution of dates in most years was skewed, with a rapid build up during the early part of the season, tailing away gradually thereafter. The spread of departures ranged from only 22 d in 1992 up to 43 d in 1998, with a mean spread of 33.4 ± 5.6 d (SD).

The distribution of departures varied among years, with most chicks leaving during a 10-d period in 1992 and 1993, but with departures much more spread out in 1998, 1999 and 2001. Departures were approximately normally distributed in 1992, 1997 and 2000. In all other years there was a longer tail off after the peak of departures (Figure 3).

Table 1.
Numbers of chicks departing through the six trapping funnels at East Limestone Island, 1990-2001 and timing of departures

Year	Captured before 0230	All captures	Date of departure					
			Mean	SD	Min.	Max.	Spread	Median
1990	812	868	55.27	6.72	43	77	34	50
1991	520	633	53.79	5.68	40	69	29	50
1992	658	720	53.54	4.38	43	65	22	51
1993	607	691	51.90	6.07	41	79	38	48
1994	624	673	51.94	5.68	38	71	33	48
1995	504	588	54.80	6.84	41	81	40	50
1996	599	649	53.25	7.15	41	73	32	48
1997	537	574	57.04	5.76	42	73	31	53
1998	508	526	57.46	9.21	41	84	43	51
1999	562	591	52.35	6.84	41	72	31	47
2000	598	620	52.73	5.42	41	72	31	49
2001	565	581	55.15	9.39	40	77	37	48
All years	7094	7714	54.03	6.88	38	84	46	50

Figure 1
Trends in numbers of chicks captured at the six funnels on East Limestone Island from 1990-2001

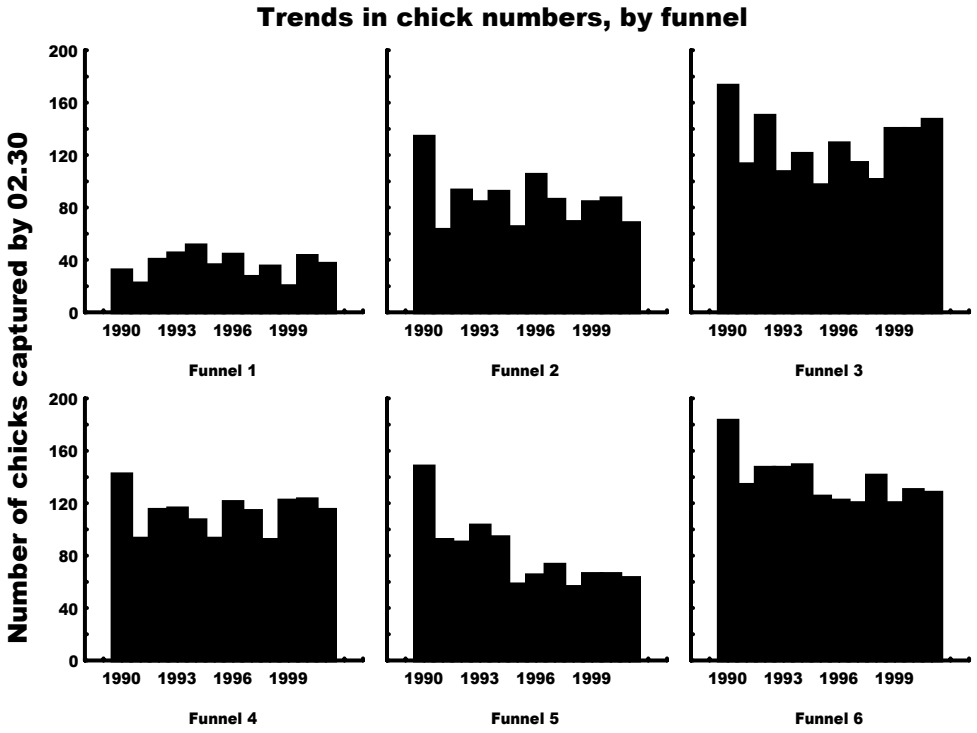


Figure 2
Chick departures by date aggregated over all years

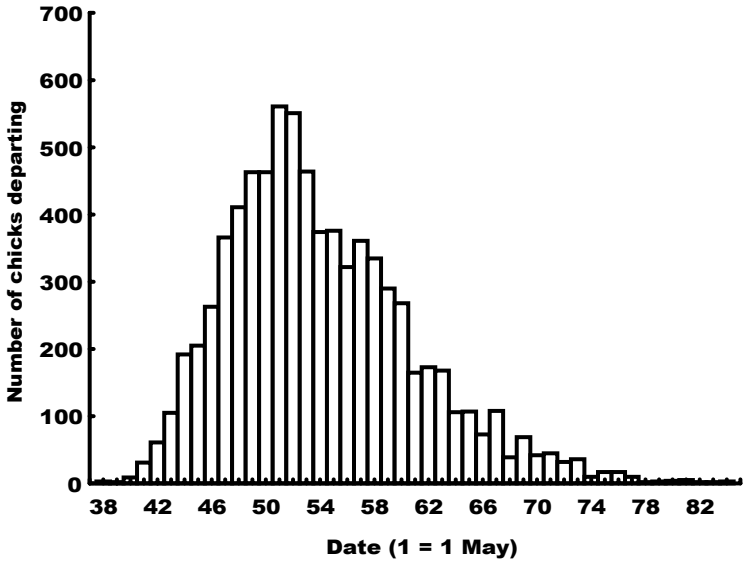
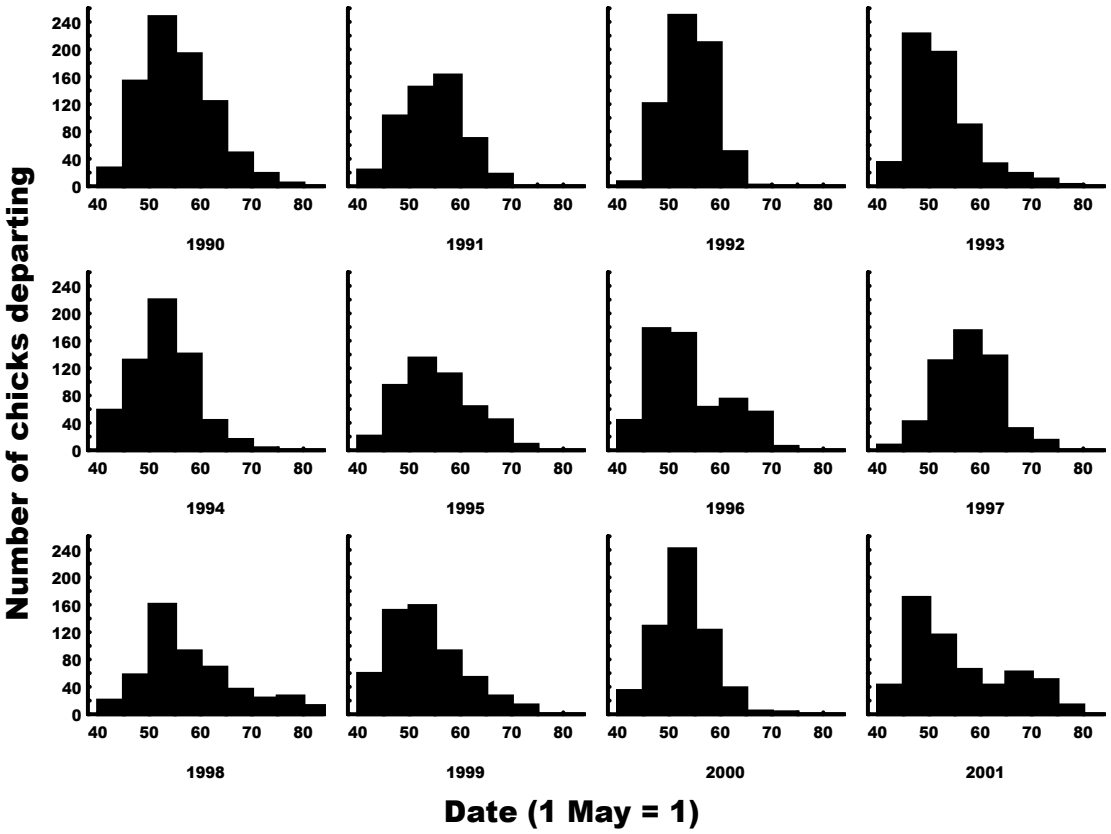


Figure 3
Pattern of departures in relation to date (by 5-d periods): note the very tightly clumped departures in 1992 and 2000, the long tail post-peak in 1998, 1999 and 2001.



