

**BIOLOGICAL MONITORING AT SAINT LAZARIA ISLAND, ALASKA IN 2021**



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Key words: Alaska, *Cephus columba*, *Cerorhinca monocerata*, common murre, diet, food habits, fork-tailed storm-petrel, *Fratercula cirrhata*, glaucous-winged gull, *Hydrobates furcatus*, *Hydrobates leucorhous*, *Larus glaucescens*, Leach's storm-petrel, pelagic cormorant, pigeon guillemot, population trends, productivity, rhinoceros auklet, St. Lazaria Island, thick-billed murre, tufted puffin, *Uria aalge*, *Uria lomvia*, *Urile pelagicus*

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St. Lazaria is a uniquely beautiful island with stunning geologic features. Photo by Kristina McOmber.

Cover photo: Pacific Giant Octopus on St. Lazaria, 5 June 2021. Photo by Kristina McOmber.



St. Lazaria tide pools are endlessly fascinating, colorful, and beautiful. In 2021, the tidepools looked to be recovering from the dry summers of 2018 and 2019. Photos by Kristina McOmber.

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## INTRODUCTION

The Alaska Maritime National Wildlife Refuge (AMNWR) conducts annual ecological monitoring at eight sites throughout Alaska. The objective of this long-term monitoring program is to collect baseline status and trend information for a suite of seabird species representing piscivorous and planktivorous trophic guilds, including key species that serve as indicators of ecosystem health. Members of these guilds include surface feeders and diving species that feed in both nearshore and offshore waters. By relating data to environmental conditions and information from other sites, ecosystem processes may be better understood. Data also provide a basis for directing management and research actions, and assessing effects of management.

Saint (St.) Lazaria Island, in southeast Alaska, was recognized as an important site for migratory birds early in the designations of conservation areas throughout the country; it was set aside in 1909 by President Theodore Roosevelt as the “Saint Lazaria Reservation”. Its prominence and recognition was due mainly to reports from naturalists of the day: Grinnell (1897, 1898), Maillard (1898), and Willett (1914). Gabrielson visited St. Lazaria during his territory-wide explorations in the 1940’s (Gabrielson and Lincoln 1959). In 1944, St. Lazaria served as an outpost (Fort Babcock) to help detect enemy forces and to act as a communications link among other units in the Sitka Sound region. Some evidence of military presence (e.g., cut trees, eyebolts cemented into bedrock) is still apparent in open areas of the island, whereas structural ruins are becoming obscured by lush temperate rainforest growth. Despite this military occupation, the island retained its wilderness character and became part of the National Wilderness Preservation System in 1967 (see also Cobb et al. 1968). With the passage of the Alaska National Interest Lands Claim Act in 1980, St. Lazaria and many other individual reservations were brought together to create the AMNWR.

Seabird work intensified at St. Lazaria in the 1980’s as part of the Outer Continental Shelf Environmental Assessment Program. A comprehensive species list of the island’s avifauna and estimates of seabird breeding population numbers were made in 1981 (Nelson et al. 1982, 1987; Sowls et al. 1982) and 1982 (Nelson and Lehnhausen 1983). Early attempts to intensively monitor storm-petrel populations occurred in 1982 (Nelson and Lenhausen 1983), 1985-1986 (Nishimoto et al. 1985, 1988), and 1987 (Byrd 1987). The first permanent study plots for long-term monitoring of burrow-nesters were established at St. Lazaria Island in 1993 (Slater et al. 1996). Additional monitoring plots for burrow-nesters, as well as those for other species, were added in 1994 when the first full field season took place. Since 1994, intensive season-long monitoring of seabird populations at St. Lazaria has been conducted every year except 2017 and 2020 (Slater et al. 1996, Slater and Loy 2000, Slater and Howard 2003, Drummond and Slater 2012, Hovis and Slater 2013, Slater and Millay 2014, Slater and Fety 2015, Evans and Slater 2015, Eby et al. 2017, Evans et al. 2018, Higgins et al. 2019).

Researchers in other disciplines also have been interested in St. Lazaria. Most studies have involved contaminants detection to establish a baseline and examine potential biological effects (e.g., Rudis 1996; Vander Pol et al. 2002a, 2002b, 2004; Rudis and Slater 2004; Day et al. 2006). With the increase in incidence of Lyme disease in the northeastern U.S. in the 1990’s, Olsen et al. (1995) investigated the occurrence of Lyme disease in seabird ticks, including those collected from storm-petrels and rhinoceros auklets at St. Lazaria. Another researcher briefly surveyed the biogeography of specific lichens as it relates to islands with and without seabird colonies (Dillman et al. 2008).

The specific monitoring goals in 2021 were to estimate productivity and/or population parameters for nine indicator species representing two major feeding guilds: 1) diving piscivores (pelagic cormorants [*Uria pelagicus*], common and thick-billed murres [*Uria aalge* and *U. lomvia*, respectively], pigeon guillemots

[*Cephus columba*], rhinoceros auklets [*Cerorhinca monocerata*], and tufted puffins [*Fratercula cirrhata*]), and 2) surface-feeding planktivores (fork-tailed and Leach's storm-petrels [*Hydrobates furcatus* and *H. leucorhous*, respectively]). Similar data were also collected for the opportunistic feeding glaucous-winged gull (*Larus glaucescens*) and intertidal foraging black oystercatchers (*Haematopus bachmani*). Additional monitoring efforts focused on indices of breeding chronology, food habits, and chick growth for one or more of the above species.

Detailed results of the 2021 monitoring program are contained in these appendices and archived at the AMNWR headquarters in Homer, Alaska. Summary data will also be included in the annual Alaska seabird monitoring summary report (e.g., Dragoo et al. 2020). Due to occasional reanalysis of some data, correction of typographical errors, and efforts to standardize presentation across sites, some values used in this report have changed from previous versions. The values presented here are considered the “cleanest” data set available at the time this report was issued and should supersede previous reports.

## STUDY AREA

St. Lazaria Island (56°59'04"N 135°42'34"W) is located in southeast Alaska approximately 2 km south of Kruzof Island at the entrance to Sitka Sound (Figures 1 and 2). The island encompasses 65 acres (Figure 3) and is approximately 1000 m long and 100-400 m wide, with a maximum elevation of about 60 m. St. Lazaria's volcanic foundation of columnar andesite lies exposed at the middle of the island, and vertical cliffs 10 to 50 m high encircle the island. These cliffs inhibit access by humans and terrestrial wildlife capable of swimming from neighboring islands.

High tides and storm tides wash the island's mid-section frequently enough to suppress plant growth in all but the most protected rock crevices. The eastern and western ends of the island are vegetated with mature Sitka spruce (*Picea sitchensis*, with a maximum age of about 200 years; M. Shephard, pers. comm.) at the higher elevations. Temperate maritime vegetation dominates the cliff tops and surrounds the forests. Dominant plants include ryegrass (*Leymus arenarius*), *Calamagrostis* spp., angelica (*Angelica lucida*), elderberry (*Sambucus callicarpa*), salmonberry (*Rubus spectabilis*), and lady fern (*Athyrium filix-femina*). Each of the latter two species can form particularly dense stands that are nearly monocultural.

St. Lazaria sits near the continental shelf edge in an area of marine upwelling, which produces rich prey resources for seabirds nesting on the island. Also making the island a suitable breeding site for many seabird species are its few mammalian predators, abundant protective cover, adequate amounts of ledges and crevices, and unconsolidated soil that allows small seabirds to dig burrows. Nearly a half-million seabirds, consisting of 11 species, are now known to breed on St. Lazaria. Nelson et al. (1987) documented 10 species, and the eleventh, Cassin's auklet (*Ptychoramphus aleuticus*), was discovered breeding there in 2001 (L. Slater, pers. obs.). The St. Lazaria colony comprises about 26% of the estimated population of breeding seabirds in southeast Alaska. The seabird population in turn supports avian predators that also breed on the island in most years, including bald eagles (*Haliaeetus leucocephalus*), peregrine falcons (*Falco peregrinus*), glaucous-winged gulls, common ravens (*Corvus corax*), and northwestern crows (*C. caurinus*).

Land mammal use of the island is sporadic. River otters (*Lontra canadensis*) are suspected to have denned on the island in a few years based on consistent observations of a litter (mid-1990s) and presence of latrine sites. They are frequently present on the island, as evidenced by scat sightings (often comprised of petrel feathers) found at consistently used locations, the occasional startling of river otters from their favorite haul-outs, and a noticeably musky smell at certain locations. A mink (*Mustela vison*) was seen many times in

2004, most often in the rhinoceros auklet colony. In at least one subsequent year, relatively extensive burrow-focused digging indicated that a mink was still present and intent on finding burrow occupants. In 1994, a Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) was observed three times over the course of five weeks, and in 2000, a brown bear (*Ursus arctos*) visited the island for no more than a week.

## METHODS

**Personnel:** The U.S. Fish and Wildlife Service field crew at St. Lazaria Island in 2021 consisted of Kristina McOmber and Aspen Ellis (15 May to 4 September). On 4-5 July, Brie Drummond, Aaron Christ, Sarah Guitart, and Erin Lefkowitz visited the island with the R/V *Tiglaax* for field camp resupply and helped conduct boat-based counts and collect rhinoceros auklet diet samples.

**Data Collection and Analysis:** Crew members followed data collection and analysis methods outlined in the annual monitoring camp standardized protocols for 2021 (Alaska Maritime National Wildlife Refuge 2021) with the following exceptions:

- Murre reproductive success: We continued to test a pilot protocol to quantify early breeding effort and success, and to obtain some absolute measures of success, in kittiwakes and murres. Within fixed-border plots and subplots, we periodically counted adults and nesting attempts (nests built for kittiwakes and eggs laid for murres) earlier in the season than usual productivity monitoring and tracked the cumulative number of nesting attempts. By using the same fixed-border plots in subsequent years, we will be able to compare absolute effort and absolute early-success measures between years, and use these values in conjunction with the ratio measures of success that we obtain from plots with non-fixed borders. At St. Lazaria, we implemented this protocol in one common murre plot and one thick-billed murre plot, beginning on 5 July. We are still analyzing these data; results will be summarized in a separate report.
- Murre population: Murres were identified to species during land-based population counts. The crew noted a surprising amount of intergrade plumage types and bill shape across the colony between the two species, documented individuals that were more visible with photographs. During population counts, crew members based species ID on either the known species ID (if it was a monitored nest site), or the first field mark or groups of field marks immediately obvious to the counter. For example, if an observer noted a white line along the bill edge of a hybrid murre before they noted extensive streaking along the flanks, then the observer would count the bird as a thick-billed murre.
- Rhinoceros auklet population: In order to limit disturbance, excavations were not used and chicks were not measured in rhinoceros auklet population plots in 2018-2021. Outside of population plot boundaries, excavations were used to access rhinoceros auklet chicks; thirteen chicks were found and measured this year.
- Tufted puffin reproductive success and population: Data on reproductive success (residency indices) and populations (density and apparent occupancy) of tufted puffins were not collected in historic plots in 2018-2021 in order to reduce risks associated with working near cliff edge habitat and minimize disturbance in important breeding habitat. Instead we continued testing a protocol being developed to track changes in puffin populations, using the presence/absence of occupied burrows (i.e., the presence of fish, guano, feathers, shell fragments, egg(s), and chick(s) inside a burrow) within randomly placed 1m<sup>2</sup> plots as a surrogate for annual breeding population and colony

attendance. Due to the difficulty of sampling tufted puffin habitat at St. Lazaria, this work was limited to a small portion of the colony where it was safe to work. We conducted one replicate of sampling, consisting of a total of 39 plots arranged along transect lines covering the entire area. Details of this survey will be described in a separate report on this protocol.

- Tufted puffin genetics: One genetics sample from an adult tufted puffin carcass was collected for a range-wide genetics study supported by the Pacific Seabird Group tufted puffin technical committee. The carcass was found opportunistically during a storm-petrel productivity check of BN1.
- Gull productivity: Nests were not followed on any of the gull spire plots in 2018-2021 due to plot accessibility/safety concerns.
- Gull and oystercatcher genetics: Freshly-hatched eggshell membranes were collected from 56 gull nests and eight oystercatcher nests for a collaborative genomics study with Environment and Climate Change Canada (ECCC).
- Storm-petrel reproductive success and population: In order to limit disturbance and better match protocols at other camps, excavations were not used in storm-petrel population and productivity plots in 2018-2021. Nests in which chambers could not be reached were instead recorded as unknown.
- Storm-petrel population: Storm-petrel plot 3 was not surveyed for density and plots 3 and 5 were not surveyed for occupancy due to concerns about habitat fragility.
- Storm-petrel diet: To increase sample size, some fork-tailed storm-petrel diet samples were collected using an ambush method (in addition to mist-netting), in which birds that had crash-landed in the vicinity of the mist-netting area at night were opportunistically grabbed and checked for a sample. Birds encountered at night along trails located in tall, dense salmonberry (a habitat type identified by the 2021 crew as favorable for encountering this species) were also ambushed and checked for diet samples. This method worked well until fledglings started to appear and it became difficult to immediately ascertain the age of the bird, causing undue stress on young birds attempting to fledge.
- Boat-based surveys: There was no skiff at St. Lazaria in 2021 so no visits were made to Kruzof Island for COASST or marine debris surveys. Boat-based counts of pigeon guillemots, murres, and cormorants were conducted by skiff from the R/V *Tigla* during resupply in early July.
- Sea surface temperature: The sea surface temperature data logger became detached from the rigging sometime during the summer and was not recovered, so no sea surface temperature data exist for 2021.

Reproductive success and chronology data for murres in 1994-2002 and 2012-2021 and storm-petrels in 2016-2021 were summarized using the AMNWR productivity database (except simple random standard deviation values for reproductive success parameters, which are calculated by hand). Reproductive success data for murres in 2003-2011 and storm-petrels prior to 2016 have not yet been added to the database and have been hand-summarized (these data will be added to and summarized by the database in the future). Data for black oystercatchers, rhinoceros auklets, tufted puffins, gulls, and cormorants in all

years were also summarized by hand.

Population estimates on index plots for murres in 2014-2021 and gull fledglings in 2021 were summarized using the AMNWR population database. Population data for murres from 1994-2013, gull fledglings prior to 2021, and pigeon guillemots, rhinoceros auklets, tufted puffins, gull nests, storm-petrels, and cormorants in all years have not yet been added to the database and have been hand-summarized (these data will be added to and summarized by the database in the future).

Diet data for species for which this information was collected were summarized for all years using the AMNWR diet database (only ongoing diet datasets are presented in this report; additional diet datasets exist [Appendix A]). Diet is summarized for frequency of occurrence, percent composition and percent biomass for rhinoceros auklets; frequency of occurrence, percent composition and percent volume for gulls; and frequency of occurrence and percent composition for other species. For brevity, presentation of diet data highlights only prey items that make up more than 5% of diets. A more detailed summary of St. Lazaria diet data is presented in a consolidated refuge-wide diet report (Drummond 2016).

Sea surface temperatures were summarized using the AMNWR sea surface temperature database.

Data for all other parameters not specified above were summarized by hand.

This report corrects the following data that were presented in previous reports:

- Standard deviations for reproductive parameters that can exceed one (mean clutch size [C/B], mean brood size [E/D], and chicks per nest start [E/A] for black osytercatchers, glaucous-winged gulls, and pelagic cormorants) were calculated with non-parametric bootstrapping.
- Reproductive success and chronology data for common and thick-billed murres 1994-2002 were resummarized using the AMNWR productivity database; these values replace hand-calculated summaries presented in previous reports. Murre data from 2003-2011 still needs to be imported into the database.
- Values for residency indices of rhinoceros auklets in 2019 were corrected to include only the subsample of nests apparently occupied at the early check.

## INTERESTING OBSERVATIONS

- In 2021, the crew monitored five nests that were believed to be mixed-species breeding pairs (a common murre breeding with either a thick-billed murre or a hybrid murre), and at least another two were noted but not monitored (due to poor visibility of nest contents). At least about a dozen apparent hybrid murres were seen throughout the colony.
- Though we monitored a record number of gull nest starts ( $n=293$ ), and had the highest ever number of chicks hatch ( $n=487$ ), the number of nets in the population plots were lower than in 2019, but fairly on-trend for the overall gradual increase of gull nests on St. Lazaria.
- Only one pair of pelagic cormorants attempted to nest on St. Lazaria in 2021 in areas viewable without a skiff, and a circumnavigation during resupply on 4 July did not find any additional nests. This single nest produced two chicks but one chick was found dead below the nest not long after it hatched. The remaining chick was still unfeathered by the time the crew departed the island.

- Humpback whales were sighted far less frequently than in past years, but at a similar frequency to 2019. A couple of individuals were observed on 23 days throughout the summer, which is notably less than in past years. However, quite a few “sightings” of humpback whales were not recorded in 2021 because crew members did not recognize the sound of a breathing whale until late July, often mistaking it for crashing waves.
- We encountered or found evidence of at least three different groups of people on the island in 2021, and talked to one kayaker that circumnavigated the island but did not land.
- Tidepools had not yet fully recovered following the big tidepool die-off that occurred in 2018, but are improving since 2019’s observations. High numbers of nudibranchs present in previous years were still notably absent.

## **ACKNOWLEDGEMENTS**

The crew of the R/V *Tigla̱x* provided safe transport of personnel and gear to and from St. Lazaria Island in 2021 as well as a mid-season resupply visit. Brendan Higgins, Jillian Soller, and Heather Renner helped orient the field crew to the island on camp drop-off day. As always, we deeply appreciate the safety support of Lisa Spitler on Adak who juggled the daily communications of dozens of people during the field season and looked out for our safety and well-being. Nora Rojek provided summaries from the AMNWR productivity and population databases and offered her availability for any needed clarification. Aaron Christ ran non-parametric bootstrapping to generate standard deviation values for several reproductive success parameters for oystercatchers, gulls, and cormorants. Rhinoceros auklet diet samples were identified by the Alaska Fisheries Science Center. Finally, covid-19 restrictions made this a difficult year to safely deploy a remote field camp, and the entire Homer AMNWR office contributed logistical support to enable the field season to occur, including help with pre-season gear purchase and packing, preparing for virtual protocol and field camp training, and facilitating a strict quarantine prior to camp deployment.

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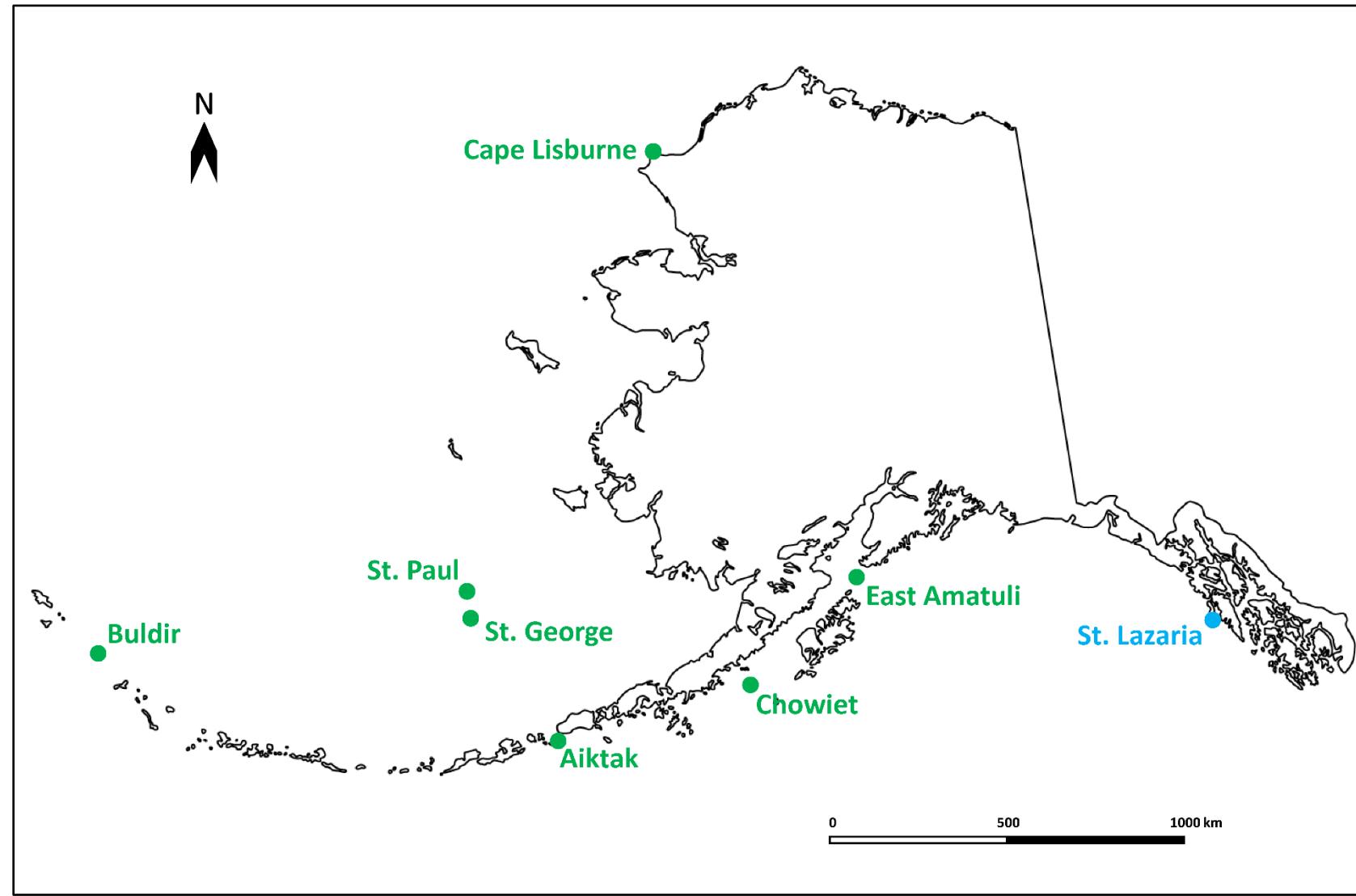
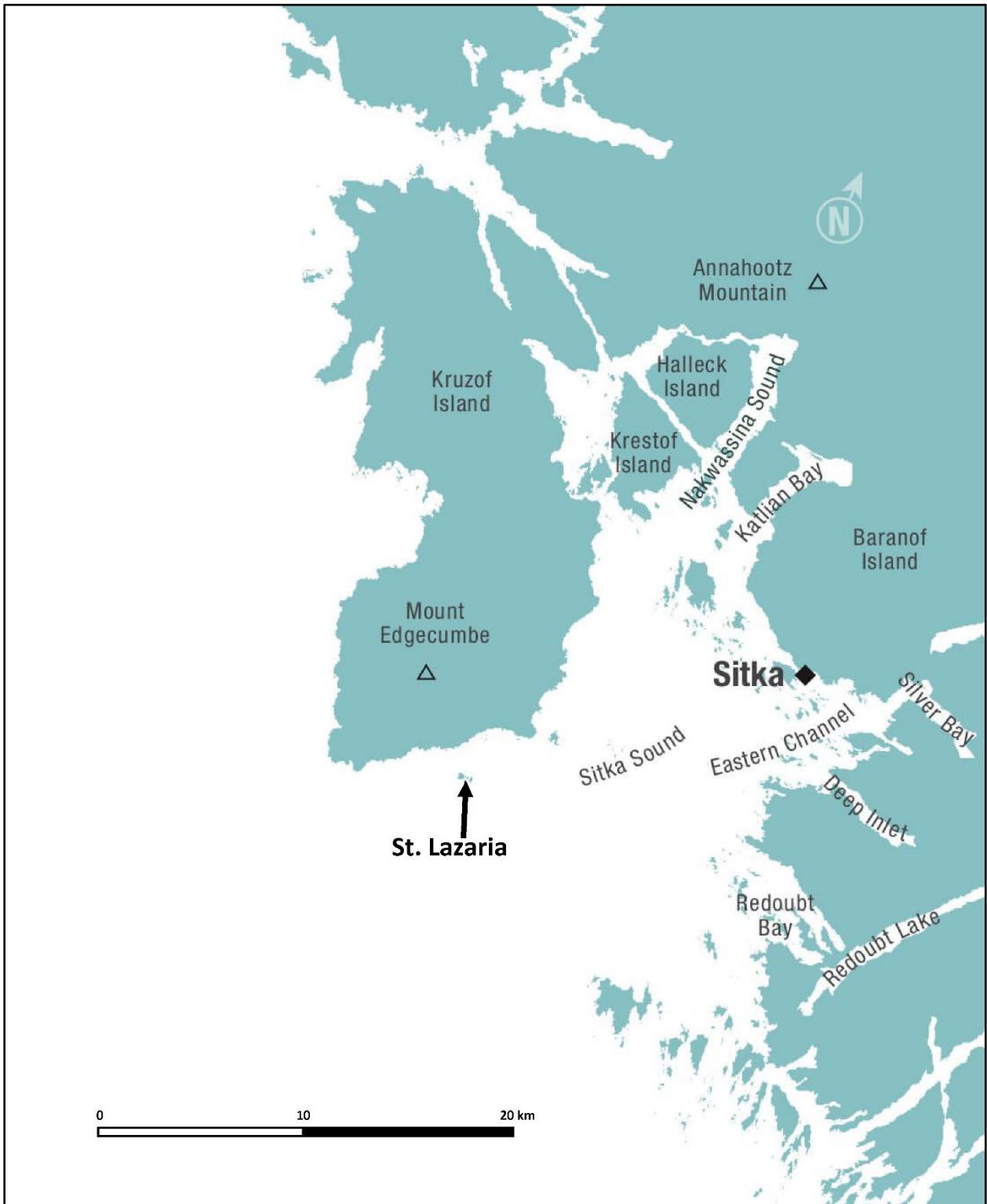
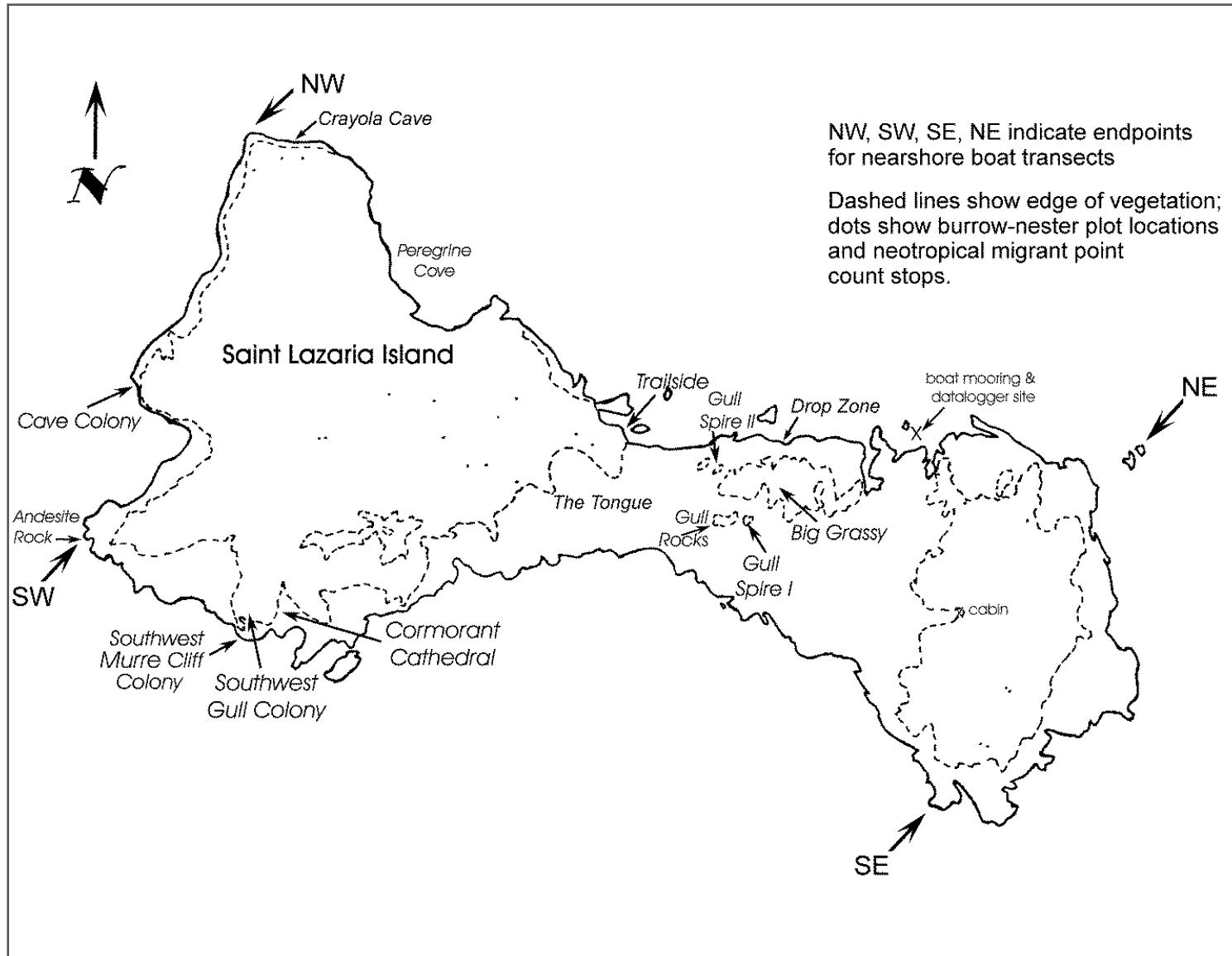


Figure 1. Location of St. Lazaria Island (in blue) in relation to other annual monitoring sites across the Alaska Maritime National Wildlife Refuge.





## **FIGURES AND TABLES**

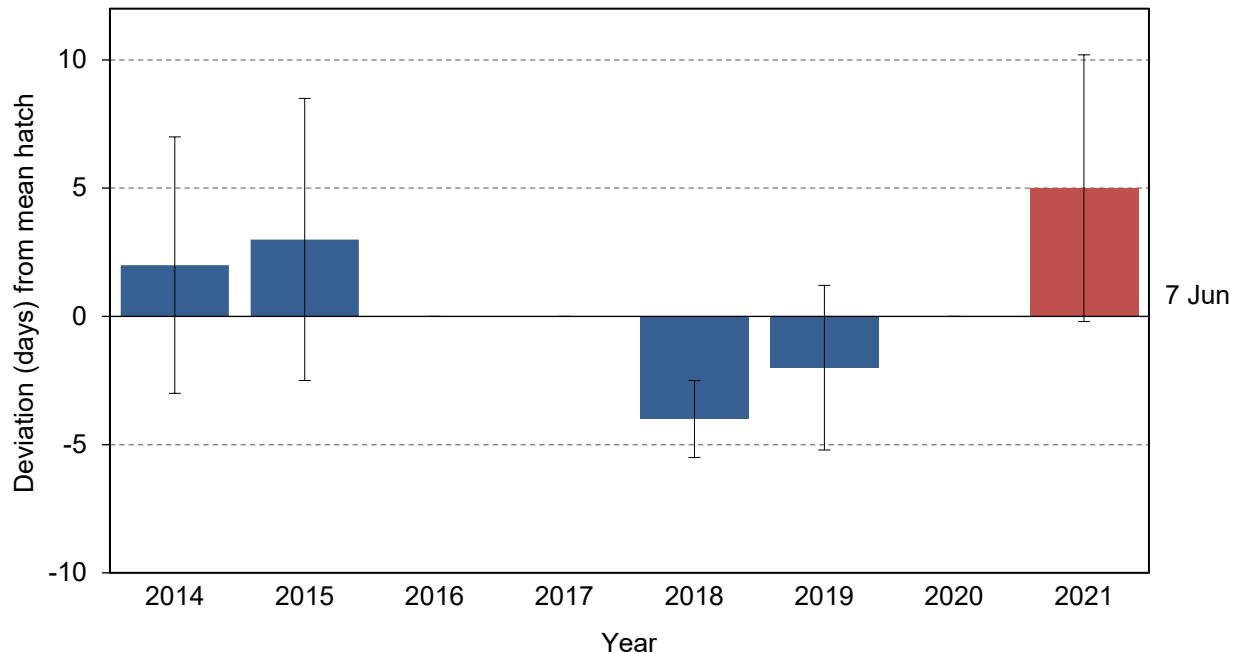


Figure 4. Yearly hatch date deviation (from the 2014-2020 average of 7 June) for black oystercatchers at St. Lazaria Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2017 or 2020, and mean hatch date could not be calculated in 2016 because a chick hatched prior to the first visit.

Table 1. Breeding chronology of black oystercatchers at St. Lazaria Island, Alaska. Data represent the date of the first chick hatched in each nest. No data were collected in 2017 or 2020.

Year	Mean hatch <sup>a</sup>	SD	n <sup>b</sup>	First hatch <sup>a</sup>	Last hatch
2014	9 Jun	5.0	6	3 Jun	15 Jun
2015	10 Jun	5.5	6	5 Jun	19 Jun
2016	-	-	-	< 8 Jun	12 Jun
2018	3 Jun	1.5	3	1 Jun	9 Jul
2019	5 Jun	3.2	3	3 Jun	11 Jun
2021	12 Jun	5.2	5	8 Jun	21 Jun

<sup>a</sup>In years when chicks have already hatched at the first visit, mean hatch date is not calculated and date of first hatch is listed as < the date of first nest check.

<sup>b</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is  $\leq 7$  days.

Table 2. Frequency distribution of hatch dates for black oystercatchers at St. Lazaria Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020.

Julian date <sup>a</sup>	No. nests hatching on Julian date					
	2014	2015	2016	2018	2019	2021
Before 1 <sup>st</sup> visit	-	-	1	-	-	-
152	-	-	-	1	-	-
153	-	-	-	-	-	-
154	2	-	-	1	1	-
155	-	-	-	1	1	-
156	-	3	-	-	-	-
157	-	-	-	-	-	-
158	-	-	-	-	-	-
159	-	-	-	-	-	1
160	1	-	-	-	1	1
161	-	-	-	-	-	-
162	1	1	2	-	-	2
163	-	-	-	-	-	-
164	-	-	-	-	-	-
165	1	-	-	-	-	-
166	1	1	-	-	-	-
167	-	-	-	-	-	-
168	-	-	-	-	-	-
169	-	-	-	-	-	-
170	-	1	-	-	-	-
171	-	-	-	-	-	-
172	-	-	-	-	-	1
<i>n</i>	6	6	2 <sup>b</sup>	3	3	5

<sup>a</sup>Julian dates are adjusted by one day in leap years.

<sup>b</sup>Does not include chicks that had already hatched at the first visit.

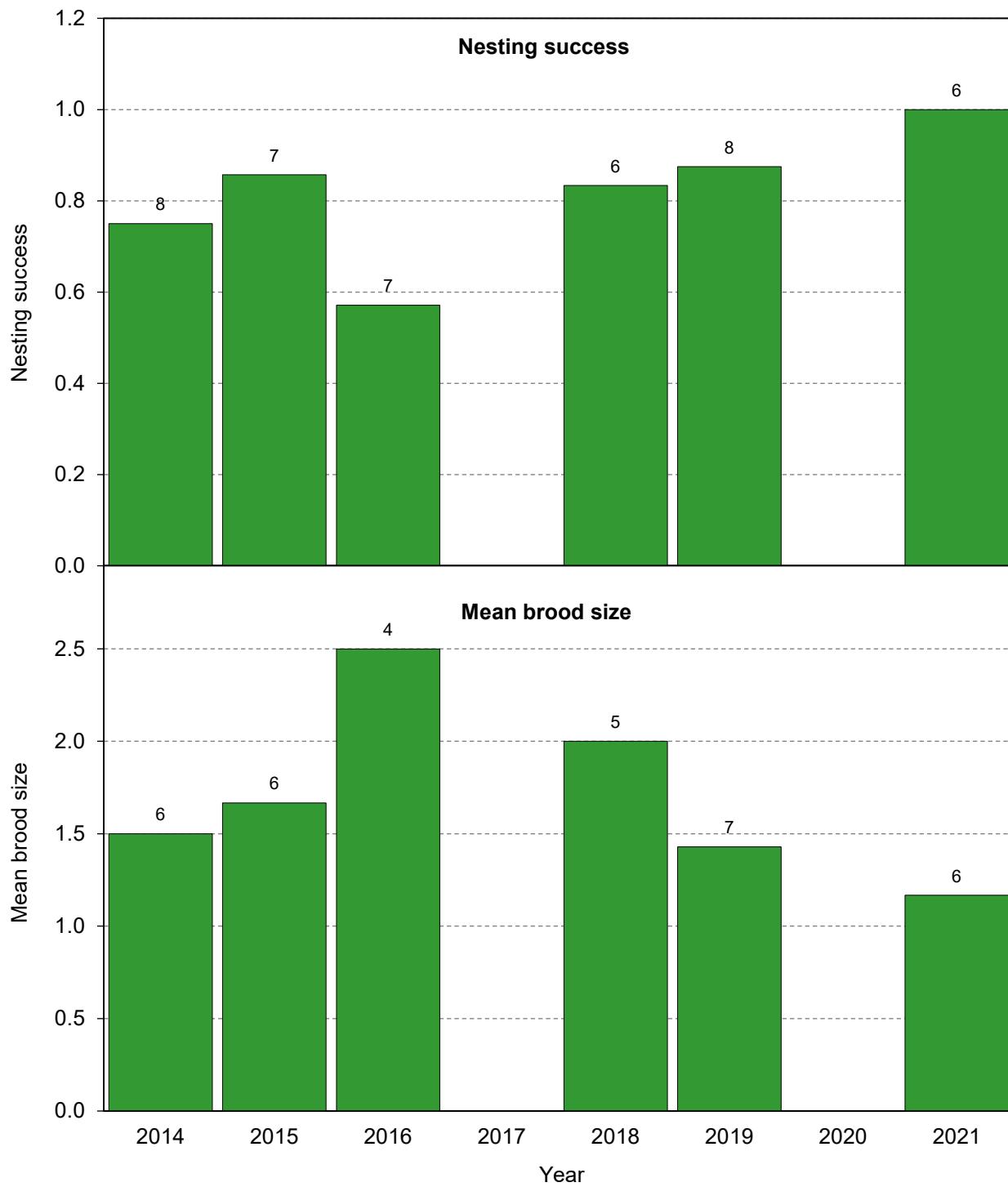


Figure 5. Reproductive performance of black oystercatchers at St. Lazaria Island, Alaska. Nesting success=D/B; Mean brood size=E/D; where B=nest sites with eggs, D=nest sites with chicks; E=total chicks. Numbers above columns indicate sample sizes ([B] for nesting success and [D] for brood size. No data were collected in 2017 or 2020.

Table 3. Reproductive performance of black oystercatchers at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Nest sites w/ eggs		Nest sites w/ x eggs:			Total eggs	Nest sites w/ chicks	Total chicks	Nest sites w/ chicks fledged	Total chicks fledged	Mean clutch size	Mean brood size	Nesting success	Hatching success	Chick success	Egg success	Fledging success	Reprod. success
	(B)	1	2	3	(C)	(D)	(E)	(F)	(G)	(C/B)	(E/D)	(D/B)	(E/C)	(G/E)	(G/C)	(F/D)	(F/B)	
	2014	8	3	3	2	15	6	9	-	-	1.9	1.5	0.75	0.60	-	-	-	-
2015	7	1	3	3	16	6	10	-	-	2.3	1.7	0.86	0.63	-	-	-	-	
2016	7	2	1	4	16	4	10	-	-	2.3	2.5	0.57	0.63	-	-	-	-	
2018	6	2	2	2	12	5	10	4	7	2.0	2.0	0.83	0.83	0.70	0.58	0.80	0.66	
2019	8	3	4	1	14	7	10	6	7	1.8	1.4	0.88	0.71	0.70	0.50	0.86	0.75	
2021	6	1	3	2	13	6	7	4	4	2.2	1.2	1.00	0.54	0.57	0.31	0.67	0.67	

Table 4. Standard deviation in reproductive performance parameters of black oystercatchers at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Total nest sites w/ eggs	Sampling design <sup>a</sup>	Mean clutch size <sup>b</sup>	Mean brood size <sup>b</sup>	Nesting success	Hatching success	Chick success	Egg success	Fledging success	Reprod. success
2014	8	Simple random	0.27	0.17	0.15	0.13	-	-	-	-
2015	7	Simple random	0.26	0.19	0.13	0.12	-	-	-	-
2016	7	Simple random	0.34	0.25	0.19	0.12	-	-	-	-
2018	6	Simple random	0.33	0.40	0.15	0.11	0.14	0.14	0.18	0.19
2019	8	Simple random	0.23	0.19	0.11	0.12	0.14	0.13	0.13	0.15
2021	6	Simple random	0.28	0.15	0.00	0.14	0.19	0.13	0.19	0.19

<sup>a</sup>Sampling for oystercatchers is based on nests as the sample unit. For simple random sampling, values are calculated using  $\sqrt{\rho * (1 - \rho) / n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>b</sup>Standard deviation values for reproductive success parameters that can exceed 1 are calculated by non-parametric bootstrapping.

Table 5. Numbers of black oystercatcher nests and breeding birds at St. Lazaria Island, Alaska. Values are derived by summing maximum nest counts across all locations throughout the breeding season; numbers of breeding birds are calculated by doubling nest numbers. No data were collected in 2017 or 2020.

Year	No. nests	Estimated no. breeding birds
2014	xx <sup>a</sup>	xx
2015	xx	xx
2016	8	16
2018	7	14
2019	8	16
2021	6	12

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

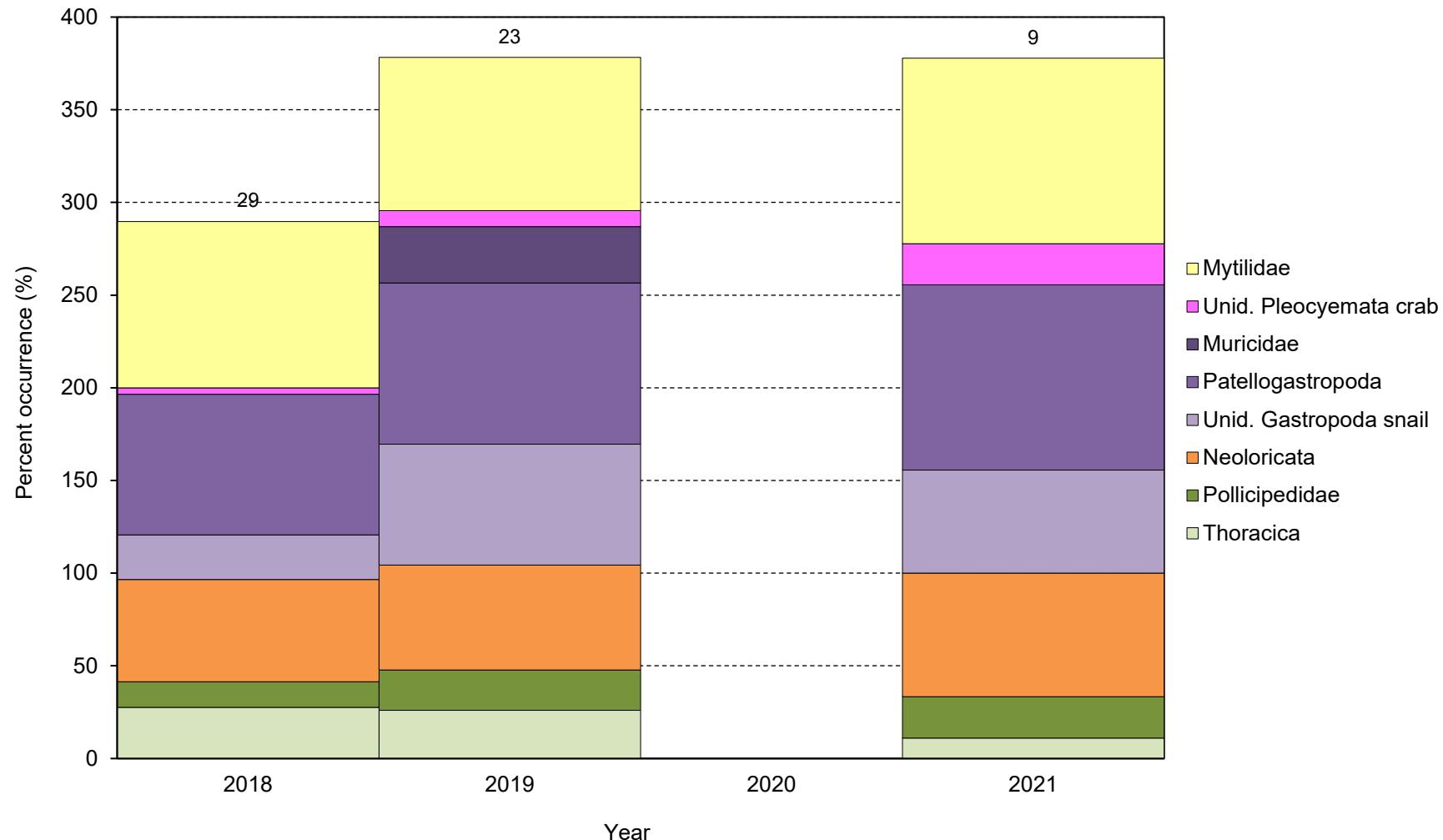


Figure 6. Frequency of occurrence of major prey items in diets of black oystercatcher chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of prey piles collected at nests at the colony. Numbers above columns indicate sample sizes. No diet samples were collected before 2018 or in 2020.