Time of departure

Recorded chick departures occurred between 80 min before and 240 min after midnight, with approximately 90% departing between 23.40 - 02.00 h (Figure 4). The timing follows a rather constant relationship with the time of sunset, with the peak shifting from just after midnight in mid-May to about 01.00 h by early June (Figures 5 and 6). Because chick trapping ceased at 02.30 h in most years, the number of chicks departing after midnight +150 min (3.5% of total) is clearly underestimated. However, although a few chicks are always heard departing after this time, only 5% of chicks departed in the period midnight + 120-150 min, so the total proportion leaving after + 150 min seems unlikely to exceed 10% of the whole population.

Figure 4
Time of departure (min +/- midnight) of chicks from East Limestone Island

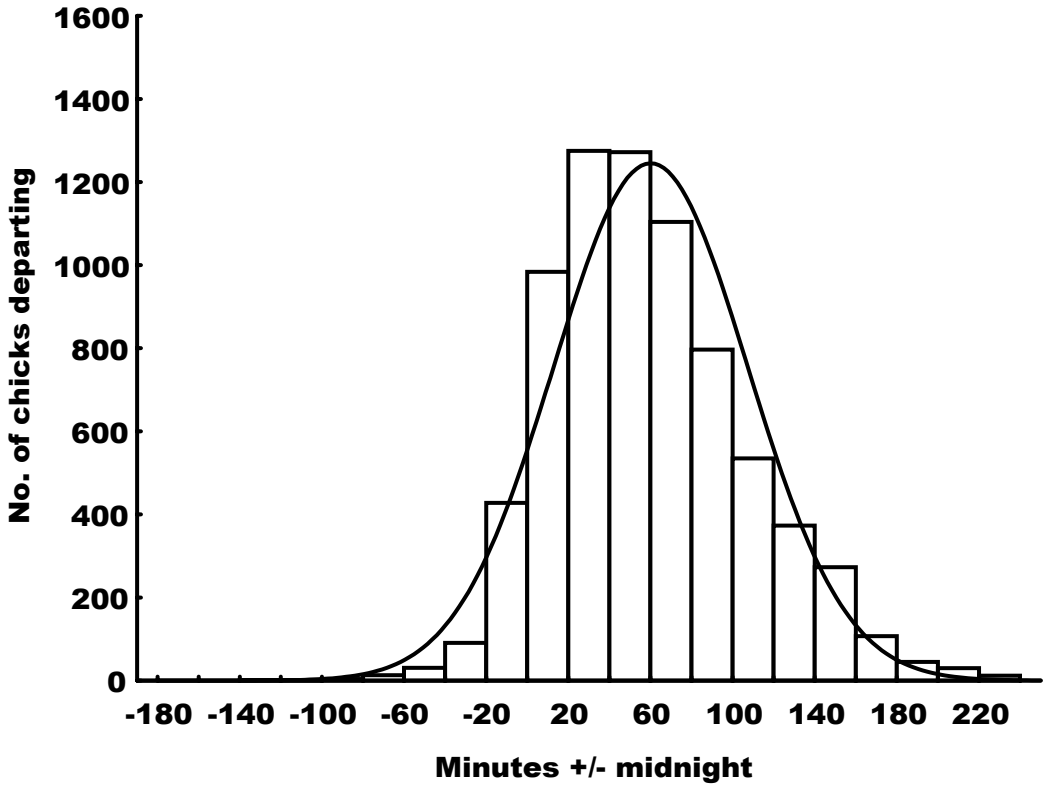


Figure 5
Time of chick departures (in min +/- midnight) in relation to date, by 3-d periods, aggregated over all years: note the gradual shift in the timing of the peak departure period.

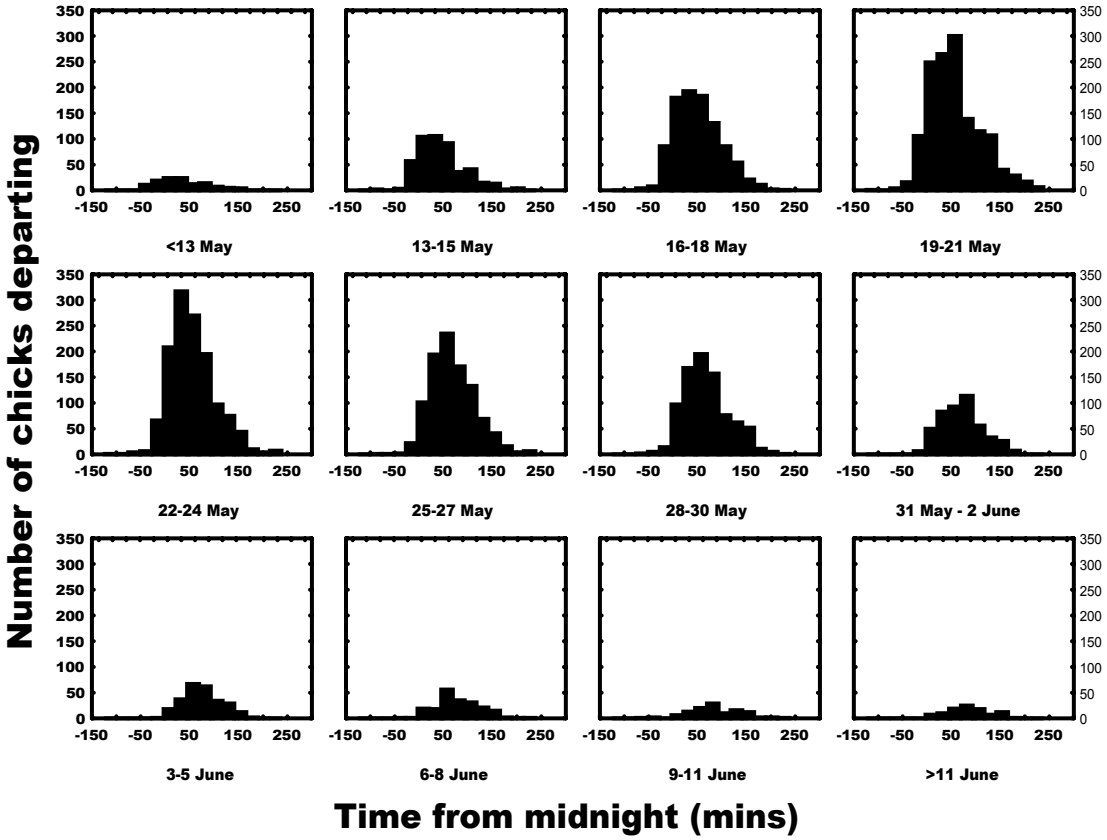
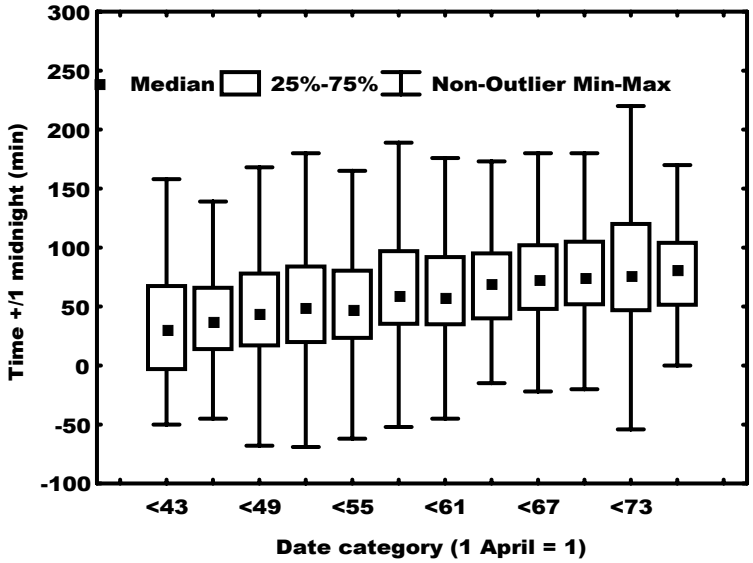