Table 6. Frequency of occurrence of major prey items in diets of black oystercatcher chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that occurred in at least 5% of diets on average across all years are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of prey piles collected at nests at the colony. No diet samples were collected before 2018 or in 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2018	2019	2021
No. samples	29	23	9
<b>Invertebrates</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Bivalvia</b>	<b>89.7</b>	<b>82.6</b>	<b>100.0</b>
<b>Mytilidae</b>	<b>89.7</b>	<b>82.6</b>	<b>100.0</b>
Unid. Mytilidae	89.7	82.6	100.0
<b>Decapoda</b>	<b>3.4</b>	<b>8.7</b>	<b>22.2</b>
Unid. Pleocyemata crab	3.4	8.7	22.2
<b>Gastropoda</b>	<b>79.3</b>	<b>100.0</b>	<b>100.0</b>
<b>Muricidae</b>	-	<b>30.4</b>	-
<i>Ceratostoma foliatum</i>	-	30.4	-
Patellogastropoda	75.9	87.0	100.0
Unid. Gastropoda snail	24.1	65.2	55.6
<b>Polyplacophora</b>	<b>55.2</b>	<b>56.5</b>	<b>66.7</b>
Neoloricata	55.2	56.5	66.7
<b>Thecostraca</b>	<b>34.5</b>	<b>43.5</b>	<b>33.3</b>
<b>Pollicipedidae</b>	<b>13.8</b>	<b>21.7</b>	<b>22.2</b>
<i>Pollicipes polymerus</i>	13.8	21.7	22.2
Thoracica	27.6	26.1	11.1
Other Invertebrates	3.4	4.3	-

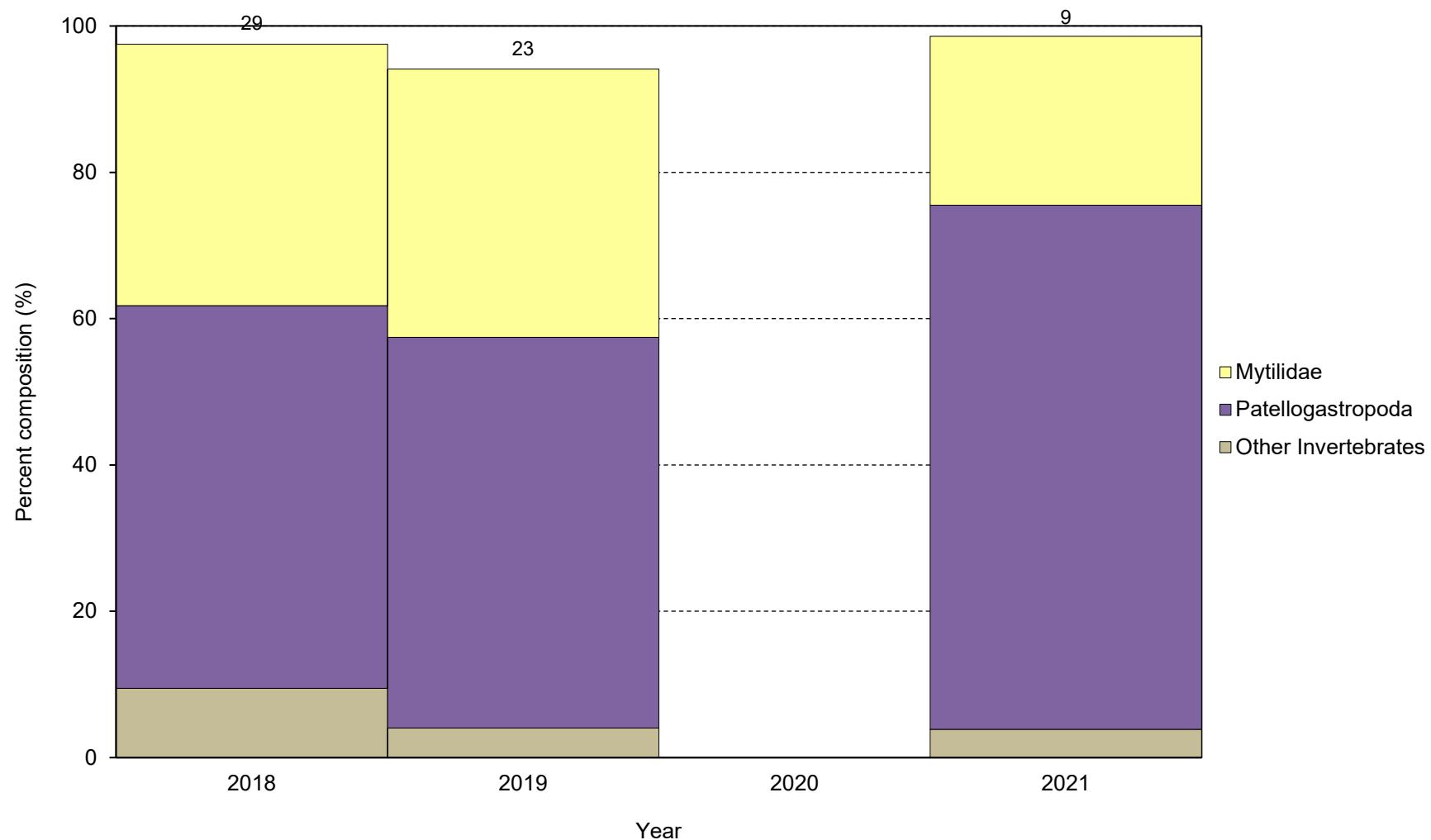


Figure 7. Percent composition of major prey items in diets of black oystercatcher chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of prey piles collected at nests at the colony. Numbers above columns indicate sample sizes. No diet samples were collected before 2018 or in 2020.

Table 7. Percent composition of major prey items in diets of black oystercatcher chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of prey piles collected at nests at the colony. No diet samples were collected before 2018 or in 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2018	2019	2021
No. samples	29	23	9
No. individuals	761	2730	1005
<b>Invertebrates</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Bivalvia</b>	<b>35.7</b>	<b>36.7</b>	<b>23.1</b>
<b>Mytilidae</b>	<b>35.7</b>	<b>36.7</b>	<b>23.1</b>
Unid. Mytilidae	35.7	36.7	23.1
<b>Gastropoda</b>	<b>54.8</b>	<b>58.1</b>	<b>73.0</b>
Patellogastropoda	52.3	53.4	71.6
Other Gastropoda	2.5	4.7	1.4
Other Invertebrates	9.5	4.0	3.9

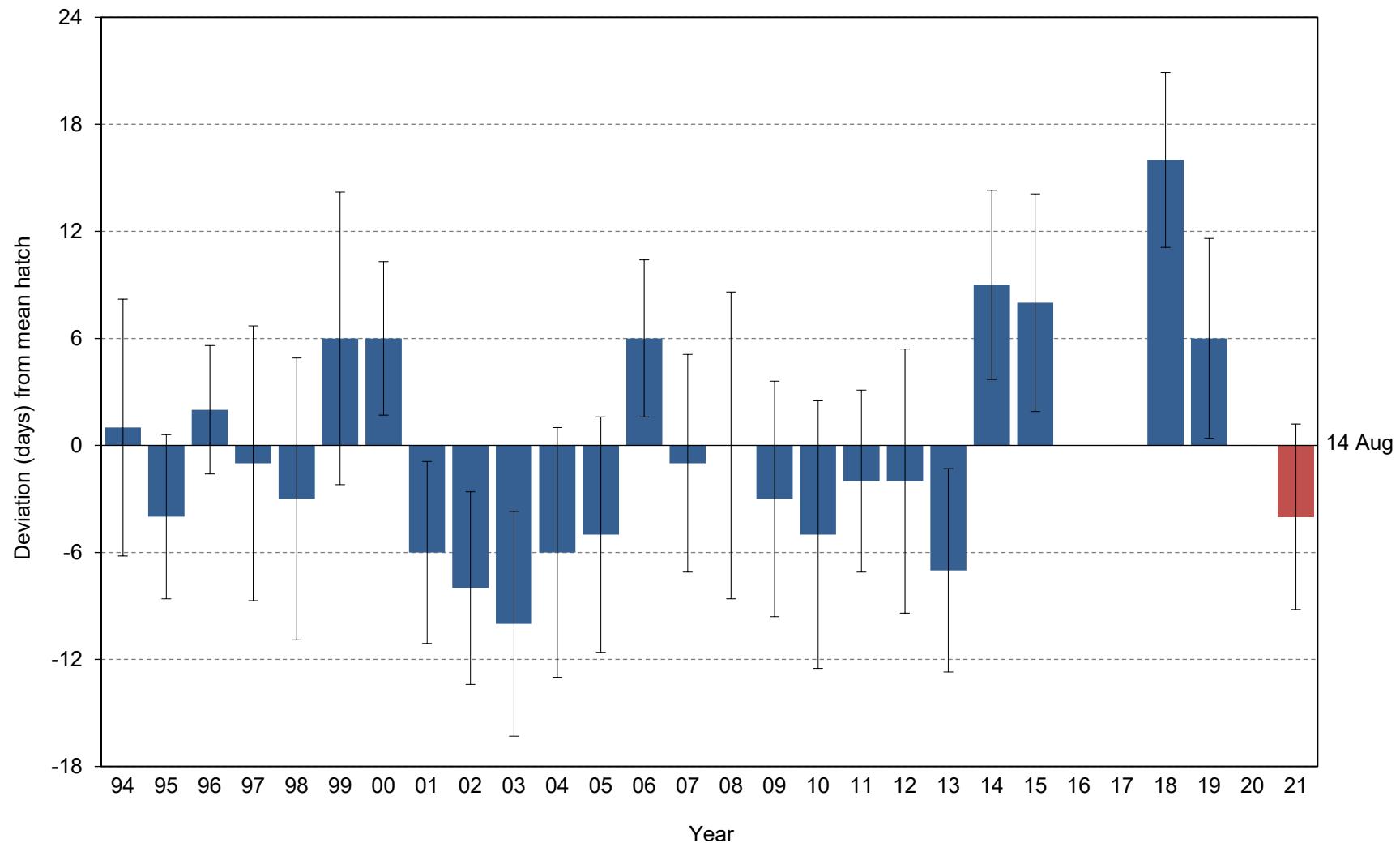


Figure 8. Yearly hatch date deviation (from the 1994-2020 average of 14 August) for common murres at St. Lazaria Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2017 or 2020; no eggs hatched in 2016 and two eggs were still being incubated at last check in 2018.

Table 8. Breeding chronology of common murres at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020; no eggs hatched in 2016.

Year	Mean hatch	SD	n <sup>a</sup>	First hatch	Last hatch	First "jump"
1994	15 Aug	7.1	22	4 Aug	26 Aug	24 Aug
1995	10 Aug	4.6	11	2 Aug	18 Aug	21 Aug
1996	15 Aug	3.6	11	9 Aug	23 Aug	28 Aug
1997	13 Aug	8.6	16	29 Jul	25 Aug	21 Aug
1998	11 Aug	7.9	17	31 Jul	31 Aug	24 Aug
1999	20 Aug	8.2	28	8 Aug	7 Sep	31 Aug
2000	19 Aug	4.3	6	14 Aug	27 Aug	30 Aug
2001	8 Aug	5.1	16	4 Aug	20 Aug	20 Aug
2002	6 Aug	5.4	21	1 Aug	19 Aug	17 Aug
2003	4 Aug	6.3	53	25 Jul	26 Aug	xx <sup>b</sup>
2004	7 Aug	7.0	53	26 Jul	28 Aug	xx
2005	9 Aug	6.6	34	31 Jul	26 Aug	xx
2006	20 Aug	4.4	40	14 Aug	1 Sep	xx
2007	13 Aug	6.1	38	31 Jul	1 Sep	xx
2008	13 Aug	8.6	54	30 Jul	31 Aug	xx
2009	11 Aug	6.6	55	27 Jul	22 Aug	xx
2010	9 Aug	7.5	11	21 Jul	18 Aug	xx
2011	12 Aug	5.1	57	30 Jul	30 Aug	xx
2012	11 Aug	7.4	15	5 Aug	25 Aug	19 Aug
2013	7 Aug	5.7	27	29 Jul	26 Aug	20 Aug
2014	23 Aug	5.3	6	23 Aug	23 Aug	31 Aug
2015	22 Aug	6.1	55	14 Aug	5 Sep	27 Aug
2018	30 Aug	4.9	43	24 Aug	8 Sep <sup>c</sup>	> Sep 10
2019	20 Aug	5.6	33	12 Aug	3 Sep	30 Aug
2021	10 Aug	5.2	24	3 Aug	24 Aug	21 Aug

<sup>a</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is  $\leq 7$  days.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>c</sup>In 2018, two eggs were still being incubated at last check on 10 September and were excluded from analysis.

Table 9. Frequency distribution of hatch dates for common murres at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; no eggs hatched in 2016.

Julian date <sup>a</sup>	No. nests hatching on Julian date												
	94	95	96	97	98	99	00	01	02	03	04	05	06
192	-	-	-	-	-	-	-	-	-	-	-	-	-
193	-	-	-	-	-	-	-	-	-	-	-	-	-
194	-	-	-	-	-	-	-	-	-	-	-	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	-	-	-	-	-	-
197	-	-	-	-	-	-	-	-	-	-	-	-	-
198	-	-	-	-	-	-	-	-	-	-	-	-	-
199	-	-	-	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	-	-	-	-	-
201	-	-	-	-	-	-	-	-	-	-	-	-	-
202	-	-	-	-	-	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	1	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	-	-	1	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	1	-	-	-	-	-	6	1	-	-
211	-	-	-	-	-	-	-	-	-	-	-	-	-
212	-	-	-	-	1	-	-	-	-	15	-	2	-
213	-	-	-	-	-	-	-	-	4	-	-	-	-
214	-	1	-	-	1	-	-	-	5	2	9	3	-
215	-	-	-	-	-	-	-	-	1	-	-	-	-
216	2	-	-	3	2	-	-	6	3	12	10	-	-
217	-	-	-	1	-	-	-	-	-	-	1	-	-
218	2	2	-	2	2	-	-	2	1	8	-	8	-
219	-	-	-	-	-	-	-	-	1	-	-	-	-
220	-	1	-	-	1	2	-	2	-	-	16	7	-
221	-	-	-	-	-	-	-	-	3	-	-	-	-
222	5	2	2	1	5	3	-	2	1	2	5	-	-
223	1	1	-	-	2	-	-	2	-	-	-	-	-
224	1	2	-	-	-	-	-	-	-	2	-	6	-
225	1	-	-	-	-	-	-	-	-	-	1	-	-
226	-	-	-	1	-	3	-	-	1	-	1	3	7
227	-	-	1	-	-	1	2	-	-	-	2	-	1
228	-	-	6	-	-	3	-	-	-	1	1	-	3
229	-	-	-	-	-	-	-	-	-	-	-	-	-
230	3	2	1	2	-	3	-	-	1	-	-	-	-
231	1	-	-	-	-	5	-	-	1	-	1	-	-
232	-	-	-	2	-	-	3	2	-	1	-	3	15
233	-	-	-	-	-	-	-	-	-	-	-	-	-
234	1	-	-	-	1	1	-	-	-	-	-	-	6
235	-	-	-	-	-	-	-	-	-	-	-	-	-
236	3	-	1	1	1	-	-	-	-	1	-	-	-
237	1	-	-	2	-	-	-	-	-	-	2	-	-
238	1	-	-	-	-	1	-	-	-	1	-	2	7
239	-	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	1	1	-	-	-	1	-	-
241	-	-	-	-	-	-	-	-	-	-	1	-	-
242	-	-	-	-	-	-	-	-	-	-	-	-	-
243	-	-	-	-	1	-	-	-	-	-	-	-	-
244	-	-	-	-	-	3	-	-	-	-	-	-	1
245	-	-	-	-	-	-	-	-	-	-	-	-	-
246	-	-	-	-	-	-	-	-	-	-	-	-	-
247	-	-	-	-	-	1	-	-	-	-	-	-	-
248	-	-	-	-	-	-	-	-	-	-	-	-	-
249	-	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	1	-	-	-	-	-	-	-
251	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>n</i>	22	11	11	16	17	28	6	16	21	53	53	34	40

Table 9 (continued). Frequency distribution of hatch dates for common murres at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; no eggs hatched in 2016.

Julian date <sup>a</sup>	No. nests hatching on Julian date											
	07	08	09	10	11	12	13	14	15	18	19	21
192	-	-	-	-	-	-	-	-	-	-	-	-
193	-	-	-	-	-	-	-	-	-	-	-	-
194	-	-	-	-	-	-	-	-	-	-	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	-	-	-	-	-
197	-	-	-	-	-	-	-	-	-	-	-	-
198	-	-	-	-	-	-	-	-	-	-	-	-
199	-	-	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	-	-	-	-
201	-	-	-	-	-	-	-	-	-	-	-	-
202	-	-	-	1	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	1	-	-	-	-	-	-	-	-	-
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210	-	-	-	-	-	-	1	-	-	-	-	-
211	-	-	-	-	1	-	-	-	-	-	-	-
212	1	2	-	-	-	-	1	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-	-
214	-	6	7	-	1	-	3	-	-	-	-	-
215	-	-	-	-	-	-	1	-	-	-	-	3
216	1	-	-	-	2	-	4	-	-	-	-	1
217	-	-	-	-	-	-	-	-	-	-	-	-
218	2	2	11	2	-	2	4	-	-	-	-	4
219	-	-	-	-	-	-	-	-	-	-	-	-
220	-	11	7	4	6	7	5	-	-	-	-	2
221	-	-	-	-	-	-	-	-	-	-	-	3
222	15	2	1	-	15	-	3	-	-	-	-	2
223	-	-	-	-	10	-	-	-	-	-	-	1
224	4	7	4	2	-	-	1	-	-	-	4	3
225	-	-	-	-	-	1	-	-	-	-	-	-
226	-	-	1	-	10	1	2	-	7	-	-	1
227	-	-	-	-	2	-	-	-	-	-	-	-
228	8	5	13	-	-	-	-	1	1	-	12	1
229	-	-	-	-	6	-	-	-	-	13	-	-
230	2	-	-	2	-	-	1	1	-	-	-	2
231	-	-	-	-	-	-	-	-	-	-	-	-
232	-	8	8	-	1	-	-	-	-	-	-	-
233	-	-	-	-	1	-	-	1	-	-	-	-
234	3	1	2	-	-	1	-	-	16	-	10	-
235	-	1	-	-	-	-	-	1	-	-	-	-
236	-	1	-	-	-	2	-	-	-	12	-	1
237	-	-	-	-	-	-	-	-	-	4	-	-
238	1	4	-	-	1	1	1	1	3	1	4	-
239	-	-	-	-	-	-	-	-	-	-	-	-
240	-	3	-	-	-	-	-	-	2	4	-	-
241	-	-	-	-	-	-	-	-	2	-	-	-
242	-	-	-	-	1	-	-	-	2	-	2	-
243	-	-	-	-	-	-	-	-	-	-	-	-
244	1	1	-	-	-	-	-	1	-	18	-	-
245	-	-	-	-	-	-	-	-	-	-	-	-
246	-	-	-	-	-	-	-	-	2	-	1	-
247	-	-	-	-	-	-	-	-	1	-	-	-
248	-	-	-	-	-	-	-	-	2	3	-	-
249	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-	-	1	-	-
251	-	-	-	-	-	-	-	-	-	4	-	-
<i>n</i>	38	54	55	11	57	15	27	6	55	43 <sup>b</sup>	33	24

<sup>a</sup>Julian dates are adjusted by one day in leap years.

<sup>b</sup>In 2018, two eggs were still being incubated at last check on 10 September and were excluded from analysis.

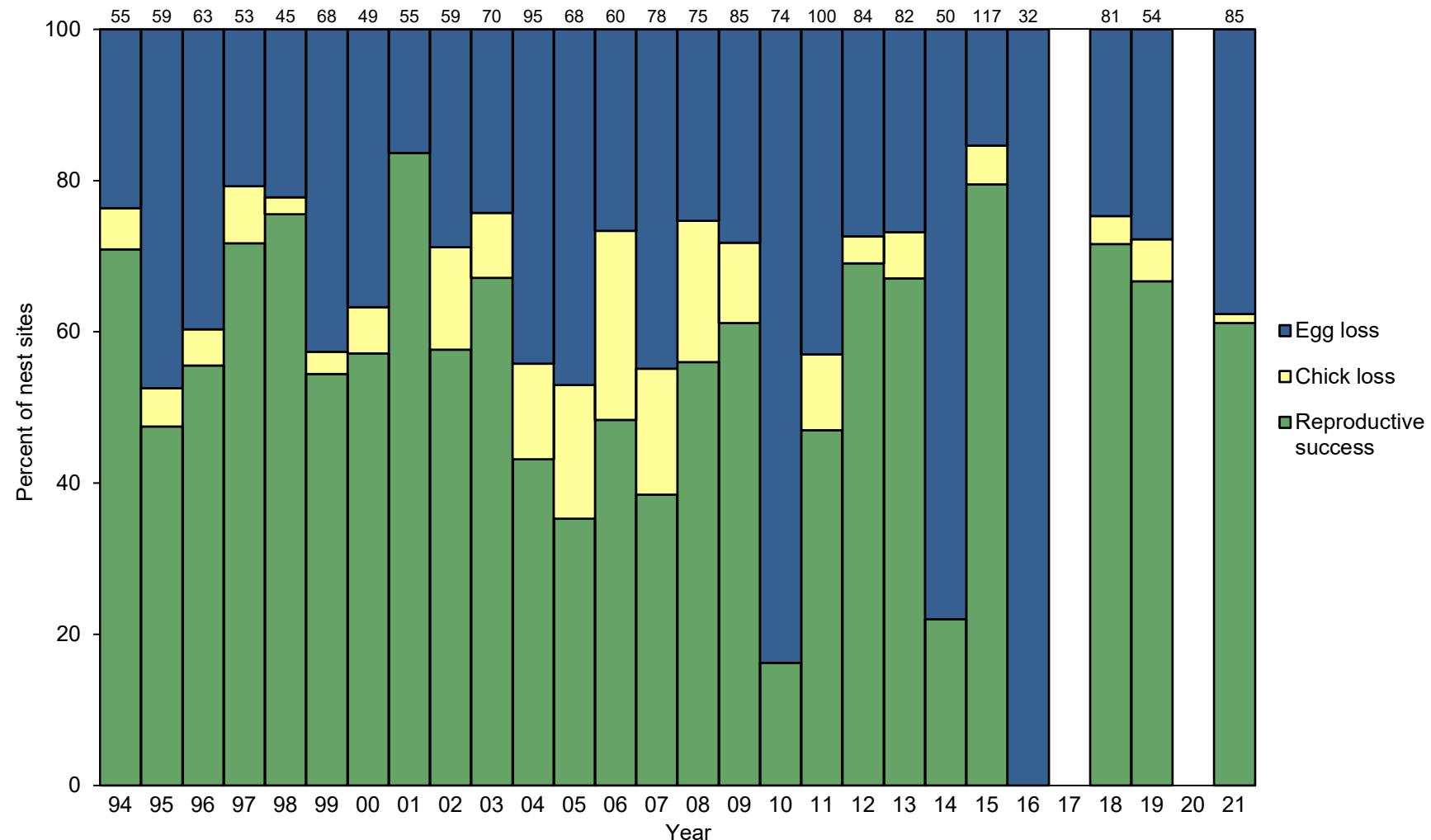


Figure 9. Reproductive performance of common murres at St. Lazaria Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Numbers above columns indicate sample sizes (B). Due to late timing of breeding, values in 1994-2002, 2014-2015, and 2018-2021 represent maximum potential reproductive success [(F+H)/(B+H)] including chicks too young to fledge at the last check (H); sample sizes in those years=(B+H). No data were collected in 2017 or 2020.

Table 10. Reproductive performance of common murres at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Nest sites w/ eggs	Nest sites w/ chicks	Nest sites w/ chicks fledged	Nest sites w/ young chicks still present <sup>a</sup>	Nesting success (D/B) <sup>b</sup>		Fledging success (F/D) <sup>c</sup>		Reproductive success (F/B)		Max. potential reproductive success <sup>d</sup> [(F+H)/(B+H)]		Sampling design <sup>f</sup>	
	(B)	(D)	(F)	(H)	Total	SD	Total	SD	Total	SD	Total	SD		
1994	47	34	31	8	0.72	0.07	0.91	0.05	0.66	0.07	0.71	0.06	9	Simple random
1995	56	28	25	3	0.50	0.07	0.89	0.06	0.45	0.07	0.47	0.07	9	Simple random
1996	48	23	20	15	0.48	0.07	0.87	0.07	0.42	0.07	0.56	0.06	9	Simple random
1997	50	39	35	3	0.78	0.06	0.90	0.05	0.70	0.06	0.72	0.06	9	Simple random
1998	39	29	28	6	0.74	0.07	0.97	0.03	0.72	0.07	0.76	0.06	9	Simple random
1999	64	35	33	4	0.55	0.06	0.94	0.04	0.52	0.06	0.54	0.06	9	Simple random
2000	46	28	25	3	0.61	0.07	0.89	0.06	0.54	0.07	0.57	0.07	9	Simple random
2001	52	43	43	3	0.83	0.05	1.00	0.00	0.83	0.05	0.84	0.05	9	Simple random
2002	58	41	33	1	0.71	0.06	0.80	0.06	0.57	0.07	0.58	0.06	9	Simple random
2003	70	53	47	xx <sup>g</sup>	0.76	0.05	0.89	0.04	0.67	0.06	xx	xx	xx	Simple random
2004	95	53	41	xx	0.56	0.05	0.77	0.06	0.43	0.05	xx	xx	xx	Simple random
2005	68	36	24	xx	0.53	0.06	0.67	0.08	0.35	0.06	xx	xx	xx	Simple random
2006	60	44	29	xx	0.73	0.06	0.66	0.07	0.48	0.06	xx	xx	xx	Simple random
2007	78	43	30	xx	0.55	0.06	0.70	0.07	0.39	0.06	xx	xx	xx	Simple random
2008	75	56	42	xx	0.75	0.05	0.75	0.06	0.56	0.06	xx	xx	xx	Simple random
2009	85	61	52	xx	0.72	0.05	0.85	0.05	0.61	0.05	xx	xx	xx	Simple random
2010	74	12	12	xx	0.16	0.04	1.00	0.00	0.16	0.04	xx	xx	xx	Simple random
2011	100	57	47	xx	0.57	0.05	0.82	0.05	0.47	0.05	xx	xx	9	Simple random
2012	84	61	58	0	0.73	0.08	0.95	0.03	0.69	0.05	0.69	0.05	3	Clustered by plot
2013	82	60	55	0	0.73	0.05	0.92	0.04	0.67	0.05	0.67	0.05	1 <sup>h</sup>	Simple random
2014	47	8	8	3	0.17	0.05	1.00	0.00	0.17	0.05	0.22	0.06	1 <sup>h</sup>	Simple random
2015	105	87	81	12	0.83	0.04	0.93	0.03	0.77	0.04	0.79	0.04	4	Clustered by plot
2016	32	0	0	0	0.00	0.00	-	-	0.00	0.00	0.00	0.00	6	Simple random
2018	43	23	20	38	0.53	0.08	0.87	0.07	0.47	0.08	0.72	0.05	9	Simple random
2019	45	30	27	9	0.67	0.07	0.90	0.05	0.60	0.07	0.67	0.06	8	Simple random
2021	84	52	51	1	0.62	0.05	0.98	0.02	0.61	0.05	0.61	0.05	8	Simple random

<sup>a</sup>Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present  $\geq 13$  d for murres). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

<sup>b</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>c</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>d</sup>Values of maximum potential success include nest sites with chicks still present but too young to consider fledged at the last check; these values may be useful in years when crews leave the island before many chicks reach fledging age.

<sup>e</sup>Plots that are combined for analysis are counted as a single "plot".

<sup>f</sup>Sampling for murres is clustered by plot except when sample sizes per plot are too small or plot data are not available. For sampling clustered by plot, standard deviation values are calculated based on plot as a sample unit; for simple random sampling, standard deviation values are calculated using  $\sqrt{\rho * (1 - \rho)/n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>g</sup>xx indicates data may potentially exist but have not yet been summarized.

<sup>h</sup>No individual plot data are available in database so all are combined; raw data may contain plot data that will allow cluster sampling by plot and should be entered when time is available.

Table 11. Reproductive performance of common murres at St. Lazaria Island, Alaska in 2021.

Parameter	Plot								Total	SD <sup>a</sup>
	1	2	3	4	5	6A&B	7	8		
Nest sites w/ eggs (B)	15	10	15	8	1	6	25	4	84	-
Nest sites w/ chicks (D)	6	6	10	4	0	4	21	1	52	-
Nest sites w/ chicks fledged (F)	6	6	10	4	0	4	20	1	51	-
Nest sites w/ young chicks still present <sup>b</sup> (H)	1	0	0	0	0	0	0	0	1	-
Nesting success (D/B) <sup>c</sup>	0.40	0.60	0.67	0.50	0.00	0.67	0.84	0.25	0.62	0.05
Fledging success (F/D) <sup>d</sup>	1.00	1.00	1.00	1.00	-	1.00	0.95	1.00	0.98	0.02
Reproductive success (F/B)	0.40	0.60	0.67	0.50	0.00	0.67	0.80	0.25	0.61	0.05
Max. potential reproductive success [(F+H)/(B+H)] <sup>e</sup>	0.44	0.60	0.67	0.50	0.00	0.67	0.80	0.25	0.61	0.05

<sup>a</sup>Due to small sample sizes per plot, standard deviations are calculated based on simple random sampling rather than cluster sampling. For simple random sampling, values are calculated using  $\sqrt{\rho * (1 - \rho) / n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>b</sup>Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present  $\geq 13$  d for common murres). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

<sup>c</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>d</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>e</sup>Maximum potential reproductive success includes nest sites with chicks too young to consider fledged at the last check; this value may be useful in years when crews leave the island before many chicks reach fledging age.

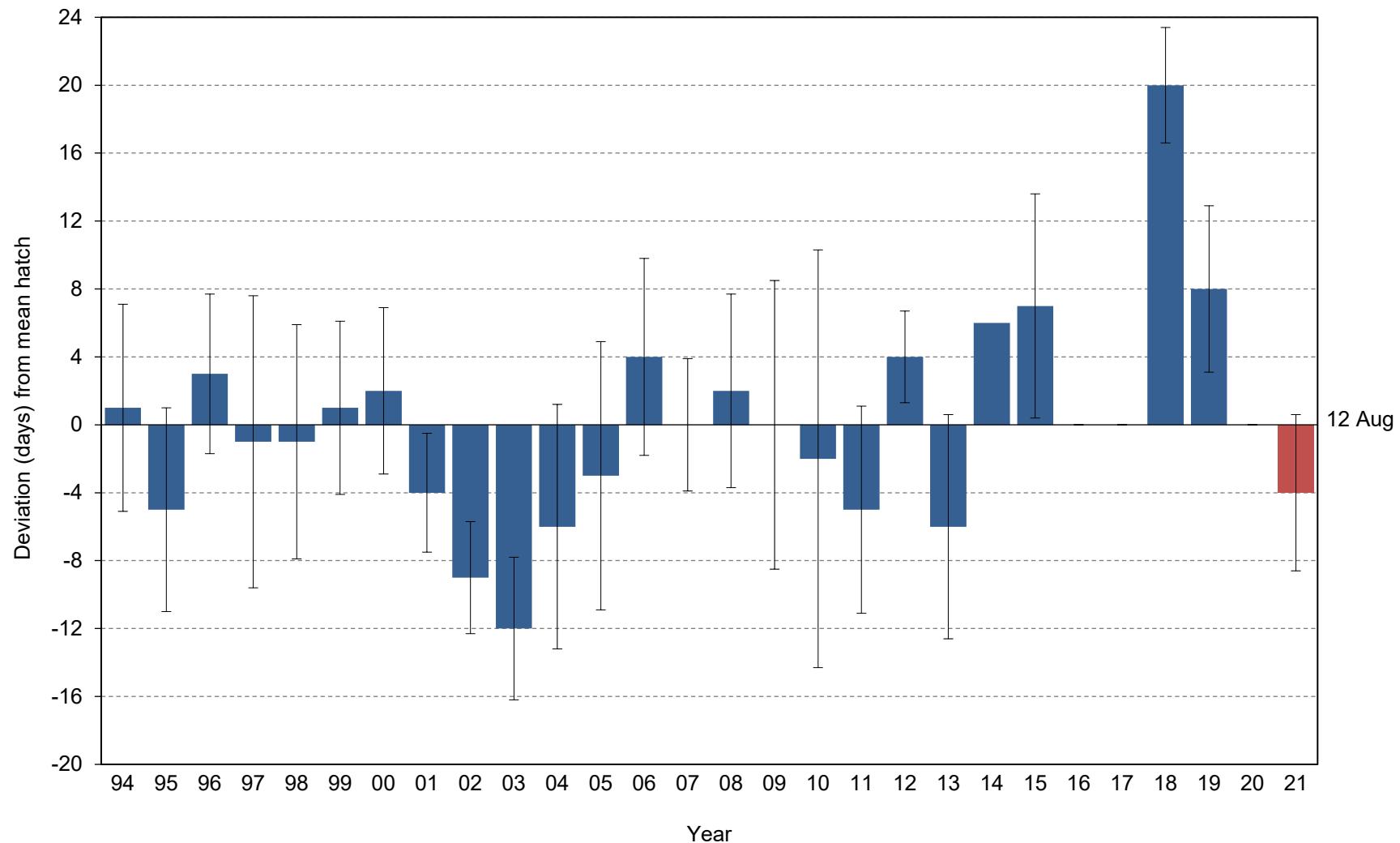


Figure 10. Yearly hatch date deviation (from the 1994-2020 average of 12 August) for thick-billed murres at St. Lazaria Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date (years without error bars have sample size of one); red highlights the current year. No data were collected in 2017 or 2020; no nests monitored for chronology hatched in 2016.

Table 12. Breeding chronology of thick-billed murres at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020; no nests monitored for chronology hatched in 2016.

Year	Mean hatch	SD	n <sup>a</sup>	First hatch	Last hatch	First "jump" <sup>b</sup>
1994	13 Aug	6.1	17	6 Aug	25 Aug	24 Aug
1995	7 Aug	6.0	6	2 Aug	18 Aug	18 Aug
1996	14 Aug	4.7	15	3 Aug	23 Aug	28 Aug
1997	11 Aug	8.6	17	30 Jul	25 Aug	18 Aug
1998	11 Aug	6.9	20	1 Aug	24 Aug	24 Aug
1999	13 Aug	5.1	13	6 Aug	22 Aug	25 Aug
2000	13 Aug	4.9	10	7 Aug	20 Aug	27 Aug
2001	8 Aug	3.5	13	4 Aug	14 Aug	18 Aug
2002	3 Aug	3.3	16	27 Jul	9 Aug	17 Aug
2003	31 Jul	4.2	39	23 Jul	14 Aug	xx <sup>c</sup>
2004	5 Aug	7.2	22	26 Jul	19 Aug	xx
2005	9 Aug	7.9	16	31 Jul	1 Sep	xx
2006	16 Aug	5.8	15	8 Aug	26 Aug	xx
2007	12 Aug	3.9	20	6 Aug	22 Aug	xx
2008	13 Aug	5.7	26	7 Aug	25 Aug	xx
2009	12 Aug	8.5	28	27 Jul	1 Sep	xx
2010	10 Aug	12.3	6	30 Jul	1 Sep	xx
2011	7 Aug	6.1	35	27 Jul	20 Aug	xx
2012	15 Aug	2.7	5	12 Aug	17 Aug	19 Aug
2013	6 Aug	6.6	10	29 Jul	22 Aug	20 Aug
2014	18 Aug	-	1	18 Aug	18 Aug	> 8 Sep
2015	19 Aug	6.6	3	14 Aug	28 Aug	2 Sep
2018	1 Sep	3.4	7	28 Aug	8 Sep	> 10 Sep
2019	20 Aug	4.9	10	16 Aug	30 Aug	3 Sep
2021	8 Aug	4.6	6	2 Aug	16 Aug	21 Aug

<sup>a</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.

<sup>b</sup>In years when no chicks fledged before the field crew left the island at the end of the season, date of first fledge is listed as > the date of last nest check.

<sup>c</sup>xx indicates data potentially exist but have not yet been summarized.

Table 13. Frequency distribution of hatch dates for thick-billed murres at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; no nests monitored for chronology hatched in 2016.

Julian date <sup>a</sup>	No. nests hatching on Julian date												
	94	95	96	97	98	99	00	01	02	03	04	05	06
204	-	-	-	-	-	-	-	-	-	1	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	2	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	1	1	2	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	1	13	3	-	-
211	-	-	-	1	-	-	-	-	-	-	-	-	-
212	-	-	-	1	-	-	-	-	-	13	-	2	-
213	-	-	-	-	1	-	-	-	1	-	-	-	-
214	-	3	-	1	3	-	-	-	5	1	2	2	-
215	-	-	-	-	-	-	-	-	-	-	-	-	-
216	-	-	1	2	1	-	-	4	2	4	6	-	-
217	-	-	-	1	-	-	-	-	-	-	-	-	-
218	1	-	-	3	3	1	-	2	4	2	-	2	-
219	1	-	-	-	-	1	-	-	1	-	1	-	-
220	6	-	-	-	1	1	2	-	-	-	1	3	1
221	-	-	-	-	-	-	-	-	1	-	-	-	-
222	2	2	1	1	1	3	3	3	-	-	2	-	4
223	-	-	3	-	2	-	-	1	-	-	-	-	-
224	1	-	-	-	1	-	-	2	-	1	1	4	-
225	-	-	-	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	3	-	1	-	1	1	1	3
227	-	-	2	-	-	-	2	-	-	-	-	-	-
228	1	-	3	-	-	1	-	-	-	-	1	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-
230	1	1	2	4	6	1	-	-	-	-	-	1	-
231	1	-	1	-	-	-	-	-	-	-	-	-	-
232	1	-	1	-	-	-	2	-	-	-	2	-	3
233	-	-	-	-	-	-	1	-	-	-	-	-	-
234	-	-	-	1	-	2	-	-	-	-	-	-	3
235	-	-	-	-	-	-	-	-	-	-	-	-	-
236	1	-	1	-	1	-	-	-	-	-	-	-	-
237	1	-	-	2	-	-	-	-	-	-	-	-	-
238	-	-	-	-	-	-	-	-	-	-	-	-	1
239	-	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	-	-	-	-	-	-	-	-
241	-	-	-	-	-	-	-	-	-	-	-	-	-
242	-	-	-	-	-	-	-	-	-	-	-	-	-
243	-	-	-	-	-	-	-	-	-	-	-	-	-
244	-	-	-	-	-	-	-	-	-	-	-	1	-
245	-	-	-	-	-	-	-	-	-	-	-	-	-
246	-	-	-	-	-	-	-	-	-	-	-	-	-
247	-	-	-	-	-	-	-	-	-	-	-	-	-
248	-	-	-	-	-	-	-	-	-	-	-	-	-
249	-	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-	-	-	-	-	-
251	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>n</i>	17	6	15	17	20	13	10	13	16	39	22	16	15

Table 13 (continued). Frequency distribution of hatch dates for thick-billed murres at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; no nests monitored for chronology hatched in 2016.

Julian date <sup>a</sup>	No. nests hatching on Julian date											
	07	08	09	10	11	12	13	14	15	18	19	21
204	-	-	-	-	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	1	-	1	-	-	-	-	-	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	3	-	2	-	-	-	-	-
211	-	-	-	2	-	-	-	-	-	-	-	-
212	-	-	1	-	-	-	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-	-
214	-	-	4	-	3	-	2	-	-	-	-	1
215	-	-	-	-	-	-	-	-	-	-	-	1
216	-	-	-	-	9	-	1	-	-	-	-	-
217	-	-	-	-	-	-	-	-	-	-	-	-
218	2	-	2	1	-	-	-	-	-	-	-	-
219	-	-	-	-	-	-	-	-	-	-	-	-
220	-	5	3	-	5	-	4	-	-	-	-	1
221	-	-	-	-	-	-	-	-	-	-	-	2
222	8	3	-	-	4	-	-	-	-	-	-	-
223	-	-	-	-	4	-	-	-	-	-	-	-
224	5	5	5	1	-	-	-	-	-	-	-	-
225	-	-	-	-	-	2	-	-	-	-	-	-
226	-	1	1	1	2	-	-	-	2	-	-	-
227	-	-	-	-	-	-	-	-	-	-	-	-
228	3	7	7	-	-	-	-	-	-	-	6	1
229	-	-	-	-	2	3	-	-	-	-	-	-
230	1	-	-	-	-	-	-	1	-	-	-	-
231	-	-	-	-	-	-	-	-	-	-	-	-
232	-	1	1	-	2	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-	-	-	-	-
234	1	1	-	-	-	-	1	-	-	-	2	-
235	-	-	-	-	-	-	-	-	-	-	-	-
236	-	-	-	-	-	-	-	-	-	-	-	-
237	-	-	-	-	-	-	-	-	-	-	-	-
238	-	3	1	-	-	-	-	-	-	-	-	1
239	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	1	-	-	-	-	-	1	2	-	-
241	-	-	-	-	-	-	-	-	-	-	-	-
242	-	-	-	-	-	-	-	-	-	-	1	-
243	-	-	-	-	-	-	-	-	-	-	-	-
244	-	-	1	1	-	-	-	-	-	4	-	-
245	-	-	-	-	-	-	-	-	-	-	-	-
246	-	-	-	-	-	-	-	-	-	-	-	-
247	-	-	-	-	-	-	-	-	-	-	-	-
248	-	-	-	-	-	-	-	-	-	-	-	-
249	-	-	-	-	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-	-	-	-	-
251	-	-	-	-	-	-	-	-	-	1	-	-
<i>n</i>	20	26	28	6	35	5	10	1	3	7	10	6

<sup>a</sup>Julian dates are adjusted by one day in leap years.

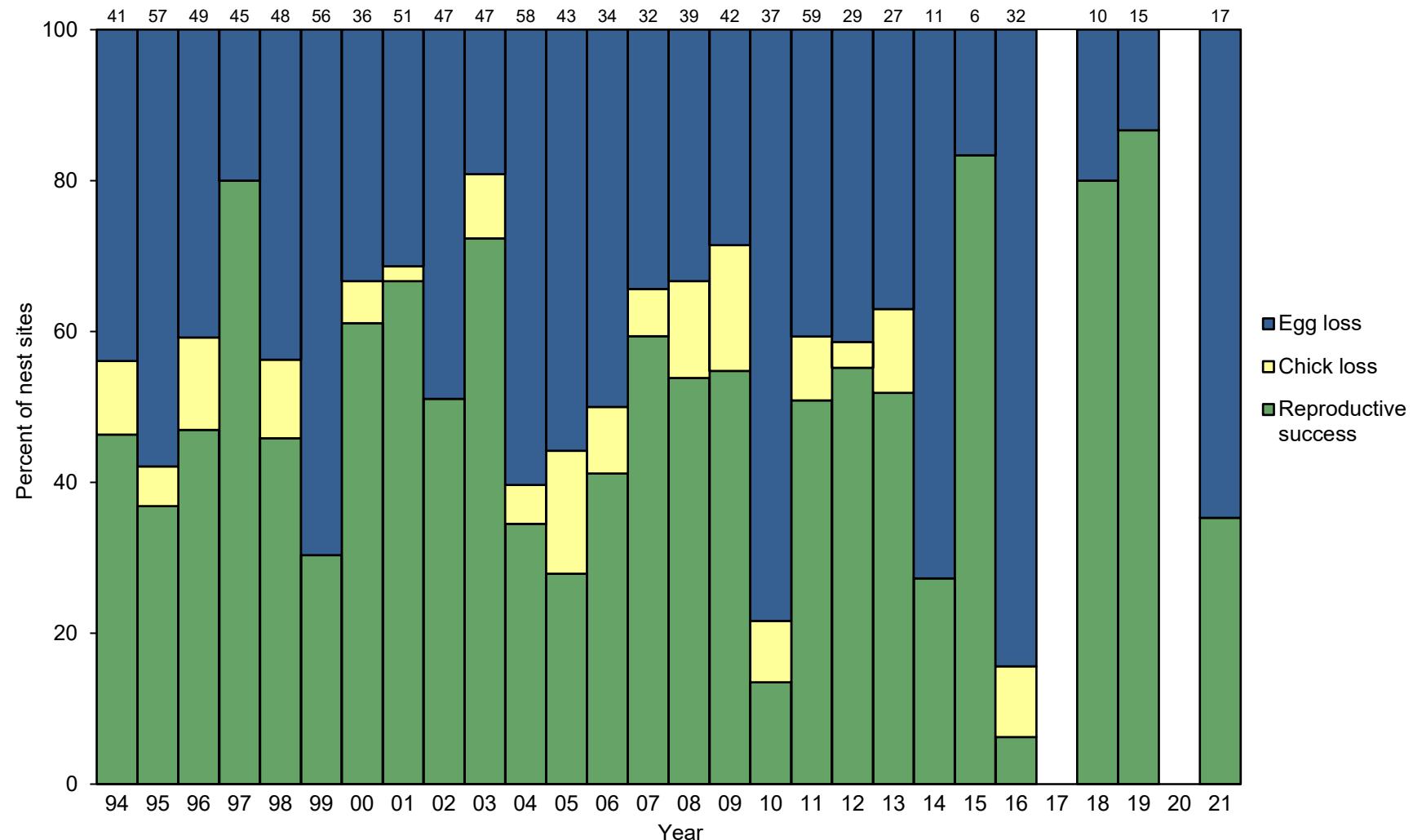


Figure 11. Reproductive performance of thick-billed murres at St. Lazaria Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Numbers above columns indicate sample sizes (B). Due to late timing of breeding, values in 1994-1996, 1998, 2001, 2014, 2016, and 2018-2019 represent maximum potential reproductive success [(F+H)/(B+H)] including chicks too young to fledge at the last check (H); sample sizes in those years=(B+H). No data were collected in 2017 or 2020.