Figure 6
Median departure times and period during which 75% departed, by 3-day periods

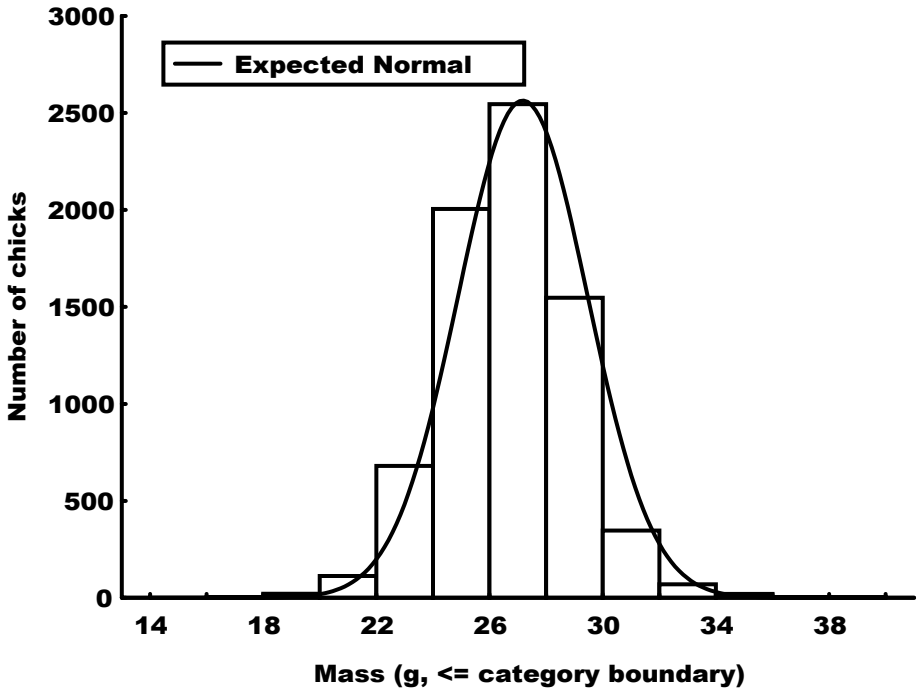


Chick mass

Chick mass during 1991-2001 varied from 15 - 33 g, with 90% of chicks leaving at 23.0-30.0 g and an overall mean of 26.82 ± 2.17 g (N = 6473). The distribution of chick mass was not distributed normally, but was in most cases, relatively flattened, with no sharp peak

Chick mass at departure varied significantly among years. Mass averaged higher in 1990 by nearly 0.7 g than in other years combined. In that year, one of the balances being used was found, part-way through the season, to be overestimating mass. Consequently, data for 1990 are unreliable and have been omitted for further analysis of chick mass. A single chick weighing less than 14 g (an outlier) and 19 chicks recorded as >34 g have been omitted from analyses, because these values seem likely to reflect incorrect reading of the 10's digit on the spring balance - an error that was sometimes detected when mass values were queried in the field. With these exclusions, chicks captured in funnels at departure during 1991-2001 averaged 27.0 ± 2.2 g (N = 6464), with 50% falling between 26-28 g and 90% between 24-30 g (Figure 7).

Figure 7
Distribution of chick mass at departure for those captured in funnels before 02.30 h, 1991-2001



With 1990 omitted, there was still significant inter-year variation (Figure 8), with chicks being significantly heavier in 1994 (27.2 ± 2.0 g) and significantly lighter in 1998 (26.4 ± 2.2 g) than in other years ($F_{10, 6462} = 7.12$, $P < 0.001$, inter-year effects tested post-hoc with Newman-Keuls test). As well, there was a tendency for mass to decrease with date, the effect being significant in all years except 1992 (Table 2, Figure 9, Appendix 1). The greatest effect was seen in 1999, when chick mass declined by 1 g for every 10 d, so that the earliest chicks averaged 28 g and the latest only 25 g.

Also, there was a slight tendency for chick departure mass to increase with time during the night, so that chicks leaving after 01.00 were heavier on average than those leaving around midnight. This effect was weak and did not show up in every year (Table 2). However, even when date and time of departure were

both taken into account, the resulting model explained a maximum of 10% (in 2001) of the total variation in departure mass among chicks.

Figure 8
Mean chick mass at departure during 1991-2001 for all captures >15 g and <34 g

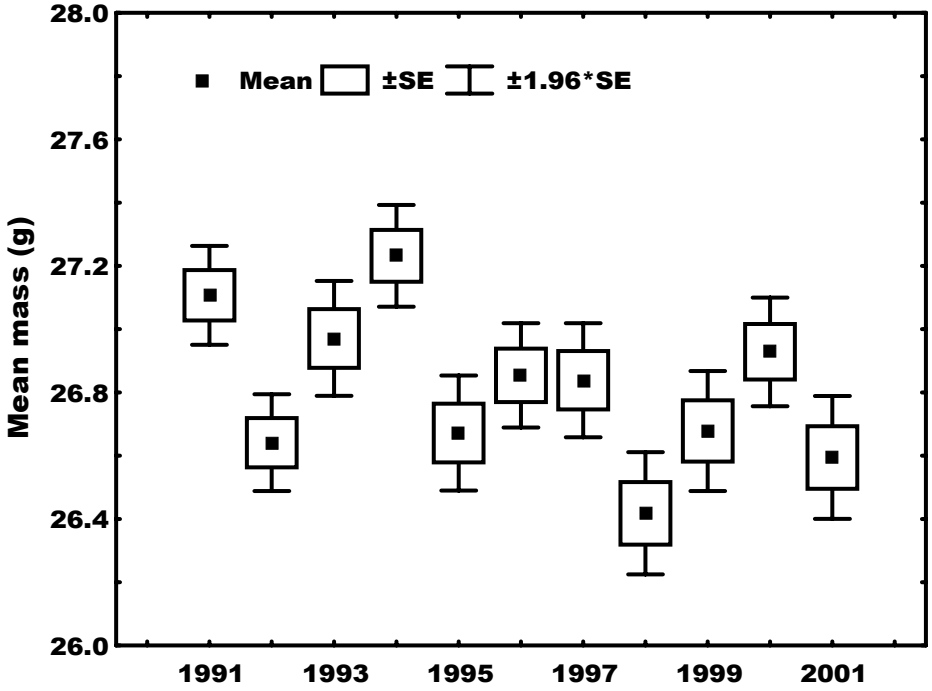
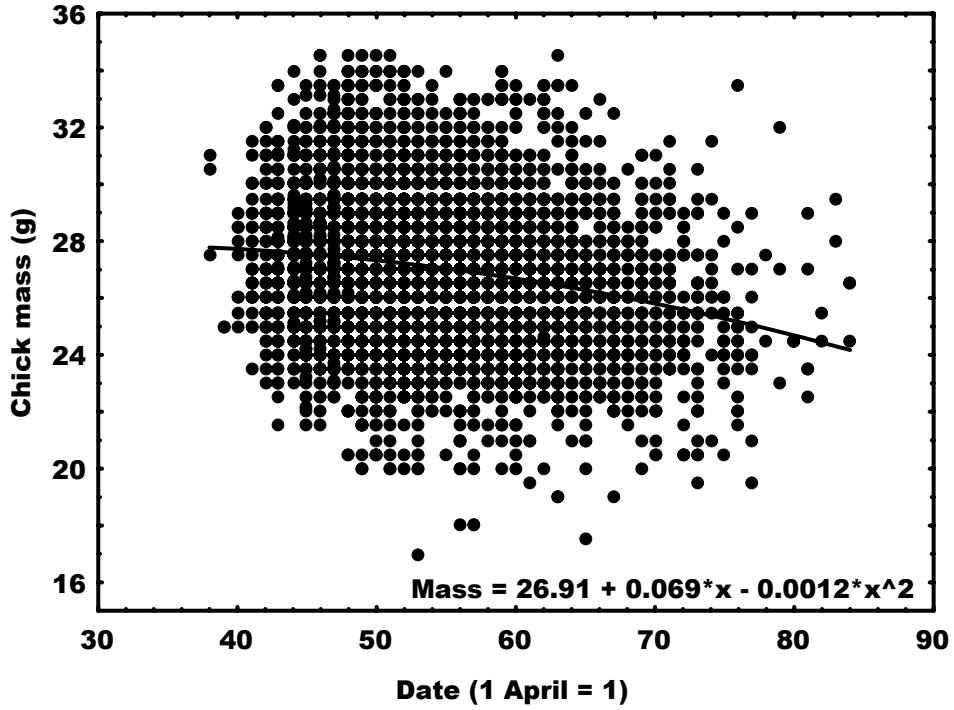


Table 2
Details of multiple regression for chick mass at departure on date and time of night (min ± midnight). Note that slopes for Beta(date) are all negative, while all those for Beta(time) are positive except for two years in which the relationship was highly non-significant.

	Date			Time +/- midnight			F	Adjusted R^2
	Beta	SD	P	Beta	SD	P		
1991	-0.20	0.04	< 0.001	0.12	0.04	< 0.001	14.66 (2, 579)	0.05
1992	-0.07	0.04	0.050	0.16	0.04	< 0.001	9.96 (2, 686)	0.03
1993	-0.12	0.04	0.002	0.03	0.04	0.450	4.52 (2, 634)	0.01
1994	-0.16	0.04	< 0.001	0.09	0.04	0.020	10.26 (2, 618)	0.03
1995	-0.26	0.04	< 0.001	-0.01	0.04	0.780	20.01 (2, 546)	0.07
1996	-0.21	0.04	< 0.001	0.07	0.04	0.120	11.85 (2, 594)	0.04
1997	-0.14	0.04	< 0.001	0.17	0.04	< 0.001	11.95 (2, 537)	0.04
1998	-0.30	0.05	< 0.001	0.01	0.05	0.840	24.05 (2, 504)	0.08
1999	-0.26	0.04	< 0.001	0.05	0.04	0.190	19.28 (2, 555)	0.06
2000	-0.20	0.04	< 0.001	-0.01	0.04	0.740	12.46 (2, 601)	0.04
2001	-0.34	0.04	< 0.001	0.14	0.04	0.001	33.18 (2, 562)	0.10

Figure 9
Chick mass in relation to date for all captures >15 g and <34 g, 1991-2001



DISCUSSION

The breeding biology of Ancient Murrelets at East Limestone Island has proved to be remarkably stable from year to year. Median departure date has varied by only 7 days (17-23 May) over the 12 years considered and mean departure date by only 5.6 d. In comparison, using published data sets of comparable length, median laying of Atlantic Puffins at St. Kilda, Scotland during 6 years, varied over 15 d (Harris 1980), mean dates of laying for 3 species of auks (Common Murre, Pigeon Guillemot and Cassin's Auklet) varied by more than 15 d over the period 1970-1982 at the Farallon Islands (Ainley and Boekelheide 1990) and median laying during 12 years varied over 10 d for Thick-billed Murres at Coats Island, northern Hudson Bay (Gaston and Jones 1998). The spread of departure dates within years at East Limestone Island has been more variable, ranging from 22-43 d, but this measure is very susceptible to alteration by a relatively small number of late-departing chicks and hence is rather imprecise.

Chick mass at capture, although varying among individuals over a very wide range, from 16 - 33 g, showed little variation among years, with the maximum difference among annual means being less than 1 g. Significant effects were detected only because of the relatively large samples sizes. Likewise, the effects of date and time of night, although significant, accounted for a maximum of 10% of within-year variation, leaving factors accounting for most of the variation unknown.

Gaston and Smith (2000) showed that chick mass at departure was lower than normal in the El Nino year of 1998. With two more years of data, 1998 continues to be the year of lowest departure mass, as well as the year when numbers of chicks captured was lowest. However, the differences are small and appear significant only in the light of the long data series. Likewise, combining data from Reef and East Limestone islands, Gaston and Smith (2000) found that chick mass at departure decreased significantly over the period 1985-1998. The present data set does not reveal a significant correlation between chick mass and year, although the general trend between 1991-2001 was also negative ($r_{10} = -0.47$, $P = 0.14$). Chick mass at departure is known to affect subsequent survival, and age at first breeding (Gaston 1997, 2003), both important demographic variables. If this trend among years continues it may have adverse consequences for the Ancient Murrelet population. However, the rather uniform number of chick captures since 1998 (numbers captured in 2002 were very similar to those in 2001) suggests that the population of East Limestone Island is more or less stable at present. Data on both timing of breeding and numbers of chicks departing (presumably a measure of reproductive success) suggests that the unusual breeding strategy adopted by Ancient Murrelets enables them to achieve a very high degree of predictability in breeding outcome.