Table 14. Reproductive performance of thick-billed murres at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Nest sites w/ eggs	Nest sites w/ chicks	Nest sites w/ chicks fledged	Nest sites w/ young chicks still present <sup>a</sup>	Nesting success (D/B) <sup>b</sup>		Fledging success (F/D) <sup>c</sup>		Reproductive success (F/B)		Max. potential reproductive success <sup>d</sup> [(F+H)/(B+H)]		Sampling design <sup>f</sup>	
	(B)	(D)	(F)	(H)	Total	SD	Total	SD	Total	SD	Total	SD		
1994	40	22	18	1	0.55	0.08	0.82	0.08	0.45	0.08	0.46	0.08	9	Simple random
1995	54	21	18	3	0.39	0.07	0.86	0.08	0.33	0.06	0.37	0.06	9	Simple random
1996	42	22	16	7	0.52	0.08	0.73	0.09	0.38	0.07	0.47	0.07	9	Simple random
1997	45	36	36	0	0.80	0.06	1.00	0.00	0.80	0.06	0.80	0.06	8	Simple random
1998	46	25	20	2	0.54	0.07	0.80	0.08	0.43	0.07	0.46	0.07	8	Simple random
1999	56	17	17	0	0.30	0.06	1.00	0.00	0.30	0.06	0.30	0.06	9	Simple random
2000	36	24	22	0	0.67	0.08	0.92	0.06	0.61	0.08	0.61	0.08	7	Simple random
2001	50	34	33	1	0.68	0.07	0.97	0.03	0.66	0.07	0.67	0.07	8	Simple random
2002	47	24	24	0	0.51	0.07	1.00	0.00	0.51	0.07	0.51	0.07	9	Simple random
2003	47	38	34	xx <sup>g</sup>	0.81	0.06	0.89	0.05	0.72	0.07	xx	xx	xx	Simple random
2004	58	23	20	xx	0.40	0.06	0.87	0.07	0.34	0.06	xx	xx	xx	Simple random
2005	43	19	12	xx	0.44	0.08	0.63	0.11	0.28	0.07	xx	xx	xx	Simple random
2006	34	17	14	xx	0.50	0.09	0.82	0.09	0.41	0.08	xx	xx	xx	Simple random
2007	32	21	19	xx	0.66	0.08	0.90	0.07	0.59	0.09	xx	xx	xx	Simple random
2008	39	26	21	xx	0.67	0.08	0.81	0.08	0.54	0.08	xx	xx	xx	Simple random
2009	42	30	23	xx	0.71	0.07	0.77	0.08	0.55	0.08	xx	xx	xx	Simple random
2010	37	8	5	xx	0.22	0.07	0.63	0.17	0.14	0.06	xx	xx	xx	Simple random
2011	59	35	30	xx	0.59	0.06	0.86	0.06	0.51	0.07	xx	xx	8	Simple random
2012	29	17	16	0	0.59	0.09	0.94	0.06	0.55	0.09	0.55	0.09	7	Simple random
2013	27	17	14	0	0.63	0.09	0.82	0.09	0.52	0.10	0.52	0.10	1 <sup>h</sup>	Simple random
2014	10	2	2	1	0.20	0.13	1.00	0.00	0.20	0.13	0.27	0.13	1 <sup>h</sup>	Simple random
2015	6	5	5	0	0.83	0.15	1.00	0.00	0.83	0.15	0.83	0.15	3	Simple random
2016	30	3	0	2	0.10	0.05	0.00	0.00	0.00	0.00	0.14	0.06	7	Simple random
2018	5	3	3	5	0.60	0.22	1.00	0.00	0.60	0.22	0.80	0.13	5	Simple random
2019	13	11	11	2	0.85	0.10	1.00	0.00	0.85	0.10	0.87	0.09	6	Simple random
2021	17	6	6	0	0.35	0.12	1.00	0.00	0.35	0.12	0.35	0.12	5	Simple random

<sup>a</sup>Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present  $\geq 13$  d for murres). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

<sup>b</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>c</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>d</sup>Values of maximum potential success include nest sites with chicks still present but too young to consider fledged at the last check; these values may be useful in years when crews leave the island before many chicks reach fledging age.

<sup>e</sup>Plots that are combined for analysis are counted as a single "plot".

<sup>f</sup>Sampling for murres is clustered by plot except when sample sizes per plot are too small or plot data are not available. For sampling clustered by plot, standard deviation values are calculated based on plot as a sample unit; for simple random sampling, standard deviation values are calculated using  $\sqrt{\rho * (1 - \rho)/n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>g</sup>xx indicates data may potentially exist but have not yet been summarized.

<sup>h</sup>No individual plot data are available in database so all are combined; raw data may contain plot data that will allow cluster sampling by plot and should be entered when time is available.

Table 15. Reproductive performance of thick-billed murres at St. Lazaria Island, Alaska in 2021.

Parameter	Plot								Total	SD <sup>a</sup>	
	1	2	3	4	5	6A	6B	7	8		
Nest sites w/ eggs (B)	3	0	2	5	3	0	0	0	4	17	-
Nest sites w/ chicks (D)	0	0	2	1	2	0	0	0	1	6	-
Nest sites w/ chicks fledged (F)	0	0	2	1	2	0	0	0	1	6	-
Nest sites w/ young chicks still present <sup>b</sup> (H)	0	0	0	0	0	0	0	0	0	0	-
Nesting success (D/B) <sup>c</sup>	0.00	-	1.00	0.20	0.67	-	-	-	0.25	0.35	0.12
Fledging success (F/D) <sup>d</sup>	-	-	1.00	1.00	1.00	-	-	-	1.00	1.00	0.00
Reproductive success (F/B)	0.00	-	1.00	0.20	0.67	-	-	-	0.25	0.35	0.12
Max. potential reproductive success [(F+H)/(B+H)] <sup>e</sup>	0.00	-	1.00	0.20	0.67	-	-	-	0.25	0.35	0.12

<sup>a</sup>Due to small sample sizes per plot, standard deviations are calculated based on simple random sampling rather than cluster sampling. For simple random sampling, values are calculated using  $\sqrt{\rho * (1 - \rho) / n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>b</sup>Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present  $\geq 13$  d for thick-billed murres). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

<sup>c</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>d</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>e</sup>Maximum potential reproductive success includes nest sites with chicks too young to consider fledged at the last check; this value may be useful in years when crews leave the island before many chicks reach fledging age.

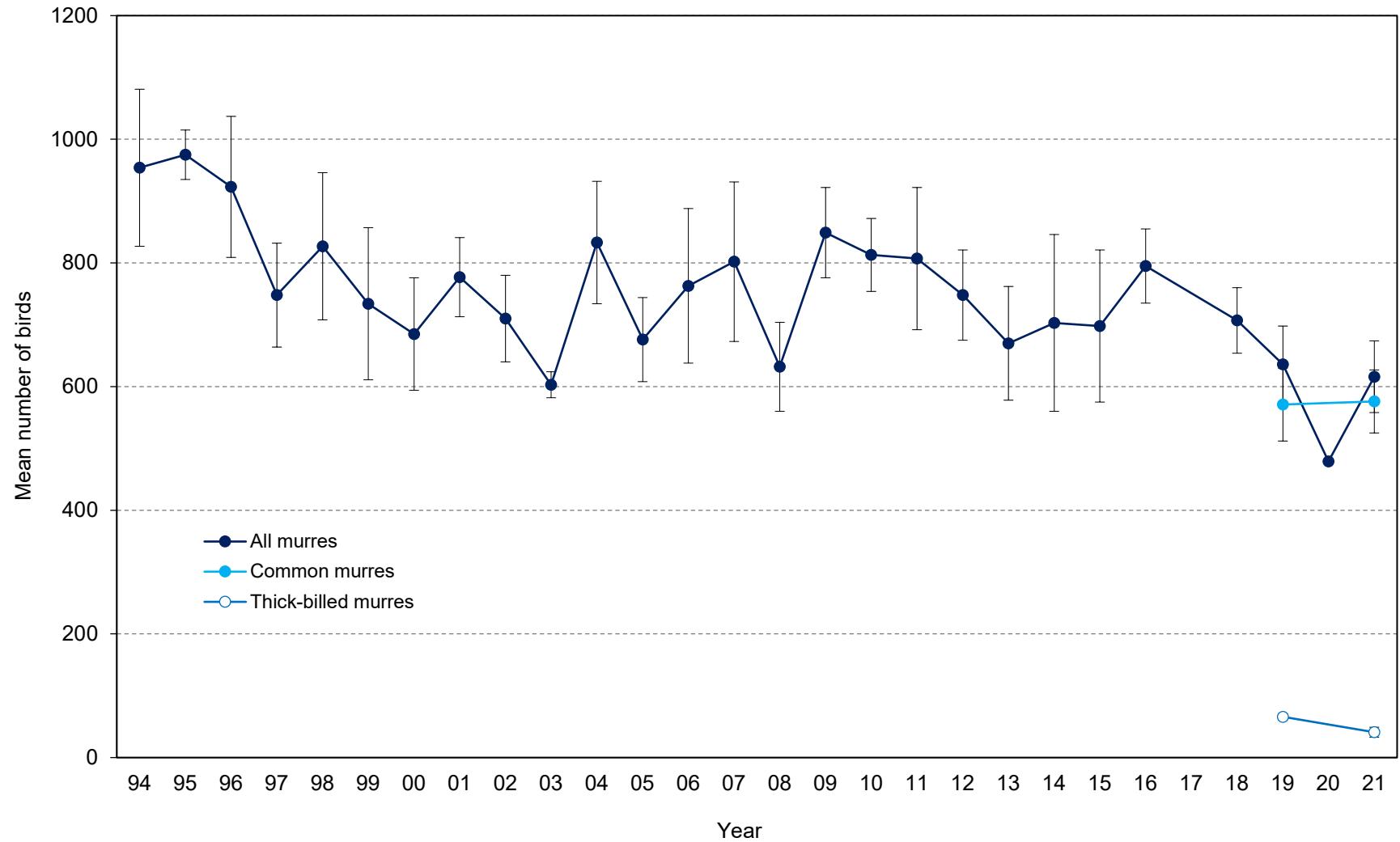


Figure 12. Mean numbers of common, thick-billed, and all murres (common and thick-billed combined) counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. Error bars represent standard deviation. Murres were not identified to species before 2019 or in 2020. No counts were conducted in 2017.

Table 16. Numbers of all murres (common and thick-billed combined) counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. No counts were conducted in 2017.

Replicate	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	1062	948	808	800	1058	xx <sup>a</sup>	810	880	818	610	912	734	741	795
2	985	922	928	688	911	xx	678	786	678	579	938	814	690	525
3	814	994	901	665	973	xx	752	752	766	577	1001	703	619	724
4	-	977	939	827	899	xx	698	679	672	605	809	605	581	903
5	-	1048	1062	788	729	xx	818	746	756	607	895	599	773	914
6	-	953	1102	594	848	xx	677	703	702	614	791	610	921	848
7	-	982	873	894	765	xx	526	712	662	602	791	674	735	890
8	-	-	769	783	705	xx	650	696	582	619	773	671	895	817
9	-	-	-	768	684	xx	648	-	685	598	738	712	911	-
10	-	-	-	701	981	xx	592	-	785	572	682	636	-	-
11	-	-	-	717	761	xx	-	-	-	647	-	-	-	-
12	-	-	-	-	763	xx	-	-	-	609	-	-	-	-
13	-	-	-	-	800	xx	-	-	-	-	-	-	-	-
14	-	-	-	-	705	xx	-	-	-	-	-	-	-	-
Mean	954	975	923	748	827	734	685	744	710	603	833	676	763	802
<i>n</i>	3	9	8	11	14	9	10	8	10	12	10	10	9	8
SD	127	40	114	84	119	123	91	65	70	21	99	68	125	129
First count	6 Jul	23 Jul	18 Jul	25 Jul	17 Jul	xx	24 Jul	2 Aug	25 Jul	25 Jul	23 Jul	27 Jul	26 Jul	23 Jul
Last count	10 Aug	14 Aug	4 Aug	8 Aug	6 Aug	xx	2 Aug	10 Aug	5 Aug	5 Aug	3 Aug	6 Aug	6 Aug	1 Aug

Table 16 (continued). Numbers of all murres (common and thick-billed combined) counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. No counts were conducted in 2017.

Replicate	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020 <sup>b</sup>	2021
1	609	923	880	628	757	841	683	458	759	675	634	479	597
2	547	795	840	767	681	666	633	606	865	779	564	-	572
3	702	735	709	913	676	586	665	787	762	769	647	-	531
4	508	950	846	833	635	613	583	787	-	703	586	-	665
5	512	817	790	893	823	693	950	728	-	649	594	-	673
6	677	892	814	-	803	621	-	759	-	725	739	-	660
7	655	818	-	-	805	-	-	759	-	650	691	-	-
8	636	795	-	-	805	-	-	-	-	-	-	-	-
9	652	914	-	-	-	-	-	-	-	-	-	-	-
10	704	-	-	-	-	-	-	-	-	-	-	-	-
11	621	-	-	-	-	-	-	-	-	-	-	-	-
12	658	-	-	-	-	-	-	-	-	-	-	-	-
13	736	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	632	849	813	807	748	670	703	698	795	707	636	479	616
<i>n</i>	13	9	6	5	8	6	5	7	3	7	7	1	6
SD	72	73	59	115	73	92	143	123	60	53	62	-	58
First count	23 Jul	25 Jul	28 Jul	20 Jul	16 Jul	11 Jul	30 Jul	20 Jul	1 Aug	4 Aug	26 Jul	29 Jul	22 Jul
Last count	4 Aug	7 Aug	4 Aug	4 Aug	24 Jul	16 Jul	22 Aug	7 Aug	3 Aug	29 Aug	19 Aug	-	8 Aug

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>b</sup>No season-long monitoring occurred in 2020 but a single count was conducted on a day-long visit from Sitka.

Table 17. Numbers of common murres counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. Murres were not counted by species prior to 2019 or in 2020.

Replicate	2019	2021
1	571	566
2	498	533
3	574	500
4	527	616
5	534	627
6	667	611
7	624	-
Mean	571	576
<i>n</i>	7	6
SD	59	51
First count	26 Jul	22 Jul
Last count	19 Aug	8 Aug

Table 18. Numbers of thick-billed murres counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. Murres were not counted by species prior to 2019 or in 2020.

Replicate	2019	2021
1	63	31
2	66	39
3	73	31
4	59	49
5	60	46
6	72	49
7	67	41
Mean	66	31
<i>n</i>	7	6
SD	5	8
First count	26 Jul	22 Jul
Last count	19 Aug	8 Aug

Table 19. Numbers of all murres (common and thick-billed combined) counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska, in 2021.

Plot	Date						Mean	SD
	22 Jul	26 Jul	29 Jul	1 Aug	5 Aug	8 Aug		
1	113	106	101	134	135	137	-	-
2	57	69	58	86	81	78	-	-
3	56	53	47	48	58	54	-	-
4	30	33	37	30	34	42	-	-
5	17	17	17	24	20	18	-	-
6A	29	21	24	34	41	35	-	-
6B	80	94	74	108	108	97	-	-
7	157	121	116	126	134	128	-	-
8	21	19	18	22	18	25	-	-
9	1	5	0	1	0	0	-	-
10	36	34	39	52	44	46	-	-
Total	597	572	531	665	673	660	616	58

Table 20. Numbers of common murres counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska, in 2021.

Plot	Date						Mean	SD
	22 Jul	26 Jul	29 Jul	1 Aug	5 Aug	8 Aug		
1	107	99	96	126	124	128	-	-
2	53	67	56	79	76	70	-	-
3	53	49	43	41	52	46	-	-
4	25	23	31	22	26	35	-	-
5	8	10	11	14	12	11	-	-
6A	29	20	24	33	40	35	-	-
6B	80	92	73	106	107	95	-	-
7	157	120	115	125	133	126	-	-
8	17	15	15	18	14	21	-	-
9	1	5	0	1	0	0	-	-
10	36	33	36	51	43	44	-	-
Total	566	533	500	616	627	611	576	51

Table 21. Numbers of thick-billed murres counted on land-based index plots at Southwest Cliff, St. Lazaria Island, Alaska, in 2021.

Plot	Date						Mean	SD
	22 Jul	26 Jul	29 Jul	1 Aug	5 Aug	8 Aug		
1	6	7	5	8	11	9	-	-
2	4	2	2	7	5	8	-	-
3	3	4	4	7	6	8	-	-
4	5	10	6	8	8	7	-	-
5	9	7	6	10	8	7	-	-
6A	0	1	0	1	1	0	-	-
6B	0	2	1	2	1	2	-	-
7	0	1	1	1	1	2	-	-
8	4	4	3	4	4	4	-	-
9	0	0	0	0	0	0	-	-
10	0	1	3	1	1	2	-	-
Total	31	39	31	49	46	49	41	8

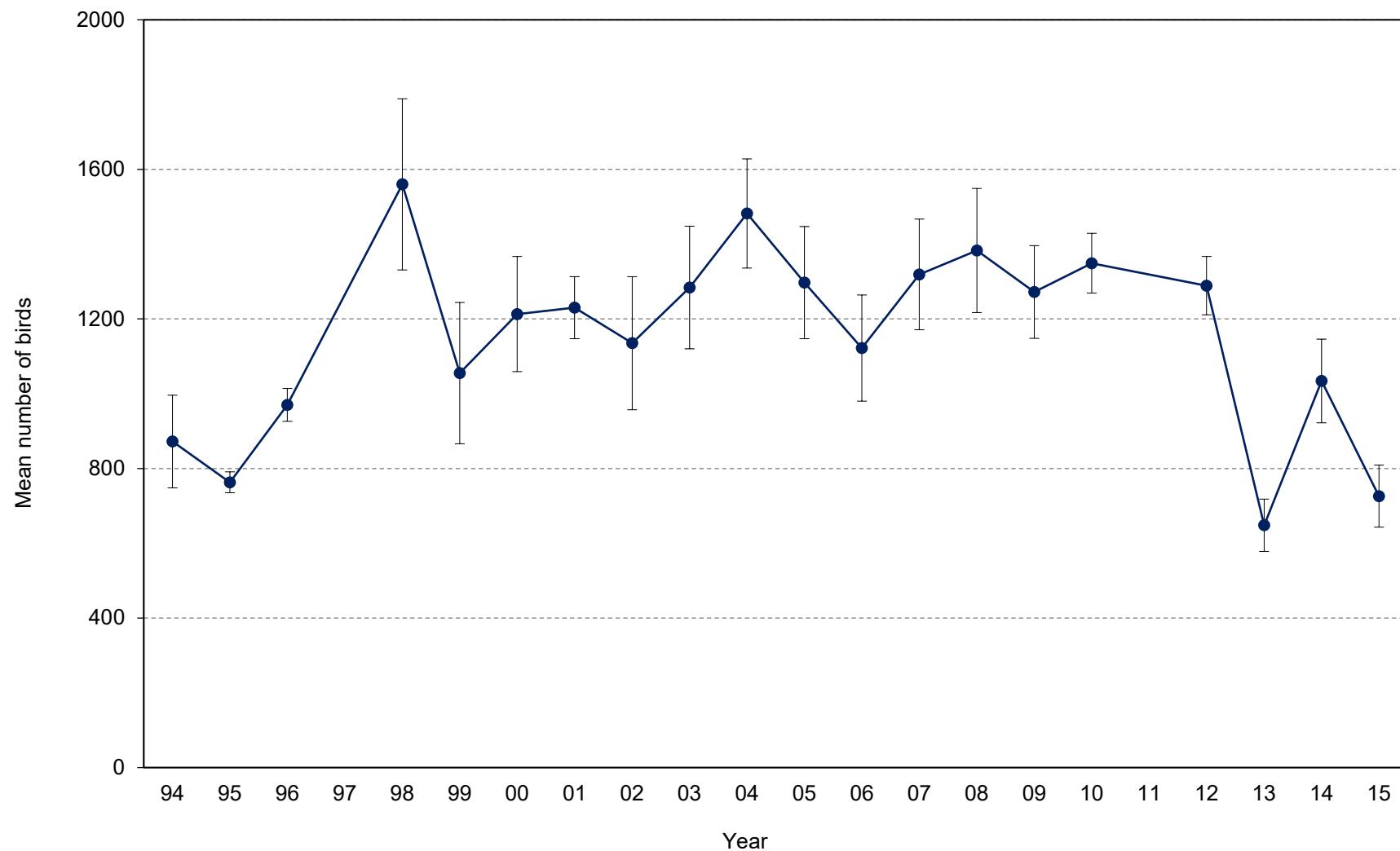


Figure 13. Mean numbers of murres (common and thick-billed combined) counted on boat-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. Error bars represent standard deviation. No counts were conducted in 1997, 2011, or after 2015.

Table 22. Numbers of murres (common and thick-billed combined) counted on water-based index plots at Southwest Cliff, St. Lazaria Island, Alaska. No counts were conducted in 1997, 2011, or after 2015.

Replicate	1994	1995	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014	2015
1	860	783	1027	1428	1287	1396	1155	1131	1263	1255	1099	1213	1100	1366	1180	1438	1245	742	1190	667
2	956	743	920	1192	1273	1031	1256	1242	1270	1395	1236	1203	1235	1358	1179	1305	1255	672	1041	785
3	681	-	969	1625	879	1311	1215	860	1100	1513	1265	894	1500	1107	1286	1390	1405	669	951	-
4	858	-	964	1330	863	1293	1130	992	1574	1506	1398	1073	1337	1295	1442	1262	1250	585	956	-
5	1005	-	-	1489	834	1025	1278	1267	1536	1643	1487	1228	1460	1535	-	-	-	572	-	-
6	-	-	-	1943	1279	1225	1106	1317	1359	1667	-	-	1283	1282	-	-	-	-	-	-
7	-	-	-	1697	848	-	1329	-	1325	1396	-	-	-	1641	-	-	-	-	-	
8	-	-	-	1577	1071	-	-	-	1190	-	-	-	-	1476	-	-	-	-	-	
9	-	-	-	1761	1062	-	-	-	1268	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	1152	-	-	-	1214	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	1027	-	-	-	-	-	-	-	-	-	-	
Mean	872	763	970	1560	1055	1213	1230	1135	1284	1482	1297	1122	1319	1383	1272	1349	1289	648	1034	726
<i>n</i>	5	2	4	9	10	6	7	6	11	7	5	5	6	8	4	4	4	5	4	2
SD	124	28	44	229	189	154	83	178	164	146	150	142	148	166	124	80	78	70	112	83
First count	30 Jul	29 Jul	22 Jul	23 Jul	29 Jul	23 Jul	2 Aug	25 Jul	24 Jul	23 Jul	30 Jul	27 Jul	23 Jul	28 Jul	31 Jul	29 Jul	18 Jul	13 Jul	30 Jul	22 Jul
Last count	6 Aug	8 Aug	16 Aug	5 Aug	7 Aug	30 Jul	8 Aug	5 Aug	6 Aug	4 Aug	5 Aug	3 Aug	1 Aug	4 Aug	7 Aug	3 Aug	22 Jul	17 Jul	20 Aug	3 Aug

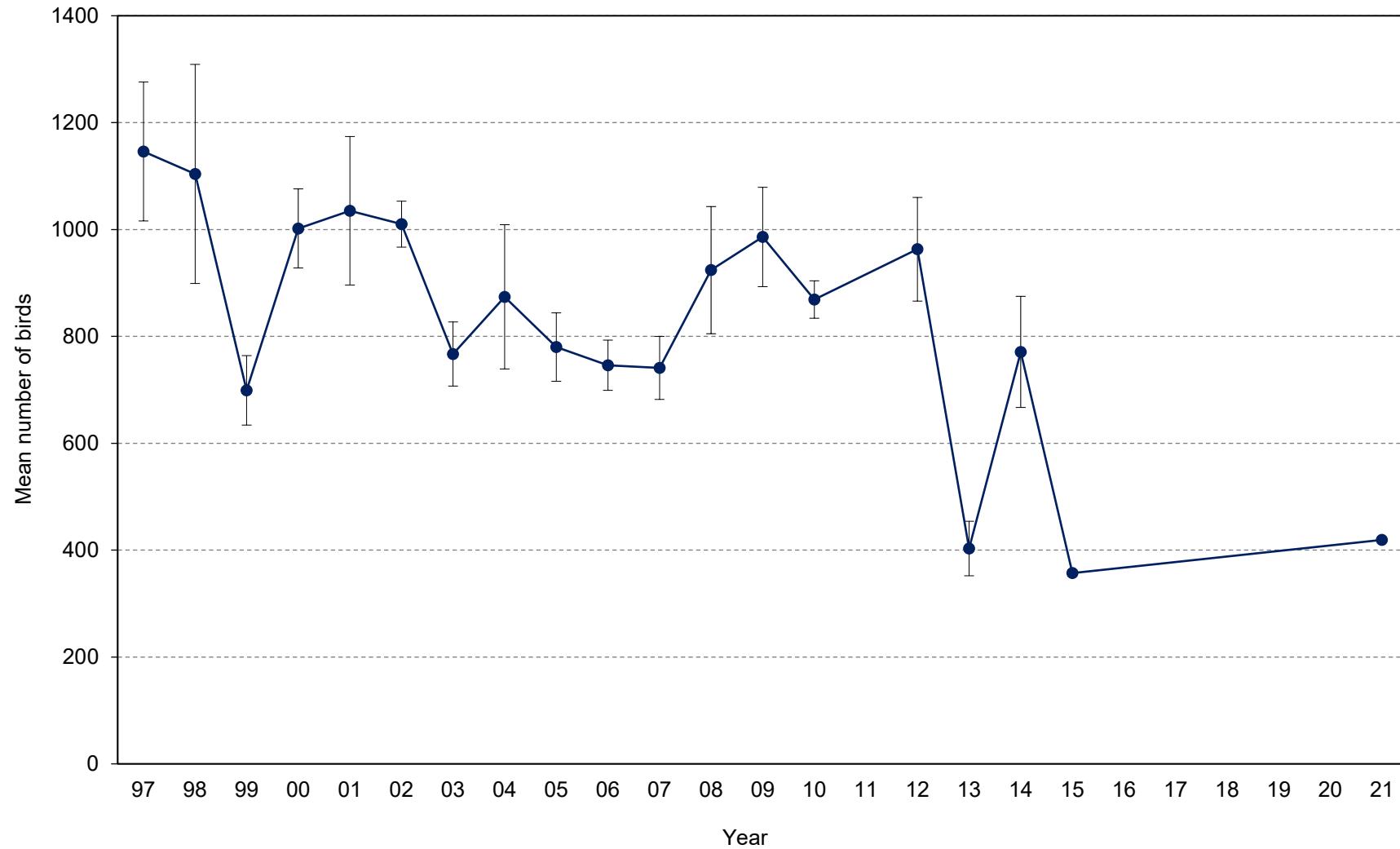


Figure 14. Mean numbers of murres (common and thick-billed combined) counted on boat-based index plots at Cave Colony, St. Lazaria Island, Alaska. Error bars represent standard deviation. No counts were conducted in 2011 or 2015-2020.

Table 23. Numbers of murres (common and thick-billed combined) counted on index plots at Cave Colony, St. Lazaria Island, Alaska. No counts were conducted in 2011 or 2015-2020.

Replicate	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014	2015	2021
1	1265	806	977	928	968	1007	802	854	726	661	741	838	830	899	858	462	629	353	419
2	994	753	631	920	871	1038	723	778	727	763	688	890	998	892	1063	384	755	361	-
3	1243	1044	656	1093	873	1045	824	607	673	769	721	725	1060	822	913	364	737	-	-
4	1080	1073	709	906	1087	951	781	873	772	813	675	845	1096	862	912	348	849	-	-
5	-	1313	689	1059	1110	-	822	840	802	725	795	994	964	-	1069	449	895	-	-
6	-	1242	788	1013	1087	-	771	941	878	746	823	1083	965	-	-	-	-	-	-
7	-	1175	817	1073	1252	-	823	1045	830	743	-	1005	-	-	-	-	-	-	-
8	-	1257	637	1023	-	-	748	1049	777	-	-	1012	-	-	-	-	-	-	-
9	-	1272	706	-	-	-	748	876	834	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	630	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	1146	1104	699	1002	1035	1010	767	874	780	746	741	924	986	869	963	403	771	357	419
<i>n</i>	4	9	9	8	7	4	10	9	9	7	6	8	6	4	5	5	5	2	1
SD	130	205	65	74	139	43	60	135	64	47	59	119	93	35	97	51	104	6	-
First count	28 Jul	23 Jul	30 Jul	25 Jul	2 Aug	31 Jul	24 Jul	23 Jul	27 Jul	27 Jul	24 Jul	28 Jul	26 Jul	28 Jul	18 Jul	12 Jul	30 Jul	22 Jul	4 Jul
Last count	18 Aug	5 Aug	7 Aug	3 Aug	8 Aug	3 Aug	6 Aug	4 Aug	5 Aug	3 Aug	1 Aug	4 Aug	7 Aug	1 Aug	23 Jul	16 Jul	21 Aug	3 Aug	-

Table 24. Numbers of all murres (common and thick-billed combined) counted on boat-based index plots at Cave Colony, St. Lazaria Island, Alaska, in 2021.

Plot	Date	Mean	SD
	4 Jul		
Arch	32	32	-
Up and to the Right	34	34	-
Deep Pocket	59	59	-
Upper Bowl & Back Wall	184	184	-
Guano Slide	110	110	-
Total	419	419	-

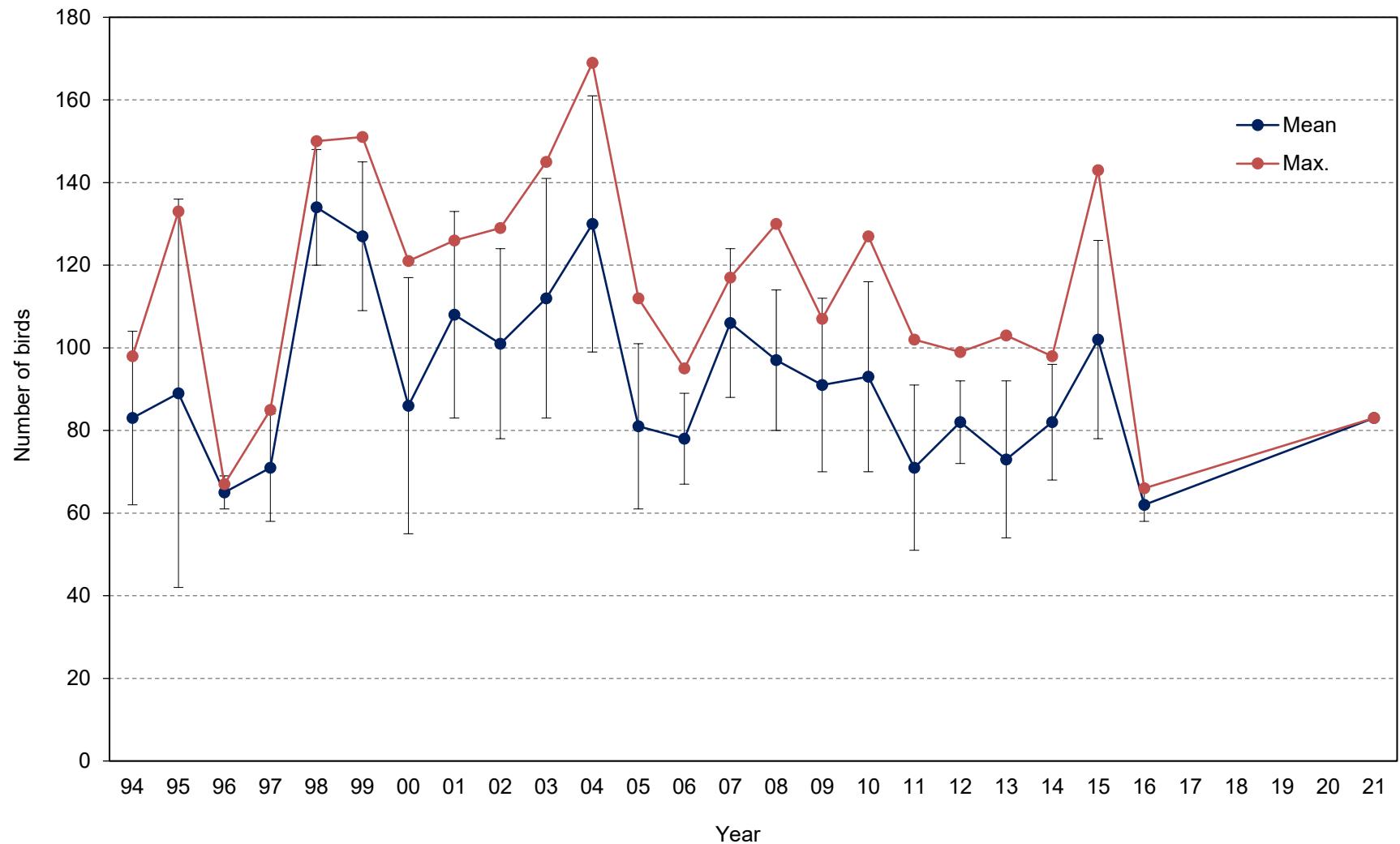


Figure 15. Mean and maximum numbers of pigeon guillemots counted during circumnavigation surveys at St. Lazaria Island, Alaska. Error bars represent standard deviation around mean values. No counts were conducted in 2017-2020.

Table 25. Numbers of pigeon guillemots counted during circumnavigation surveys at St. Lazaria Island, Alaska. No counts were conducted in 2017-2020.

Replicate	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2021
1	68	93	67	85	123	107	78	110	87	90	98	49	69	85	76	55	81	60	75	58	74	88	66	83
2	98	40	62	72	150	124	60	72	77	102	111	74	76	117	78	96	127	70	88	61	76	82	61	-
3	-	133	-	53	128	151	121	126	111	145	89	83	69	117	103	94	66	36	99	89	62	97	58	-
4	-	-	-	74	-	127	-	123	129	-	118	84	95	-	105	102	80	65	69	57	70	102	-	-
5	-	-	-	-	-	-	-	-	-	-	169	81	82	-	98	107	108	68	88	103	84	143	-	-
6	-	-	-	-	-	-	-	-	-	-	156	112	-	-	95	-	114	102	78	68	98	-	-	-
7	-	-	-	-	-	-	-	-	-	-	167	-	-	-	87	-	77	72	80	-	98	-	-	-
8	-	-	-	-	-	-	-	-	-	-	130	-	-	-	130	-	-	92	-	-	93	-	-	-
Mean	83	89	65	71	134	127	86	108	101	112	130	81	78	106	97	91	93	71	82	73	82	102	62	83
Max.	98	133	67	85	150	151	121	126	129	145	169	112	95	117	130	107	127	102	99	103	98	143	66	83
<i>n</i>	2	3	2	4	3	4	3	4	4	3	8	6	5	3	8	5	7	8	7	6	8	5	3	1
SD	21	47	4	13	14	18	31	25	23	29	31	20	11	18	17	21	23	20	10	19	14	24	4	-
First count	8 Jul	2 Jul	12 Jul	25 Jun	27 Jun	22 Jul	7 Jul	29 Jun	3 Jul	1 Jul	29 Jun	27 Jun	28 Jun	17 Jul	25 Jun	8 Jul	2 Jul	25 Jun	27 Jun	24 Jun	20 Jun	22 Jun	3 Jul	5 Jul
Last count	31 Jul	1 Aug	5 Aug	26 Jul	30 Jul	4 Aug	27 Jul	3 Aug	6 Aug	31 Jul	3 Aug	28 Jul	28 Jul	27 Jul	1 Aug	5 Aug	20 Jul	17 Jul	16 Jul	12 Jul	10 Jul	11 Jul	6 Jul	-

Table 26. Numbers of pigeon guillemots counted during circumnavigation surveys at St. Lazaria Island, Alaska, in 2021.

Segment	Date	Mean	SD	Max.
	5 Jul			
NE – NW	47	47	-	47
NW – SW	10	10	-	10
SW – SE	25	25	-	25
SE – NE	1	1	-	1
Total	83	83	-	83
Start time (AKDT) <sup>a</sup>	0736	-	-	-
End time (AKDT)	0804	-	-	-

<sup>a</sup>Times are Alaska Daylight Time.

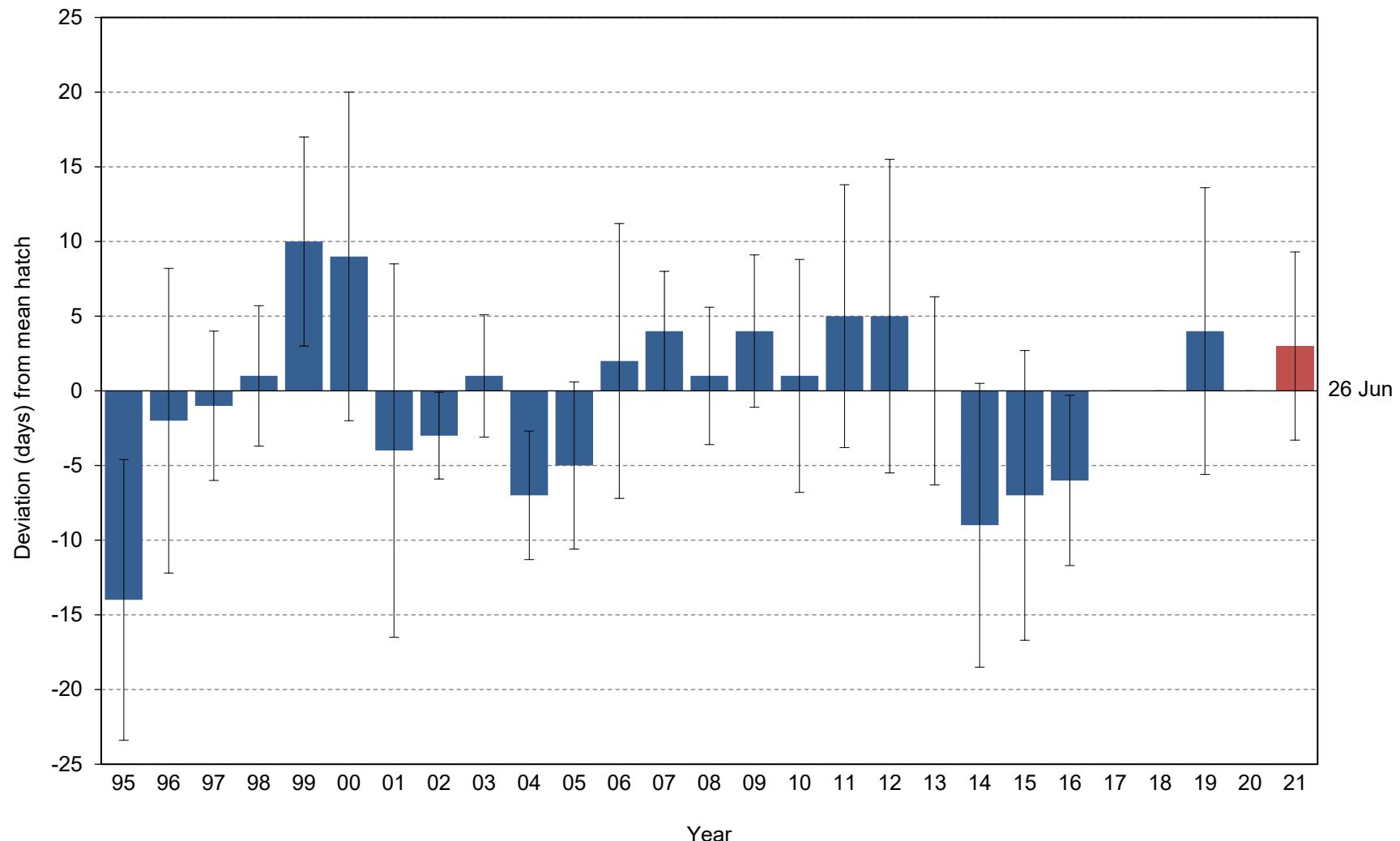


Figure 16. Yearly hatch date deviation (from the 1995-2020 average of 26 June) for rhinoceros auklets at St. Lazaria Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2017-2018 or 2020.

Table 27. Breeding chronology of rhinoceros auklets at St. Lazaria Island, Alaska. No data were collected in 2017-2018 or 2020.

Year	Mean hatch	SD	n <sup>a</sup>	First hatch	Last hatch	First fledge
1995	12 Jun	9.4	6	30 May	23 Jun	14 Aug
1996	23 Jun	10.2	xx <sup>b</sup>	xx	xx	xx
1997	25 Jun	5.0	xx	xx	xx	xx
1998	27 Jun	4.7	33	17 Jun	9 Jul	xx
1999	6 Jul	7.0	12	26 Jun	20 Jul	xx
2000	4 Jul	11.0	7	22 Jun	27 Jul	xx
2001	22 Jun	12.5	11	28 May	14 Jul	xx
2002	23 Jun	2.9	9	xx	xx	3 Aug
2003	27 Jun	4.1	11	21 Jun	4 Jul	xx
2004	18 Jun	4.3	21	10 Jun	27 Jun	xx
2005	21 Jun	5.6	9	16 Jun	3 Jul	xx
2006	28 Jun	9.2	10	13 Jun	15 Jul	31 Jul
2007	30 Jun	4.0	8	24 Jun	6 Jul	16 Aug
2008	26 Jun	4.6	17	18 Jun	6 Jul	5 Aug
2009	30 Jun	5.1	7	xx	xx	xx
2010	27 Jun	7.8	13	19 Jun	15 Jul	5 Aug
2011	1 Jul	8.8	8	18 Jun	14 Jul	6 Aug
2012	30 Jun	10.5	10	11 Jun	16 Jul	29 Jul
2013	26 Jun	6.3	12	16 Jun	8 Jul	2 Aug
2014	17 Jun	9.5	14	11 Jun	6 Jul	4 Aug
2015	19 Jun	9.7	16	3 Jun	7 Jul	26 Jul
2016	19 Jun	5.7	5	14 Jun	28 Jun	2 Aug
2019	30 Jun	9.6	5	13 Jun	16 Jul	-
2021	29 Jun	6.3	4	21 Jun	6 Jul	4 Aug

<sup>a</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which (a) egg to chick interval is ≤ 7 days (some or all of 1999, 2000, 2006, and 2010) or (b) chick wing chord measurements during the linear period of growth are used to calculate hatch (some or all of 1995-1998, 2001-2016, and 2019; Leschner 1976).

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

Table 28. Frequency distribution of hatch dates for rhinoceros auklets at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days (some or all of 1999, 2000, 2006, and 2010) or chick wing chord measurements during the linear period of growth (50-80mm) are used to calculate hatch (some or all of 1995-1998, 2001-2016, and 2019; Leschner 1976). No data were collected in 2017-2018 or 2020.

Julian date <sup>a</sup>	No. eggs hatching on Julian date																						
	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	19
148	xx <sup>b</sup>	xx	xx	-	-	-	1	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
149	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
150	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
151	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
152	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
153	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
154	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	1	-	-
155	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
156	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
157	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
158	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	1	-	-
159	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	1	-	-
160	xx	xx	xx	-	-	-	1	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
161	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	1	-	-
162	xx	xx	xx	-	-	-	-	xx	-	1	-	-	-	-	xx	-	xx	-	-	-	1	-	-
163	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	1	-	3	-	-	-
164	xx	xx	xx	-	-	-	-	xx	-	3	-	1	-	-	xx	-	xx	-	-	3	-	-	1
165	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-
166	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	1	-
167	xx	xx	xx	-	-	-	-	xx	-	3	2	-	-	-	xx	-	xx	-	1	-	1	1	-
168	xx	xx	xx	2	-	-	-	xx	-	1	2	-	-	-	xx	-	xx	-	1	2	1	-	-
169	xx	xx	xx	-	-	-	1	xx	-	1	-	-	-	-	xx	-	xx	-	-	1	3	1	-
170	xx	xx	xx	-	-	-	-	xx	-	2	-	1	-	1	xx	2	xx	1	-	-	1	-	-
171	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	1	xx	-	-	-	-	-	-
172	xx	xx	xx	-	-	-	4	xx	2	4	1	1	-	-	xx	2	xx	-	1	-	-	-	1
173	xx	xx	xx	1	-	-	-	xx	-	1	1	-	-	1	xx	-	xx	-	1	-	-	1	-
174	xx	xx	xx	3	-	1	-	xx	1	3	-	1	-	2	xx	-	xx	-	-	1	-	-	-
175	xx	xx	xx	3	-	-	-	xx	1	-	-	-	1	-	xx	-	xx	1	-	-	-	-	-
176	xx	xx	xx	1	-	-	-	xx	-	1	2	1	-	2	xx	1	xx	-	3	1	-	-	-
177	xx	xx	xx	-	1	-	-	xx	-	-	-	-	1	1	xx	1	xx	-	1	-	2	-	-
178	xx	xx	xx	9	-	-	-	xx	2	-	-	-	1	3	xx	1	xx	1	1	-	-	-	-
179	xx	xx	xx	1	-	-	1	xx	1	1	-	1	-	-	xx	-	xx	-	-	-	-	1	1
180	xx	xx	xx	5	-	-	1	xx	1	-	-	1	-	2	xx	2	xx	1	-	1	-	1	-
181	xx	xx	xx	1	2	-	-	xx	1	-	-	1	1	-	xx	-	xx	-	-	-	-	-	1
182	xx	xx	xx	2	-	1	-	xx	1	-	-	1	2	3	xx	-	xx	-	1	-	1	-	-

Table 28 (continued). Frequency distribution of hatch dates for rhinoceros auklets at St. Lazaria Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days (some or all of 1999, 2000, 2006, and 2010) or chick wing chord measurements during the linear period of growth (50-80mm) are used to calculate hatch (some or all of 1995-1998, 2001-2016, and 2019; Leschner 1976). No data were collected in 2017-2018 or 2020.