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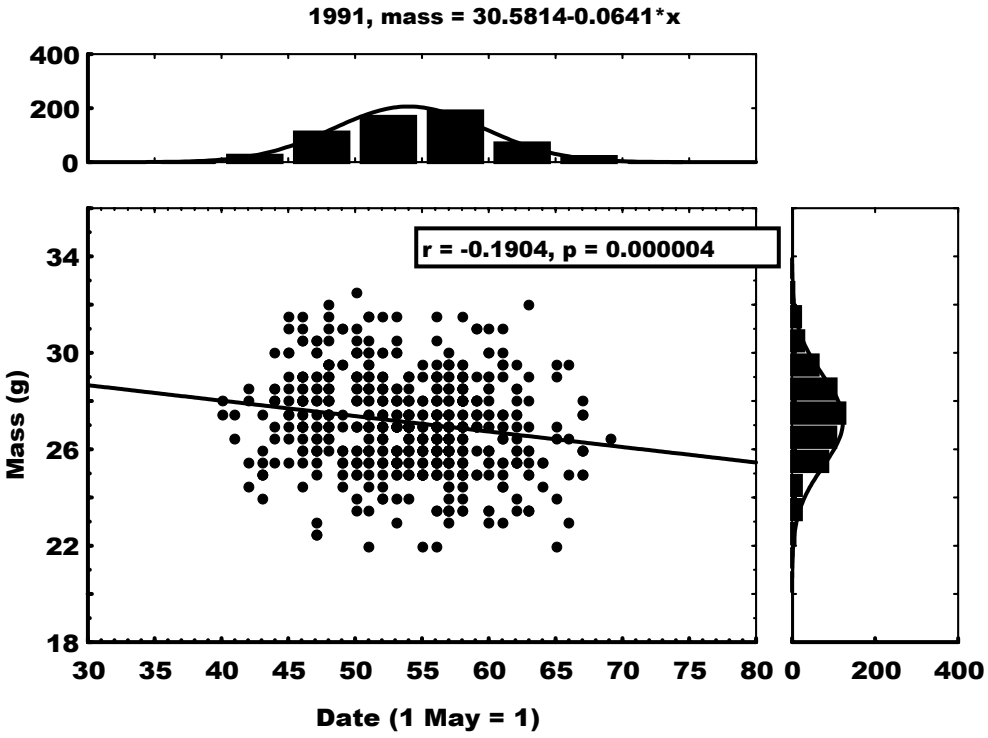
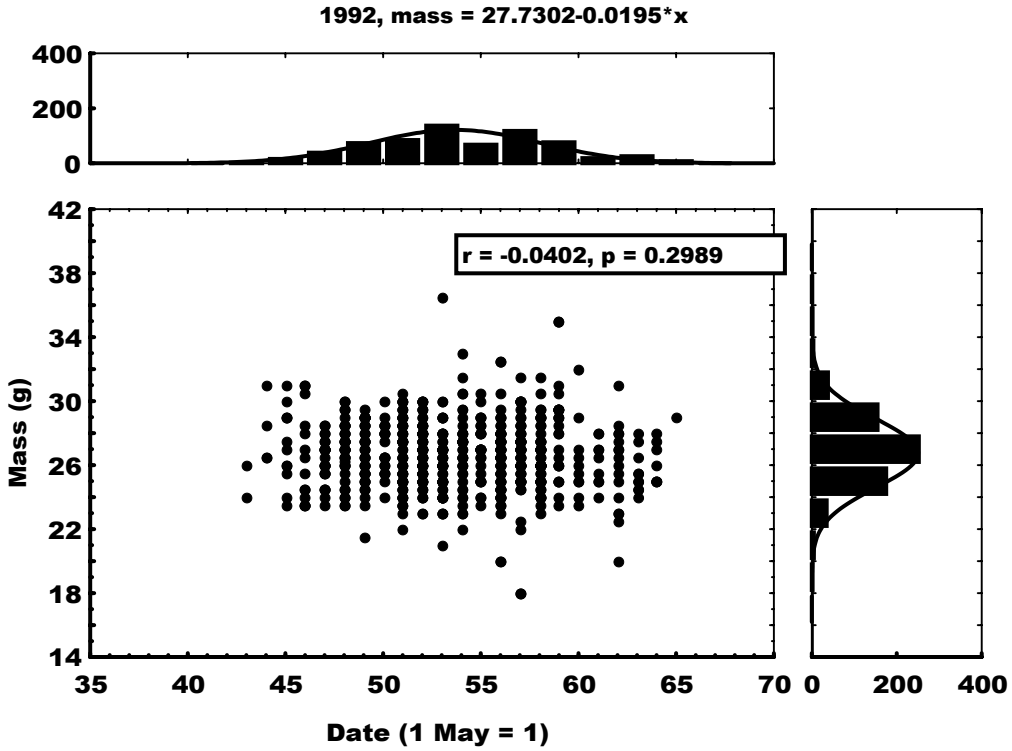
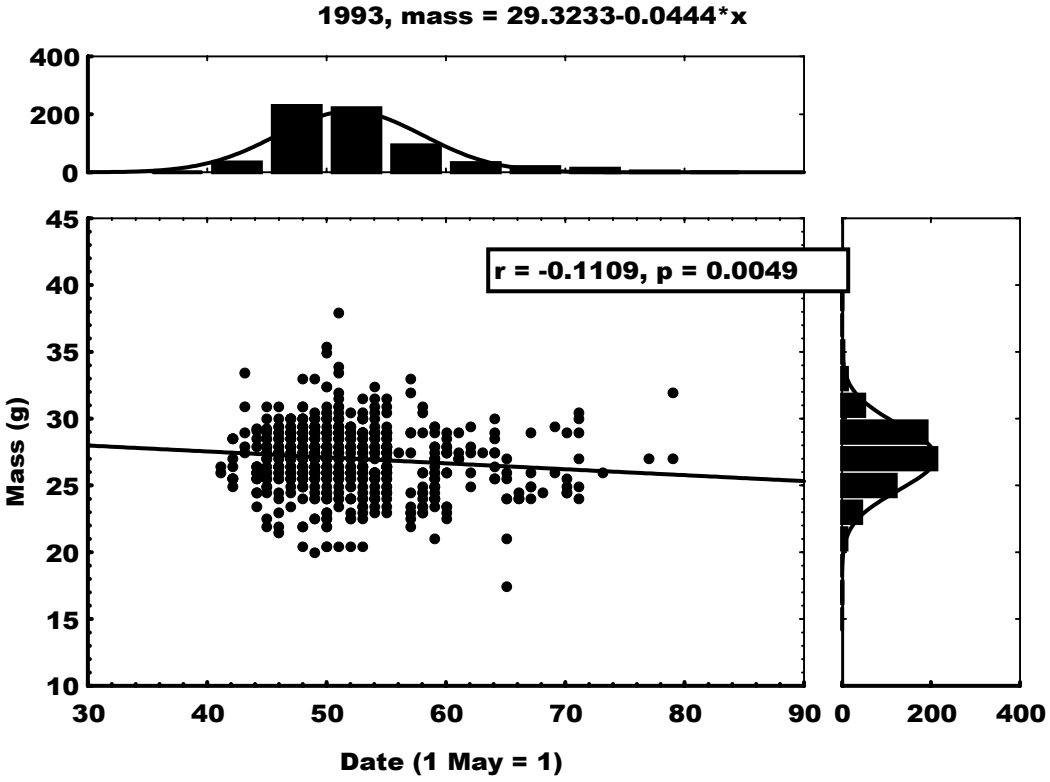