Julian date	No. eggs hatching on Julian date																							
	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	19	21
183	xx	xx	xx	2	-	2	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
184	xx	xx	xx	-	1	1	-	xx	-	-	1	-	-	-	xx	-	xx	1	1	-	1	-	-	
185	xx	xx	xx	-	-	1	-	xx	1	-	-	-	-	1	xx	1	xx	1	-	-	-	1	-	
186	xx	xx	xx	1	3	-	1	xx	-	-	-	-	-	-	1	xx	-	xx	-	-	-	-	-	
187	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	1	-	xx	-	xx	-	-	2	-	-	
188	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	1	xx	1	xx	-	-	1	-	-	
189	xx	xx	xx	1	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	1	-	-	-	-	
190	xx	xx	xx	1	2	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
191	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	2	-	-	-	-	-	
192	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
193	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
194	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
195	xx	xx	xx	-	2	-	1	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
196	xx	xx	xx	-	-	-	-	xx	-	-	-	1	-	-	xx	1	xx	-	-	-	-	-	-	
197	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	1	-	
198	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	1	-	-	-	-	-	
199	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
200	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
201	xx	xx	xx	-	1	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
202	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
203	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
204	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
205	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
206	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
207	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
208	xx	xx	xx	-	-	-	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
209	xx	xx	xx	-	-	1	-	xx	-	-	-	-	-	-	xx	-	xx	-	-	-	-	-	-	
n	xx	xx	xx	33	12	7	11	xx	11	21	9	10	8	17	xx	13	xx	10	12	14	16	5	5	4

<sup>a</sup>Julian dates are adjusted by one day in leap years.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

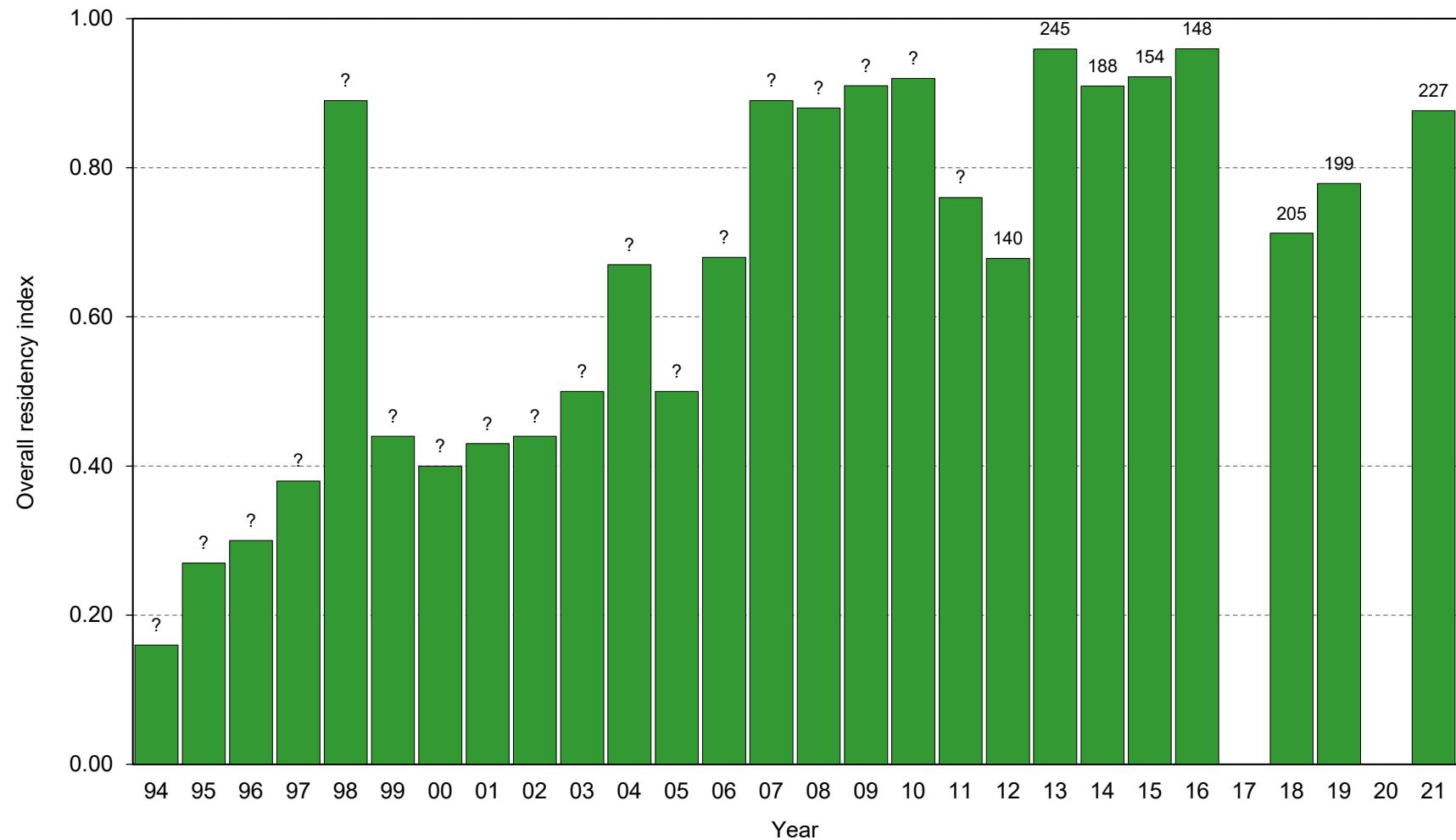


Figure 17. Residency indices of rhinoceros auklets at St. Lazaria Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed. Overall residency index=  $f/b$ , where  $b$ =nests with evidence of apparent occupancy early in the season (representing eggs) and  $f$ =nests with evidence of apparent occupancy late in the season (representing large chicks/potential fledglings). Numbers above columns indicate sample sizes ( $b$ ). The residency index includes a sub-set of active nests (those found active during the early visit) and may not equal values of active nests reported in apparent occupancy rates. No data were collected in 2017 or 2020.

Table 29. Residency indices of rhinoceros auklets at St. Lazaria Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed, based on the assumption that evidence of activity during early and late periods in the breeding season represent the presence of eggs and large chicks/potential fledglings, respectively. Surveys are conducted around hatching (late June to mid-July) and late in chick-rearing (late July to mid-August). Evidence of activity includes observations of feathers, droppings, eggs, eggshell fragments, or chicks in the burrow. The residency index is calculated using only the subset of nests occupied on the first visit and thus may not equal values reported in apparent occupancy rates (Tables 32-33). No data were collected in 2017 or 2020.

Year	Medium/large ( $\geq 9.5$ cm) burrows <sup>a</sup> with activity		Overall residency index <sup>b</sup> (f/b)
	Early (b)	Late (f)	
1994	xx <sup>c</sup>	xx	0.16
1995	xx	xx	0.27
1996	xx	xx	0.30
1997	xx	xx	0.38
1998	xx	xx	0.89
1999	xx	xx	0.44
2000	xx	xx	0.40
2001	xx	xx	0.43
2002	xx	xx	0.44
2003	xx	xx	0.50
2004	xx	xx	0.67
2005	xx	xx	0.50
2006	xx	xx	0.68
2007	xx	xx	0.89
2008	xx	xx	0.88
2009	xx	xx	0.91
2010	xx	xx	0.92
2011	xx	xx	0.76
2012	140	95	0.67
2013	245	235	0.96
2014	188	171	0.91
2015	154	142	0.92
2016	148	142	0.96
2018	205	146	0.71
2019	199	155	0.78
2021	227	199	0.88

<sup>a</sup>By definition, burrows must be  $\geq 60$  cm in length.

<sup>b</sup>Overall residency index (f/b) is a surrogate for reproductive success (F/B).

<sup>c</sup>xx indicates data potentially exist but have not yet been summarized.

Table 30. Residency indices of rhinoceros auklets at St. Lazaria Island, Alaska in 2021. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed, based on the assumption that evidence of activity during early and late periods in the breeding season represent the presence of eggs and large chicks/potential fledglings, respectively. Surveys are conducted around hatching (late June to mid-July) and late in chick-rearing (late July to mid-August). Evidence of activity includes observations of feathers, guano, eggs, eggshell fragments, prey remains, or chicks in the burrow. The residency index is calculated using only the subset of nests occupied on the first visit and thus may not equal values reported in apparent occupancy rates (Tables 32-33).

Parameter	Plot			Total	Mean	SD
	BN1-1	BN1-2	BN1-3			
<b>Medium/large (<math>\geq 9.5</math> cm) burrows<sup>a</sup> with activity</b>						
Early (b)	63	55	109	227	-	-
Late (f)	53	53	93	199	-	-
Overall residency index (f/b) <sup>b</sup>	0.84	0.96	0.85	0.88	0.89	0.07
<b>Survey dates</b>						
Early	1 Jul	1 Jul	2 Jul	-	-	-
Late	5 Aug	5 Aug	11 Aug	-	-	-

<sup>a</sup>By definition, burrows must be  $\geq 60$  cm in length.

<sup>b</sup>Overall residency index (f/b) is a surrogate for reproductive success (F/B).

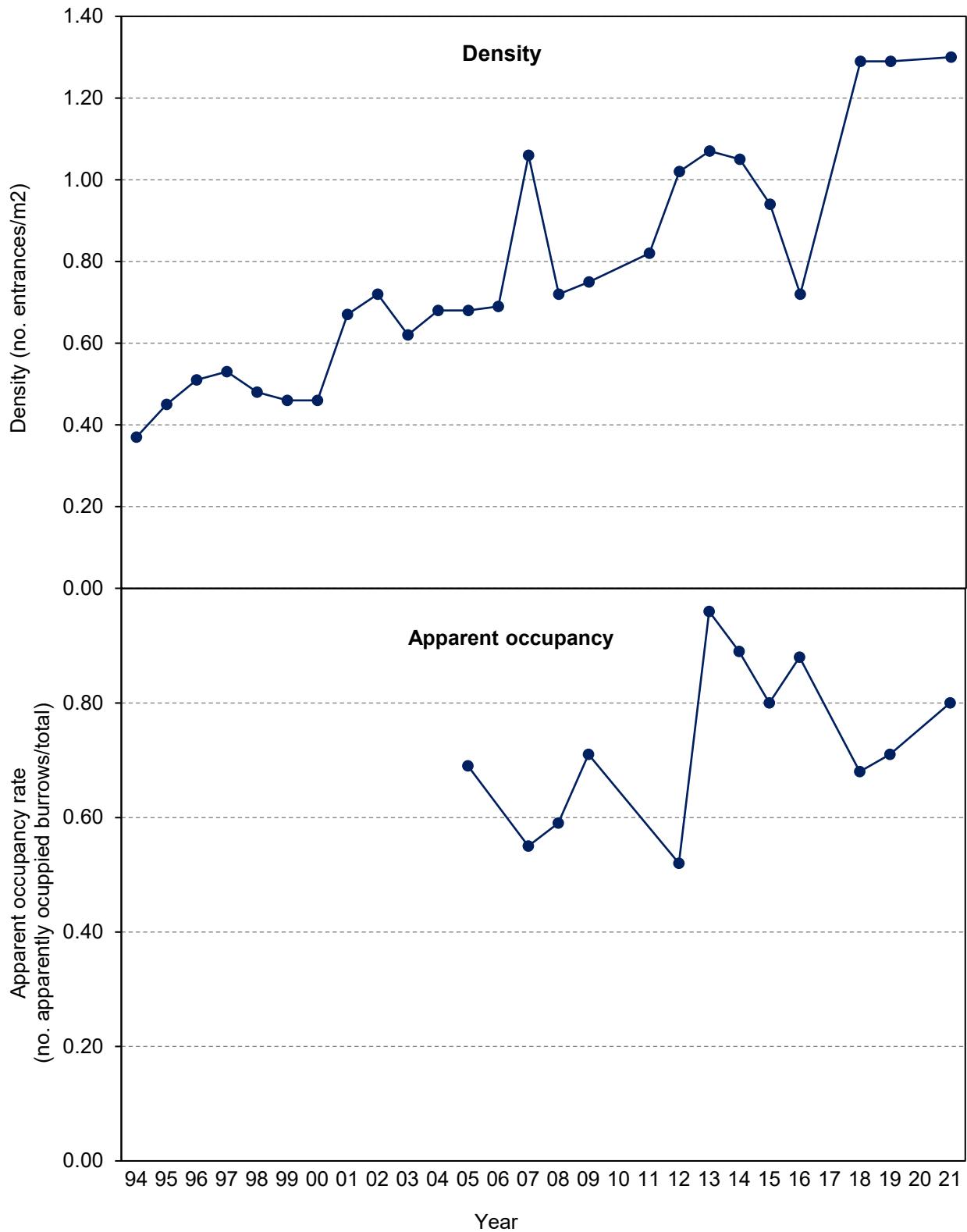


Figure 18. Burrow entrance densities and apparent occupancy rates of rhinoceros auklets on index plots at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Table 31. Burrow entrance densities of rhinoceros auklets on index plots at St. Lazaria Island, Alaska. Density is expressed as the number of medium (9.5-14.5 cm) and large (>14.5 cm) burrow entrances<sup>a</sup> per m<sup>2</sup> and is assessed in late June to mid-July, around predicted hatching. No data were collected in 2017 or 2020.

Year	Plot			Total	Mean	SD
	BN1-1	BN1-2	BN1-3			
1994	xx <sup>b</sup>	xx	xx	0.37	xx	xx
1995	xx	xx	xx	0.45	xx	xx
1996	xx	xx	xx	0.51	xx	xx
1997	xx	xx	xx	0.53	xx	xx
1998	xx	xx	xx	0.48	xx	xx
1999	xx	xx	xx	0.46	xx	xx
2000	xx	xx	xx	0.46	xx	xx
2001	xx	xx	xx	0.67	xx	xx
2002	xx	xx	xx	0.72	xx	xx
2003	xx	xx	xx	0.62	xx	xx
2004	xx	xx	xx	0.68	xx	xx
2005	0.66	0.33	1.04	0.68	0.68	0.35
2006	0.59	0.33	1.14	0.69	0.69	0.41
2007	0.84	0.72	1.61	1.06	1.06	0.48
2008	0.38	0.46	1.30	0.72	0.72	0.51
2009	0.58	0.45	1.23	0.75	0.75	0.42
2010	xx	xx	xx	xx	xx	xx
2011	xx	xx	xx	0.82	xx	xx
2012	0.96	0.54	1.58	1.02	1.03	0.52
2013	0.87	0.64	1.72	1.07	1.07	0.57
2014	0.84	0.62	1.68	1.05	1.05	0.56
2015	0.82	0.41	1.60	0.94	0.94	0.61
2016	0.59	0.36	1.21	0.72	0.72	0.43
2018	1.11	0.74	2.03	1.29	1.29	0.66
2019	1.34	0.74	1.80	1.29	1.29	0.53
2021	1.15	0.80	1.95	1.30	1.30	0.59
Plot area (m <sup>2</sup> )	78.5	78.5	78.5	235.5	-	-

<sup>a</sup>By definition, burrows must be ≥ 60 cm in length.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

Table 32. Apparent occupancy rates of rhinoceros auklets on index plots at St. Lazaria Island, Alaska. Apparent occupancy is expressed as the proportion of medium (9.5-14.5 cm) and large (>14.5 cm) burrows<sup>a</sup> with evidence of apparent occupancy late in the nesting period. Evidence of apparent occupancy includes observations of feathers, droppings, fresh vegetation, clipped vegetation and roots, eggs, eggshell fragments, or chicks in the burrow. Apparent occupancy is assessed from late July to mid-August, toward the end of the chick-rearing period. No data were collected in 2017 or 2020.

Year	Plot			Total	Mean	SD
	BN1-1	BN1-2	BN1-3			
1994	xx <sup>b</sup>	xx	xx	xx	xx	xx
1995	xx	xx	xx	xx	xx	xx
1996	xx	xx	xx	xx	xx	xx
1997	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx
1999	xx	xx	xx	xx	xx	xx
2000	xx	xx	xx	xx	xx	xx
2001	xx	xx	xx	xx	xx	xx
2002	xx	xx	xx	xx	xx	xx
2003	xx	xx	xx	xx	xx	xx
2004	xx	xx	xx	xx	xx	xx
2005	0.75	0.50	0.72	0.69	0.66	0.14
2006	xx	xx	xx	xx	xx	xx
2007	0.48	0.52	0.60	0.55	0.54	0.06
2008	0.67	0.58	0.57	0.59	0.61	0.05
2009	0.74	0.62	0.73	0.71	0.70	0.07
2010	xx	xx	xx	xx	xx	xx
2011	xx	xx	xx	xx	xx	xx
2012	0.39	0.74	0.56	0.52	0.56	0.17
2013	0.97	0.98	0.94	0.96	0.96	0.02
2014	0.88	0.82	0.92	0.89	0.87	0.05
2015	0.69	0.88	0.83	0.80	0.80	0.08
2016	0.85	0.97	0.86	0.88	0.89	0.07
2018	0.56	0.77	0.72	0.68	0.68	0.12
2019	0.72	0.80	0.67	0.71	0.73	0.07
2021	0.77	0.90	0.72	0.77	0.80	0.09

<sup>a</sup>By definition, burrows must be ≥ 60 cm in length.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

Table 33. Burrow entrance density and apparent occupancy rates of rhinoceros auklets on index plots at St. Lazaria Island, Alaska in 2021. Density is expressed as the number of medium (9.5-14.5 cm) and large (>14.5 cm) burrow entrances per m<sup>2</sup>. Apparent occupancy rate is expressed as the proportion of medium (9.5-14.5 cm) and large (>14.5 cm) burrows with evidence of apparent occupancy late in the nesting period. Evidence of apparent occupancy includes observations of feathers, droppings, fresh vegetation, clipped vegetation and roots, eggs, eggshell fragments, or chicks in the burrow. Density is assessed in late June to mid-July, around hatching, whereas apparent occupancy rate is assessed in late July to mid-August, toward the end of the chick-rearing period. The number of burrows used to calculate apparent occupancy rate is not necessarily the same as those presented for density because not all nests counted during density surveys are found later during plot re-checks and some nests are excluded from apparent occupancy analysis (e.g., nests with only storm-petrels and undetermined activity statuses).

Parameter	Plot			Total	Mean	SD			
	BN1-1	BN1-2	BN1-3						
<b>Density</b>									
Number of burrow entrances <sup>a</sup>									
Small (<9.5 cm)	53	29	44	126	-	-			
Medium (9.5-14.5 cm)	26	37	74	137	-	-			
Large (>14.5 cm)	64	26	79	169	-	-			
Total medium/large	90	63	153	306	-	-			
Plot area (m <sup>2</sup> )	78.5	78.5	78.5	235.5	-	-			
Density of medium/large burrows	1.15	0.80	1.95	1.30	1.30	0.59			
Survey date	1 Jul	1 Jul	2 Jul	1-2 Jul	-	-			
<b>Apparent occupancy rate</b>									
Medium/large burrows <sup>a</sup> with apparent occupancy	67	57	109	233	-	-			
Total medium/large burrows <sup>a</sup>	87	63	151	301	-	-			
Apparent occupancy rate of medium/large burrows	0.77	0.90	0.72	0.77	0.80	0.09			
Survey date	5 Aug	5 Aug	11 Aug	5-11 Aug	-	-			

<sup>a</sup>By definition, burrows must be ≥ 60 cm in length.

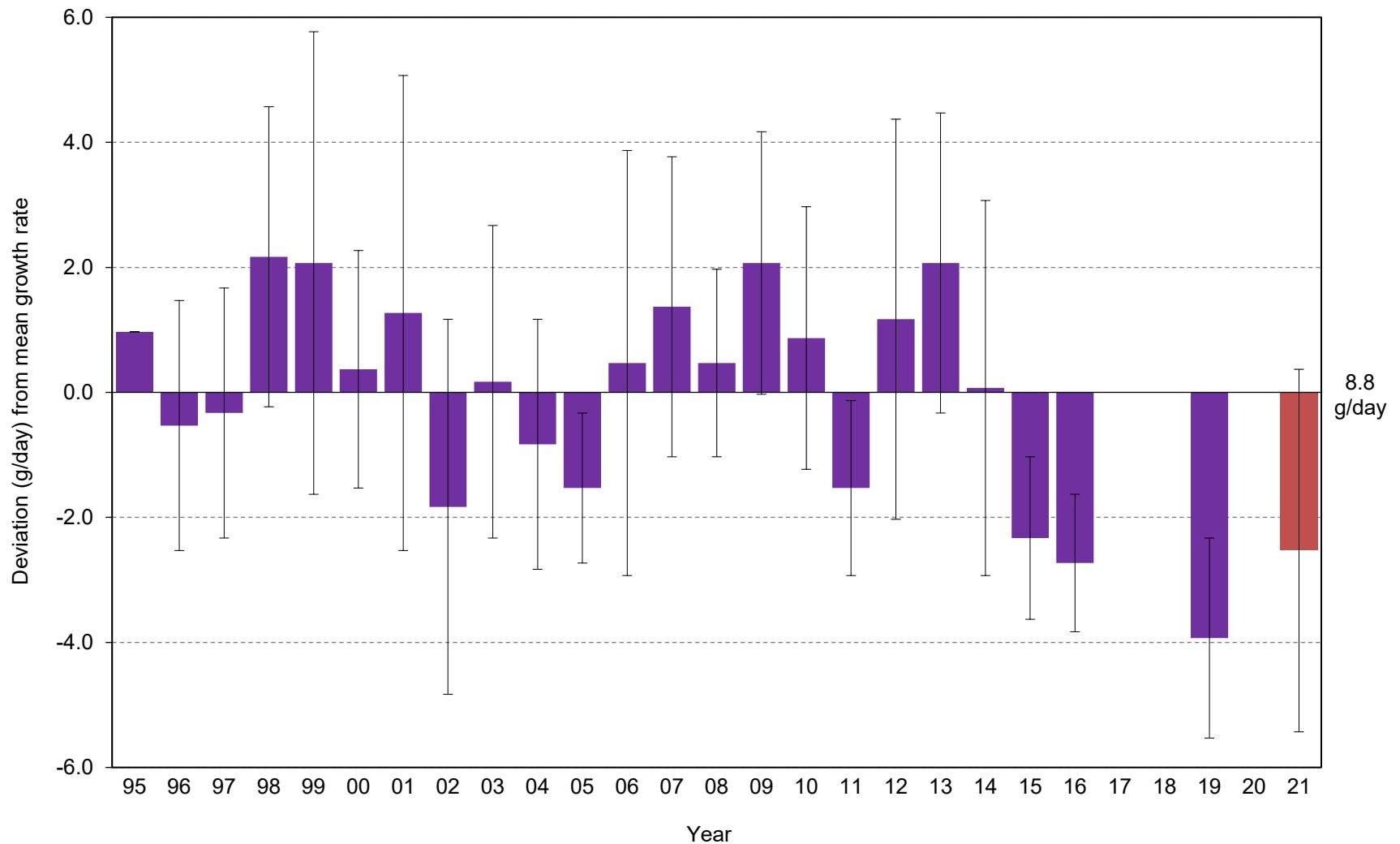


Figure 19. Yearly chick growth (mass) rate deviation (from the 1995-2020 average of 8.8 g/day) for rhinoceros auklets at St. Lazaria Island, Alaska. Data include only chicks monitored on an interval of about 5-7 days. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate. No data were collected in 2017-2018 or 2020.

Table 34. Mean growth rates of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Data include chicks measured at least two times during the linear phase of growth. No data were collected in 2017-2018 or 2020.

Year	Mass (g/day)				Wing chord (mm/day)			
	Mean	SD	Range	n	Mean	SD	Range	n
1995	9.8	-	-	1	- <sup>a</sup>	-	-	-
1996	8.3	2.0	4.0 - 11.2	14	3.0	0.4	2.4 - 3.6	7
1997	8.5	2.0	4.8 - 12.0	13	- <sup>a</sup>	-	-	-
1998	11.0	2.4	4.7 - 17.9	33	3.0	0.3	2.4 - 3.4	19
1999	10.9	3.7	4.9 - 19.2	10	3.1	0.3	2.5 - 3.5	7
2000	9.2	1.9	5.8 - 11.3	12	3.5	0.6	2.8 - 4.9	8
2001	10.1	3.8	5.6 - 18.5	14	3.4	0.8	2.9 - 4.0	2
2002	7.0	3.0	3.5 - 8.9	3	3.2	0.7	2.4 - 3.7	3
2003	9.0	2.5	4.6 - 12.5	10	3.6	0.4	3.0 - 4.2	9
2004	8.0	2.0	5.9 - 12.4	13	3.2	0.9	2.0 - 5.8	15
2005	7.3	1.2	5.5 - 8.9	9	2.7	-	-	1
2006	9.3	3.4	3.7 - 13.8	8	3.3	0.2	3.0 - 3.5	6
2007	10.2	2.4	5.4 - 12.9	9	3.2	0.5	2.9 - 3.6	2
2008	9.3	1.5	6.2 - 12.0	20	3.1	0.2	2.7 - 3.5	20
2009	10.9	2.1	7.4 - 13.8	8	3.6	0.3	3.1 - 3.8	4
2010	9.7	2.1	7.0 - 13.5	12	3.2	0.4	2.7 - 3.7	10
2011	7.3	1.4	5.9 - 9.7	6	3.2	0.7	2.4 - 4.5	7
2012	10.0	3.2	6.3 - 16.3	9	2.7	0.5	2.1 - 3.7	8
2013	10.9	2.4	6.4 - 14.3	12	3.5	0.6	2.3 - 4.6	10
2014	8.9	3.0	4.9 - 14.9	12	3.5	0.6	2.5 - 4.4	13
2015	6.5	1.3	4.2 - 8.8	15	3.3	0.7	2.1 - 5.3	16
2016	6.1	1.1	5.0 - 8.0	6	2.9	0.6	2.0 - 3.5	6
2019	4.9	1.6	1.6 - 6.5	6	3.1	0.5	2.3 - 3.7	6
2021	6.3	2.9	3.3 - 10.7	7	2.8	0.5	2.2 - 3.6	7

<sup>a</sup>Data exist for flattened wing chord only.

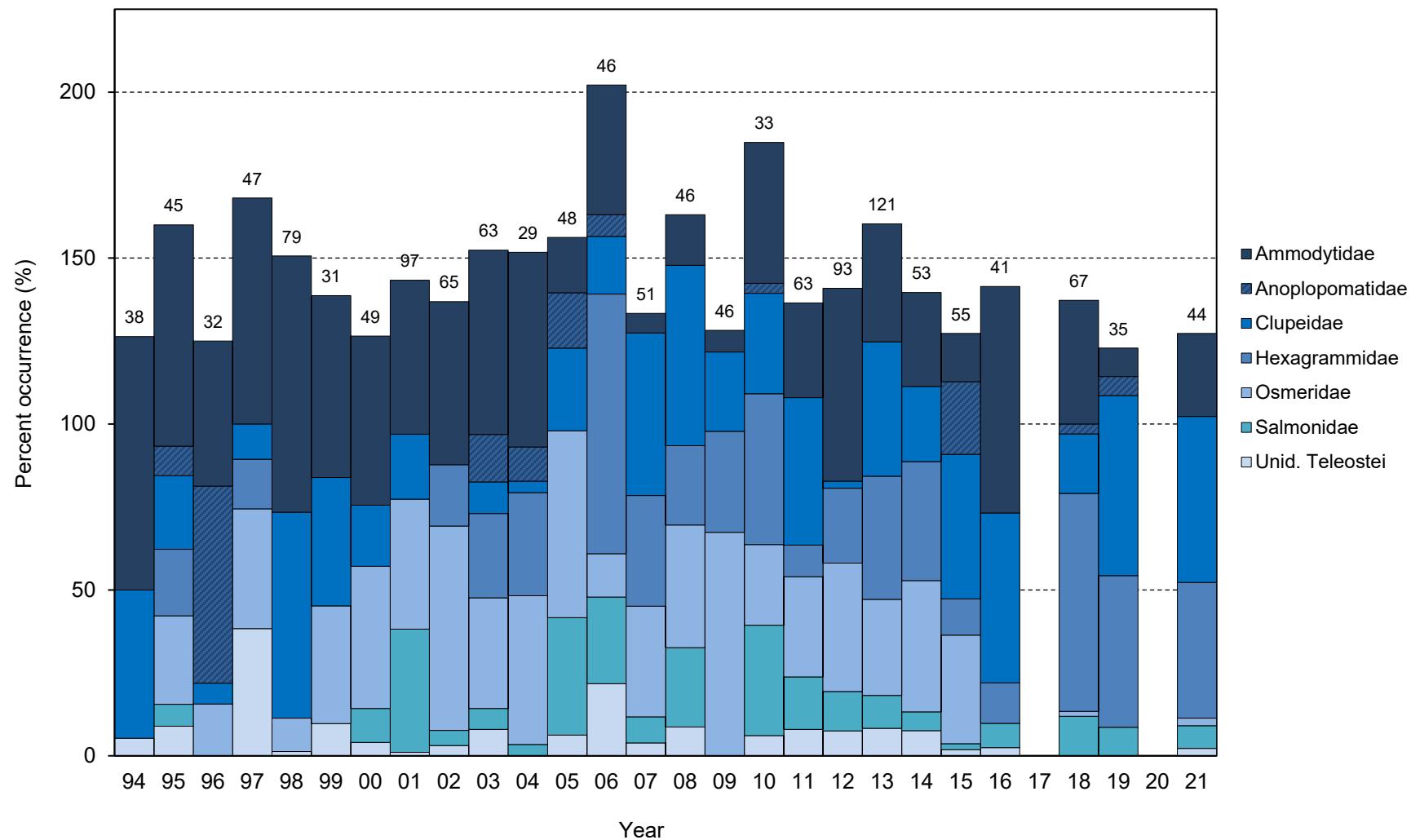


Figure 20. Frequency of occurrence of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicates sample sizes. No diet samples were collected in 2017 or 2020.

Table 35. Frequency of occurrence of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. samples	38	45	32	47	79	31	49	97	65	63	29	48	46
Invertebrates	-	-	3.1	-	-	-	-	-	-	-	-	-	-
<b>Fish</b>	<b>100.0</b>												
<b>Teleostei</b>	<b>100.0</b>												
<b>Ammodytidae</b>	<b>76.3</b>	<b>66.7</b>	<b>43.8</b>	<b>68.1</b>	<b>77.2</b>	<b>54.8</b>	<b>51.0</b>	<b>46.4</b>	<b>49.2</b>	<b>55.6</b>	<b>58.6</b>	<b>16.7</b>	<b>39.1</b>
<i>Ammodytes</i> spp.	76.3	66.7	43.8	68.1	77.2	54.8	51.0	46.4	49.2	55.6	58.6	16.7	39.1
<b>Anoplopomatidae</b>	-	<b>8.9</b>	<b>59.4</b>	-	-	-	-	-	-	<b>14.3</b>	<b>10.3</b>	<b>16.7</b>	<b>6.5</b>
<i>Anoplopoma fimbria</i>	-	8.9	59.4	-	-	-	-	-	-	14.3	10.3	16.7	6.5
<b>Clupeidae</b>	<b>44.7</b>	<b>22.2</b>	<b>6.3</b>	<b>10.6</b>	<b>62.0</b>	<b>38.7</b>	<b>18.4</b>	<b>19.6</b>	-	<b>9.5</b>	<b>3.4</b>	<b>25.0</b>	<b>17.4</b>
<i>Clupea pallasii</i>	44.7	22.2	6.3	10.6	62.0	38.7	18.4	19.6	-	9.5	3.4	25.0	17.4
<b>Hexagrammidae</b>	-	<b>20.0</b>	-	<b>14.9</b>	-	-	-	-	<b>18.5</b>	<b>25.4</b>	<b>31.0</b>	-	<b>78.3</b>
<i>Pleurogrammus monopterygius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. Hexagrammidae	-	20.0	-	14.9	-	-	-	-	18.5	25.4	31.0	-	78.3
Other Hexagrammidae	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Osmeridae</b>	-	<b>26.7</b>	<b>15.6</b>	<b>36.2</b>	<b>10.1</b>	<b>35.5</b>	<b>42.9</b>	<b>39.2</b>	<b>61.5</b>	<b>33.3</b>	<b>44.8</b>	<b>56.3</b>	<b>13.0</b>
<i>Mallotus villosus</i>	-	20.0	12.5	36.2	10.1	35.5	42.9	38.1	52.3	33.3	41.4	56.3	13.0
Other Osmeridae	-	6.7	3.1	-	-	-	-	1.0	13.8	-	6.9	-	-
<b>Salmonidae</b>	-	<b>6.7</b>	-	-	-	-	<b>10.2</b>	<b>37.1</b>	<b>4.6</b>	<b>6.3</b>	<b>3.4</b>	<b>35.4</b>	<b>26.1</b>
<i>Oncorhynchus</i> spp.	-	-	-	-	-	-	8.2	15.5	-	6.3	3.4	35.4	21.7
Other Salmonidae	-	6.7	-	-	-	-	2.0	22.7	4.6	-	-	-	4.3
Unid. Teleostei	5.3	8.9	-	38.3	1.3	9.7	4.1	1.0	3.1	7.9	-	6.3	21.7
Other Teleostei	-	24.4	-	-	1.3	-	-	-	1.5	-	-	-	-

Table 35 (continued). Frequency of occurrence of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	51	46	46	33	63	93	121	53	55	41	67	35	44
Invertebrates	-	-	-	-	-	-	-	-	1.8	2.4	3.0	-	2.3
<b>Fish</b>	<b>100.0</b>	<b>98.2</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>							
<b>Teleostei</b>	<b>100.0</b>	<b>98.2</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>							
<b>Ammodytidae</b>	<b>5.9</b>	<b>15.2</b>	<b>6.5</b>	<b>42.4</b>	<b>28.6</b>	<b>58.1</b>	<b>35.5</b>	<b>28.3</b>	<b>14.5</b>	<b>68.3</b>	<b>37.3</b>	<b>8.6</b>	<b>25.0</b>
<i>Ammodytes</i> spp.	5.9	15.2	6.5	42.4	28.6	58.1	35.5	28.3	14.5	68.3	37.3	8.6	25.0
<b>Anoplopomatidae</b>	-	-	-	<b>3.0</b>	-	-	-	-	<b>21.8</b>	-	<b>3.0</b>	<b>5.7</b>	-
<i>Anoplopoma fimbria</i>	-	-	-	3.0	-	-	-	-	21.8	-	3.0	5.7	-
<b>Clupeidae</b>	<b>49.0</b>	<b>54.3</b>	<b>23.9</b>	<b>30.3</b>	<b>44.4</b>	<b>2.2</b>	<b>40.5</b>	<b>22.6</b>	<b>43.6</b>	<b>51.2</b>	<b>17.9</b>	<b>54.3</b>	<b>50.0</b>
<i>Clupea pallasii</i>	49.0	54.3	23.9	30.3	44.4	2.2	40.5	22.6	43.6	51.2	17.9	54.3	50.0
<b>Hexagrammidae</b>	<b>33.3</b>	<b>23.9</b>	<b>30.4</b>	<b>45.5</b>	<b>9.5</b>	<b>22.6</b>	<b>37.2</b>	<b>35.8</b>	<b>10.9</b>	<b>12.2</b>	<b>65.7</b>	<b>45.7</b>	<b>40.9</b>
<i>Pleurogrammus monopterygius</i>	-	-	-	-	-	-	-	-	10.9	9.8	65.7	45.7	38.6
Unid. Hexagrammidae	33.3	23.9	30.4	45.5	9.5	22.6	37.2	35.8	-	-	-	-	2.3
Other Hexagrammidae	-	-	-	-	-	-	-	-	-	2.4	3.0	-	11.4
<b>Osmeridae</b>	<b>33.3</b>	<b>37.0</b>	<b>67.4</b>	<b>24.2</b>	<b>30.2</b>	<b>38.7</b>	<b>28.9</b>	<b>39.6</b>	<b>32.7</b>	-	<b>1.5</b>	-	<b>2.3</b>
<i>Mallotus villosus</i>	33.3	37.0	67.4	24.2	30.2	38.7	28.9	39.6	29.1	-	-	-	-
Other Osmeridae	-	-	-	-	-	-	-	-	3.6	-	1.5	-	2.3
<b>Salmonidae</b>	<b>7.8</b>	<b>23.9</b>	-	<b>33.3</b>	<b>15.9</b>	<b>11.8</b>	<b>9.9</b>	<b>5.7</b>	<b>1.8</b>	<b>7.3</b>	<b>11.9</b>	<b>8.6</b>	<b>6.8</b>
<i>Oncorhynchus</i> spp.	-	10.9	-	24.2	15.9	11.8	9.9	5.7	1.8	7.3	11.9	8.6	6.8
Other Salmonidae	7.8	13.0	-	12.1	-	-	-	-	-	-	-	-	-
Unid. Teleostei	3.9	8.7	-	6.1	7.9	7.5	8.3	7.5	1.8	2.4	-	-	2.3
Other Teleostei	-	-	4.3	-	-	7.5	8.3	17.0	5.5	26.8	-	-	15.9

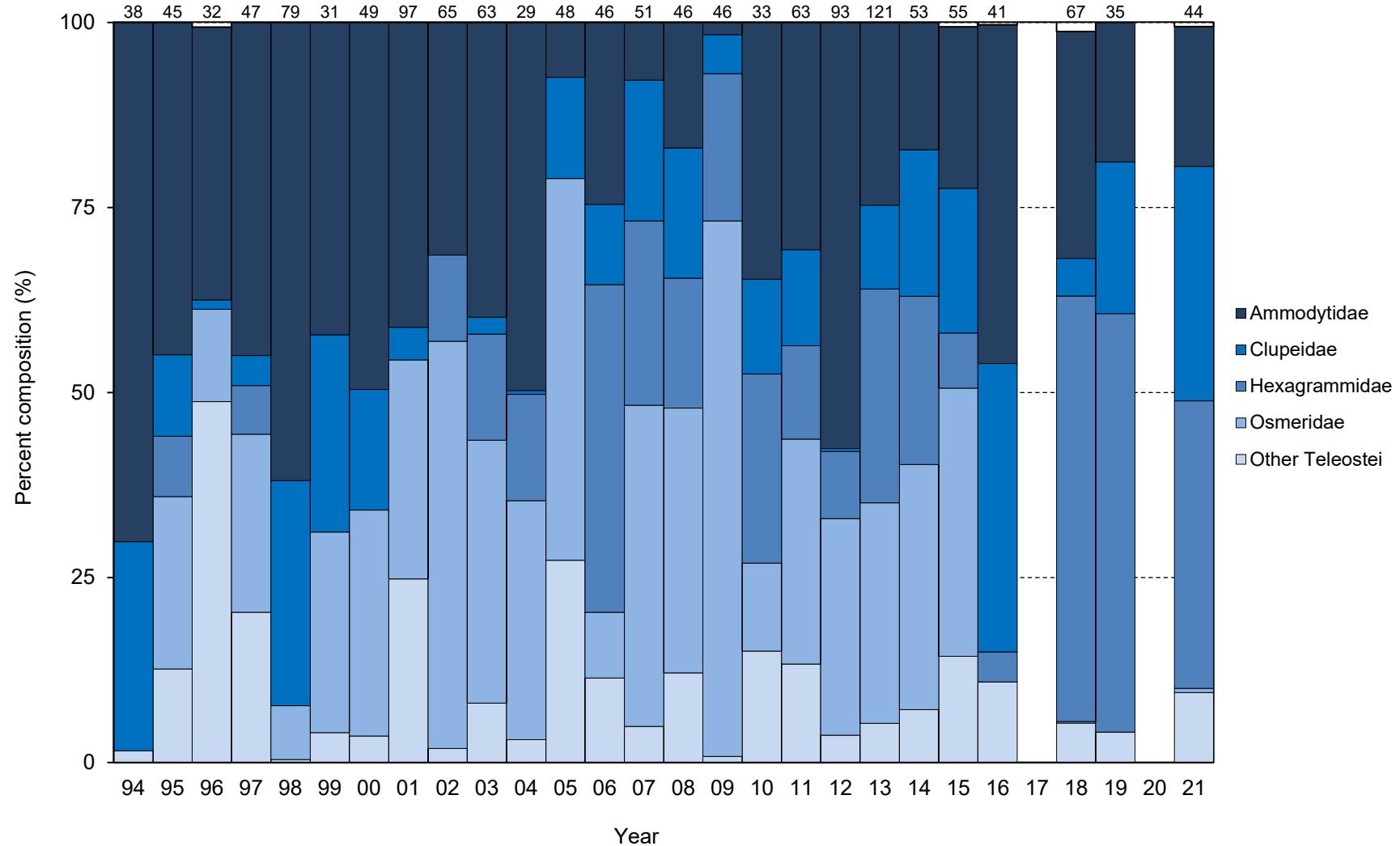


Figure 21. Percent composition of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2017 or 2020.