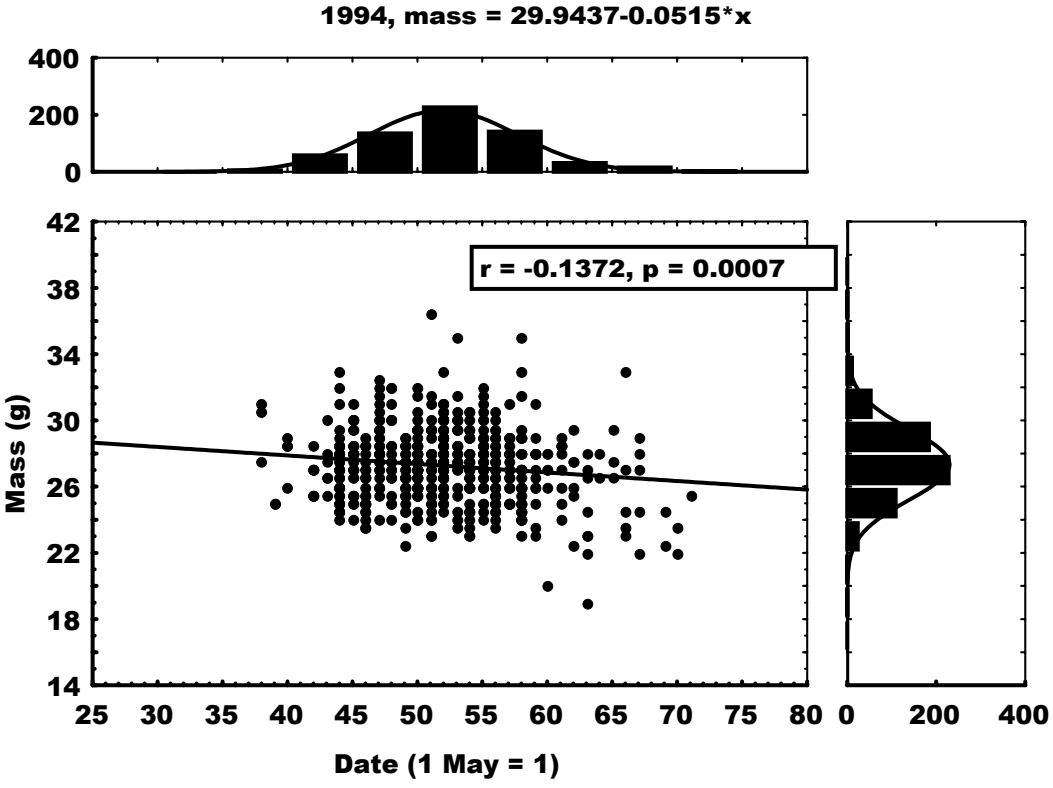
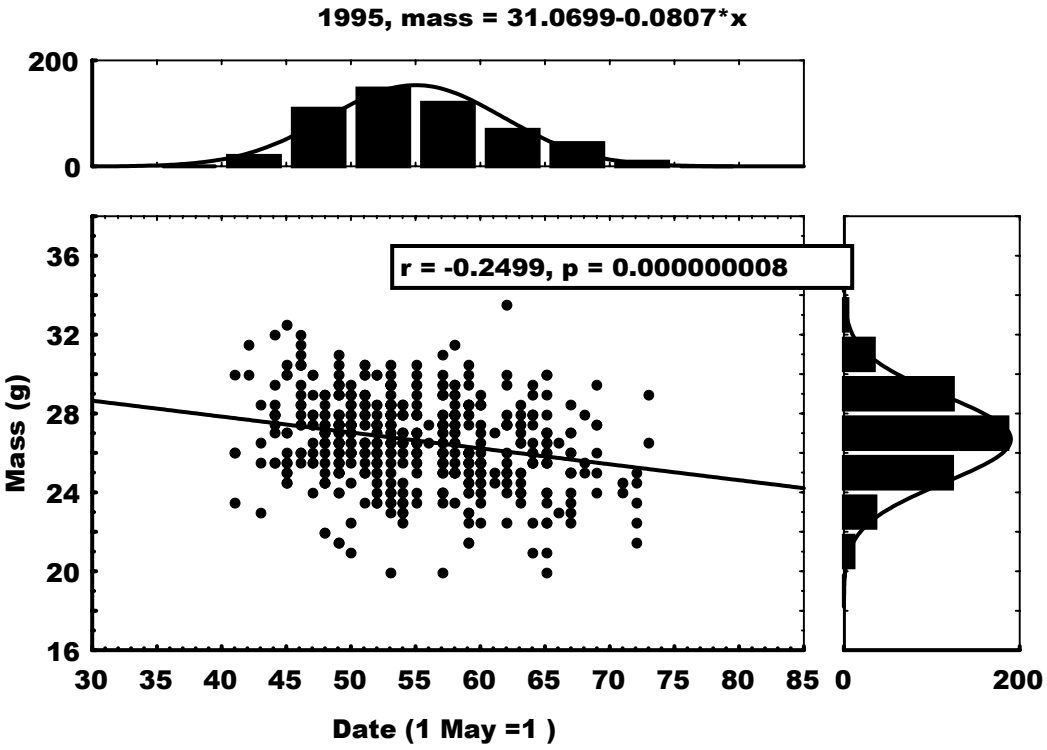
Appendix 1
Annual trends in chick mass on date for Ancient Murrelet chicks captured in funnels up to 02.30 h