Table 36. Percent composition of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (values sum to 100% each year). Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items, so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. samples	38	45	32	47	79	31	49	97	65	63	29	48	46
No. individuals	191	245	160	320	496	199	252	500	318	349	195	256	350
Invertebrates	-	-	0.6	-	-	-	-	-	-	-	-	-	-
<b>Fish</b>	<b>100.0</b>	<b>100.0</b>	<b>99.4</b>	<b>100.0</b>									
<b>Teleostei</b>	<b>100.0</b>	<b>100.0</b>	<b>99.4</b>	<b>100.0</b>									
<b>Ammodytidae</b>	<b>70.2</b>	<b>44.9</b>	<b>36.9</b>	<b>45.0</b>	<b>61.9</b>	<b>42.2</b>	<b>49.6</b>	<b>41.2</b>	<b>31.4</b>	<b>39.8</b>	<b>49.7</b>	<b>7.4</b>	<b>24.6</b>
<i>Ammodytes</i> spp.	70.2	44.9	36.9	45.0	61.9	42.2	49.6	41.2	31.4	39.8	49.7	7.4	24.6
<b>Clupeidae</b>	<b>28.3</b>	<b>11.0</b>	<b>1.3</b>	<b>4.1</b>	<b>30.4</b>	<b>26.6</b>	<b>16.3</b>	<b>4.4</b>	-	<b>2.3</b>	<b>0.5</b>	<b>13.7</b>	<b>10.9</b>
<i>Clupea pallasii</i>	28.3	11.0	1.3	4.1	30.4	26.6	16.3	4.4	-	2.3	0.5	13.7	10.9
<b>Hexagrammidae</b>	-	<b>8.2</b>	-	<b>6.6</b>	-	-	-	-	<b>11.6</b>	<b>14.3</b>	<b>14.4</b>	-	<b>44.3</b>
<i>Pleurogrammus monopterygius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. Hexagrammidae	-	8.2	-	6.6	-	-	-	-	11.6	14.3	14.4	-	44.3
Other Hexagrammidae	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Osmeridae</b>	-	<b>23.3</b>	<b>12.5</b>	<b>24.1</b>	<b>7.3</b>	<b>27.1</b>	<b>30.6</b>	<b>29.6</b>	<b>55.0</b>	<b>35.5</b>	<b>32.3</b>	<b>51.6</b>	<b>8.9</b>
<i>Mallotus villosus</i>	-	21.2	11.9	24.1	7.3	27.1	30.6	29.4	47.8	35.5	30.8	51.6	8.9
Other Osmeridae	-	2.0	0.6	-	-	-	-	0.2	7.2	-	1.5	-	-
Other Teleostei	1.6	12.7	48.8	20.3	0.4	4.0	3.6	24.8	1.9	8.0	3.1	27.3	11.4

Table 36 (continued). Percent composition of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (values sum to 100% each year). Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	51	46	46	33	63	93	121	53	55	41	67	35	44
No. individuals	205	165	246	219	293	707	547	308	174	321	414	122	180
Invertebrates	-	-	-	-	-	-	-	-	0.6	0.3	1.2	-	0.6
<b>Fish</b>	<b>100.0</b>	<b>99.4</b>	<b>99.7</b>	<b>98.8</b>	<b>100.0</b>	<b>99.4</b>							
<b>Teleostei</b>	<b>100.0</b>	<b>99.4</b>	<b>99.7</b>	<b>98.8</b>	<b>100.0</b>	<b>99.4</b>							
<b>Ammodytidae</b>	<b>7.8</b>	<b>17.0</b>	<b>1.6</b>	<b>34.7</b>	<b>30.7</b>	<b>57.6</b>	<b>24.7</b>	<b>17.2</b>	<b>21.8</b>	<b>45.8</b>	<b>30.7</b>	<b>18.9</b>	<b>18.9</b>
<i>Ammodytes</i> spp.	7.8	17.0	1.6	34.7	30.7	57.6	24.7	17.2	21.8	45.8	30.7	18.9	18.9
<b>Clupeidae</b>	<b>19.0</b>	<b>17.6</b>	<b>5.3</b>	<b>12.8</b>	<b>13.0</b>	<b>0.4</b>	<b>11.3</b>	<b>19.8</b>	<b>19.5</b>	<b>38.9</b>	<b>5.1</b>	<b>20.5</b>	<b>31.7</b>
<i>Clupea pallasii</i>	19.0	17.6	5.3	12.8	13.0	0.4	11.3	19.8	19.5	38.9	5.1	20.5	31.7
<b>Hexagrammidae</b>	<b>24.9</b>	<b>17.6</b>	<b>19.9</b>	<b>25.6</b>	<b>12.6</b>	<b>9.1</b>	<b>28.9</b>	<b>22.7</b>	<b>7.5</b>	<b>4.0</b>	<b>57.5</b>	<b>56.6</b>	<b>38.9</b>
<i>Pleurogrammus monopterygius</i>	-	-	-	-	-	-	-	-	7.5	3.7	57.0	56.6	33.3
Unid. Hexagrammidae	24.9	17.6	19.9	25.6	12.6	9.1	28.9	22.7	-	-	-	-	0.6
Other Hexagrammidae	-	-	-	-	-	-	-	-	-	0.3	0.5	-	5.0
<b>Osmeridae</b>	<b>43.4</b>	<b>35.8</b>	<b>72.4</b>	<b>11.9</b>	<b>30.4</b>	<b>29.3</b>	<b>29.8</b>	<b>33.1</b>	<b>36.2</b>	-	<b>0.2</b>	-	<b>0.6</b>
<i>Mallotus villosus</i>	43.4	35.8	72.4	11.9	30.4	29.3	29.8	33.1	35.1	-	-	-	-
Other Osmeridae	-	-	-	-	-	-	-	-	1.1	-	0.2	-	0.6
Other Teleostei	4.9	12.1	0.8	15.1	13.3	3.7	5.3	7.1	14.4	10.9	5.3	4.1	9.4

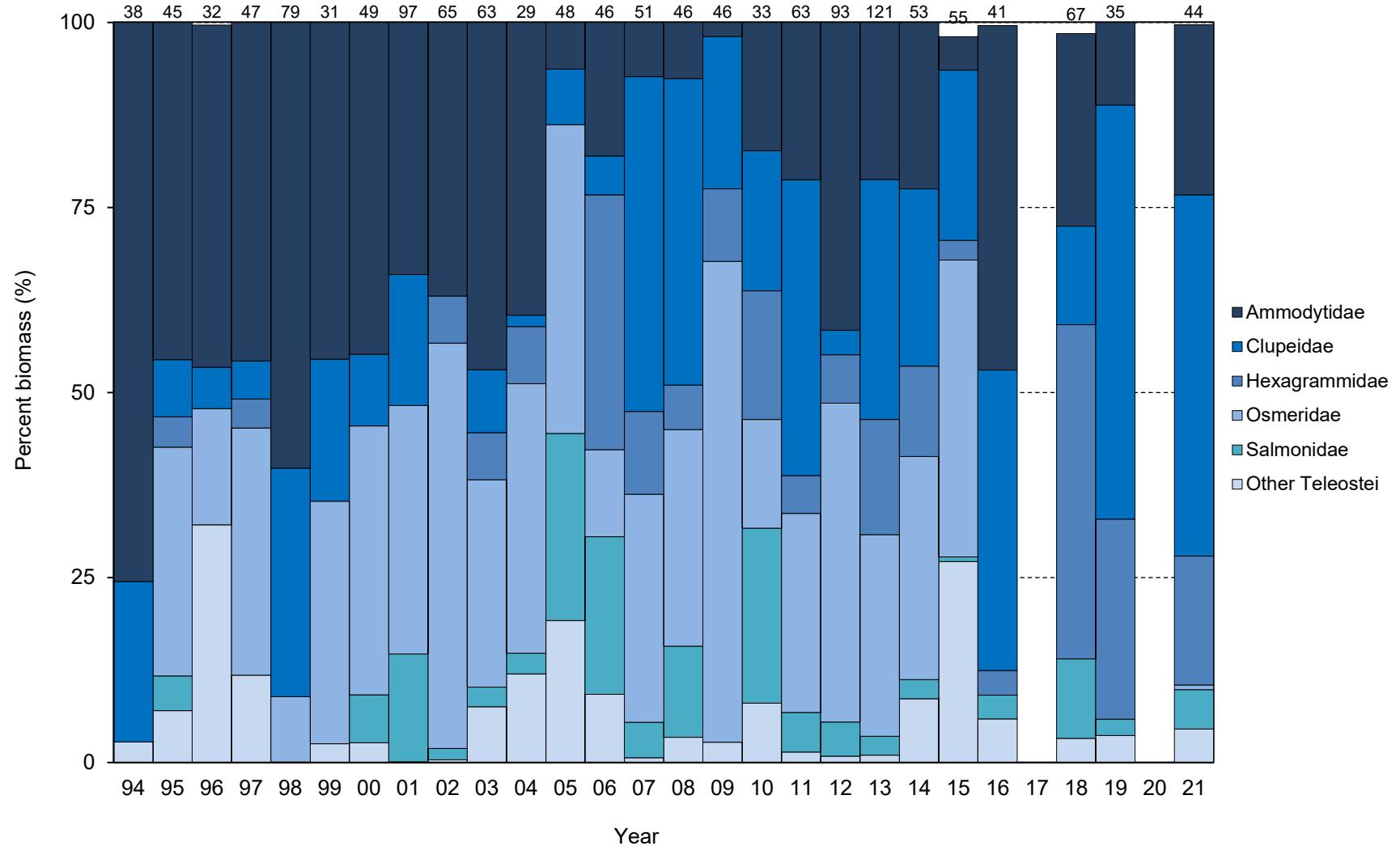


Figure 22. Relative biomass of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. Numbers above columns indicate sample sizes.

Table 37. Relative biomass of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (values sum to 100% each year). Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Mass data are not always available for all samples so sample sizes for biomass may not equal those for frequency of occurrence and some prey types may not appear in biomass data although they were present in diet samples. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
No. samples	38	45	32	47	79	31	49	97	65	63	29	48	46
Total mass (g)	978	1191	834	1240	2451	1074	1320	2550	1600	2104	966	1388	1385
Invertebrates	-	-	0.3	-	-	-	-	-	-	-	-	-	-
<b>Fish</b>	<b>100.0</b>	<b>100.0</b>	<b>99.7</b>	<b>100.0</b>									
<b>Teleostei</b>	<b>100.0</b>	<b>100.0</b>	<b>99.7</b>	<b>100.0</b>									
<b>Ammodytidae</b>	<b>75.5</b>	<b>45.6</b>	<b>46.2</b>	<b>45.7</b>	<b>60.2</b>	<b>45.5</b>	<b>44.8</b>	<b>34.1</b>	<b>37.0</b>	<b>46.9</b>	<b>39.6</b>	<b>6.3</b>	<b>18.0</b>
<i>Ammodytes</i> spp.	75.5	45.6	46.2	45.7	60.2	45.5	44.8	34.1	37.0	46.9	39.6	6.3	18.0
<b>Clupeidae</b>	<b>21.7</b>	<b>7.7</b>	<b>5.6</b>	<b>5.2</b>	<b>30.9</b>	<b>19.2</b>	<b>9.7</b>	<b>17.7</b>	-	<b>8.5</b>	<b>1.5</b>	<b>7.5</b>	<b>5.2</b>
<i>Clupea pallasii</i>	21.7	7.7	5.6	5.2	30.9	19.2	9.7	17.7	-	8.5	1.5	7.5	5.2
<b>Hexagrammidae</b>	-	<b>4.1</b>	-	<b>3.9</b>	-	-	-	-	<b>6.3</b>	<b>6.4</b>	<b>7.7</b>	-	<b>34.5</b>
Unid. Hexagrammidae	-	4.1	-	3.9	-	-	-	-	6.3	6.4	7.7	-	34.5
Other Hexagrammidae	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Osmeridae</b>	-	<b>30.9</b>	<b>15.7</b>	<b>33.4</b>	<b>8.8</b>	<b>32.8</b>	<b>36.3</b>	<b>33.6</b>	<b>54.8</b>	<b>28.0</b>	<b>36.4</b>	<b>41.7</b>	<b>11.7</b>
<i>Mallotus villosus</i>	-	23.6	15.2	33.4	8.8	32.8	36.3	33.3	47.5	28.0	34.0	41.7	11.7
Other Osmeridae	-	7.3	0.5	-	-	-	-	0.3	7.3	-	2.4	-	-
<b>Salmonidae</b>	-	4.7	-	-	-	-	6.5	14.6	1.5	2.6	2.8	25.3	21.3
Other Teleostei	2.8	7.0	32.1	11.8	0.1	2.5	2.7	0.1	0.4	7.5	12.0	19.2	9.2

Table 37 (continued). Relative biomass of major prey items in diets of rhinoceros auklet chicks at St. Lazaria Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (values sum to 100% each year). Prey was measured and identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Mass data are not always available for all samples so sample sizes for biomass may not equal those for frequency of occurrence and some prey types may not appear in biomass data although they were present in diet samples. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017 or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	51	46	46	33	63	93	121	53	55	41	67	35	44
Total mass (g)	1390	1519	1649	835	1819	2755	3413	1463	1062	898	1430	869	950
Invertebrates	-	-	-	-	-	-	-	-	1.9	0.4	1.5	-	0.3
<b>Fish</b>	<b>100.0</b>	<b>98.1</b>	<b>99.6</b>	<b>98.5</b>	<b>100.0</b>	<b>99.7</b>							
<b>Teleostei</b>	<b>100.0</b>	<b>98.1</b>	<b>99.6</b>	<b>98.5</b>	<b>100.0</b>	<b>99.7</b>							
<b>Ammodytidae</b>	<b>7.3</b>	<b>7.6</b>	<b>1.9</b>	<b>17.3</b>	<b>21.3</b>	<b>41.6</b>	<b>21.2</b>	<b>22.5</b>	<b>4.5</b>	<b>46.5</b>	<b>26.0</b>	<b>11.2</b>	<b>23.0</b>
<i>Ammodytes</i> spp.	7.3	7.6	1.9	17.3	21.3	41.6	21.2	22.5	4.5	46.5	26.0	11.2	23.0
<b>Clupeidae</b>	<b>45.3</b>	<b>41.4</b>	<b>20.6</b>	<b>18.9</b>	<b>40.0</b>	<b>3.3</b>	<b>32.4</b>	<b>23.9</b>	<b>23.0</b>	<b>40.6</b>	<b>13.4</b>	<b>56.0</b>	<b>48.8</b>
<i>Clupea pallasii</i>	45.3	41.4	20.6	18.9	40.0	3.3	32.4	23.9	23.0	40.6	13.4	56.0	48.8
<b>Hexagrammidae</b>	<b>11.2</b>	<b>6.0</b>	<b>9.8</b>	<b>17.4</b>	<b>5.1</b>	<b>6.5</b>	<b>15.6</b>	<b>12.2</b>	<b>2.7</b>	<b>3.3</b>	<b>45.1</b>	<b>27.0</b>	<b>17.4</b>
Unid. Hexagrammidae	11.2	6.0	9.8	17.4	5.1	6.5	15.6	12.2	-	-	-	-	0.1
Other Hexagrammidae	-	-	-	-	-	-	-	-	2.7	3.3	45.1	27.0	17.3
<b>Osmeridae</b>	<b>30.8</b>	<b>29.3</b>	<b>65.0</b>	<b>14.7</b>	<b>26.9</b>	<b>43.1</b>	<b>27.3</b>	<b>30.1</b>	<b>40.1</b>	-	<0.1	-	<b>0.6</b>
<i>Mallotus villosus</i>	30.8	29.3	65.0	14.7	26.9	43.1	27.3	30.1	37.8	-	-	-	-
Other Osmeridae	-	-	-	-	-	-	-	-	2.3	-	<0.1	-	0.6
<b>Salmonidae</b>	4.8	12.3	-	23.6	5.3	4.6	2.6	2.6	0.6	3.2	10.8	2.2	5.3
Other Teleostei	0.6	3.4	2.7	8.0	1.4	0.8	1.0	8.6	27.2	5.9	3.3	3.6	4.5

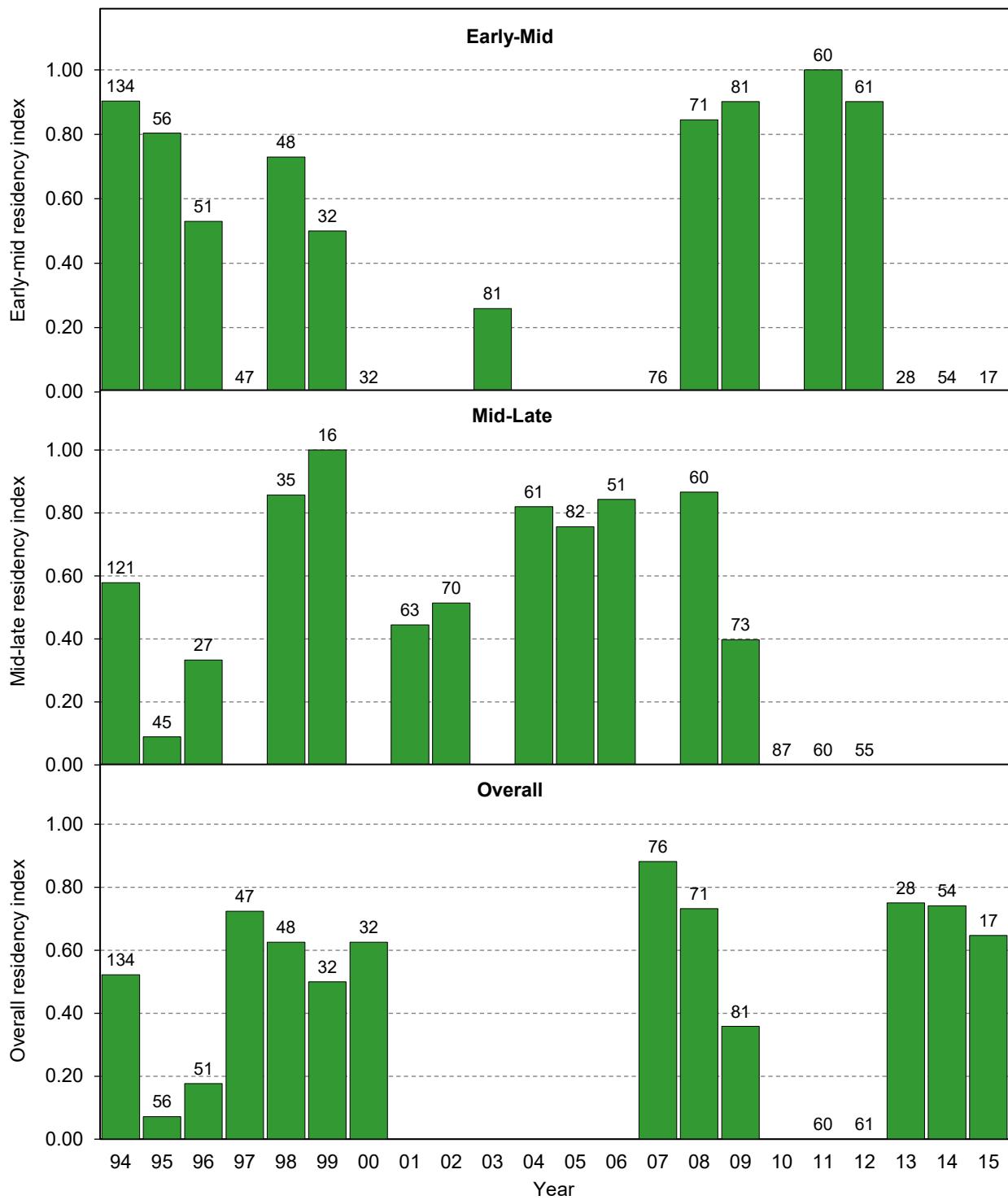


Figure 23. Residency indices of tufted puffins at St. Lazaria Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed. Early-mid residency index=d/b, mid-late residency index=f/d, and overall residency index= f/b, where b=nests with evidence of activity early in the season (representing eggs), d=nests with evidence of activity mid-season (representing chicks), and f=nests with evidence of activity late in the season (representing large chicks/potential fledglings). No data were collected after 2015.

Table 38. Residency indices of tufted puffins at St. Lazaria Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed, based on the assumption that evidence of activity during early, middle, and late periods in the breeding season represent the presence of eggs, chicks, and large chicks/potential fledglings, respectively. Surveys are conducted during incubation (late June to early July), early chick-rearing (mid-July to early August), and late chick-rearing (mid-August to early September). Evidence of activity includes observations of feathers, droppings, fresh vegetation, clipped vegetation and roots, eggs, eggshell fragments, or chicks in the burrow. No data were collected after 2015.

Year	Large (>14.5 cm) burrows <sup>a</sup> with activity			Residency indices <sup>b</sup>		
	Early (b)	Mid (d)	Late (f)	Early-Mid (d/b)	Mid-Late (f/d)	Overall (f/b)
1994	134	121	70	0.90	0.58	0.52
1995	56	45	4	0.80	0.09	0.07
1996	51	27	9	0.53	0.33	0.18
1997	47	-	34	-	-	0.72
1998	48	35	30	0.73	0.86	0.63
1999	32	16	16	0.50	1.00	0.50
2000	32	-	20	-	-	0.63
2001	-	63	28	-	0.44	-
2002	-	70	36	-	0.51	-
2003	81	21	-	0.26	-	-
2004	-	61	50	-	0.82	-
2005	-	82	62	-	0.76	-
2006	-	51	43	-	0.84	-
2007	76	-	67	-	-	0.88
2008	71	60	52	0.85	0.87	0.73
2009	81	73	29	0.90	0.40	0.36
2010	-	87	-	-	-	-
2011	60	60	-	1.00	-	-
2012	61	55	-	0.90	-	-
2013	28	-	21	-	-	0.75
2014	54	-	40	-	-	0.74
2015	17	-	11	-	-	0.65

<sup>a</sup>By definition, burrows must be > 60 cm in length.

<sup>b</sup>Early-mid residency index (d/b) is a surrogate for nesting success (D/B), mid-late residency index (f/d) is a surrogate for fledgling success (F/B), and overall residency index (f/b) is a surrogate for reproductive success (F/B).

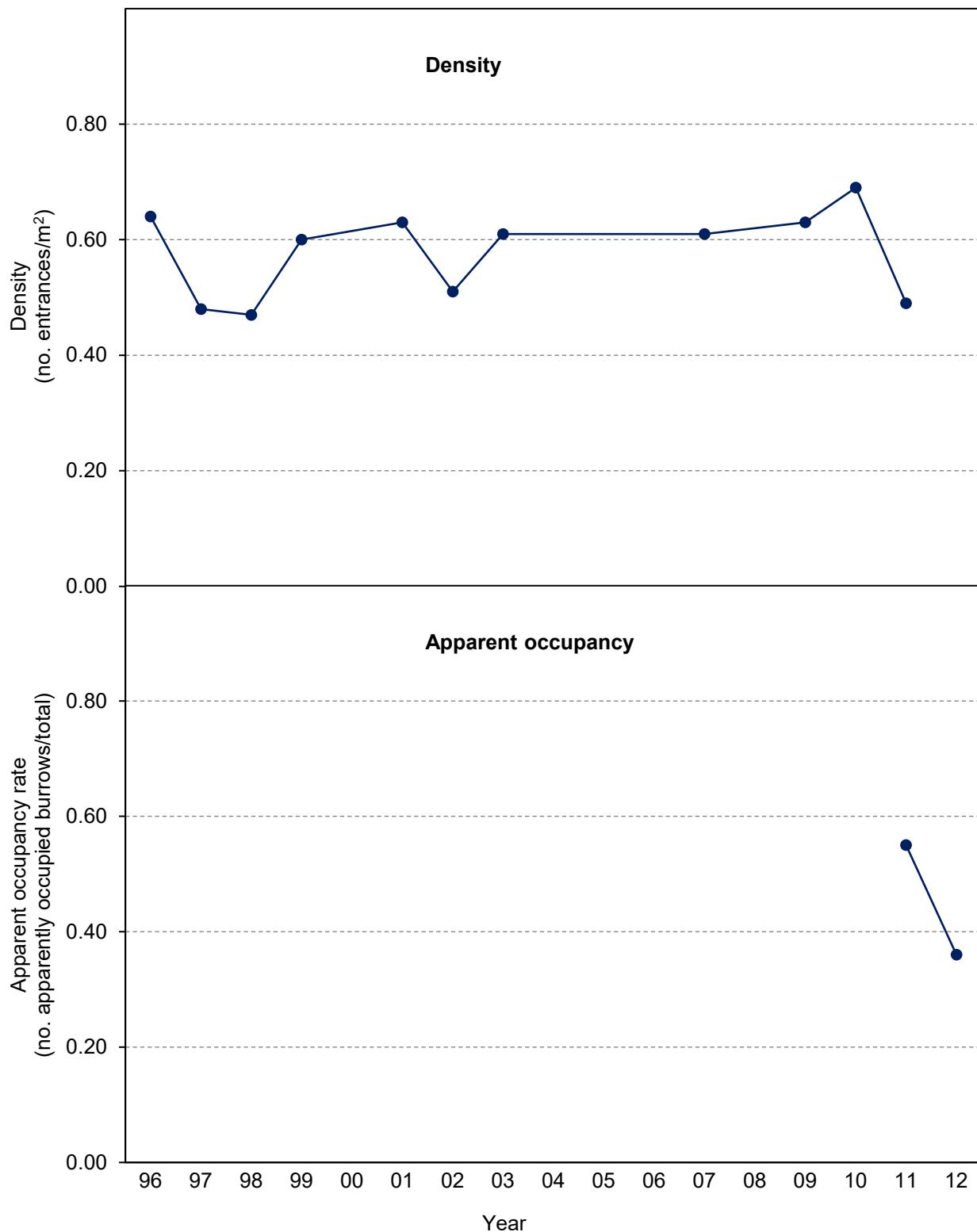


Figure 24. Burrow entrance densities and apparent occupancy rates of tufted puffins on index plots at St. Lazaria Island, Alaska. Values are shown only for years in which data exist for all plots. No data were collected after 2015.

Table 39. Burrow entrance densities of tufted puffins on index plots at St. Lazaria Island, Alaska. Density is expressed as the number of large (>14.5 cm) burrow entrances<sup>a</sup> per m<sup>2</sup> and is assessed in late June to early July, during incubation. Areas of transects surveyed varied across years and are shown in Table 38. No data were collected after 2015.

Year	Transect								Total	Mean	SD
	1	2	3	4	5	6	7	8			
1996	0.55	0.35	0.97	0.71	0.39	0.58	0.00	0.17	0.64	0.47	0.31
1997	0.58	0.23	0.94	0.37	0.15	0.44	0.48	0.08	0.48	0.41	0.27
1998	0.95	0.68	1.00	0.26	0.20	0.16	0.21	0.06	0.47	0.44	0.38
1999	0.37	0.90	0.51	0.61	0.63	1.23	0.29	0.22	0.60	0.60	0.34
2000	0.96	1.08	0.99	-	0.61	0.00	0.00	0.11	- <sup>b</sup>	-	-
2001	1.11	1.04	0.90	0.49	0.67	0.00	0.00	0.00	0.63	0.53	0.48
2002	0.42	1.13	0.77	0.28	0.50	0.67	0.16	0.00	0.51	0.49	0.36
2003	1.03	1.33	0.60	0.33	0.73	0.56	0.16	0.00	0.61	0.59	0.44
2004	xx <sup>c</sup>	xx	xx	xx							
2005	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2006	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2007	1.21	0.61	0.78	0.47	0.80	0.21	0.20	0.00	0.61	0.54	0.40
2008	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2009	1.43	0.89	0.62	0.38	0.98	0.49	0.00	0.00	0.63	0.60	0.49
2010	1.17	0.80	0.89	0.60	0.51	0.51	0.27	0.29	0.69	0.63	0.31
2011	0.54	0.95	0.79	0.50	0.37	0.10	0.00	0.00	0.49	0.41	0.36
2012	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2013	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2014	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2015	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx

<sup>a</sup>By definition, burrows must be ≥ 60 cm in length.

<sup>b</sup>Summary statistics are not calculated in years when not all plots are monitored.

<sup>c</sup>xx indicates data potentially exist but have not yet been summarized.

Table 40. Lengths (m) of transects used for tufted puffin density plots at St. Lazaria Island, Alaska. All transects were 3m wide but lengths varied across years because of different observer comfort levels in surveying potentially dangerous portions of the plot/transect. Areas used to calculate densities of burrows in Table 39 are defined as transect length x width.

Year	Transect							
	1	2	3	4	5	6	7	8
1996	4.3	10.5	24.0	14.0	6.0	4.0	2.7	4.0
1997	6.3	7.2	24.0	18.0	18.0	3.8	2.8	4.0
1998	3.5	7.3	19.0	18.0	18.0	6.2	3.2	5.5
1999	3.6	6.3	26.0	12.5	10.1	6.5	3.5	6.0
2000	4.5	7.4	13.8	-	5.5	4.0	2.1	3.1
2001	4.5	7.4	10.0	18.2	5.5	4.1	2.1	3.1
2002	5.5	7.4	9.9	19.2	6.0	2.5	2.1	3.1
2003	5.5	7.0	10.0	17.0	5.0	6.0	2.1	3.0
2004	5.5	7.0	10.0	17.0	5.0	6.0	2.1	3.0
2005	5.5	7.0	10.0	17.0	5.0	6.0	2.1	3.0
2006	5.5	7.0	10.0	17.0	5.0	6.0	2.1	3.0
2007	5.8	7.6	10.2	17.2	5.0	6.4	3.3	3.0
2008	xx <sup>a</sup>	xx	xx	xx	xx	xx	xx	xx
2009	5.8	6.7	9.8	18.3	5.4	6.1	2.0	2.6
2010	7.1	7.9	10.5	16.0	6.5	7.2	2.5	3.5
2011	6.8	7.0	8.4	15.4	8.9	6.9	1.9	3.0
2012	xx	xx	xx	xx	xx	xx	xx	xx
2013	xx	xx	xx	xx	xx	xx	xx	xx
2014	xx	xx	xx	xx	xx	xx	xx	xx
2015	xx	xx	xx	xx	xx	xx	xx	xx

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

Table 41. Apparent occupancy rates of tufted puffins on index plots at St. Lazaria Island, Alaska. Apparent occupancy rate is expressed as the proportion of large (>14.5 cm) burrows<sup>a</sup> with evidence of apparent occupancy late in the nesting period. Evidence of apparent occupancy includes observations of feathers, droppings, fresh vegetation, clipped vegetation and roots, eggs, eggshell fragments, or chicks in the burrow. Apparent occupancy rate is assessed in August, toward the end of the chick-rearing period. No data were collected after 2015.

Year	Transect								Total	Mean	SD
	1	2	3	4	5	6	7	8			
1996	xx <sup>b</sup>	xx	xx	xx							
1997	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1999	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2000	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2001	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2002	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2003	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2004	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2005	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2006	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2007	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2008	0.53	0.47	0.65	0.56	0.64	0.38	0.00	0.00	0.55	0.40	0.26
2009	0.19	0.24	0.65	0.38	0.50	0.13	0.00	0.00	0.36	0.34	0.20
2010	-	-	-	-	-	-	-	-	-c	-	-
2011	0.82	0.71	0.71	0.81	0.70	1.00	-	-	-c	-	-
2012	0.70	0.45	0.86	0.56	-	0.00	0.00	0.00	-c	-	-
2013	0.79	0.71	-	-	-	-	-	-	-c	-	-
2014	0.75	0.73	-	-	-	-	-	-	-c	-	-
2015	0.48	-	-	-	-	-	-	-	-c	-	-

<sup>a</sup>By definition, burrows must be ≥ 60 cm in length.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>c</sup>Summary statistics are not calculated in years when not all plots are monitored.

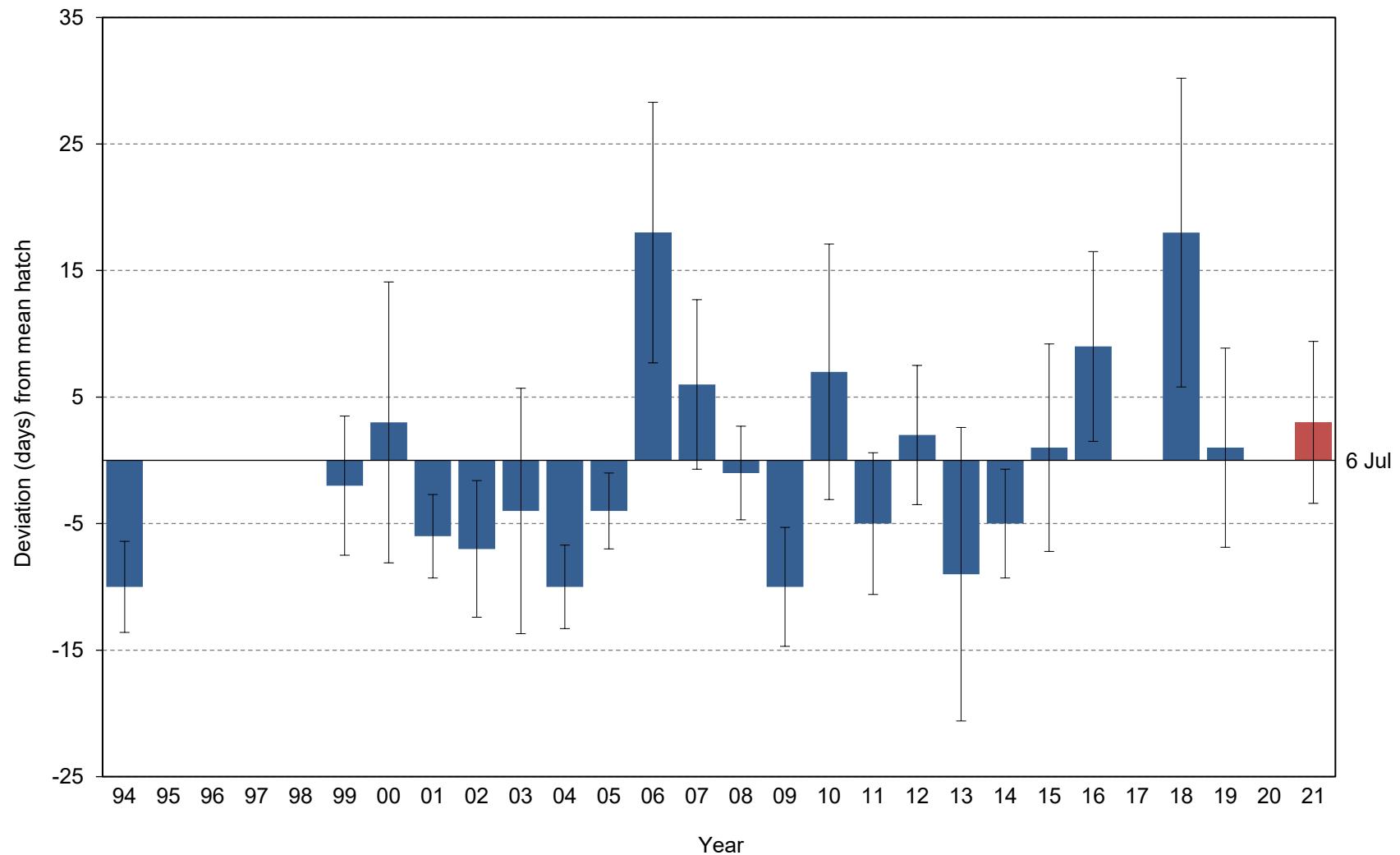


Figure 25. Yearly hatch date deviation (from the 1994-2020 average of 6 July) for glaucous-winged gulls at St. Lazaria Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2017 or 2020.

Table 42. Breeding chronology of glaucous-winged gulls at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Mean lay <sup>a</sup>	SD	n <sup>b</sup>	Mean hatch	SD	n <sup>c</sup>	First lay <sup>a</sup>	First hatch	Last hatch
1994	- <sup>d</sup>	-	-	26 Jun	3.6	17	<9 Jun	18 Jun	≥30 Jun
1995	xx <sup>e</sup>	xx	xx	xx	xx	xx	xx	xx	xx
1996	xx	xx	xx	xx	xx	xx	xx	xx	xx
1997	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx	xx	xx	xx
1999	xx	xx	xx	4 Jul	5.5	23	xx	22 Jun	12 Jul
2000	xx	xx	xx	8 Jul	11.1	14	xx	28 Jun	3 Aug
2001	xx	xx	xx	30 Jun	3.3	27	xx	21 Jun	7 Jul
2002	xx	xx	xx	29 Jun	5.4	31	xx	17 Jun	13 Jul
2003	xx	xx	xx	2 Jul	9.7	61	xx	17 Jun	27 Jul
2004	xx	xx	xx	25 Jun	3.3	45	xx	18 Jun	2 Jul
2005	xx	xx	xx	2 Jul	3.0	59	xx	25 Jun	11 Jul
2006	xx	xx	xx	24 Jul	10.3	15	xx	1 Jul	31 Jul
2007	-	-	-	12 Jul	6.7	43	<8 Jun	1 Jul	31 Jul
2008	xx	xx	xx	4 Jul	3.7	87	xx	24 Jun	12 Jul
2009	xx	xx	xx	26 Jun	4.7	58	xx	17 Jun	9 Jul
2010	-	-	-	13 Jul	10.1	66	<14 Jun	16 Jun	24 Jul
2011	xx	xx	xx	1 Jul	5.6	63	xx	19 Jun	25 Jul
2012	-	-	-	7 Jul	5.5	81	<11 Jun	28 Jun	30 Jul
2013	- <sup>f</sup>	-	-	27 Jun	11.6	92	<9 Jun	16 Jun	24 Jul
2014	-	-	-	1 Jul	4.3	73	<12 Jun	27 Jun	11 Jul
2015	-	-	-	7 Jul	8.2	96	<2 Jun	23 Jun	23 Jul
2016	-	-	-	14 Jul	7.5	8	<7 Jun	25 Jun	1 Aug
2018	-	-	-	24 Jul	12.2	21	<9 Jun	9 Jul	15 Aug
2019	-	-	-	7 Jul	7.9	131	<2 Jun	21 Jun	12 Aug
2021	- <sup>g</sup>	-	-	9 Jul	6.4	181	26 May	25 Jun	27 Jul

<sup>a</sup>In years when eggs are already present at the first visit, mean lay date is not calculated and date of first lay is listed as < the date of first nest check.

<sup>b</sup>Sample sizes for mean lay dates are a sub-sample of total nests for which no egg to egg interval is ≤ 7 days.

<sup>c</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.

<sup>d</sup>50% of nests contained one or more eggs when plots were checked for the first time in 1994 (9 Jun)

<sup>e</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>f</sup>53% of nests contained one or more eggs when plots were checked for the first time in 2013 (9 Jun).

<sup>g</sup>A majority of nests were initiated during a long check interval so an accurate mean lay date could not be calculated.

Table 43. Frequency distribution of hatch dates for glaucous-winged gulls at St. Lazaria Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020.

Julian date <sup>a</sup>	No. nests hatching on Julian date																				
	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
167	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
168	-	-	-	1	2	-	-	-	-	-	1	-	-	-	5	-	-	-	-	-	-
169	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170	-	-	-	-	-	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
171	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	-	-	1	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	1	-
173	-	-	-	-	15	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
174	3	-	-	5	-	14	-	-	-	-	33	-	-	-	-	-	1	-	-	-	-
175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-
176	-	-	1	-	2	-	2	-	-	1	1	-	12	-	-	-	-	-	-	-	2
177	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	1	-	2	-	-
178	-	-	3	11	8	16	-	-	-	6	-	-	4	-	11	22	2	-	-	21	-
179	-	-	-	-	-	-	-	-	-	9	4	-	-	-	-	-	6	-	-	-	1
180	2	2	7	-	-	4	-	-	-	-	-	15	1	-	-	-	-	-	-	-	5
181	-	-	-	-	1	3	-	-	5	-	-	-	-	-	27	4	-	-	-	-	15
182	-	1	3	-	6	5	41	1	3	-	1	-	-	1	6	-	10	1	-	9	-
183	2	2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	6
184	5	4	11	11	-	1	-	-	31	2	-	-	-	-	-	-	10	-	-	19	15
185	-	-	-	-	1	-	-	-	-	1	6	17	21	-	-	-	-	-	-	-	21
186	-	-	-	-	1	-	-	-	9	-	-	-	-	-	6	17	1	1	-	-	-
187	-	-	-	-	-	14	1	-	15	-	-	3	1	-	-	6	-	-	2	2	-
188	5	-	1	2	10	-	-	-	23	-	-	-	8	-	-	15	-	-	29	24	-
189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	5	-	-	-	-	-	-	-	-	4	-	7	26	-	-	-	-	-	1	-	5
191	-	-	-	-	1	-	-	-	-	-	9	-	-	-	-	2	-	-	1	10	-
192	-	1	-	-	1	-	2	-	18	1	-	-	-	-	2	7	5	-	1	7	25
193	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	2	20	-	-
194	1	1	-	1	-	-	-	-	-	5	-	-	-	-	-	2	-	2	-	13	-
195	-	-	-	-	-	-	-	-	-	-	3	-	15	-	-	-	-	-	1	7	-
196	-	-	-	-	5	-	-	2	6	-	-	-	-	33	-	-	1	2	2	5	-
197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	1	-	1	-
198	-	-	-	-	5	-	-	-	-	-	-	-	1	-	-	11	-	-	5	4	-
199	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	12	-
200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
201	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	3	-	1	1	1	-
202	-	-	-	-	-	-	-	-	4	-	-	-	1	5	-	3	2	-	7	1	-

Table 43 (continued). Frequency distribution of hatch dates for glaucous-winged gulls at St. Lazaria Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick  $\leq$  7 days. No data were collected in 2017 or 2020.

Julian date <sup>a</sup>	No. nests hatching on Julian date																				
	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	2
204	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
205	-	-	-	-	-	-	-	-	1	-	-	11	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	1	3	-
207	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	1	-	-
208	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
212	-	-	-	-	-	-	-	8	1	-	-	-	2	-	-	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
217	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
223	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
<i>n</i>	23	14	27	31	61	45	59	15	43	87	58	66	63	81	92	73	96	8	21	131	181

<sup>a</sup>Julian dates are adjusted by one day in leap year.

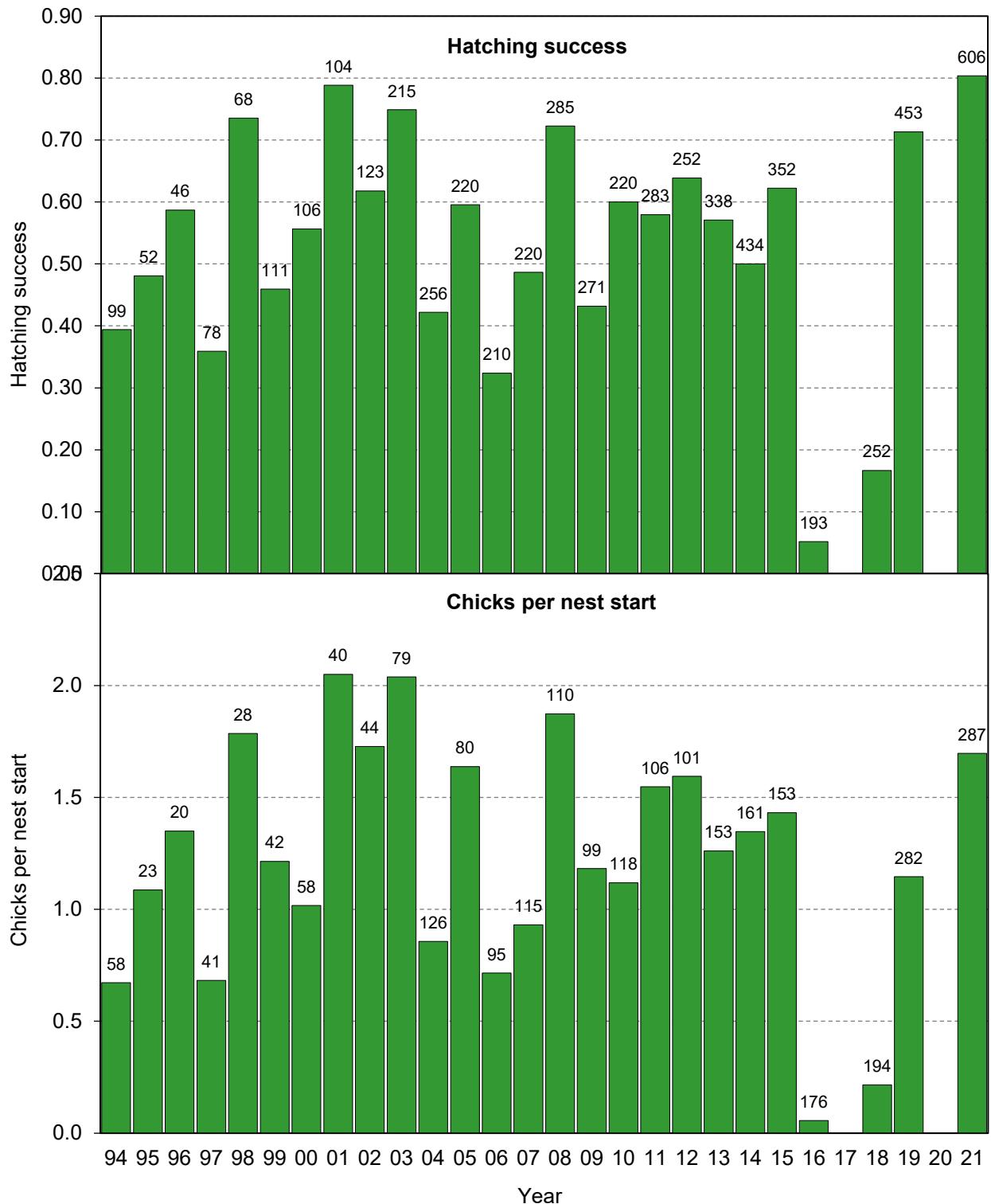


Figure 26. Reproductive performance of glaucous-winged gulls at St. Lazaria Island, Alaska. Hatching success=E/C; Chicks per nest start=E/A, where A=total nest starts; C=total eggs; E=total chicks. Numbers above columns indicate sample sizes ([C] for hatching success, [A] for chicks per nest start). No data were collected in 2017 or 2020.

Table 44. Reproductive performance of glaucous-winged gulls at St. Lazaria Island, Alaska, as determined by a nest-monitoring methodology. Measures of success are based on frequent monitoring of individual nests. No data were collected in 2017 or 2020.

Year	Total nest starts	Nests w/ x eggs:					Nests w/ eggs (B)	Total eggs (C)	Nests w/ x chicks:				Nests w/ chicks (D)	Total chicks (E)	Laying success (B/A)	Mean clutch size (C/B)	Mean brood size (E/D)	Nesting success (D/B)	Hatching success (E/C)	Prop. nests w/ chicks (D/A)	Chicks/nest start (E/A)	
		0	1	2	3	4			1	2	3	4										
		(A)							1	2	3	4										
1994	58	19	5	8	26	0	0	39	99	4	10	5	0	19	39	0.67	2.5	2.1	0.49	0.39	0.33	0.7
1995	23	1	xx <sup>a</sup>	xx	xx	xx	0	22	52	xx	xx	xx	xx	xx	25	0.96	2.4	xx	xx	0.48	xx	1.1
1996	20	2	xx	xx	xx	xx	0	20	46	xx	xx	xx	xx	xx	27	1.00	2.3	xx	xx	0.59	xx	1.4
1997	41	13	0	6	22	0	0	28	78	3	8	3	0	14	28	0.68	2.8	2.0	0.50	0.36	0.34	0.7
1998	28	4	1	2	21	0	0	24	68	3	7	11	0	21	50	0.86	2.8	2.4	0.88	0.74	0.75	1.8
1999	42	3	1	4	34	0	0	39	111	5	11	8	0	24	51	0.93	2.8	2.1	0.62	0.46	0.57	1.2
2000	58	19	2	7	30	0	0	39	106	7	8	12	0	27	59	0.67	2.7	2.2	0.69	0.56	0.47	1.0
2001	40	4	0	5	30	1	0	36	104	2	13	18	0	33	82	0.90	2.9	2.5	0.92	0.79	0.83	2.1
2002	44	0	1	8	34	1	0	44	123	7	15	13	0	35	76	1.00	2.8	2.2	0.80	0.62	0.80	1.7
2003	79	3	3	7	66	0	0	76	215	14	27	31	0	72	161	0.96	2.8	2.2	0.95	0.75	0.91	2.0
2004	126	27	10	21	68	0	0	99	256	11	17	21	0	49	108	0.79	2.6	2.2	0.49	0.42	0.39	0.9
2005	80	1	2	13	64	0	0	79	220	21	25	20	0	66	131	0.99	2.8	2.0	0.84	0.60	0.83	1.6
2006	95	9	15	18	53	0	0	86	210	16	20	4	0	40	68	0.91	2.4	1.7	0.47	0.32	0.42	0.7
2007	115	26	10	27	52	0	0	89	220	17	21	16	0	54	107	0.77	2.5	2.0	0.61	0.49	0.47	0.9
2008	110	3	5	17	85	0	0	107	285	9	31	49	0	89	206	0.97	2.7	2.3	0.83	0.72	0.81	1.9
2009	99	0	6	14	79	0	0	99	271	7	22	22	0	51	117	1.00	2.7	2.3	0.52	0.43	0.52	1.2
2010	118	33	7	24	52	1	1	85	220	17	32	17	0	66	132	0.72	2.6	2.0	0.78	0.60	0.56	1.1
2011	106	4	5	14	82	1	0	102	283	12	31	30	0	73	164	0.96	2.8	2.2	0.72	0.58	0.69	1.6
2012	101	10	4	14	73	0	0	91	252	20	28	28	0	76	161	0.90	2.8	2.1	0.84	0.64	0.75	1.6
2013	153	28	8	22	94	1	0	125	338	22	39	31	0	92	193	0.82	2.7	2.1	0.74	0.57	0.60	1.3
2014	161	4	8	22	126	1	0	157	434	21	29	46	0	96	217	0.98	2.8	2.3	0.61	0.50	0.60	1.4
2015	153	15	13	36	89	0	0	138	352	19	31	46	0	96	219	0.90	2.6	2.3	0.70	0.62	0.63	1.4
2016	176	78	45	21	24	6	2	98	193	8	1	0	0	9	10	0.56	2.0	1.1	0.09	0.05	0.05	0.1
2018	194	64	48	42	40	0	0	130	252	8	11	4	0	23	42	0.67	1.9	1.8	0.18	0.17	0.12	0.2
2019	282	113	9	40	120	1	0	170	453	22	47	69	0	138	323	0.60	2.7	2.3	0.81	0.71	0.49	1.1
2021	287	74	8	18	186	1	0	213	606	17	44	126	1	188	487	0.74	2.8	2.6	0.88	0.80	0.66	1.7

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

Table 45. Standard deviation in reproductive performance parameters of glaucous-winged gulls at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	No. plots	Total nest starts	Sampling design <sup>a</sup>	Laying success	Mean clutch size <sup>b</sup>	Mean brood size <sup>b</sup>	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/nest start <sup>b</sup>
1994	xx <sup>c</sup>	xx	xx	-	-	-	-	-	-	xx
1995	xx	22	xx	-	xx	xx	xx	xx	xx	xx
1996	xx	23	xx	-	xx	xx	xx	xx	xx	xx
1997	3	41	Cluster by plot	0.17	xx	xx	0.08	0.05	0.14	xx
1998	3	28	Cluster by plot	0.10	xx	xx	0.09	0.09	0.16	xx
1999	4	42	Cluster by plot	0.07	xx	xx	0.18	0.16	0.15	xx
2000	4	58	Cluster by plot	0.10	xx	xx	0.13	0.14	0.15	xx
2001	3	40	Cluster by plot	0.03	xx	xx	0.01	0.04	0.02	xx
2002	4	44	Cluster by plot	0.00	xx	xx	0.04	0.05	0.04	xx
2003	3	79	Cluster by plot	0.05	xx	xx	0.03	0.09	0.06	xx
2004	4	126	Cluster by plot	0.05	xx	xx	0.03	0.03	0.05	xx
2005	4	80	Cluster by plot	0.01	xx	xx	0.09	0.07	0.09	xx
2006	4	95	Cluster by plot	0.01	xx	xx	0.12	0.11	0.11	xx
2007	3	115	Cluster by plot	0.05	xx	xx	0.01	0.02	0.04	xx
2008	4	110	Cluster by plot	0.01	xx	xx	0.03	0.04	0.02	xx
2009	4	99	Cluster by plot	0.00	xx	xx	0.15	0.13	0.15	xx
2010	3	118	Simple random	0.05	xx	xx	0.08	0.11	0.09	xx
2011	3	106	Cluster by plot	0.01	0.05	0.08	0.10	0.09	0.10	0.12
2012	4	101	Cluster by plot	0.04	0.05	0.09	0.03	0.02	0.04	0.11
2013	5	153	Cluster by plot	0.07	0.05	0.08	0.06	0.08	0.10	0.10
2014	6	161	Cluster by plot	0.01	0.04	0.08	0.10	0.09	0.09	0.10
2015	5	153	Cluster by plot	0.02	0.06	0.08	0.12	0.10	0.10	0.10
2016	4	176	Cluster by plot	0.08	0.11	0.10	0.04	0.02	0.03	0.02
2018	3	194	Cluster by plot	0.04	0.07	0.14	0.05	0.03	0.03	0.05
2019	4	282	Cluster by plot	0.05	0.04	0.06	0.05	0.01	0.05	0.08
2021	4	293	Cluster by plot	0.04	0.03	0.05	0.03	0.04	0.09	0.08

<sup>a</sup>Sampling for gulls is clustered by plot except when sample sizes per plot are too small or plot data are not available. For sampling clustered by plot, values are calculated using ratio estimator spreadsheets based on plot as a sample unit; for simple random sampling, values are calculated using  $\sqrt{\rho * (1 - \rho)}/n$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>b</sup>Standard deviation values for reproductive success parameters that can exceed 1 are calculated by non-parametric bootstrapping.

<sup>c</sup>xx indicates data potentially exist but have not yet been summarized.

Table 46. Reproductive performance of glaucous-winged gulls at St. Lazaria Island, Alaska in 2021, as determined by a nest-monitoring methodology. Data come from frequent monitoring of individual nests.

Parameter	Plot				Total	SD <sup>a</sup>
	Guano Ridge	Gull Rocks	Big Grassy	Big Grassy Off Pop Plot		
Total nest starts (A)	49	79	26	133	287	-
Nest sites w/ x eggs:						
0	11	13	12	38	74	-
1	1	1	1	5	8	-
2	8	2	0	8	18	-
3	28	63	13	82	186	-
4	1	0	0	0	1	-
5	0	0	0	0	0	-
Nest sites w/ eggs (B)	38	66	14	95	213	-
Total eggs (C)	105	194	40	267	606	-
Nest sites w/ x chicks:						
1	5	2	1	9	17	-
2	6	12	1	25	44	-
3	21	48	11	46	126	-
4	1	0	0	0	1	-
Nest sites w/ chicks (D)	33	62	13	80	188	-
Total chicks (E)	84	170	36	197	487	-
Laying success (B/A)	0.78	0.84	0.54	0.71	0.74	0.04
Mean clutch size (C/B)	2.8	2.9	2.9	2.8	2.8	0.03
Mean brood size (E/D)	2.5	2.7	2.8	2.5	2.6	0.05
Nesting success (D/B)	0.87	0.94	0.93	0.84	0.88	0.03
Hatching success (E/C)	0.80	0.88	0.90	0.74	0.80	0.04
Prop. nest sites w/ chicks (D/A)	0.67	0.78	0.50	0.60	0.66	0.09
Chicks/nest start (E/A)	1.7	2.2	1.4	1.5	1.65	0.08

<sup>a</sup>Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit; for reproductive success parameters that can exceed 1 (mean clutch size, mean brood size, and chicks/nest start), standard deviations are calculated by non-parametric bootstrapping.

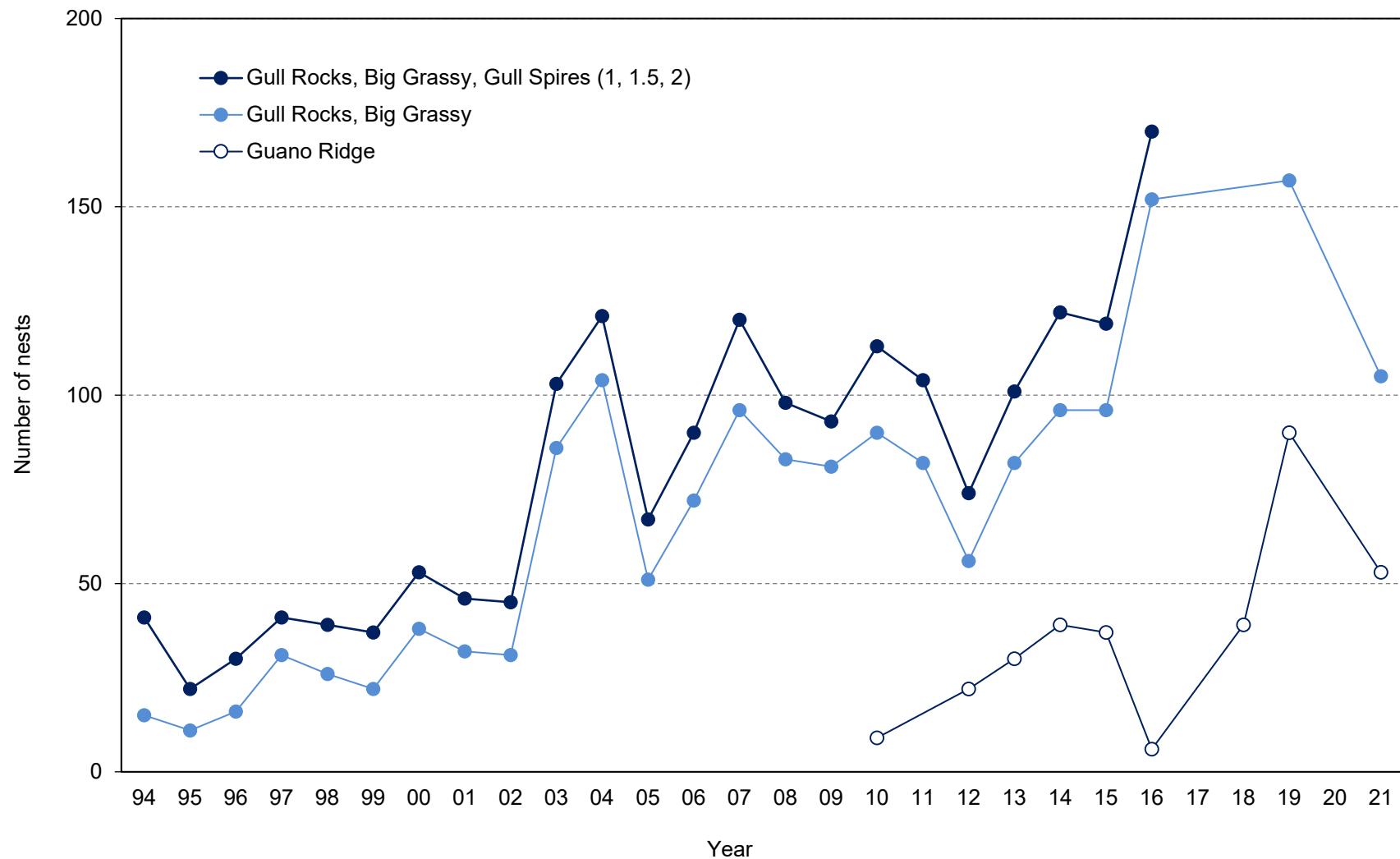


Figure 27. Numbers of glaucous-winged gull nests counted on index plots at St. Lazaria, Alaska. Nest numbers are based on the total cumulative number of nests counted on plots throughout the year. Not all plots were counted in all years so several combinations of plots are shown. No counts were conducted in 2017 or 2020.

Table 47. Numbers of glaucous-winged gull nests counted on index plots at St. Lazaria, Alaska. Nest numbers are based on the total cumulative number of nests counted on plots throughout the year. No counts were conducted in 2017 or 2020.

Year	Plots						Totals	
	Big Grassy <sup>a</sup>	Guano Ridge	Gull Rocks	Gull Spire 1	Gull Spire 1.5	Gull Spire 2	Big Grassy, Gull Rocks, Gull Spires	Big Grassy, Gull Rocks
1994	7	-	8	10	-	16	34	15
1995	7	-	4	10	-	1	15	11
1996	10	-	6	12	-	2	20	16
1997	14	-	17	10	-	-	27	31
1998	15	-	11	11	-	2	24	26
1999	12	-	10	12	-	3	25	22
2000	24	-	14	15	-	-	29	38
2001	15	-	17	9	2	3	31	32
2002	10	-	21	10	2	2	35	31
2003	47	-	39	12	-	5	56	86
2004	47	-	57	17	-	-	74	104
2005	16	-	35	14	1	1	51	51
2006	14	-	58	15	1	2	76	72
2007	18	-	78	24	-	-	102	96
2008	16	-	67	12	-	3	82	83
2009	12	-	69	12	-	-	81	81
2010	34	9	56	16	1	6	79	90
2011	15	-	67	15	1	6	89	82
2012	16	22	40	16	1	1	58	56
2013	19	30	63	19	-	-	82	82
2014	32	39	64	15	3	8	90	96
2015	32	37	64	13	-	10	87	96
2016	47	6	105	18	-	-	123	152
2018	-	39	109	-	-	-	-	-
2019	25	90	132	-	-	-	-	157
2021	26	53	79	-	-	-	-	105

<sup>a</sup>The Big Grassy plot includes only nests within the 20x25m rectangular population plot on Big Grassy; nests on the Big Grassy hillside but outside that area are considered out of the plot and may be followed for productivity but are not included population totals shown here.

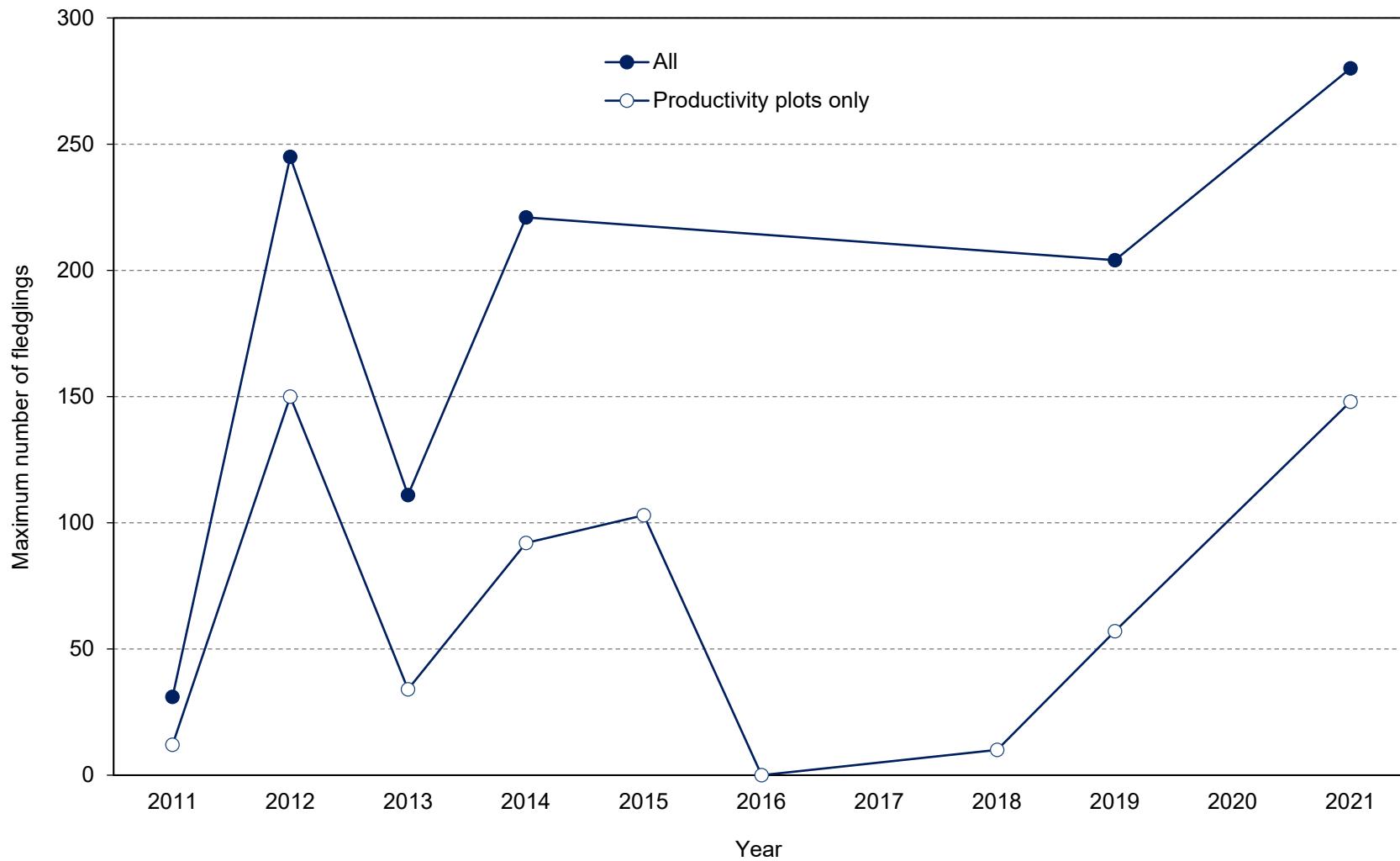


Figure 28. Numbers of glaucous-winged gull fledglings counted from two gull counting locations at St. Lazaria Island, Alaska. Data include only fledglings (fully feathered and full sized young of the year) and counts made at least 35 days past mean hatch in a given year. Separate time series are shown for all fledglings visible from counting locations and only fledglings on productivity plots, due to inconsistencies in where fledglings were counted across years. Counts from several previous years were excluded because counts included chicks of all sizes (2005-2006 and 2008-2009) or all counts were conducted too early (<35 days past mean hatch; 2007 and 2010). No counts were conducted in 2017 or 2020.

Table 48. Numbers of glaucous-winged gull fledglings counted on all areas visible from two gull counting locations at St. Lazaria Island, Alaska. Data include only fledglings (fully feathered and full sized young of the year) and counts made at least 35 days past mean hatch in a given year. Counts from several previous years were excluded because counts included chicks of all sizes (2005-2006 and 2008-2009), all counts were conducted too early (<35 days past mean hatch; 2007 and 2010), or not all areas were counted (areas outside productivity plots; 2015-2016 and 2018). No counts were conducted in 2017 or 2020.

Replicate	2011	2012 <sup>a</sup>	2013	2014 <sup>b</sup>	2019	2021
1	0	0	111	221	78	44
2	0	37	107	125	177	223
3	0	154	81	-	193	280
4	2	245	86	-	204	192
5	31	-	75	-	155	-
6	20	-	-	-	-	-
Max.	31	245	111	221	204	280
<i>n</i>	6	4	5	2	5	4
SD	13	112	16	68	50	101
First count	9 Aug	11 Aug	8 Aug	8 Aug	11 Aug	14 Aug
Last count	21 Aug	24 Aug	4 Sep	27 Aug	4 Sep	1 Sep

<sup>a</sup>First two counts in 2012 (4 and 7 Aug) were excluded because <35 days past mean hatch (7 Jul).

<sup>b</sup>First two counts in 2014 (24 Jul and 4 Aug) were excluded because <35 days past mean hatch (1 Jul).

Table 49. Numbers of glaucous-winged gull fledglings counted only on productivity plots (Guano Ridge, Gull Rocks, Big Grassy, and Gull Spires) visible from two gull counting locations at St. Lazaria Island, Alaska. Data include only fledglings (fully feathered and full sized young of the year) and counts made at least 35 days past mean hatch in a given year. Counts from several previous years were excluded because counts included chicks of all sizes (2005-2006 and 2008-2009) or all counts were conducted too early (<35 days past mean hatch; 2007 and 2010). No counts were conducted in 2017 or 2020.

Replicate	2011	2012 <sup>a</sup>	2013	2014 <sup>b</sup>	2015	2016 <sup>c</sup>	2018	2019	2021
1	0	0	32	92	64	0	10	-	41
2	0	34	14	36	103	0	9	45	148
3	0	124	12	-	100	0	10	55	107
4	0	150	34	-	81	-	10	57	56
5	0	-	23	-	-	-	-	40	-
6	12	-	-	-	-	-	-	-	-
Max.	12	150	34	92	103	0	10	57	148
<i>n</i>	6	4	5	2	4	3	4	4	4
SD	5	71	10	40	18	0	1	8	49
First count	9 Aug	11 Aug	8 Aug	8 Aug	12 Aug	31 Aug	25 Aug	16 Aug	14 Aug
Last count	21 Aug	24 Aug	4 Sep	27 Aug	31 Aug	3 Sep	10 Sep	4 Sep	1 Sep

<sup>a</sup>First two counts in 2012 (4 and 7 Aug) were excluded because <35 days past mean hatch (7 Jul).

<sup>b</sup>First two counts in 2014 (24 Jul and 4 Aug) were excluded because <35 days past mean hatch (1 Jul).

<sup>c</sup>First two counts in 2016 (3 and 11 Aug) were excluded because <35 days past mean hatch (14 Jul).

Table 50. Numbers of glaucous-winged gull fledglings counted on all areas visible from two gull counting locations at St. Lazaria Island, Alaska in 2021.

Plot	Date				Max.
	14 Aug	22 Aug	27 Aug	1 Sep	
Guano Ridge	2	22	30	18	-
Gull Rocks	7	66	25	20	-
Big Grassy	26	48	46	16	-
Gull Spires	6	12	6	2	-
Other Areas	3	75	173	136	-
Total	44	223	280	192	280

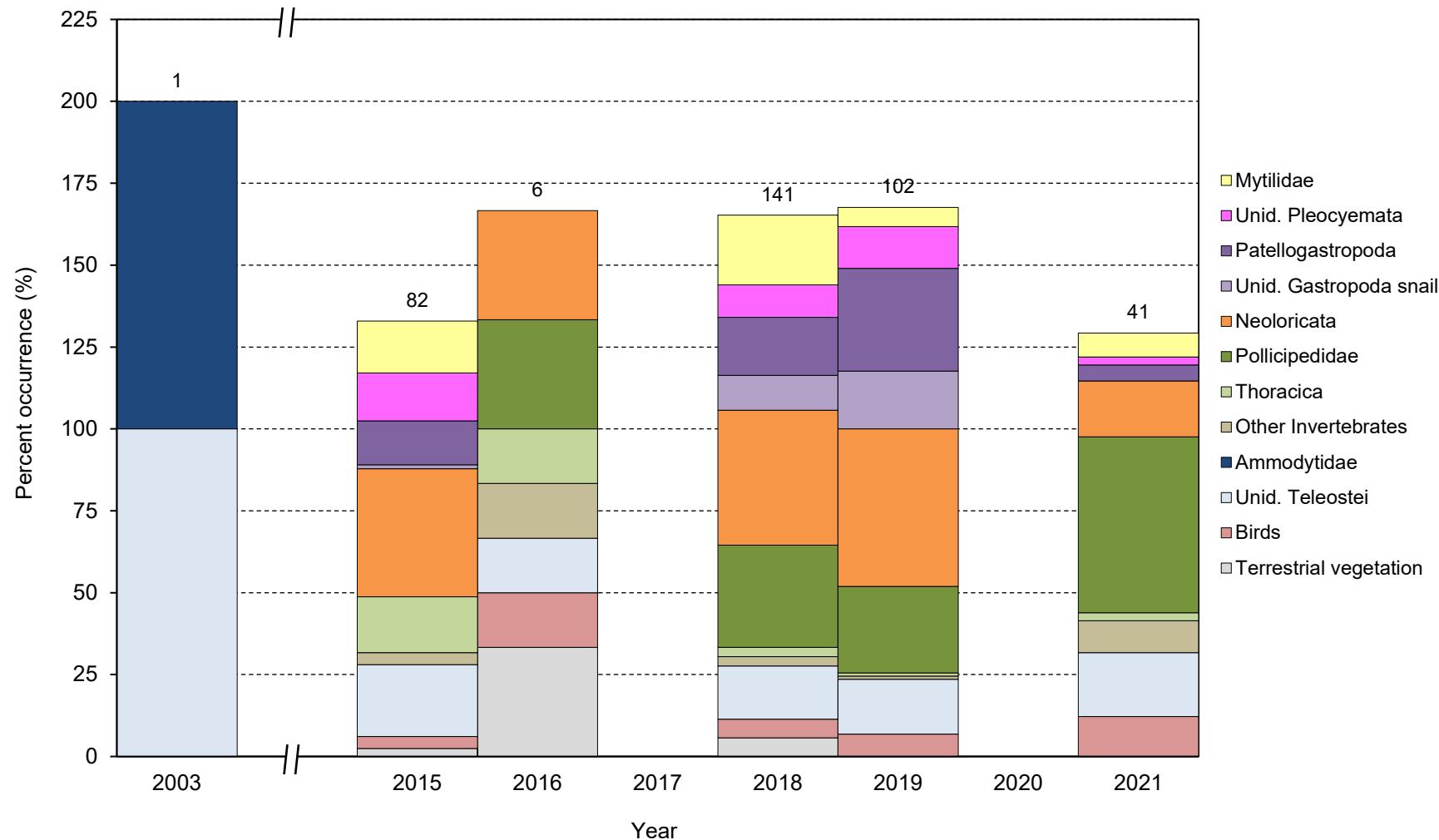


Figure 29. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of stomach contents from adults collected at or near the colony (2003) and pellets regurgitated by adults at the colony (2015-2021). Numbers above columns indicate sample sizes. No diet samples were collected in 2004-2014, 2017, or 2020.

Table 51. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the laboratory (2003 and 2016) or field (2015 and 2018-2021) to the lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that occurred in at least 5% of diets on average across all years are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of stomach contents from adults collected at or near the colony (2003) and pellets regurgitated by adults at the colony (2015-2021). No diet samples were collected in 2004-2014, 2017, or 2020. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2003	2015	2016	2018	2019	2021
No. samples	1	82	6	141	102	41
<b>Invertebrates</b>	-	<b>84.1</b>	<b>83.3</b>	<b>83.0</b>	<b>82.4</b>	<b>73.2</b>
<b>Bivalvia</b>	-	<b>15.9</b>	-	<b>22.7</b>	<b>5.9</b>	<b>7.3</b>
<b>Mytilidae</b>	-	<b>15.9</b>	-	<b>21.3</b>	<b>5.9</b>	<b>7.3</b>
Unid. Mytilidae	-	15.9	-	21.3	5.9	7.3
Other Bivalvia	-	-	-	1.4	-	-
<b>Decapoda</b>	-	<b>14.6</b>	-	<b>9.9</b>	<b>12.7</b>	<b>2.4</b>
Unid. Pleocyemata crab	-	14.6	-	9.9	12.7	2.4
<b>Gastropoda</b>	-	<b>14.6</b>	-	<b>25.5</b>	<b>39.2</b>	<b>4.9</b>
Patellogastropoda	-	13.4	-	17.7	31.4	4.9
Unid. Gastropoda snail	-	1.2	-	10.6	17.6	-
Other Gastropoda	-	-	-	-	2.9	-
<b>Polyplacophora</b>	-	<b>39.0</b>	<b>33.3</b>	<b>41.1</b>	<b>48.0</b>	<b>17.1</b>
Neoloricata	-	39.0	33.3	41.1	48.0	17.1
<b>Thecostraca</b>	-	<b>17.1</b>	<b>16.7</b>	<b>34.0</b>	<b>27.5</b>	<b>53.7</b>
<b>Pollicipedidae</b>	-	-	<b>33.3</b>	<b>31.2</b>	<b>26.5</b>	<b>53.7</b>
<i>Pollicipes polymerus</i>	-	-	33.3	31.2	26.5	53.7
Thoracica	-	17.1	16.7	2.8	1.0	2.4
Other Invertebrates	-	3.7	16.7	2.8	1.0	9.8
<b>Fish</b>	<b>100.0</b>	<b>22.0</b>	<b>16.7</b>	<b>16.3</b>	<b>17.6</b>	<b>19.5</b>
<b>Teleostei</b>	<b>100.0</b>	<b>22.0</b>	<b>16.7</b>	<b>16.3</b>	<b>17.6</b>	<b>19.5</b>
<b>Ammodytidae</b>	<b>100.0</b>	-	-	-	-	-
<i>Ammodytes</i> spp.	100.0	-	-	-	-	-
Unid. Teleostei	100.0	22.0	16.7	16.3	16.7	19.5
Other Teleostei	-	-	-	-	1.0	-
Birds	-	3.7	16.7	5.7	6.9	12.2
<b>Other</b>	-	<b>12.2</b>	<b>33.3</b>	<b>5.7</b>	<b>2.0</b>	<b>2.4</b>
Terrestrial vegetation	-	2.4	33.3	5.7	-	-
Other	-	9.8	-	-	2.0	2.4

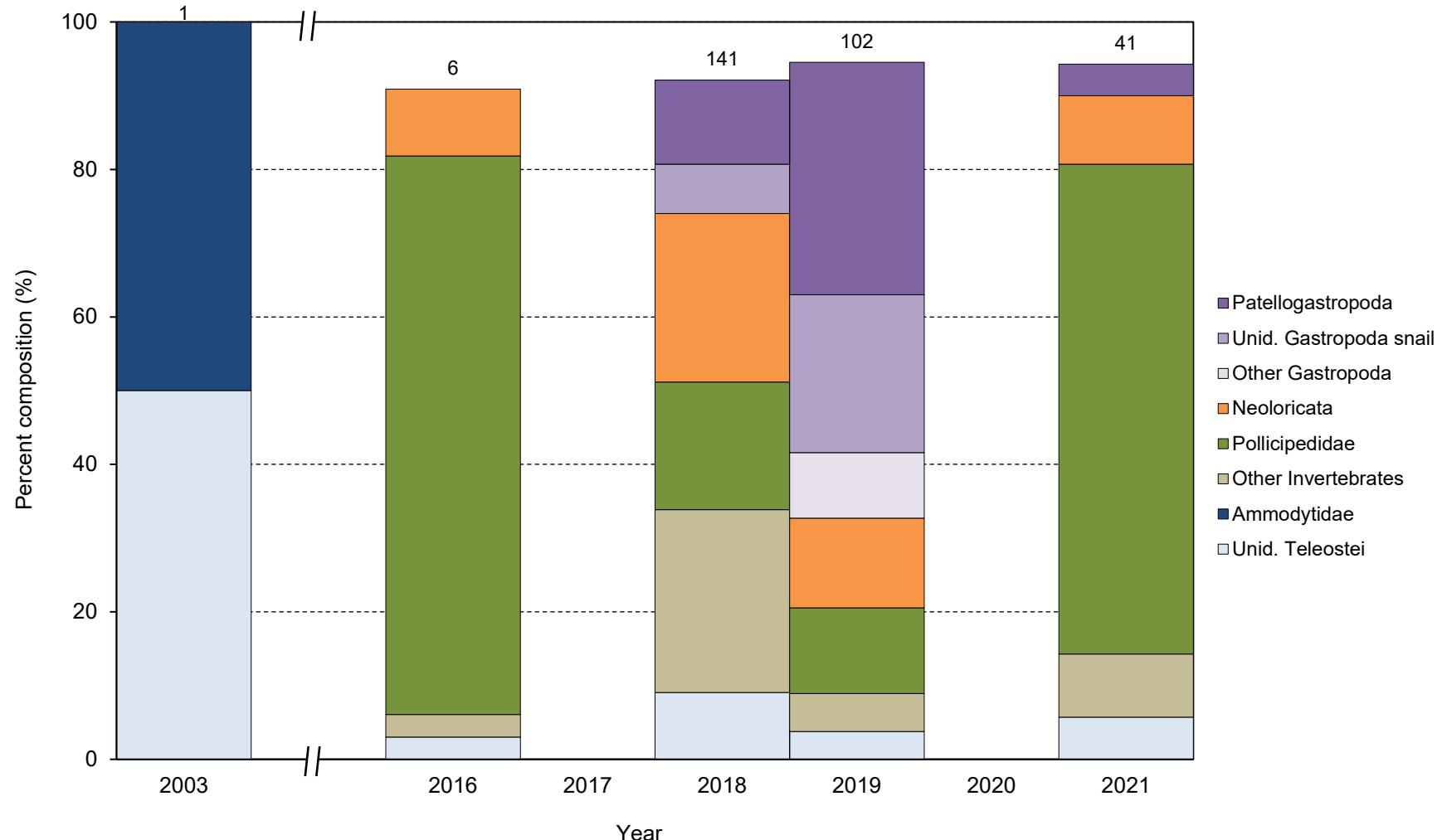


Figure 30. Percent composition of major prey items in diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of stomach contents from adults collected at or near the colony (2003) and pellets regurgitated by adults at the colony (2016-2021). Numbers above columns indicate sample sizes. No diet samples were collected in 2004-2014, 2017, or 2020 and no count data exist for 2015.

Table 52. Percent composition of major prey items in diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified in the laboratory (2003 and 2016) or field (2018-2021) to the lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear percent composition data although they were present in diet samples. Samples consist of stomach contents from adults collected at or near the colony (2003) and pellets regurgitated by adults at the colony (2016-2021). No diet samples were collected in 2004-2014, 2017, or 2020 and no count data exist for 2015. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2003	2016	2018	2019	2021
No. samples	1	6	141	102	41
No. individuals	2	33	254	584	140
<b>Invertebrates</b>	-	<b>90.9</b>	<b>84.6</b>	<b>90.9</b>	<b>89.3</b>
<b>Gastropoda</b>	-	-	<b>18.1</b>	<b>61.8</b>	<b>4.3</b>
Patellogastropoda	-	-	11.4	31.5	4.3
Unid. Gastropoda snail	-	-	6.7	21.4	-
Other Gastropoda	-	-	-	8.9	-
<b>Polyplacophora</b>	-	<b>9.1</b>	<b>22.8</b>	<b>12.2</b>	<b>9.3</b>
Neoloricata	-	9.1	22.8	12.2	9.3
<b>Thecostraca</b>	-	<b>78.8</b>	<b>18.9</b>	<b>11.8</b>	<b>67.1</b>
<b>Pollicipedidae</b>	-	<b>75.8</b>	<b>17.3</b>	<b>11.6</b>	<b>66.4</b>
<i>Pollicipes polymerus</i>	-	75.8	17.3	11.6	66.4
Other Thecostraca	-	3.0	1.6	0.2	0.7
Other Invertebrates	-	3.0	24.8	5.1	8.6
<b>Fish</b>	<b>100.0</b>	<b>3.0</b>	<b>9.1</b>	<b>7.2</b>	<b>5.7</b>
<b>Teleostei</b>	<b>100.0</b>	<b>3.0</b>	<b>9.1</b>	<b>7.2</b>	<b>5.7</b>
<b>Ammodytidae</b>	<b>50.0</b>	-	-	-	-
<i>Ammodytes</i> spp.	50.0	-	-	-	-
Unid. Teleostei	50.0	3.0	9.1	3.8	5.7
Other Teleostei	-	-	-	3.4	-
Birds	-	6.1	3.1	1.2	3.6
Other	-	-	3.1	0.7	1.4

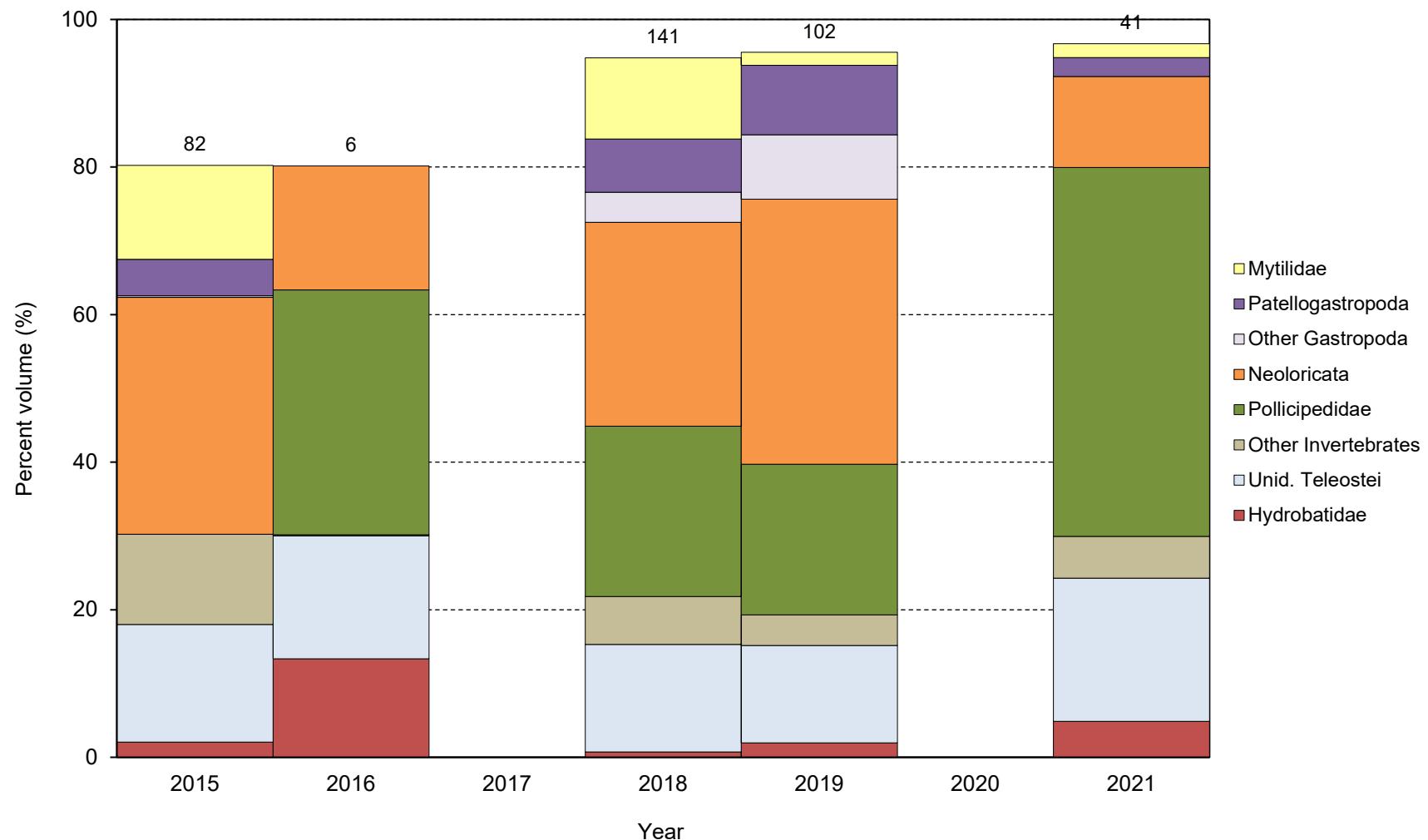


Figure 31. Percent volume of major prey items in diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Values represent the average percent volume of a prey item in all pellets. Prey is grouped to family level or higher; only taxa with an among-year average volume of at least 5% are shown. Samples consist of pellets regurgitated by adults at the colony. Numbers above columns indicate sample sizes. No diet samples were collected in 2004-2014, 2017, or 2020 and no volume data exist for 2003.

Table 53. Percent volume of major prey items diets of glaucous-winged gull adults at St. Lazaria Island, Alaska. Values represent the average percent volume of a prey item in all pellets (sums to 100% each year). Prey was identified in the laboratory (2016) or field (2015 and 2018-2021) to the lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that made up at least 5% of diet volume on average across all years are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of pellets regurgitated by adults at the colony. No diet samples were collected in 2004-2014, 2017, or 2020 and no volume data exist for 2003. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2015	2016	2018	2019	2021
No. samples	82	6	141	102	41
<b>Invertebrates</b>	<b>77.9</b>	<b>50.3</b>	<b>81.1</b>	<b>80.6</b>	<b>72.9</b>
<b>Bivalvia</b>	<b>12.7</b>	-	<b>12.1</b>	<b>1.8</b>	<b>1.9</b>
<b>Mytilidae</b>	<b>12.7</b>	-	<b>11.0</b>	<b>1.8</b>	<b>1.9</b>
Unid. Mytilidae	12.7	-	11.0	1.8	1.9
Other Bivalvia	-	-	1.1	-	-
<b>Gastropoda</b>	<b>5.2</b>	-	<b>11.3</b>	<b>18.1</b>	<b>2.6</b>
Patellogastropoda	4.9	-	7.2	9.4	2.6
Other Gastropoda	0.2	-	4.1	8.7	-
<b>Polyplacophora</b>	<b>32.1</b>	<b>16.8</b>	<b>27.6</b>	<b>35.9</b>	<b>12.3</b>
Neoloricata	32.1	16.8	27.6	35.9	12.3
<b>Thecostraca</b>	<b>15.7</b>	<b>33.3</b>	<b>23.6</b>	<b>20.6</b>	<b>50.5</b>
<b>Pollicipedidae</b>	-	<b>33.2</b>	<b>23.1</b>	<b>20.5</b>	<b>50.0</b>
<i>Pollicipes polymerus</i>	-	33.2	23.1	20.5	50.0
Other Invertebrates	15.7	0.2	0.5	0.2	0.5
<b>Fish</b>	12.3	0.2	6.5	4.1	5.7
<b>Teleostei</b>	<b>15.9</b>	<b>16.7</b>	<b>14.6</b>	<b>14.2</b>	<b>19.4</b>
Unid. Teleostei	<b>15.9</b>	<b>16.7</b>	<b>14.6</b>	<b>14.2</b>	<b>19.4</b>
Other Teleostei	15.9	16.7	14.6	13.2	19.4
<b>Birds</b>	-	-	-	1.0	-
<b>Procellariiformes</b>	<b>2.1</b>	<b>13.5</b>	<b>3.1</b>	<b>4.9</b>	<b>7.6</b>
Hydrobatidae	<b>2.1</b>	<b>13.3</b>	<b>0.7</b>	<b>2.0</b>	<b>4.9</b>
Other Birds	2.1	13.3	0.7	2.0	4.9
<b>Other</b>	0.1	0.2	2.4	2.9	2.7
Terrestrial vegetation	<b>4.0</b>	<b>19.5</b>	<b>1.2</b>	<b>0.3</b>	<b>0.1</b>
Other	0.7	19.5	1.2	-	-

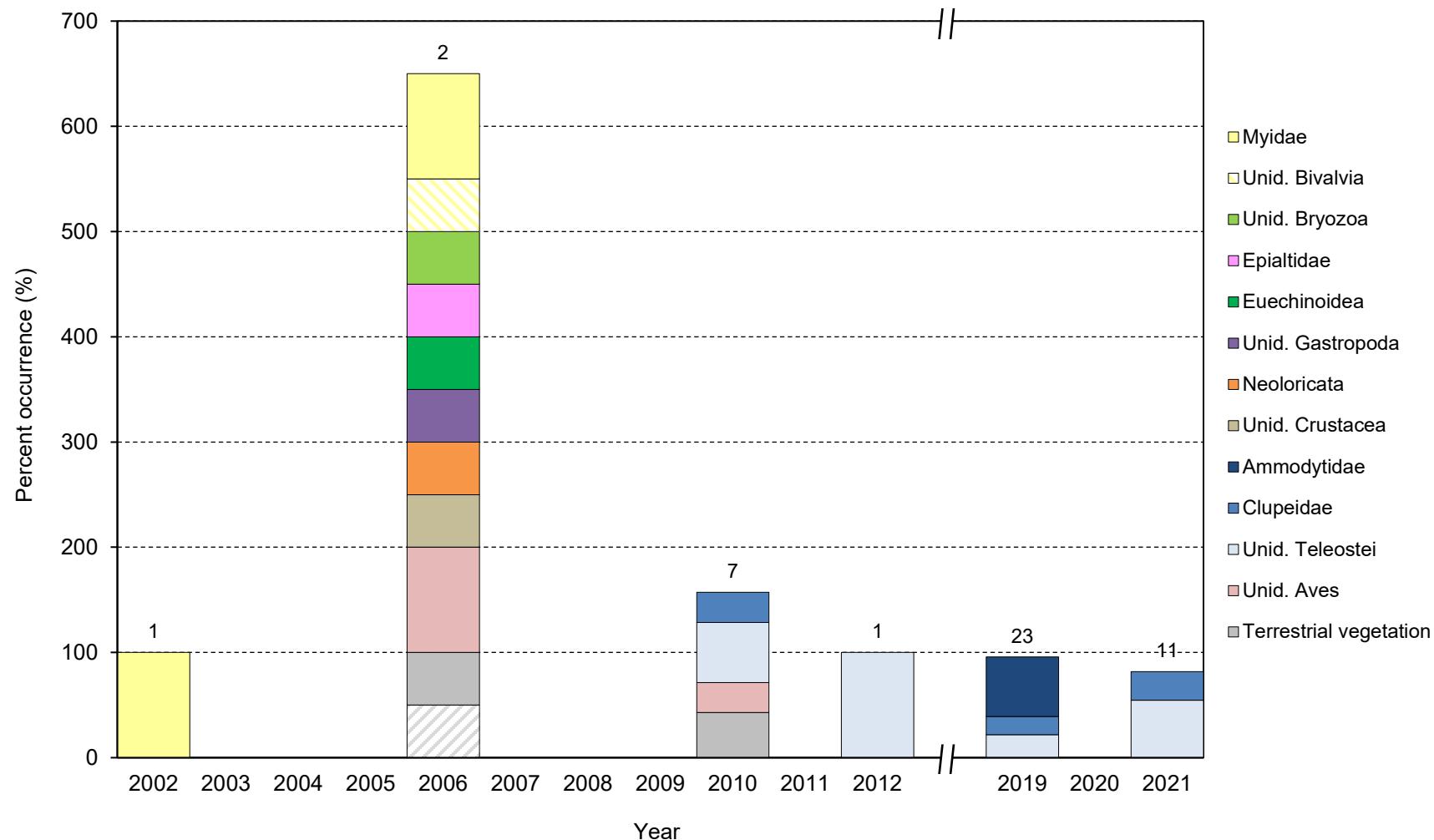


Figure 32. Frequency of occurrence of major prey items in diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations from adults or chicks collected at the colony. Numbers above columns indicate sample sizes. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; samples were collected in 2011 but have not yet been analyzed.