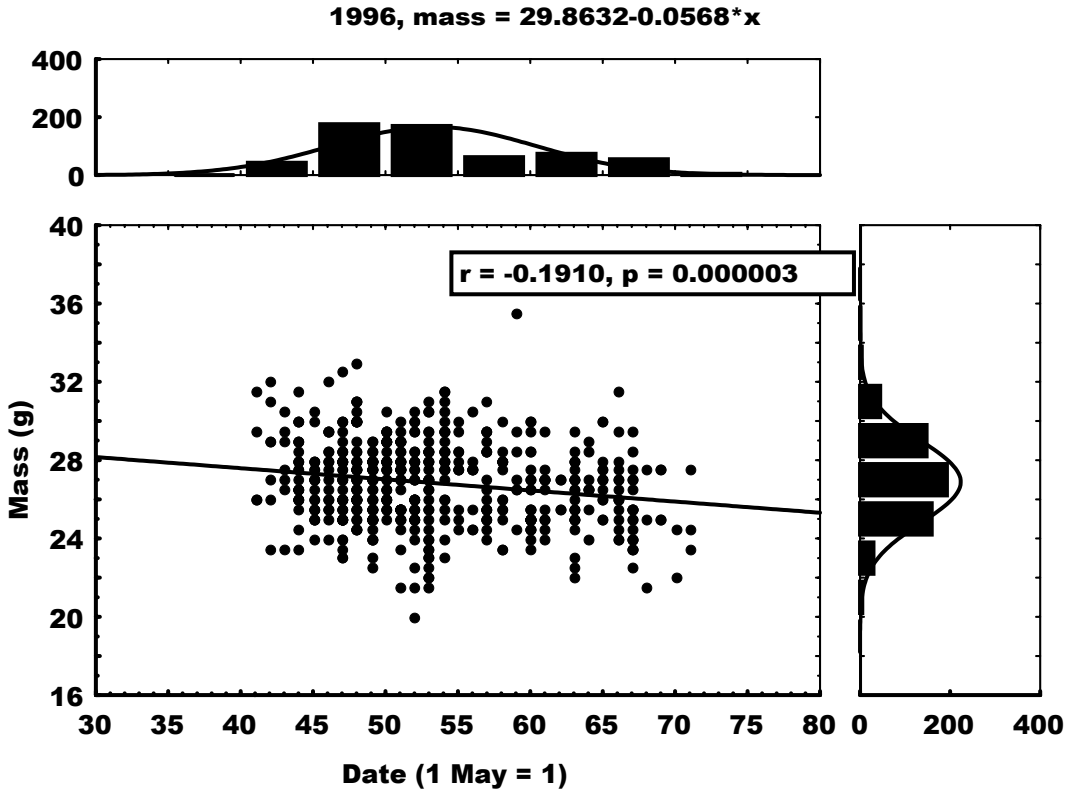


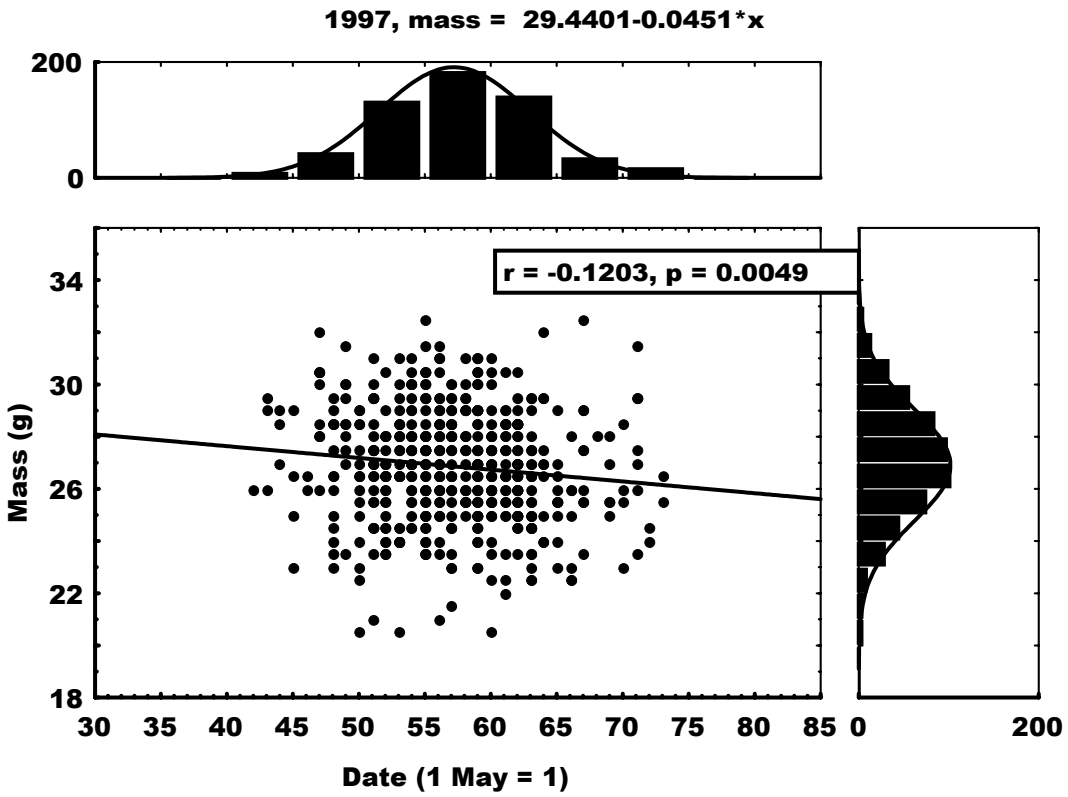


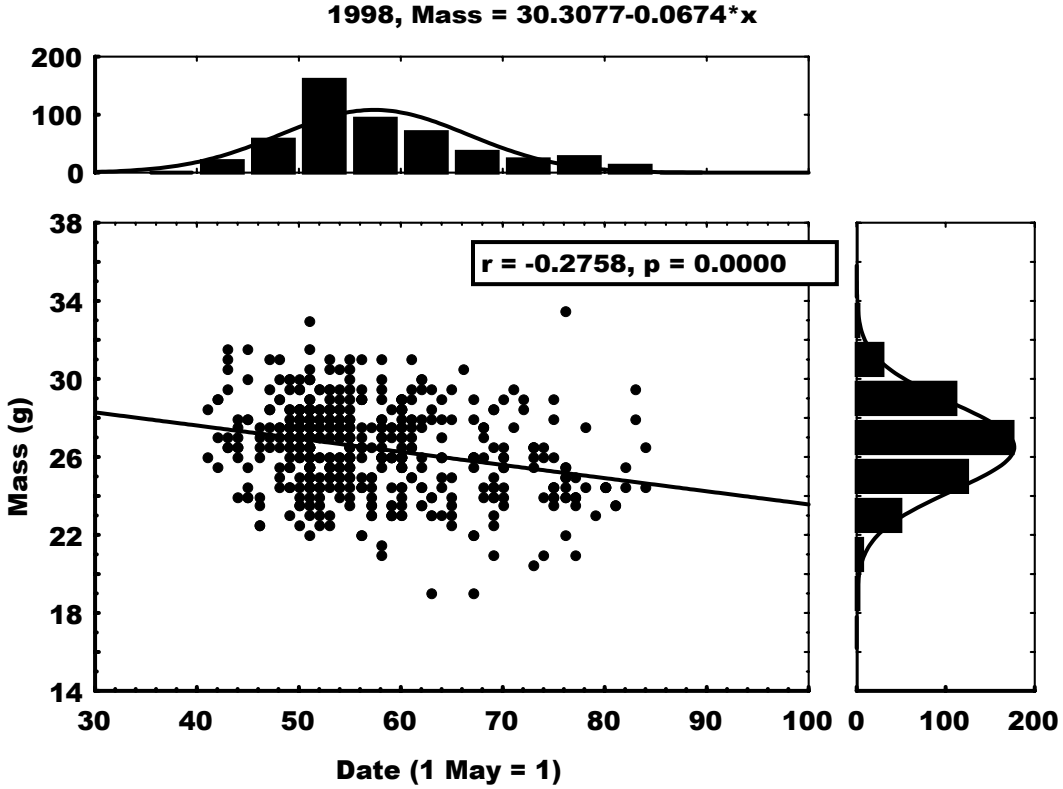

1993, mass = 29.3233-0.0444*x
r = -0.1109, p = 0.0049
Mass (g)
Date (1 May = 1)

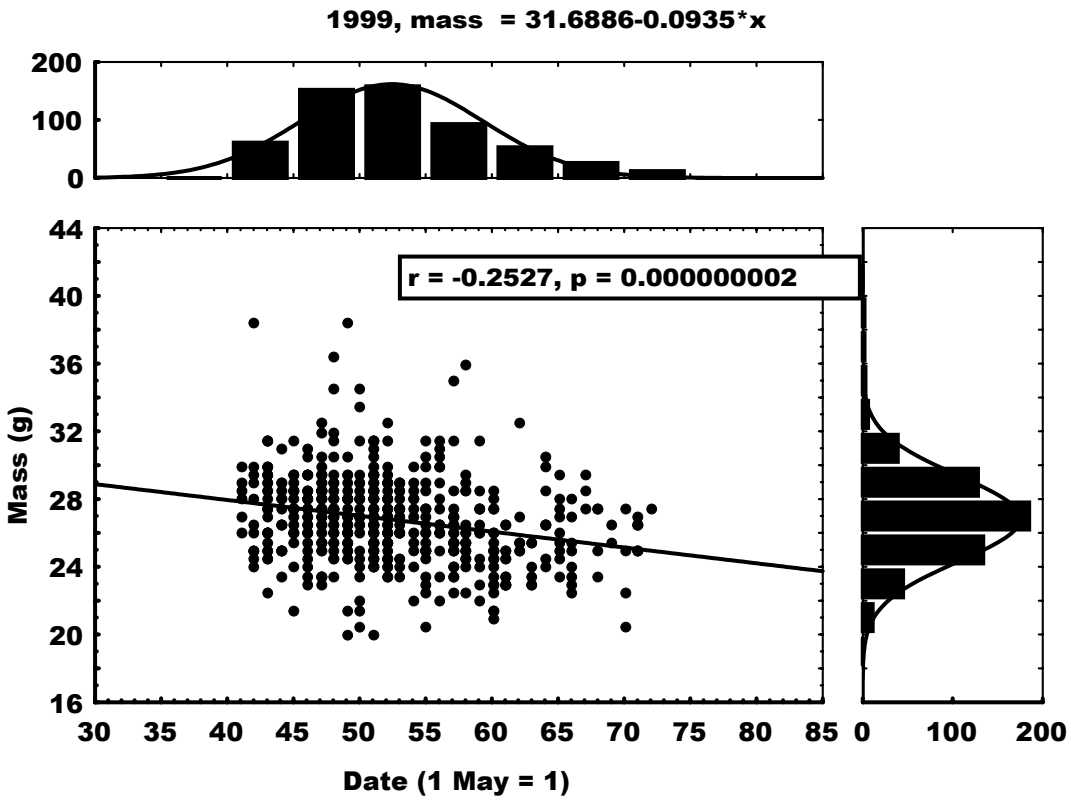

1994, mass = 29.9437-0.0515*x
r = -0.1372, p = 0.0007
Mass (g)
Date (1 May = 1)