Table 54. Frequency of occurrence of major prey items in diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey that occurred in at least 5% of diets on average across all years are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of regurgitations from adults or chicks collected at the colony. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; samples were collected in 2011 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2002	2006	2010	2011	2012	2019	2021
No. samples	1	2	7	3	1	23	11
<b>Invertebrates</b>	<b>100.0</b>	<b>100.0</b>	<b>14.3</b>	<i>pending</i>	-	-	<b>9.1</b>
<b>Bivalvia</b>	<b>100.0</b>	<b>50.0</b>	-	-	-	-	-
<b>Myidae</b>	<b>100.0</b>	<b>100.0</b>	-	-	-	-	-
<i>Mya</i> spp.	100.0	-	-	-	-	-	-
Unid. Bivalvia	-	50.0	-	-	-	-	-
<b>Bryozoa</b>	-	<b>50.0</b>	-	-	-	-	-
Unid. Bryozoa	-	50.0	-	-	-	-	-
<b>Decapoda</b>	-	<b>50.0</b>	-	-	-	-	-
<b>Epioltidae</b>	-	<b>50.0</b>	-	-	-	-	-
<i>Pugettia</i> spp.	-	50.0	-	-	-	-	-
<b>Echinoidea</b>	-	<b>50.0</b>	-	-	-	-	-
Euechinoidea	-	50.0	-	-	-	-	-
<b>Gastropoda</b>	-	<b>50.0</b>	-	-	-	-	-
Unid. Gastropoda	-	50.0	-	-	-	-	-
<b>Polyplacophora</b>	-	<b>50.0</b>	-	-	-	-	-
Neoloricata	-	50.0	-	-	-	-	-
Unid. Crustacea	-	50.0	-	-	-	-	-
Other Invertebrates	-	-	14.3	-	-	-	9.1
<b>Fish</b>	-	-	<b>85.7</b>	-	<b>100.0</b>	<b>100.0</b>	<b>90.9</b>
<b>Teleostei</b>	-	-	<b>85.7</b>	-	<b>100.0</b>	<b>100.0</b>	<b>90.9</b>
<b>Ammodytidae</b>	-	-	-	-	-	<b>56.5</b>	-
<i>Ammodytes</i> spp.	-	-	-	-	-	56.5	-
<b>Clupeidae</b>	-	-	<b>28.6</b>	-	-	<b>17.4</b>	<b>27.3</b>
<i>Clupea pallasii</i>	-	-	28.6	-	-	-	27.3
Unid. Teleostei	-	-	57.1	-	100.0	21.7	54.5
Other Teleostei	-	-	-	-	-	13.0	9.1
<b>Birds</b>	-	<b>100.0</b>	<b>28.6</b>	-	-	-	-
Unid. Aves	-	100.0	28.6	-	-	-	-
<b>Other</b>	-	<b>100.0</b>	<b>57.1</b>	-	-	-	-
Rocks	-	50.0	28.6	-	-	-	-
Terrestrial vegetation	-	50.0	42.9	-	-	-	-
Unidentified marine kelp/algae	-	50.0	-	-	-	-	-
Other	-	-	14.3	-	-	-	-

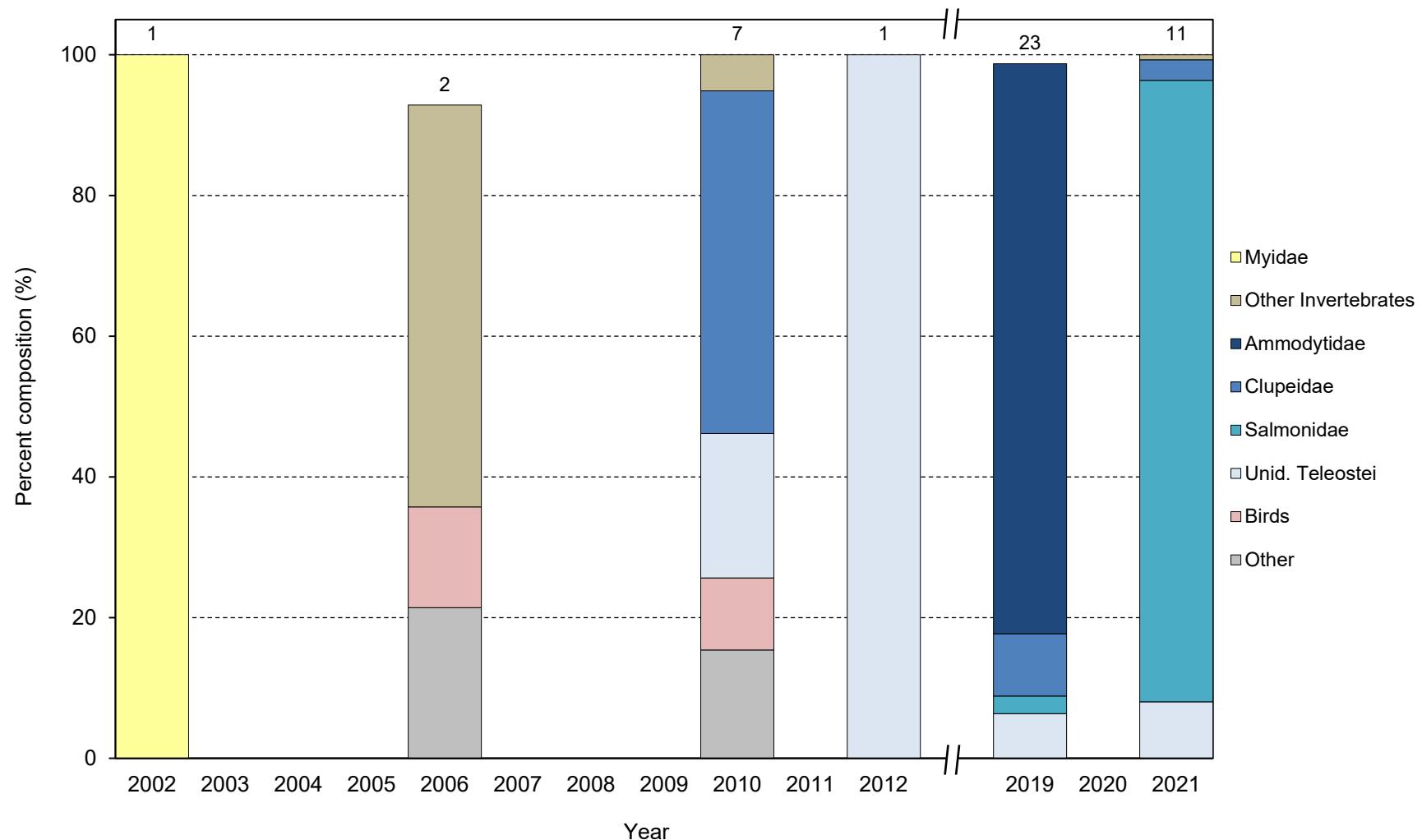


Figure 33. Percent composition of major prey items in diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations from adults or chicks collected at the colony. Numbers above columns indicate sample sizes. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; samples were collected in 2011 but have not yet been analyzed.

Table 55. Percent composition of major prey items in diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items, so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of regurgitations from adults or chicks collected at the colony. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; samples were collected in 2011 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2002	2006	2010	2011	2012	2019	2021
No. samples	1	2	7	3	1	23	11
No. individuals	6	14	39	<i>pending</i>	1	79	137
<b>Invertebrates</b>	<b>100.0</b>	<b>64.3</b>	<b>5.1</b>	-	-	-	<b>0.7</b>
<b>Bivalvia</b>	<b>100.0</b>	<b>7.1</b>	-	-	-	-	-
<b>Myidae</b>	<b>100.0</b>	-	-	-	-	-	-
<i>Mya</i> spp.	100.0	-	-	-	-	-	-
Other Bivalvia	-	7.1	-	-	-	-	-
Other Invertebrates	-	57.1	5.1	-	-	-	0.7
<b>Fish</b>	-	-	<b>69.2</b>	-	<b>100.0</b>	<b>100.0</b>	<b>99.3</b>
<b>Teleostei</b>	-	-	<b>69.2</b>	-	<b>100.0</b>	<b>100.0</b>	<b>99.3</b>
<b>Ammodytidae</b>	-	-	-	-	-	<b>81.0</b>	-
<i>Ammodytes</i> spp.	-	-	-	-	-	81.0	-
<b>Clupeidae</b>	-	-	<b>48.7</b>	-	-	<b>8.9</b>	<b>2.9</b>
<i>Clupea pallasii</i>	-	-	48.7	-	-	8.9	2.9
<b>Salmonidae</b>	-	-	-	-	-	<b>2.5</b>	<b>88.3</b>
<i>Oncorhynchus</i> spp. eggs	-	-	-	-	-	-	87.6
Other Salmonidae	-	-	-	-	-	2.5	0.7
Unid. Teleostei	-	-	20.5	-	100.0	6.3	8.0
Other Teleostei	-	-	-	-	-	1.3	-
Birds	-	14.3	10.3	-	-	-	-
Other	-	21.4	15.4	-	-	-	-

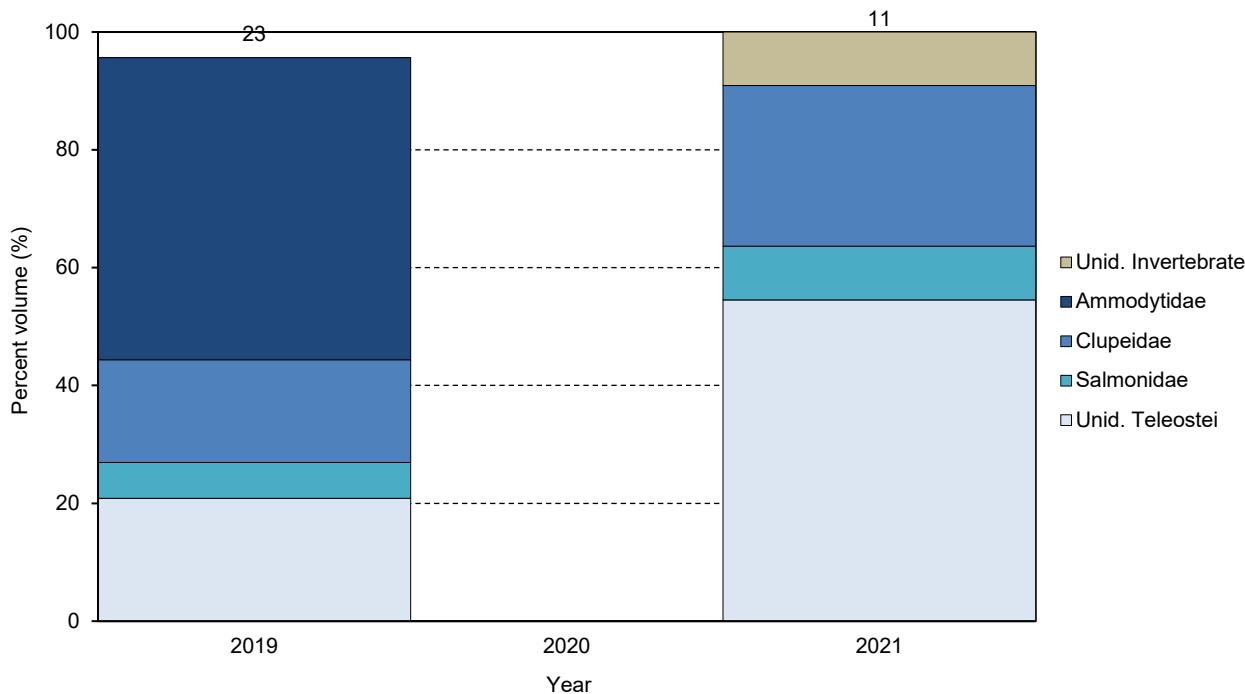


Figure 34. Percent volume of major prey items in diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Values represent the average percent volume of a prey item in all samples. Prey is grouped to family level or higher; only taxa with an among-year average volume of at least 5% are shown. Samples consist of regurgitations from adults or chicks collected at the colony. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; no volume data exist for 2002, 2006, or 2010-2012.

Table 56. Percent volume of major prey items diets of glaucous-winged gull chicks at St. Lazaria Island, Alaska. Values represent the average percent volume of a prey item in all samples (sums to 100% each year). Prey was identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that made up at least 5% of diet volume on average across all years are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of regurgitations from adults or chicks collected at the colony. No diet samples were collected in 2003-2005, 2007-2009, 2013-2018, or 2020; no volume data exist for 2002, 2006, or 2010-2012. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2019	2021
No. samples	23	11
<b>Invertebrates</b>	-	<b>9.1</b>
Unid. Invertebrates	-	9.1
<b>Fish</b>	<b>100.0</b>	<b>90.9</b>
<b>Teleostei</b>	<b>100.0</b>	<b>90.9</b>
<b>Ammodytidae</b>	<b>51.3</b>	-
<i>Ammodytes</i> spp.	51.3	-
<b>Clupeidae</b>	<b>17.4</b>	<b>27.3</b>
<i>Clupea pallasii</i>	17.4	27.3
Salmonidae	6.1	9.1
Unid. Teleostei	20.9	54.5
Other Teleostei	4.3	-

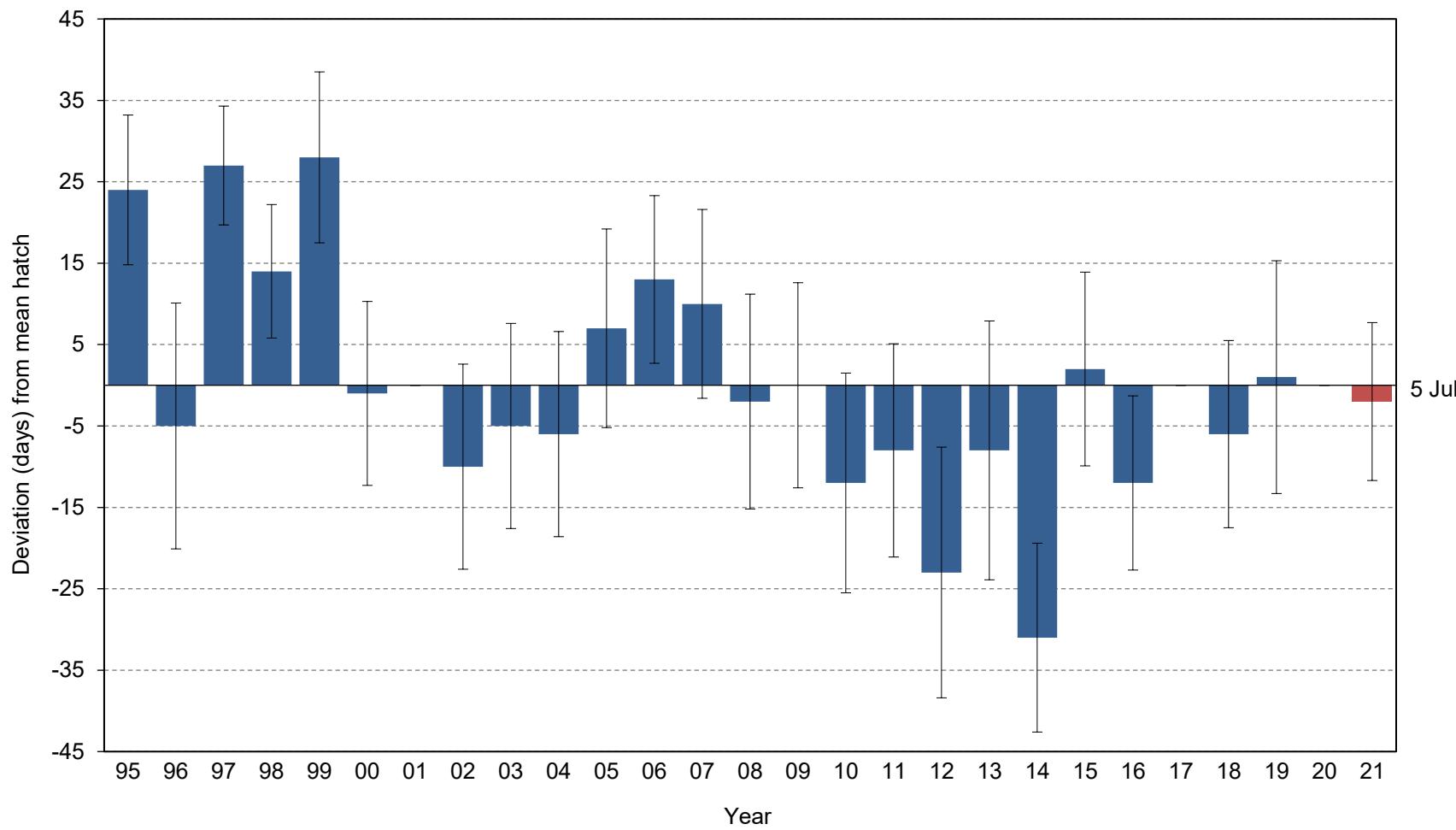


Figure 35. Yearly hatch date deviation (from the 1995-2020 average of 5 July) for fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots monitored on an interval of about 5-7 days. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent one standard deviation around each year's mean hatch date; red highlights the current year. Mean hatch dates include those back-calculated from fledge dates because some nests contained chicks at the first visit in 1996, 2000, 2004, 2007, 2010, 2012, and 2014-2016. No data were collected in 2017 or 2020; some hatch data were collected in 2001 but are excluded because data are biased towards only late hatch dates due to large nest check intervals earlier in the season.

Table 57. Breeding chronology of fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only chronology burrows monitored on an interval of about 5-7 days. No data were collected in 2017 or 2020; some hatch data were collected in 2001 but are excluded because data are biased towards only late hatch dates due to large nest check intervals earlier in the season.

Year	Mean hatch	SD	n <sup>a</sup>	First hatch	Last hatch	First fledge
1995	29 Jul <sup>b</sup>	9.2	22	15 Jul	15 Aug <sup>b</sup>	xx <sup>c</sup>
1996 <sup>d</sup>	29 Jun	15.1	35	13 Jun	18 Aug	xx
1997	1 Aug	7.3	24	19 Jul	18 Aug	xx
1998	19 Jul	8.2	43	8 Jul	7 Aug	xx
1999	2 Aug	10.5	35	9 Jul	1 Sep	xx
2000 <sup>e</sup>	3 Jul	11.3	55	10 Jun	30 Aug	xx
2001	-	-	-	-	20 Aug	xx
2002	25 Jun	12.6	45	7 Jun	2 Aug	xx
2003	30 Jun	12.6	43	5 Jun	6 Aug	xx
2004 <sup>e</sup>	28 Jun	12.6	63	8 Jun	28 Jul	xx
2005	12 Jul	12.2	36	23 Jun	12 Aug	xx
2006	18 Jul	10.3	35	3 Jul	6 Aug	xx
2007 <sup>f</sup>	15 Jul	11.6	37	28 Jun	13 Aug	xx
2008	2 Jul	13.2	57	14 Jun	3 Aug	xx
2009	5 Jul	12.6	40	13 Jun	2 Aug	xx
2010 <sup>f</sup>	23 Jun	13.5	60	3 Jun	12 Aug	xx
2011	27 Jun	13.1	33	9 Jun	4 Aug	xx
2012 <sup>g</sup>	11 Jun	15.4	45	25 May	30 Jul	26 Jul
2013	27 Jun	15.9	43	3 Jun	8 Aug	8 Aug
2014 <sup>h</sup>	4 Jun	11.6	48	23 May	15 Jul	24 Jul
2015 <sup>d</sup>	7 Jul	11.9	39	9 Jun	6 Aug	24 Aug
2016 <sup>i</sup>	22 Jun	10.7	28	6 Jun	18 Jul	2 Aug
2018	29 Jun	11.5	36	11 Jun	29 Jul	10 Aug
2019	6 Jul	14.3	36	4 Jun	2 Aug	21 Aug
2021	3 Jul	9.7	45	19 Jun	30 Jul	19 Aug

<sup>a</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.

<sup>b</sup>Last check was 18 August, at which time there were still some viable eggs remaining in chronology plots; in some years, very small numbers of fork-tailed storm-petrel chicks hatched on or after that date (1 in 1996, 1 in 1997, 3 in 1999, 2 in 2001), so it is possible some remaining eggs may have hatched.

<sup>c</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>d</sup>Hatch dates were back-calculated based on fledge dates for three nests containing chicks at the first check.

<sup>e</sup>Hatch date was back-calculated based on fledge date for one nest containing a chick at the first check.

<sup>f</sup>Hatch dates were back-calculated based on fledge dates for two nests containing chicks at the first check.

<sup>g</sup>Hatch dates were back-calculated based on fledge dates for 19 nests containing chicks at the first check.

<sup>h</sup>Hatch dates were back-calculated based on fledge dates for 33 nests containing chicks at the first check.

<sup>i</sup>Hatch dates were back-calculated based on fledge dates for four nests containing chicks at the first check.

Table 58. Frequency distribution of hatch dates for fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. Values in parentheses represent hatch dates back-calculated from fledge dates because chicks were present at the first check. No data were collected in 2017 or 2020; some hatch data were collected in 2001 but are excluded because data are biased towards only late hatch dates due to large nest check intervals earlier in the season.

Julian date <sup>a</sup>	No. nests hatching on Julian date																							
	95	96	97	98	99	00	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7)	-	-	-	-	-	
144	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
146	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(2)	-	-	-	-	-	-	
147	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
148	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12)	-	-	-	-	-	
149	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7)	-	-	-	-	-	-	
151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(6)	-	-	-	-	-	-
153	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
154	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(1)	-	1	2	5	-	-	-	-	-
155	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
156	-	-	-	-	-	-	1	-	-	-	-	-	-	2	-	(5)	-	-	-	-	-	-	-	-
157	-	-	-	-	-	-	-	-	-	-	-	-	-	(1)	-	-	-	-	-	-	-	-	-	-
158	-	-	-	-	-	-	2	-	-	-	-	-	-	-	8	-	3	-	1	-	-	-	-	-
159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(1)	-	-	-	-	-	-	-
160	-	-	-	-	-	-	4	-	-	-	-	-	6	1	(3)	1	2	1	-	-	-	-	-	-
161	-	-	-	-	-	-	1	-	-	-	-	-	-	-	(1)	-	-	-	-	-	-	-	-	-
162	-	-	-	-	-	1	6	-	-	-	-	-	-	5	1	-	-	-	(2)	2	1	-	-	-
163	-	-	-	-	-	(1)	-	-	-	-	-	-	-	-	-	-	-	-	(2)	-	-	-	-	-
164	-	-	-	-	-	1	-	-	-	-	-	-	1	9	-	6	8	2+(1)	-	5	-	-	-	-
165	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
166	-	-	-	-	-	-	3	3	-	-	4	3	-	6	-	-	-	-	-	-	-	-	1	-
167	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	(1)	-	-	-	-	-	-	-
168	-	6	-	-	-	1	6	-	5	-	(2)	-	1	-	5	-	-	-	-	7	1	-	-	-
169	-	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170	-	-	-	-	-	-	-	7	-	-	8	-	7	-	(1)	7	1	2	6	2	-	5	-	-
171	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	-	7	-	-	-	3	10	-	2	-	-	2	6	-	7	-	-	2	-	-	-	-	-	-
173	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	-	-	-	-	-	-	-	-	1	-	-	-	-	4	-	-	9	-	4	-	1	6	-	-
175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
176	-	2	-	-	-	-	-	11	8	-	-	6	-	-	9	-	-	-	-	5	7	-	-	10
177	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
178	-	3	-	-	-	-	10	3	-	-	1	-	-	5	-	-	2	-	(1)	-	-	-	-	-
179	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-	6	-	-	-	10	-	5	-	-	1	1	2	1	-	5	-

Table 58 (continued). Frequency distribution of hatch dates for fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. Values in parentheses represent hatch dates back-calculated from fledge dates because chicks were present at the first check. No data were collected in 2017 or 2020; some hatch data were collected in 2001 but are excluded because data are biased towards only late hatch dates due to large nest check intervals earlier in the season.

Julian date <sup>a</sup>	No. nests hatching on Julian date																							
	95	96	97	98	99	00	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
181	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
182	-	-	-	-	-	8	4	12	-	-	-	-	1	-	-	1	-	-	-	-	6	-	-	
183	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
184	-	3	-	-	-	-	-	-	-	11	4	7	-	3	10	-	-	-	1	7+(2)	1	2	-	15
185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
186	-	-	-	-	-	-	-	1	9	-	-	-	7	1	-	-	-	3	-	-	-	4	-	
187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
188	-	-	-	-	-	11	3	-	-	-	3	-	-	7	-	-	-	-	-	-	-	-	-	
189	-	-	-	7	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	
190	-	5	-	-	1	-	-	-	5	11	-	-	3	1	5	-	-	4	-	9	1	4	-	8
191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
192	-	-	-	2	-	1	4	1	3	-	2	-	-	-	-	5	-	-	-	-	-	4	-	
193	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
194	-	-	-	5	-	-	-	-	-	2	6	6	-	3	2	-	-	-	-	-	3	-	-	
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
196	2	1	-	-	-	-	-	1	4	-	-	-	2	1	-	-	-	-	1	5	-	2	-	
197	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
198	-	-	-	-	4	1	1	-	1	7	-	-	6	-	-	-	-	-	-	-	1	6	4	
199	-	-	7	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	
200	-	2	1	-	2	-	-	4	-	-	-	7	-	-	-	-	2	-	-	1	-	-	-	
201	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
202	-	-	-	2	1	1	-	3	-	-	-	-	1	-	1	1	2	-	-	2	-	-	-	
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	
204	-	-	-	8	1	-	1	-	-	2	4	3	-	-	-	-	-	-	-	-	1	-	2	
205	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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207	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
208	-	-	10	-	2	3	-	1	-	2	2	-	-	1	-	-	1	-	-	-	-	3	-	
209	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
210	5	-	-	-	4	-	-	-	2	-	-	-	1	1	-	-	-	1	-	-	1	-	-	
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
212	-	-	-	-	2	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	
213	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
214	-	-	-	2	5	-	1	-	-	3	5	3	-	1	-	-	-	-	-	-	-	1	-	
215	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
216	1	-	-	-	2	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	-	-	
217	-	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
218	-	-	-	-	1	-	-	1	-	1	2	-	-	-	-	-	-	-	1	-	-	-	-	

Table 58 (continued). Frequency distribution of hatch dates for fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. Values in parentheses represent hatch dates back-calculated from fledge dates because chicks were present at the first check. No data were collected in 2017 or 2020; some hatch data were collected in 2001 but are excluded because data are biased towards only late hatch dates due to large nest check intervals earlier in the season.

Julian date <sup>a</sup>	No. nests hatching on Julian date																							
	95	96	97	98	99	00	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
219	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
220	-	1	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
221	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
222	1	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
223	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
224	-	-	2	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	
225	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
226	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
227	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
228	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
229	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
230	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
231	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
232	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
233	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
234	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
235	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
236	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
238	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
241	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
242	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
244	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<i>n</i>	22	35	24	43	35	55	45	43	63	36	35	37	57	40	60	33	45	43	48	39	28	36	36	45

<sup>a</sup>Julian dates are adjusted by one day in leap years.

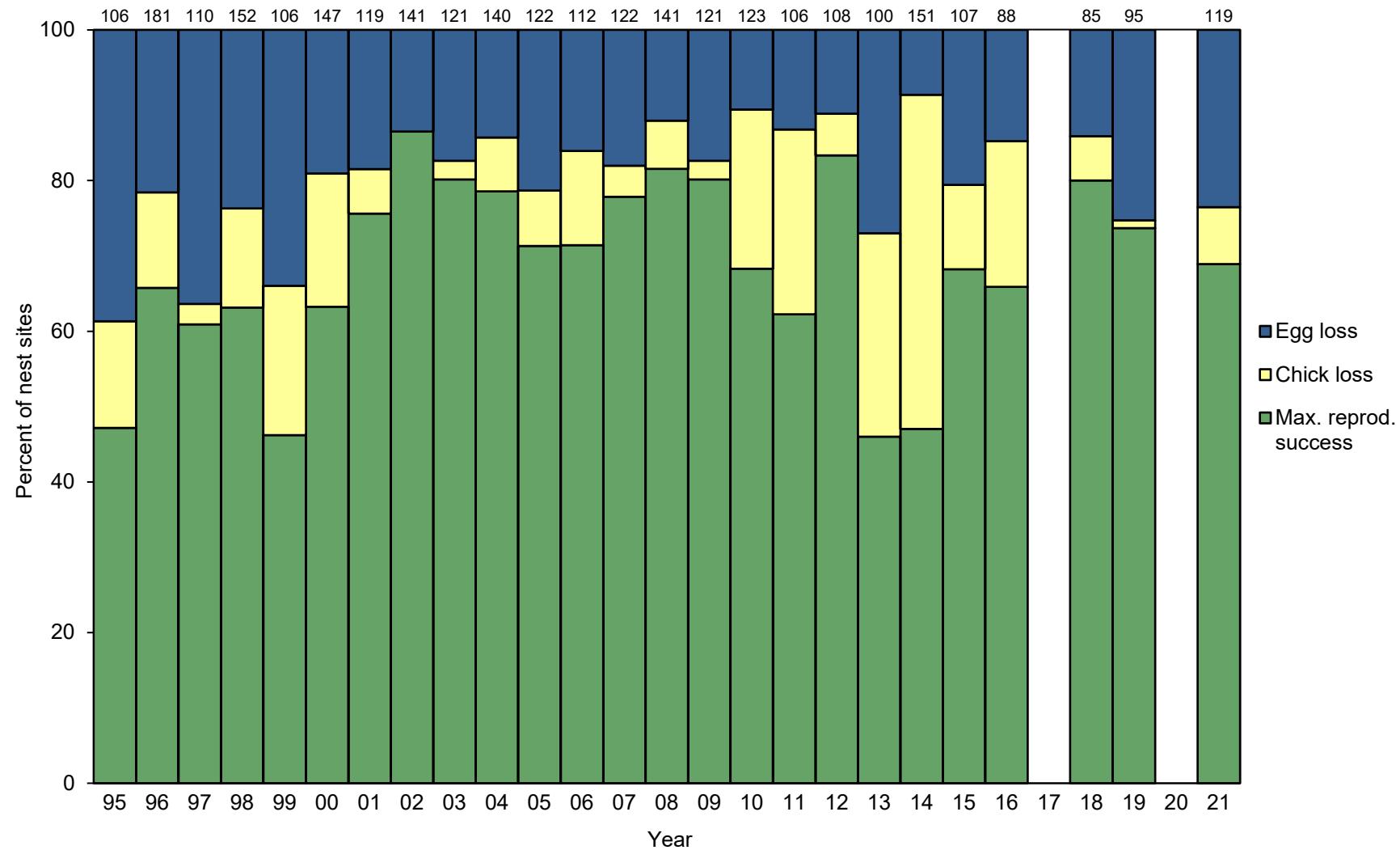


Figure 36. Reproductive performance of fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only productivity plots monitored on an interval of about 14 days. Egg loss=[(B+H)-(D+H)]/(B+H); Chick loss=[(D+H)-(F+H)]/(B+H); Maximum potential reproductive success=(F+H)/(B+H), where B+H=maximum nest sites with eggs; D+H=maximum nest sites with chicks; F+H=maximum nest sites with chicks fledged. Numbers above columns indicate sample sizes (B+H). No data were collected in 2017 or 2020.

Table 59. Reproductive performance of fork-tailed storm-petrels at St. Lazaria Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Most chicks are too young to fledge by the time of last visit so measures of success represent maximum potential estimates, based on the assumption that any chick still present at last check could fledge. No data were collected in 2017 or 2020.

Year	Max. nest sites w/ eggs	Max nest sites w/ chicks	Max. nest sites w/ chicks fledged	Nest sites w/ viable eggs at last visit <sup>b</sup>	Max. potential nesting success [(D+H)/(B+H)] <sup>c</sup>		Max. potential fledging success [(F+H)/(D+H)] <sup>d</sup>		Max. potential reproductive success [(F+H)/(B+H)]		No. plots <sup>e</sup>	Sampling design <sup>f</sup>
	(B+H)	(D+H)	(F+H) <sup>a</sup>		Total	SD	Total	SD	Total	SD		
1995	106	65	50	xx <sup>g</sup>	0.61	0.07	0.77	0.05	0.47	0.07	7	Cluster by plot
1996	181	142	119	xx	0.78	0.06	0.84	0.02	0.66	0.06	8	Cluster by plot
1997	110	70	67	xx	0.64	0.04	0.96	0.03	0.61	0.03	8	Cluster by plot
1998	152	116	96	xx	0.76	0.02	0.83	0.04	0.63	0.03	8	Cluster by plot
1999	106	70	49	xx	0.66	0.07	0.70	0.04	0.46	0.07	8	Cluster by plot
2000	147	119	93	xx	0.81	0.03	0.78	0.05	0.63	0.03	8	Cluster by plot
2001	119	97	90	xx	0.82	0.01	0.93	0.02	0.76	0.02	8	Cluster by plot
2002	141	122	122	xx	0.87	0.03	1.00	0.00	0.87	0.03	8	Cluster by plot
2003	121	100	97	xx	0.83	0.04	0.97	0.02	0.80	0.05	8	Cluster by plot
2004	140	120	110	xx	0.86	0.02	0.92	0.03	0.79	0.04	8	Cluster by plot
2005	122	96	87	xx	0.79	0.04	0.91	0.02	0.71	0.04	8	Cluster by plot
2006	112	94	80	xx	0.84	0.02	0.85	0.05	0.71	0.06	8	Cluster by plot
2007	122	100	95	xx	0.82	0.04	0.95	0.02	0.78	0.05	8	Cluster by plot
2008	141	124	115	xx	0.88	0.04	0.93	0.02	0.82	0.04	8	Cluster by plot
2009	121	100	97	xx	0.83	0.04	0.97	0.01	0.80	0.04	8	Cluster by plot
2010	123	110	84	xx	0.89	0.03	0.76	0.04	0.68	0.03	8	Cluster by plot
2011	106	92	66	xx	0.87	0.03	0.72	0.06	0.62	0.06	8	Cluster by plot
2012	108	96	90	xx	0.89	0.02	0.83	0.07	0.94	0.06	8	Cluster by plot
2013	100	73	46	0	0.73	0.04	0.63	0.05	0.46	0.05	8	Cluster by plot
2014	151	138	71	0	0.91	0.01	0.51	0.10	0.47	0.09	8	Cluster by plot
2015	107	85	73	0	0.79	0.05	0.86	0.03	0.68	0.07	8	Cluster by plot
2016	88	75	58	0	0.85	0.06	0.77	0.01	0.66	0.06	7	Cluster by plot
2018	85	73	68	0	0.86	0.04	0.93	0.04	0.80	0.05	8	Cluster by plot
2019	95	71	70	0	0.75	0.05	0.99	0.01	0.74	0.05	8	Cluster by plot
2021	119	91	82	0	0.76	0.03	0.90	0.04	0.69	0.04	8	Cluster by plot

<sup>a</sup>F+H=maximum number of chicks potentially fledged and includes both fledged chicks (F) and chicks still present at last check but too young to have fledged (H).

<sup>b</sup>Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

<sup>c</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>d</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>e</sup>Plots that are combined for analysis are counted as a single "plot".

<sup>f</sup>Sampling for storm-petrels is clustered by plot except when sample sizes per plot are too small or plot data are not available. For sampling clustered by plot, standard deviation values are calculated based on plot as a sample unit; for simple random sampling, standard deviation values are calculated using  $\sqrt{\rho * (1 - \rho)/n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>g</sup>xx indicate data potentially exist but have not yet been summarized.

Table 60. Reproductive performance of fork-tailed storm-petrels at St. Lazaria Island, Alaska in 2021. Data include only productivity plots monitored on an interval of about 14 days.

Parameter	Plot								Total	SD <sup>a</sup>
	1	4	8	10	12	13	15	16		
Max. nest sites w/ eggs (B+H)	29	9	8	33	6	3	25	6	119	-
Max. nest sites w/ chicks (D+H)	21	8	5	25	3	3	21	5	91	-
Max. nest sites w/ chicks fledged (F+H) <sup>b</sup>	16	7	5	24	3	3	19	5	82	-
Nest sites w/ viable eggs at last visit <sup>c</sup>	0	0	0	0	0	0	0	0	0	-
Max. potential nesting success [(D+H)/(B+H)] <sup>d</sup>	0.70	0.89	0.63	0.76	0.50	1.00	0.84	0.83	0.76	0.03
Max. potential fledging success [(F+H)/(D+H)] <sup>e</sup>	0.76	0.88	1.00	0.96	1.00	1.00	0.90	1.00	0.90	0.04
Maximum reproductive success [(F+H)/(B+H)]	0.55	0.78	0.63	0.73	0.50	1.00	0.76	0.83	0.69	0.04

<sup>a</sup>Standard deviations are calculated based on plot as a sample unit.

<sup>b</sup>F+H=maximum number of chicks potentially fledged and includes both fledged chicks (F) and chicks still present at last check but too young to have fledged (H).

<sup>c</sup>Eggs still present and apparently viable at last check are considered unknown fate and are not included in the number of nest sites w/ eggs (B) or success estimates.

<sup>d</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>e</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

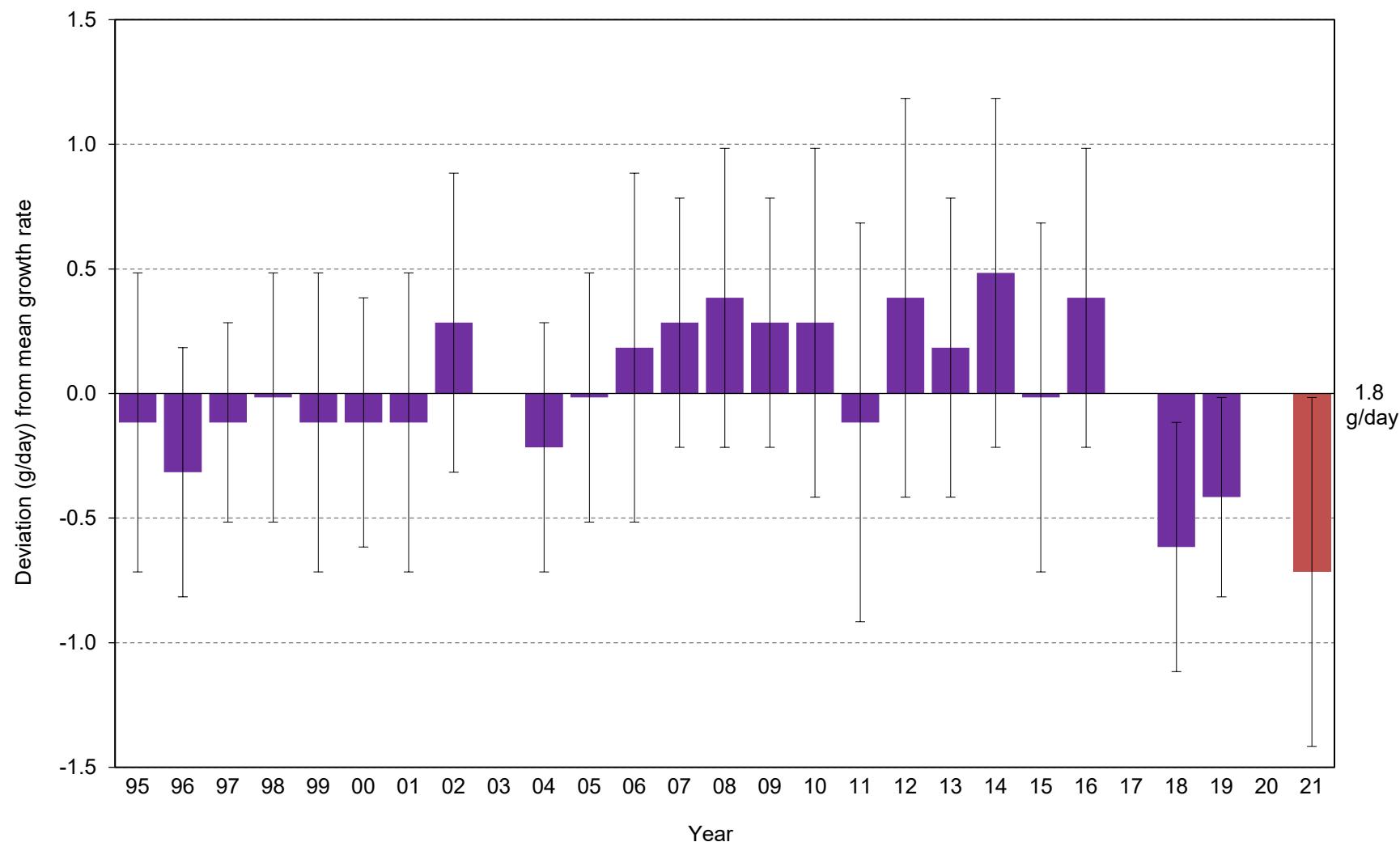


Figure 37. Yearly chick growth (mass) rate deviation (from the 1995-2020 average of 1.8 g/day) for fork-tailed storm-petrels at St. Lazaria Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate; red highlights the current year. No data were collected in 2017 or 2020.

Table 61. Mean growth rates of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (i.e., approximate mass is 10-80g and wing chord is 20-140mm). No data were collected in 2017 or 2020.

Year	Mass (g/day)				Wing chord (mm/day)			
	Mean	SD	Range	n	Mean	SD	Range	n
1995	1.7	0.6	1.1 - 2.8	8	-	-	-	-
1996	1.5	0.5	0.8 - 2.7	25	2.3	1.1	0.7 - 3.0	4
1997	1.7	0.4	1.2 - 2.7	24	3.4	0.2	3.2 - 3.7	5
1998	1.8	0.5	0.9 - 2.9	40	2.9	0.3	2.3 - 3.5	33
1999	1.7	0.6	0.8 - 3.5	26	2.9	0.3	2.3 - 3.3	12
2000	1.7	0.5	0.8 - 3.3	49	2.9	0.4	1.8 - 3.8	42
2001	1.7	0.6	0.6 - 3.4	48	3.1	0.3	2.0 - 3.8	35
2002	2.1	0.6	1.2 - 3.5	42	2.9	0.4	1.6 - 4.4	41
2003	1.7	0.6	0.9 - 3.0	37	3.1	0.4	1.9 - 4.0	59
2004	1.6	0.5	0.8 - 3.1	57	3.0	0.3	2.3 - 3.7	59
2005	1.8	0.5	0.9 - 3.2	48	2.8	2.9	0.5 - 4.1	27
2006	2.0	0.7	0.4 - 4.1	36	2.9	0.5	1.9 - 4.0	24
2007	2.1	0.5	1.4 - 3.9	45	2.9	1.8	2.3 - 3.8	38
2008	2.2	0.6	1.2 - 4.0	61	2.9	0.3	2.1 - 3.7	52
2009	2.1	0.5	1.0 - 3.3	42	3.0	0.3	2.2 - 3.8	38
2010	2.1	0.7	0.7 - 3.8	64	3.0	0.3	2.2 - 3.7	49
2011	1.7	0.8	0.4 - 3.5	33	2.6	0.6	0.9 - 3.6	33
2012	2.2	0.8	0.5 - 4.7	54	2.9	0.6	1.0 - 3.7	53
2013	2.0	0.6	0.9 - 3.9	37	2.7	0.6	0.4 - 3.7	31
2014	2.3	0.7	1.0 - 3.8	49	3.2	0.3	2.3 - 3.8	52
2015	1.8	0.7	0.5 - 3.2	32	2.6	0.6	1.2 - 3.8	33
2016	2.2	0.6	0.7 - 3.3	29	3.2	0.3	2.1 - 3.6	29
2018	1.2	0.5	0.3 - 2.9	35	2.7	0.3	1.6 - 3.1	35
2019	1.4	0.4	0.3 - 2.2	36	2.7	0.4	0.8 - 3.4	35
2021	1.1	0.7	-1.3 - 2.6	37	2.6	0.5	1.7 - 3.3	27

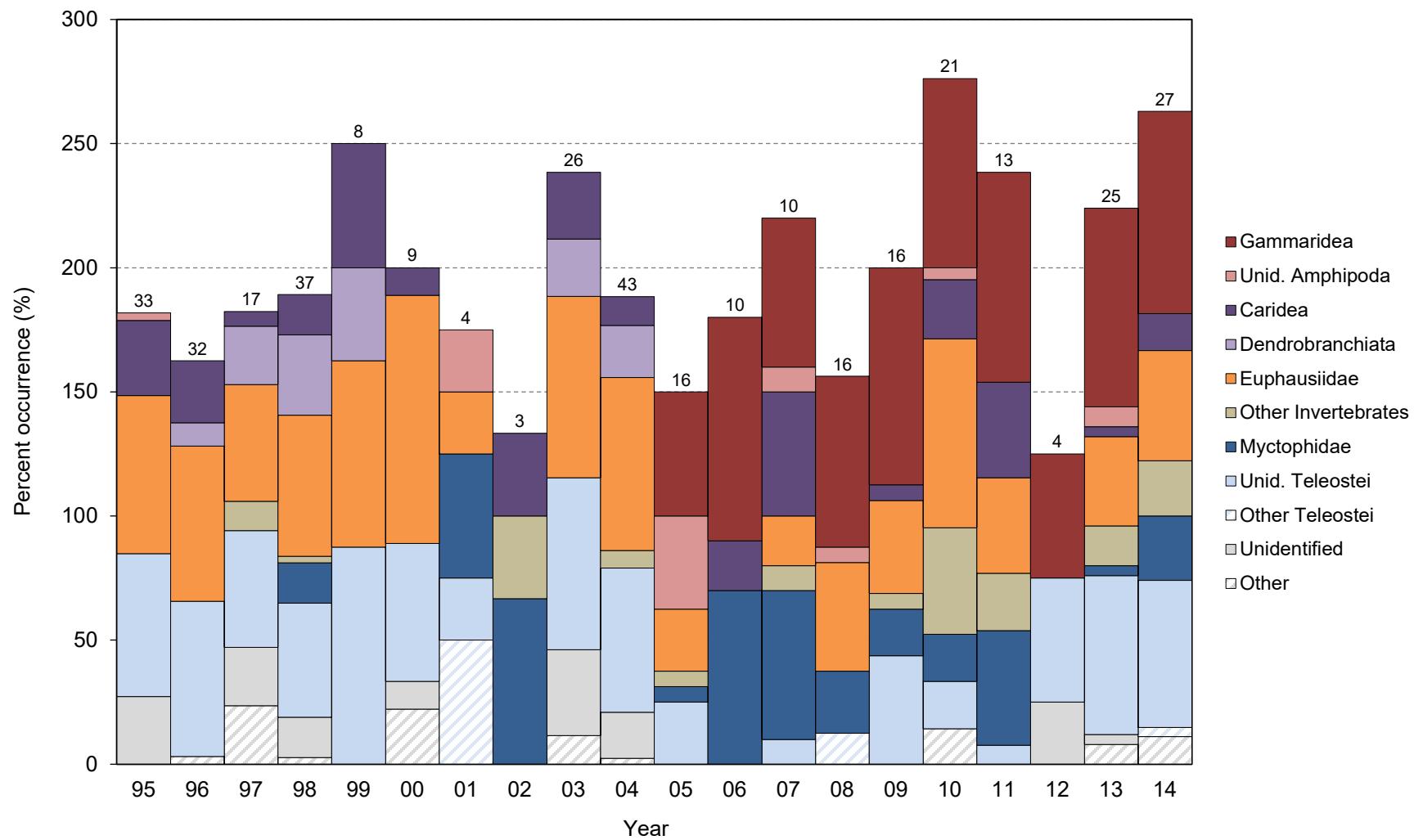


Figure 38. Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. Numbers above columns indicates sample sizes. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed.