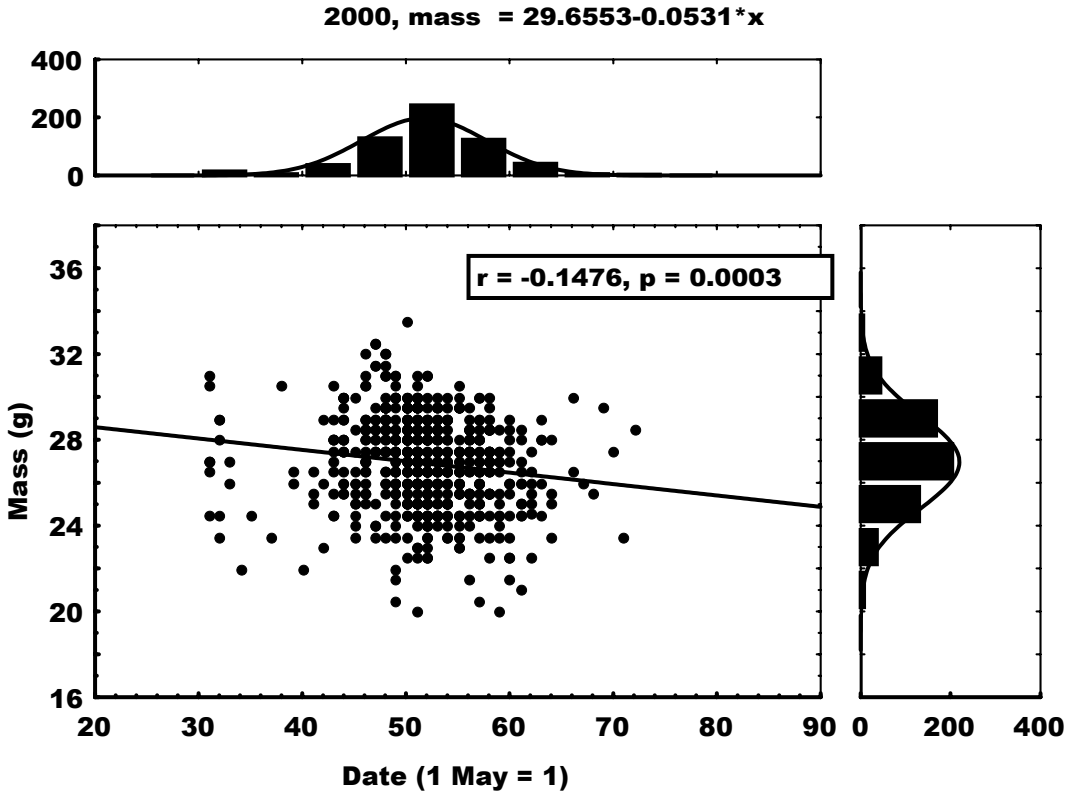

1995, mass = 31.0699-0.0807*x
r = -0.2499, p = 0.000000008
Mass (g)
Date (1 May =1)

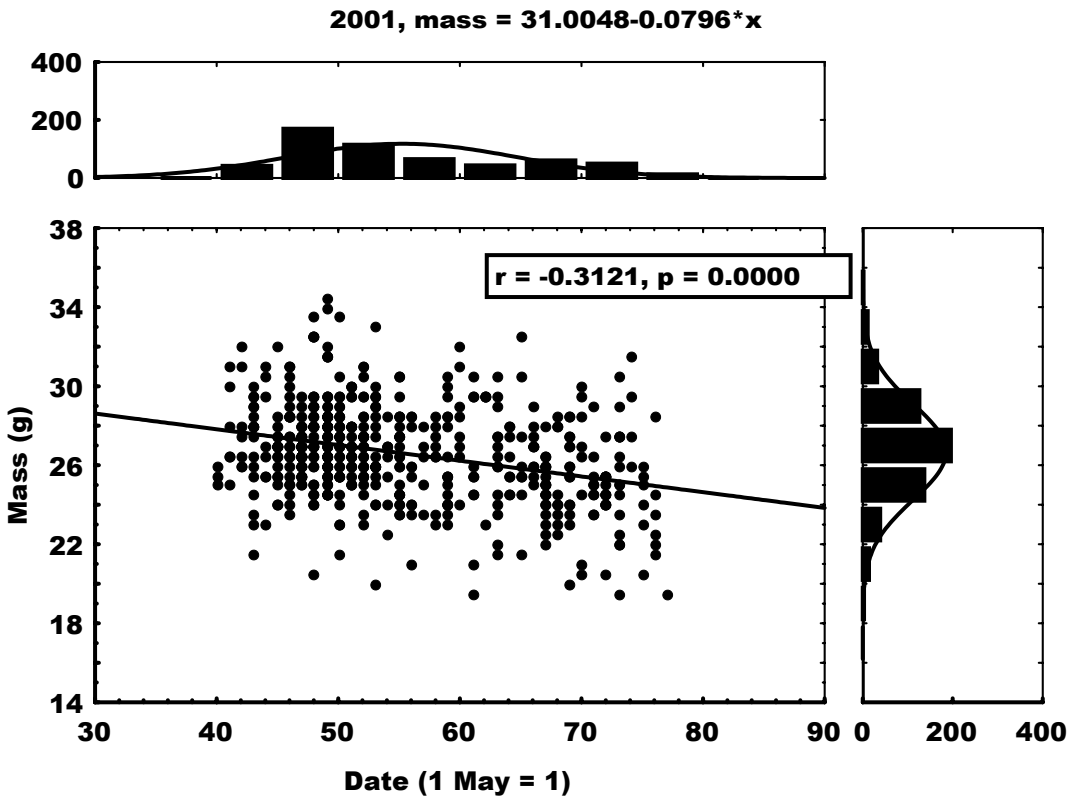

1996, mass = 29.8632-0.0568*x
r = -0.1910, p = 0.000003
Mass (g)
Date (1 May = 1)


1997, mass = 29.4401-0.0451*x
r = -0.1203, p = 0.0049
Mass (g)
Date (1 May = 1)


1998, Mass = 30.3077-0.0674*x
r = -0.2758, p = 0.0000
Mass (g)
Date (1 May = 1)


1999, mass = 31.6886-0.0935*x
r = -0.2527, p = 0.000000002
Mass (g)
Date (1 May = 1)


2000, mass = 29.6553-0.0531*x
r = -0.1476, p = 0.0003
Mass (g)
Date (1 May = 1)


2001, mass = 31.0048-0.0796*x
r = -0.3121, p = 0.0000
Mass (g)
Date (1 May = 1)
400
200
0
38
34
30
26
22
18
14
30
40
50
60
70
80
90
0
200
400

For more information, copies of this report, or other publications, please contact us at:

Laskeek Bay Conservation Society
Box 867, Queen Charlotte, B.C., V0T 1S0
(250) 559-2345 ph/fax
laskeek@qcislands.net
www.laskeekbay.org