Table 62. Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. samples	33	32	17	37	8	9 <sup>a</sup>	4	3	26	43	16	10	10
<b>Invertebrates</b>	<b>78.8</b>	<b>75.0</b>	<b>64.7</b>	<b>81.1</b>	<b>87.5</b>	<b>100.0</b>	<b>25.0</b>	<b>66.7</b>	<b>88.5</b>	<b>88.4</b>	<b>100.0</b>	<b>90.0</b>	<b>100.0</b>
<b>Amphipoda</b>	<b>3.0</b>	-	-	-	-	-	<b>25.0</b>	-	-	-	<b>87.5</b>	<b>90.0</b>	<b>70.0</b>
<b>Gammaridea</b>	-	-	-	-	-	-	-	-	-	-	<b>50.0</b>	<b>90.0</b>	<b>60.0</b>
Lysianassidae	-	-	-	-	-	-	-	-	-	-	50.0	40.0	20.0
<i>Paracallisoma coecum</i>	-	-	-	-	-	-	-	-	-	-	50.0	40.0	-
Other Gammaridea	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. Amphipoda	3.0	-	-	-	-	-	25.0	-	-	-	37.5	-	10.0
Other Amphipoda	-	-	-	-	-	-	-	-	-	-	18.8	-	-
<b>Decapoda</b>	<b>30.3</b>	<b>34.4</b>	<b>23.5</b>	<b>45.9</b>	<b>50.0</b>	<b>11.1</b>	-	<b>33.3</b>	<b>34.6</b>	<b>32.6</b>	<b>6.3</b>	<b>20.0</b>	<b>50.0</b>
<b>Caridea</b>	<b>30.3</b>	<b>25.0</b>	<b>5.9</b>	<b>16.2</b>	<b>50.0</b>	<b>11.1</b>	-	<b>33.3</b>	<b>26.9</b>	<b>11.6</b>	-	<b>20.0</b>	<b>50.0</b>
Unid. Caridea	30.3	21.9	-	2.7	-	-	-	33.3	-	-	-	20.0	40.0
Other Caridea	-	3.1	5.9	13.5	50.0	11.1	-	-	26.9	11.6	-	-	10.0
<b>Dendrobranchiata</b>	-	<b>9.4</b>	<b>23.5</b>	<b>32.4</b>	<b>37.5</b>	-	-	-	<b>23.1</b>	<b>20.9</b>	-	-	-
<i>Litopenaeus vannamei</i>	-	9.4	23.5	32.4	37.5	-	-	-	23.1	20.9	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	-	-	6.3	-	-
<b>Euphausiacea</b>	<b>63.6</b>	<b>62.5</b>	<b>47.1</b>	<b>56.8</b>	<b>75.0</b>	<b>100.0</b>	<b>25.0</b>	-	<b>73.1</b>	<b>69.8</b>	<b>25.0</b>	-	<b>20.0</b>
<b>Euphausiidae</b>	<b>63.6</b>	<b>62.5</b>	<b>47.1</b>	<b>56.8</b>	<b>75.0</b>	<b>100.0</b>	<b>25.0</b>	-	<b>73.1</b>	<b>69.8</b>	<b>25.0</b>	-	<b>20.0</b>
Unid. Euphausiidae	63.6	62.5	47.1	56.8	75.0	100.0	25.0	-	73.1	69.8	25.0	-	20.0
Other Euphausiidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Invertebrates	-	-	11.8	2.7	-	-	-	33.3	-	7.0	6.3	-	10.0
<b>Fish</b>	<b>57.6</b>	<b>62.5</b>	<b>47.1</b>	<b>59.5</b>	<b>87.5</b>	<b>55.6</b>	<b>100.0</b>	<b>66.7</b>	<b>69.2</b>	<b>58.1</b>	<b>25.0</b>	<b>70.0</b>	<b>70.0</b>
<b>Teleostei</b>	<b>57.6</b>	<b>62.5</b>	<b>47.1</b>	<b>59.5</b>	<b>87.5</b>	<b>55.6</b>	<b>100.0</b>	<b>66.7</b>	<b>69.2</b>	<b>58.1</b>	<b>25.0</b>	<b>70.0</b>	<b>70.0</b>
<b>Myctophidae</b>	-	-	-	<b>16.2</b>	-	-	<b>50.0</b>	<b>66.7</b>	-	-	<b>6.3</b>	<b>70.0</b>	<b>60.0</b>
Unid. Myctophidae	-	-	-	16.2	-	-	50.0	-	-	-	6.3	70.0	60.0
Other Myctophidae	-	-	-	-	-	-	-	66.7	-	-	-	-	-
Unid. Teleostei	57.6	62.5	47.1	45.9	87.5	55.6	25.0	-	69.2	58.1	25.0	-	10.0
Other Teleostei	-	-	-	-	-	50.0	-	-	-	-	-	-	-
<b>Other</b>	<b>27.3</b>	<b>3.1</b>	<b>52.9</b>	<b>18.9</b>	<b>12.5</b>	<b>33.3</b>	-	-	<b>46.2</b>	<b>20.9</b>	-	-	-
Unidentified	27.3	-	23.5	16.2	-	11.1	-	-	34.6	18.6	-	-	-
Other	-	3.1	23.5	2.7	-	22.2	-	-	11.5	2.3	-	-	-

Table 62 (continued). Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	16	16	21	13	4 <sup>b</sup>	25	27	17	6	22	26	27
<b>Invertebrates</b>	<b>93.8</b>	<b>93.8</b>	<b>95.2</b>	<b>100.0</b>	<b>50.0</b>	<b>92.0</b>	<b>92.6</b>	pending	pending	pending	pending	pending
<b>Amphipoda</b>	<b>75.0</b>	<b>87.5</b>	<b>76.2</b>	<b>84.6</b>	<b>50.0</b>	<b>88.0</b>	<b>81.5</b>	-	-	-	-	-
<b>Gammaridea</b>	<b>68.8</b>	<b>87.5</b>	<b>76.2</b>	<b>84.6</b>	<b>50.0</b>	<b>80.0</b>	<b>81.5</b>	-	-	-	-	-
Lysianassidae	37.5	62.5	-	76.9	-	-	-	-	-	-	-	-
<i>Paracallisoma coecum</i>	37.5	-	76.2	7.7	25.0	72.0	81.5	-	-	-	-	-
Other Gammaridea	-	43.8	-	-	25.0	16.0	7.4	-	-	-	-	-
Unid. Amphipoda	6.3	-	4.8	-	-	8.0	-	-	-	-	-	-
Other Amphipoda	-	6.3	-	-	-	4.0	3.7	-	-	-	-	-
<b>Decapoda</b>	-	<b>6.3</b>	<b>23.8</b>	<b>38.5</b>	-	<b>4.0</b>	<b>14.8</b>	-	-	-	-	-
<b>Caridea</b>	-	<b>6.3</b>	<b>23.8</b>	<b>38.5</b>	-	<b>4.0</b>	<b>14.8</b>	-	-	-	-	-
Unid. Caridea	-	-	-	23.1	-	-	3.7	-	-	-	-	-
Other Caridea	-	6.3	23.8	15.4	-	4.0	11.1	-	-	-	-	-
<b>Dendrobranchiata</b>	-	-	-	-	-	-	-	-	-	-	-	-
<i>Litopenaeus vannamei</i>	-	-	-	-	-	-	-	-	-	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	-	-	-	-
<b>Euphausiacea</b>	<b>43.8</b>	<b>37.5</b>	<b>76.2</b>	<b>38.5</b>	-	<b>36.0</b>	<b>44.4</b>	-	-	-	-	-
<b>Euphausiidae</b>	<b>43.8</b>	<b>37.5</b>	<b>76.2</b>	<b>38.5</b>	-	<b>36.0</b>	<b>44.4</b>	-	-	-	-	-
Unid. Euphausiidae	12.5	37.5	42.9	30.8	-	16.0	7.4	-	-	-	-	-
Other Euphausiidae	31.3	-	42.9	7.7	-	20.0	40.7	-	-	-	-	-
Other Invertebrates	-	6.3	42.9	23.1	-	16.0	22.2	-	-	-	-	-
<b>Fish</b>	<b>37.5</b>	<b>62.5</b>	<b>38.1</b>	<b>53.8</b>	<b>50.0</b>	<b>68.0</b>	<b>85.2</b>	-	-	-	-	-
<b>Teleostei</b>	<b>37.5</b>	<b>62.5</b>	<b>38.1</b>	<b>53.8</b>	<b>50.0</b>	<b>68.0</b>	<b>85.2</b>	-	-	-	-	-
<b>Myctophidae</b>	<b>25.0</b>	<b>18.8</b>	<b>19.0</b>	<b>46.2</b>	-	<b>4.0</b>	<b>25.9</b>	-	-	-	-	-
Unid. Myctophidae	25.0	18.8	19.0	38.5	-	4.0	25.9	-	-	-	-	-
Other Myctophidae	-	-	-	7.7	-	-	-	-	-	-	-	-
Unid. Teleostei	-	43.8	19.0	7.7	50.0	64.0	59.3	-	-	-	-	-
Other Teleostei	12.5	-	-	-	-	-	3.7	-	-	-	-	-
<b>Other</b>	-	-	<b>14.3</b>	-	<b>25.0</b>	<b>12.0</b>	<b>11.1</b>	-	-	-	-	-
Unidentified	-	-	-	-	25.0	4.0	-	-	-	-	-	-
Other	-	-	14.3	-	-	8.0	11.1	-	-	-	-	-

<sup>a</sup>Data for 7 additional samples are currently lost.

<sup>b</sup>Data for 31 additional samples are currently lost.

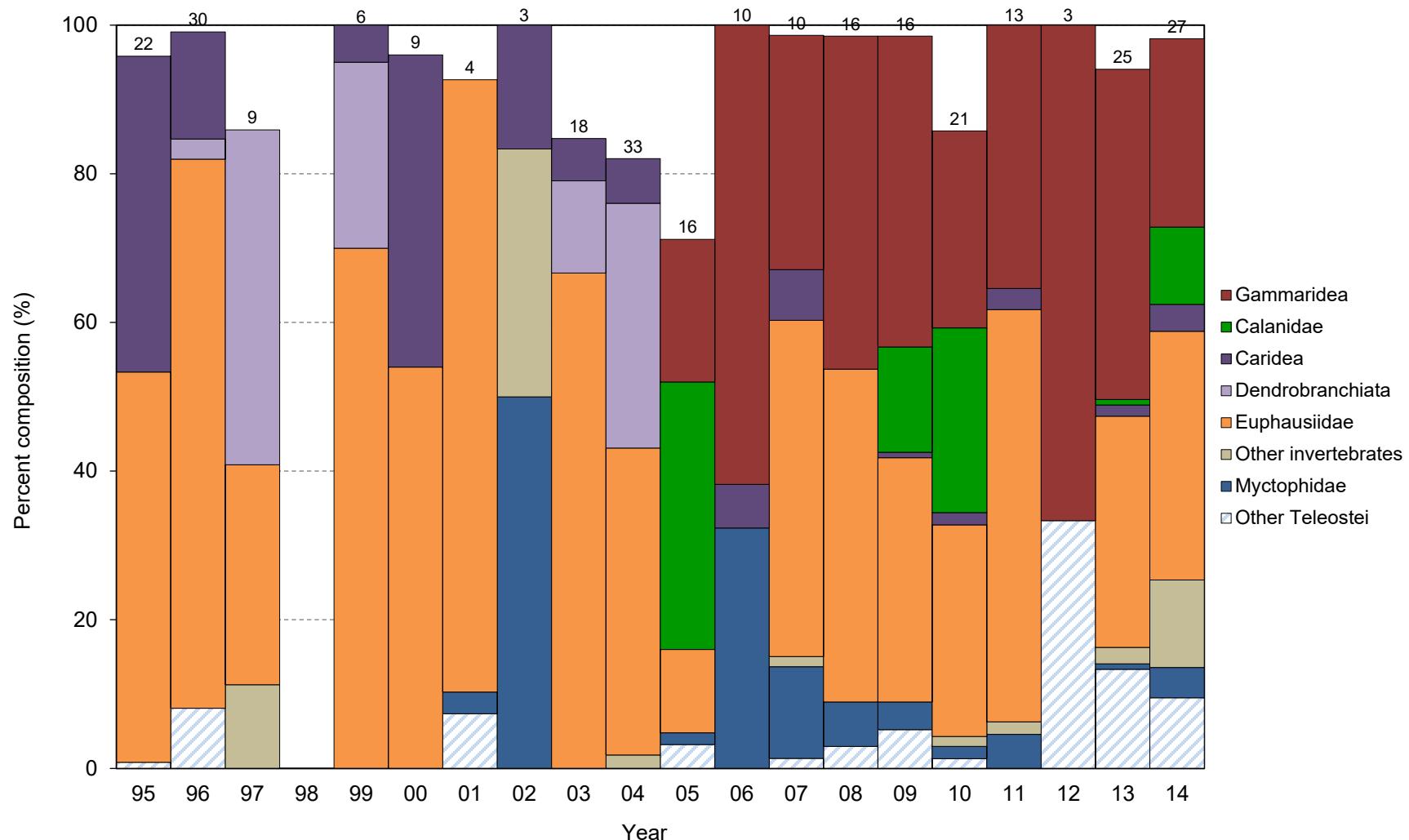


Figure 39. Percent composition of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. Numbers above columns indicates sample sizes. No count data exist in 1988 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed.

Table 63. Percent composition of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No count data exist in 1998 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. samples	22	30	9	6 <sup>a</sup>	9	4	3	18	33	16	10	10
No. individuals	120	111	71	20	50	68	6	105	167	125	34	73
<b>Invertebrates</b>	<b>95.8</b>	<b>91.0</b>	<b>85.9</b>	<b>100.0</b>	<b>96.0</b>	<b>89.7</b>	<b>50.0</b>	<b>84.8</b>	<b>82.0</b>	<b>95.2</b>	<b>67.6</b>	<b>86.3</b>
<b>Amphipoda</b>	<b>0.8</b>	-	-	-	-	<b>7.4</b>	-	-	-	<b>47.2</b>	<b>61.8</b>	<b>32.9</b>
<b>Gammaridea</b>	-	-	-	-	-	-	-	-	-	<b>19.2</b>	<b>61.8</b>	<b>31.5</b>
Lysianassidae	-	-	-	-	-	-	-	-	-	19.2	38.2	9.6
<i>Paracallisoma coecum</i>	-	-	-	-	-	-	-	-	-	-	23.5	21.9
Other Gammaridea	-	-	-	-	-	-	-	-	-	-	-	-
Other Amphipoda	0.8	-	-	-	-	7.4	-	-	-	28.0	-	1.4
<b>Copepoda</b>	-	-	-	-	-	-	-	-	-	<b>36.0</b>	-	-
Calanidae	-	-	-	-	-	-	-	-	-	36.0	-	-
<b>Decapoda</b>	<b>42.5</b>	<b>17.1</b>	<b>45.1</b>	<b>30.0</b>	<b>42.0</b>	-	<b>16.7</b>	<b>18.1</b>	<b>38.9</b>	<b>0.8</b>	<b>5.9</b>	<b>6.8</b>
<b>Caridea</b>	<b>42.5</b>	<b>14.4</b>	-	<b>5.0</b>	<b>42.0</b>	-	<b>16.7</b>	<b>5.7</b>	<b>6.0</b>	-	<b>5.9</b>	<b>6.8</b>
Unid. Caridea	42.5	13.5	-	-	-	-	16.7	-	-	-	5.9	5.5
Other Caridea	-	0.9	-	5.0	42.0	-	-	5.7	6.0	-	-	1.4
<b>Dendrobranchiata</b>	-	<b>2.7</b>	<b>45.1</b>	<b>25.0</b>	-	-	-	<b>12.4</b>	<b>32.9</b>	-	-	-
<i>Litopenaeus vannamei</i>	-	2.7	45.1	25.0	-	-	-	12.4	32.9	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	-	0.8	-	-
<b>Euphausiacea</b>	<b>52.5</b>	<b>73.9</b>	<b>29.6</b>	<b>70.0</b>	<b>54.0</b>	<b>82.4</b>	-	<b>66.7</b>	<b>41.3</b>	<b>11.2</b>	-	<b>45.2</b>
<b>Euphausiidae</b>	<b>52.5</b>	<b>73.9</b>	<b>29.6</b>	<b>70.0</b>	<b>54.0</b>	<b>82.4</b>	-	<b>66.7</b>	<b>41.3</b>	<b>11.2</b>	-	<b>45.2</b>
Unid. Euphausiidae	52.5	73.9	29.6	70.0	54.0	82.4	-	66.7	41.3	11.2	-	45.2
Other Euphausiidae	-	-	-	-	-	-	-	-	-	-	-	-
Other Invertebrates	-	-	11.3	-	-	-	33.3	-	1.8	-	-	1.4
<b>Fish</b>	<b>0.8</b>	<b>8.1</b>	-	-	-	<b>10.3</b>	<b>50.0</b>	-	-	<b>4.8</b>	<b>32.4</b>	<b>13.7</b>
<b>Teleostei</b>	<b>0.8</b>	<b>8.1</b>	-	-	-	<b>10.3</b>	<b>50.0</b>	-	-	<b>4.8</b>	<b>32.4</b>	<b>13.7</b>
Myctophidae	-	-	-	-	-	2.9	50.0	-	-	1.6	32.4	12.3
Other Teleostei	0.8	8.1	-	-	-	7.4	-	-	-	3.2	-	1.4
Other	3.3	0.9	14.1	-	4.0	-	-	15.2	18.0	-	-	-

Table 63 (continued). Percent composition of major prey items in diets of fork-tailed storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No count data exist in 1998 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	16	16	21	13	3 <sup>b</sup>	25	27	17	6	22	26	27
No. individuals	67	134	302	175	6	135	221	pending	pending	pending	pending	pending
<b>Invertebrates</b>	<b>91.0</b>	<b>91.0</b>	<b>96.0</b>	<b>95.4</b>	<b>66.7</b>	<b>83.7</b>	<b>85.1</b>	-	-	-	-	-
<b>Amphipoda</b>	<b>46.3</b>	<b>43.3</b>	<b>27.8</b>	<b>35.4</b>	<b>66.7</b>	<b>48.1</b>	<b>25.8</b>	-	-	-	-	-
<b>Gammaridea</b>	<b>44.8</b>	<b>41.8</b>	<b>26.5</b>	<b>35.4</b>	<b>66.7</b>	<b>44.4</b>	<b>25.3</b>	-	-	-	-	-
Lysianassidae	28.4	32.8	-	32.6	-	-	-	-	-	-	-	-
<i>Paracallisoma coecum</i>	16.4	-	26.5	2.9	33.3	38.5	24.4	-	-	-	-	-
Other Gammaridea	-	9.0	-	-	33.3	5.9	0.9	-	-	-	-	-
Other Amphipoda	1.5	1.5	1.3	-	-	3.7	0.5	-	-	-	-	-
<b>Copepoda</b>	-	<b>14.2</b>	<b>36.8</b>	-	-	<b>0.7</b>	<b>10.4</b>	-	-	-	-	-
Calanidae	-	14.2	24.8	-	-	0.7	10.4	-	-	-	-	-
<b>Decapoda</b>	-	<b>0.7</b>	<b>1.7</b>	<b>2.9</b>	-	<b>1.5</b>	<b>3.6</b>	-	-	-	-	-
<b>Caridea</b>	-	<b>0.7</b>	<b>1.7</b>	<b>2.9</b>	-	<b>1.5</b>	<b>3.6</b>	-	-	-	-	-
Unid. Caridea	-	-	-	1.7	-	-	2.3	-	-	-	-	-
Other Caridea	-	0.7	1.7	1.1	-	1.5	1.4	-	-	-	-	-
<b>Dendrobranchiata</b>	-	-	-	-	-	-	-	-	-	-	-	-
<i>Litopenaeus vannamei</i>	-	-	-	-	-	-	-	-	-	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	-	-	-	-
<b>Euphausiacea</b>	<b>44.8</b>	<b>32.8</b>	<b>28.5</b>	<b>55.4</b>	-	<b>31.1</b>	<b>33.5</b>	-	-	-	-	-
<b>Euphausiidae</b>	<b>44.8</b>	<b>32.8</b>	<b>28.5</b>	<b>55.4</b>	-	<b>31.1</b>	<b>33.5</b>	-	-	-	-	-
Unid. Euphausiidae	7.5	32.8	12.9	50.9	-	6.7	2.3	-	-	-	-	-
Other Euphausiidae	37.3	-	15.6	4.6	-	24.4	31.2	-	-	-	-	-
Other Invertebrates	-	-	1.3	1.7	-	2.2	11.8	-	-	-	-	-
<b>Fish</b>	<b>9.0</b>	<b>9.0</b>	<b>3.0</b>	<b>4.6</b>	<b>33.3</b>	<b>14.1</b>	<b>13.6</b>	-	-	-	-	-
<b>Teleostei</b>	<b>9.0</b>	<b>9.0</b>	<b>3.0</b>	<b>4.6</b>	<b>33.3</b>	<b>14.1</b>	<b>13.6</b>	-	-	-	-	-
Myctophidae	6.0	3.7	1.7	4.6	-	0.7	4.1	-	-	-	-	-
Other Teleostei	3.0	5.2	1.3	-	33.3	13.3	9.5	-	-	-	-	-
Other	-	-	1.0	-	-	2.2	1.4	-	-	-	-	-

<sup>a</sup>Data for 7 additional samples are currently lost.

<sup>b</sup>Data for 31 additional samples are currently lost.

Table 64. Morphological measurements of adult fork-tailed storm-petrels at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Mass (g)				Wing chord (mm)				Diagonal tarsus (mm)			
	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range	n
1995	xx <sup>a</sup>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1996	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1997	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1999	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2000	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2001	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2002	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2003	55	4.4	49 - 67	31	153	5.8	133 - 162	29	-	-	-	-
2004	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2005	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2006	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2007	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2008	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2009	54	3.3	29 - 61	16	149	3.5	143 - 156	17	-	-	-	-
2010	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2011	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2012	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2013	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2014	57	4.9	47 - 67	38	150	3.1	145 - 158	47	26.0	0.8	24.1 - 27.8	46
2015	55	5.3	45 - 66	29	154	3.5	145 - 160	23	25.8	1.0	23.4 - 28.2	29
2016	58	5.6	42 - 68	49	149	3.9	141 - 159	50	25.8	1.0	23.0 - 27.0	39
2018	55	5.9	47 - 63	27	150	3.0	143 - 155	25	26.1	1.0	23.3 - 27.1	14
2019	60	2.6	57 - 63	7	151	3.3	145 - 154	8	26.2	1.2	24.3 - 27.6	8
2021	54	3.8	48 - 62	18	151	3.3	145 - 157	18	25.7	0.8	24.0 - 27.2	18

<sup>a</sup>xx indicates data potentially exist but have not yet been incorporated

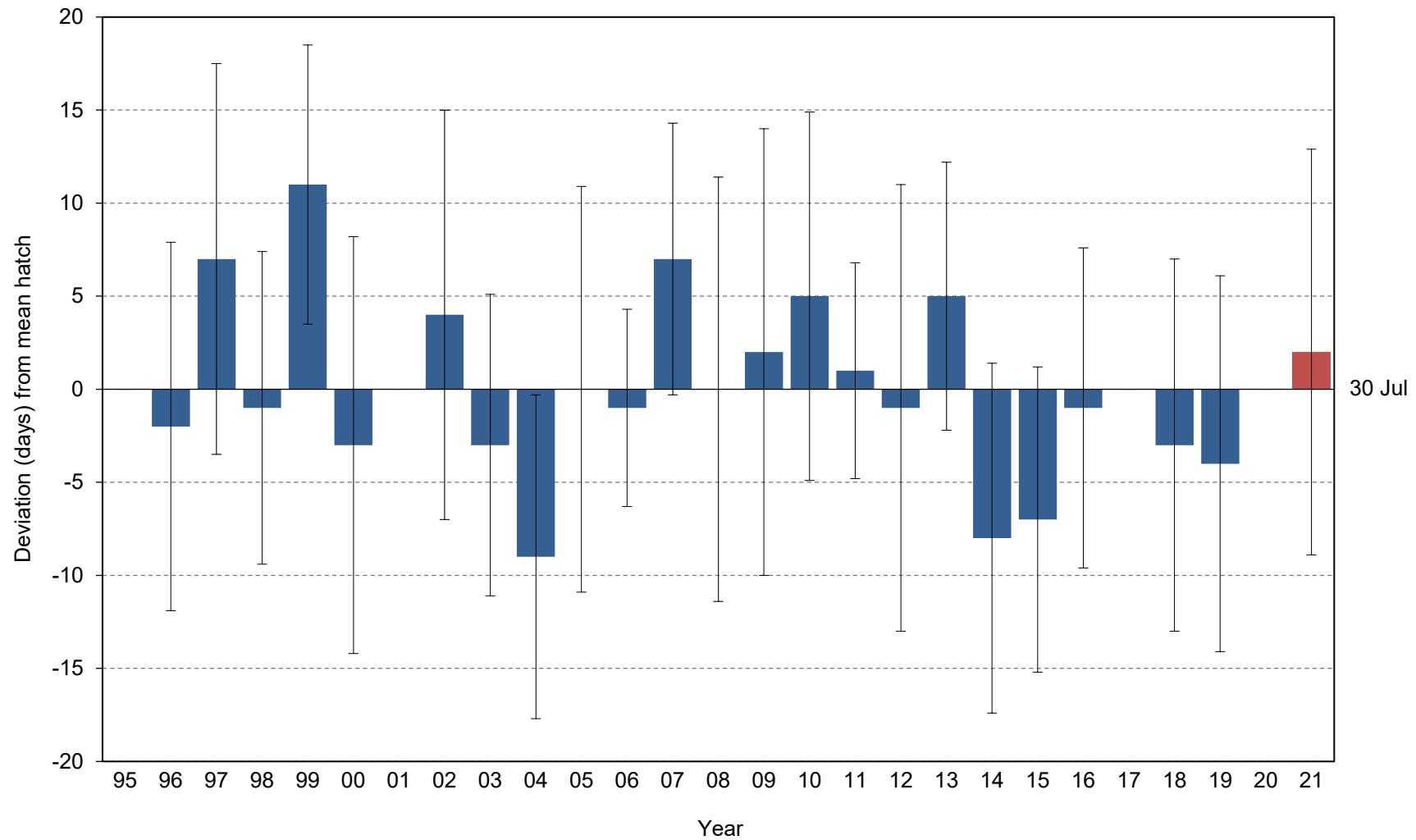


Figure 40. Yearly hatch date deviation (from the 1995-2020 average of 30 July) for Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots monitored on an interval of about 5-7 days. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2017 or 2020; some hatch data were collected in 1995 and 2001 but are excluded because crews left the island before all eggs hatched (1995) or data are biased towards only late hatch dates due to large nest check intervals earlier in the season (2001).

Table 65. Breeding chronology of Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only chronology burrows monitored on an interval of about 5-7 days. No data were collected in 2017 or 2020; some hatch data were collected in 1995 and 2001 but are excluded because crews left the island before all eggs hatched (1995) or data are biased towards only late hatch dates due to large nest check intervals earlier in the season (2001).

Year	Mean hatch	SD	n <sup>a</sup>	First hatch	Last hatch	First fledge <sup>b</sup>
1995	-	-	-	20 Jul	-	> 18 Aug
1996	27 Jul	9.9	18	16 Jul	13 Aug	> 30 Aug
1997	6 Aug	10.5	41	23 Jul	28 Aug	> 4 Sep
1998	29 Jul	8.4	54	8 Jul	22 Aug	> 30 Aug
1999	10 Aug	7.5	41	29 Jul	1 Sep	> 30 Sep
2000	26 Jul	11.2	27	26 Jun	9 Aug	> 4 Sep
2001	-	-	-	-	14 Aug	> 13 Sep
2002	3 Aug	11.0	23	17 Jul	30 Aug	> 6 Sep
2003	27 Jul	8.1	34	15 Jul	20 Aug	> 5 Sep
2004	20 Jul	8.7	34	8 Jul	13 Aug	> 8 Sep
2005	30 Jul	10.9	14	23 Jul	28 Aug	> 9 Sep
2006	29 Jul	5.3	25	17 Jul	12 Aug	> 7 Sep
2007	6 Aug	7.3	23	28 Jul	18 Aug	> 4 Sep
2008	29 Jul	11.4	29	14 Jul	6 Sep	> 8 Sep
2009	1 Aug	12.0	19	13 Jul	30 Aug	> 7 Sep
2010	4 Aug	9.9	12	17 Jul	22 Aug	> 13 Sep
2011	31 Jul	5.8	16	21 Jul	10 Aug	> 9 Sep
2012	28 Jul	12.0	20	16 Jul	29 Aug	> 6 Sep
2013	4 Aug	7.2	13	25 Jul	18 Aug	> 5 Sep
2014	22 Jul	9.4	32	3 Jul	18 Aug	> 8 Sep
2015	23 Jul	8.2	28	9 Jul	10 Aug	> 2 Sep
2016 <sup>c</sup>	28 Jul	8.6	26	18 Jul	23 Aug	> 8 Sep
2018	27 Jul	10.0	25	9 Jul	17 Aug	> 7 Sep
2019	26 Jul	10.1	35	11 Jul	28 Aug	> 31 Aug
2021	1 Aug	10.9	33	17 Jul	26 Aug	> 30 Aug

<sup>a</sup>Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.

<sup>b</sup>In years when no chicks fledged before the field crew left the island at the end of the season, date of first fledge is listed as > the date of last nest check.

Table 66. Frequency distribution of hatch dates for Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; some hatch data were collected in 1995 and 2001 but are excluded because crews left the island before all eggs hatched (1995) or data are biased towards only late hatch dates due to large nest check intervals earlier in the season (2001).

Julian date <sup>a</sup>	No. nests hatching on Julian date																					
	96	97	98	99	00	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19
178	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
179	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
181	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
189	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	2	-	2	-
191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
194	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3	2	-	-	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	4	8	-	-	-	2	-	-	-	-	7	1	-	-	-	-
197	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
198	2	-	-	-	-	2	-	-	1	-	-	2	1	-	3	-	-	-	4	5	3	-
199	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	1	-	-	-	-	-	-	8	-	-	-	4	-	1	-	-	6	9	9	-	-	-
201	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
202	7	-	7	-	9	3	4	2	-	-	-	-	-	-	1	6	-	-	1	-	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-
204	-	3	7	-	-	-	-	-	9	2	-	-	4	-	-	-	-	-	3	7	2	9
205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-
206	-	-	-	-	-	-	10	6	-	-	8	-	-	4	-	2	-	7	-	-	-	-
207	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	11	-	-	4	4	-	-	-	14	-	-	1	-	-	4	-	-	-	-	7	-
209	-	-	7	-	-	-	1	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	2	-	-	-	2	-	-	3	-	1	-	-	2	2	-	3	2	-	-
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	6	1	6
212	-	-	3	3	4	1	8	1	-	-	-	-	-	-	5	2	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	-	7	5	2	-	1	-	-	1	5	8	-	4	3	-	-	-	-	-	-	7	-
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
216	3	1	-	1	-	-	4	1	-	-	7	-	-	4	-	4	-	3	-	-	-	-
217	1	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
218	-	7	-	9	5	4	-	-	2	2	-	1	3	-	-	1	-	1	-	-	-	11

Table 66 (continued). Frequency distribution of hatch dates for Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. No data were collected in 2017 or 2020; some hatch data were collected in 1995 and 2001 but are excluded because crews left the island before all eggs hatched (1995) or data are biased towards only late hatch dates due to large nest check intervals earlier in the season (2001).

Julian date <sup>a</sup>	No. nests hatching on Julian date																						
	96	97	98	99	00	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	19	21
219	-	-	1	-	-	-	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-	
220	1	-	-	1	-	-	-	2	-	-	-	2	-	-	-	-	3	3	-	2	-	1	
221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
222	1	-	1	9	3	4	-	-	-	-	-	-	-	1	2	1	-	-	1	-	2	-	
223	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
224	1	3	1	-	-	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-	
225	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	2	-	-	
226	1	-	-	-	-	-	1	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	
227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
228	-	-	-	10	-	2	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	
229	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	
230	-	2	-	-	-	-	-	-	-	-	3	-	-	-	-	1	1	-	-	-	-	-	
231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
232	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
233	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
234	-	3	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	
235	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
236	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	
237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
238	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
240	-	2	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
241	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
242	-	-	-	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	
243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
244	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
245	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
246	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
249	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
250	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
<i>n</i>	18	41	54	41	27	23	34	34	14	25	23	29	19	12	16	20	13	32	28	26	25	35	33

<sup>a</sup>Julian dates are adjusted by one day in leap years.

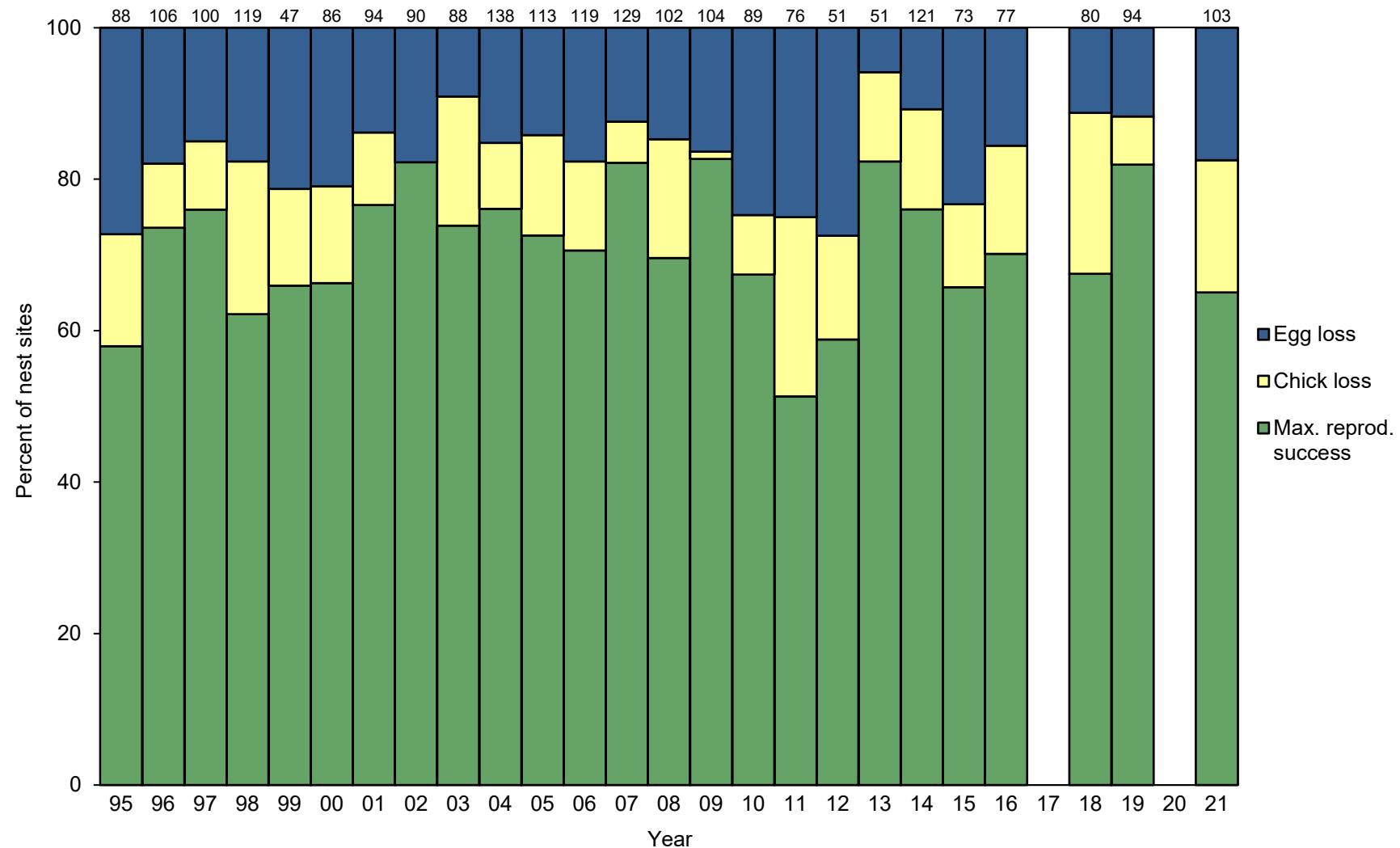


Figure 41. Reproductive performance of Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only productivity plots monitored on an interval of about 14 days. Egg loss=[(B+H)-(D+H)]/(B+H); Chick loss=[(D+H)-(F+H)]/(B+H); Maximum reproductive success=(F+H)/(B+H), where B+H=maximum nest sites with eggs; D+H=maximum nest sites with chicks; F+H=maximum nest sites with chicks fledged. Numbers above columns indicate sample sizes (B+H). No data were collected in 2017 or 2020.

Table 67. Reproductive performance of Leach's storm-petrels at St. Lazaria Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days; the same plots have been used in all years. Most chicks are too young to fledge by the time of the last visit so measures of success represent maximum potential estimates, based on the assumption that any chick still present at last check could fledge. No data were collected in 2017 or 2020.

Year	Max. nest sites w/ eggs	Max nest sites w/ chicks	Max. nest sites w/ chicks fledged	Nest sites w/ viable eggs at last visit <sup>b</sup>	Max. potential nesting success [(D+H)/(B+H)] <sup>c</sup>		Max. potential fledging success [(F+H)/(D+H)] <sup>d</sup>		Max. potential reproductive success [(F+H)/(B+H)]		No. plots <sup>e</sup>	Sampling design <sup>f</sup>
	(B+H)	(D+H)	(F+H) <sup>a</sup>		Total	SD	Total	SD	Total	SD		
1995	88	64	51	xx <sup>g</sup>	0.73	0.06	0.80	0.05	0.58	0.05	7	Cluster by plot
1996	106	87	78	xx	0.82	0.03	0.90	0.04	0.74	0.04	8	Cluster by plot
1997	100	85	76	xx	0.85	0.03	0.89	0.03	0.76	0.03	8	Cluster by plot
1998	119	98	74	xx	0.82	0.02	0.76	0.04	0.62	0.03	8	Cluster by plot
1999	47	37	31	xx	0.79	0.06	0.84	0.03	0.66	0.07	8	Cluster by plot
2000	86	68	57	xx	0.79	0.05	0.84	0.04	0.66	0.04	8	Cluster by plot
2001	94	81	72	xx	0.86	0.02	0.89	0.04	0.77	0.05	8	Cluster by plot
2002	90	74	74	xx	0.82	0.04	1.00	0.00	0.82	0.04	8	Cluster by plot
2003	88	80	65	xx	0.91	0.01	0.81	0.03	0.74	0.03	8	Cluster by plot
2004	138	117	105	xx	0.85	0.03	0.90	0.03	0.76	0.03	8	Cluster by plot
2005	113	97	82	xx	0.86	0.03	0.85	0.03	0.73	0.02	8	Cluster by plot
2006	119	98	84	xx	0.82	0.04	0.86	0.03	0.71	0.05	8	Cluster by plot
2007	129	113	106	xx	0.88	0.02	0.94	0.02	0.82	0.03	8	Cluster by plot
2008	102	87	71	xx	0.85	0.02	0.82	0.05	0.70	0.05	8	Cluster by plot
2009	104	87	86	xx	0.84	0.01	0.99	0.01	0.83	0.02	8	Cluster by plot
2010	89	67	60	0	0.75	0.06	0.90	0.06	0.67	0.08	7	Cluster by plot
2011	76	57	39	1	0.75	0.04	0.68	0.03	0.51	0.04	8	Cluster by plot
2012	51	37	30	0	0.73	0.04	0.81	0.06	0.59	0.06	8	Cluster by plot
2013	51	48	42	0	0.94	0.04	0.88	0.01	0.82	0.03	8	Cluster by plot
2014	121	108	92	0	0.89	0.02	0.85	0.03	0.76	0.03	8	Cluster by plot
2015	73	56	48	0	0.77	0.03	0.86	0.05	0.66	0.03	8	Cluster by plot
2016	77	65	54	2	0.84	0.02	0.83	0.04	0.70	0.03	8	Cluster by plot
2018	80	71	54	0	0.89	0.03	0.76	0.03	0.68	0.05	7	Cluster by plot
2019	94	83	77	0	0.88	0.04	0.93	0.03	0.82	0.06	8	Cluster by plot
2021	103	85	67	1	0.83	0.03	0.79	0.06	0.65	0.06	8	Cluster by plot

<sup>a</sup>F+H=maximum number of chicks potentially fledged and includes both fledged chicks (F) and chicks still present at last check but too young to have fledged (H).

<sup>b</sup>Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

<sup>c</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>d</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

<sup>e</sup>Plots that are combined for analysis are counted as a single "plot".

<sup>f</sup>Sampling for storm-petrels is clustered by plot except when sample sizes per plot are too small or plot data are not available. For sampling clustered by plot, standard deviation values are calculated based on plot as a sample unit; for simple random sampling, standard deviation values are calculated using  $\sqrt{\rho * (1 - \rho)/n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>g</sup>xx indicate data potentially exist but have not yet been summarized.

Table 68. Reproductive performance of Leach's storm-petrels at St. Lazaria Island, Alaska in 2021. Data include only productivity plots monitored on an interval of about 14 days.

Parameter	Plot								Total	SD <sup>a</sup>
	1	4	8	10	12	13	15	16		
Max. nest sites w/ eggs (B+H)	7	4	25	11	20	2	12	22	103	-
Max. nest sites w/ chicks (D+H)	6	3	21	9	15	2	12	17	85	-
Max. nest sites w/ chicks fledged (F+H) <sup>b</sup>	5	2	20	6	11	2	10	11	67	-
Nest sites w/ viable eggs at last visit <sup>c</sup>	0	0	1	0	0	0	0	0	1	-
Max. potential nesting success $[(D+H)/(B+H)]^d$	0.86	0.75	0.84	0.82	0.75	1.00	1.00	0.77	0.83	0.03
Max. potential fledging success $[(F+H)/(D+H)]^e$	0.83	0.67	0.95	0.67	0.73	1.00	0.83	0.65	0.79	0.06
Max. potential reproductive success $[(F+H)/(B+H)]$	0.71	0.50	0.80	0.55	0.55	1.00	0.83	0.50	0.65	0.06

<sup>a</sup>Standard deviations are calculated based on plot as a sample unit.

<sup>b</sup>F+H=maximum number of chicks potentially fledged and includes both fledged chicks (F) and chicks still present at last check but too young to have fledged (H).

<sup>c</sup>Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

<sup>d</sup>For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B)=total eggs (C) and nest sites w/ chicks (D)=total chicks (E).

<sup>e</sup>For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D)=total chicks (E) and nest sites w/ chicks fledged (F)=total chicks fledged (G).

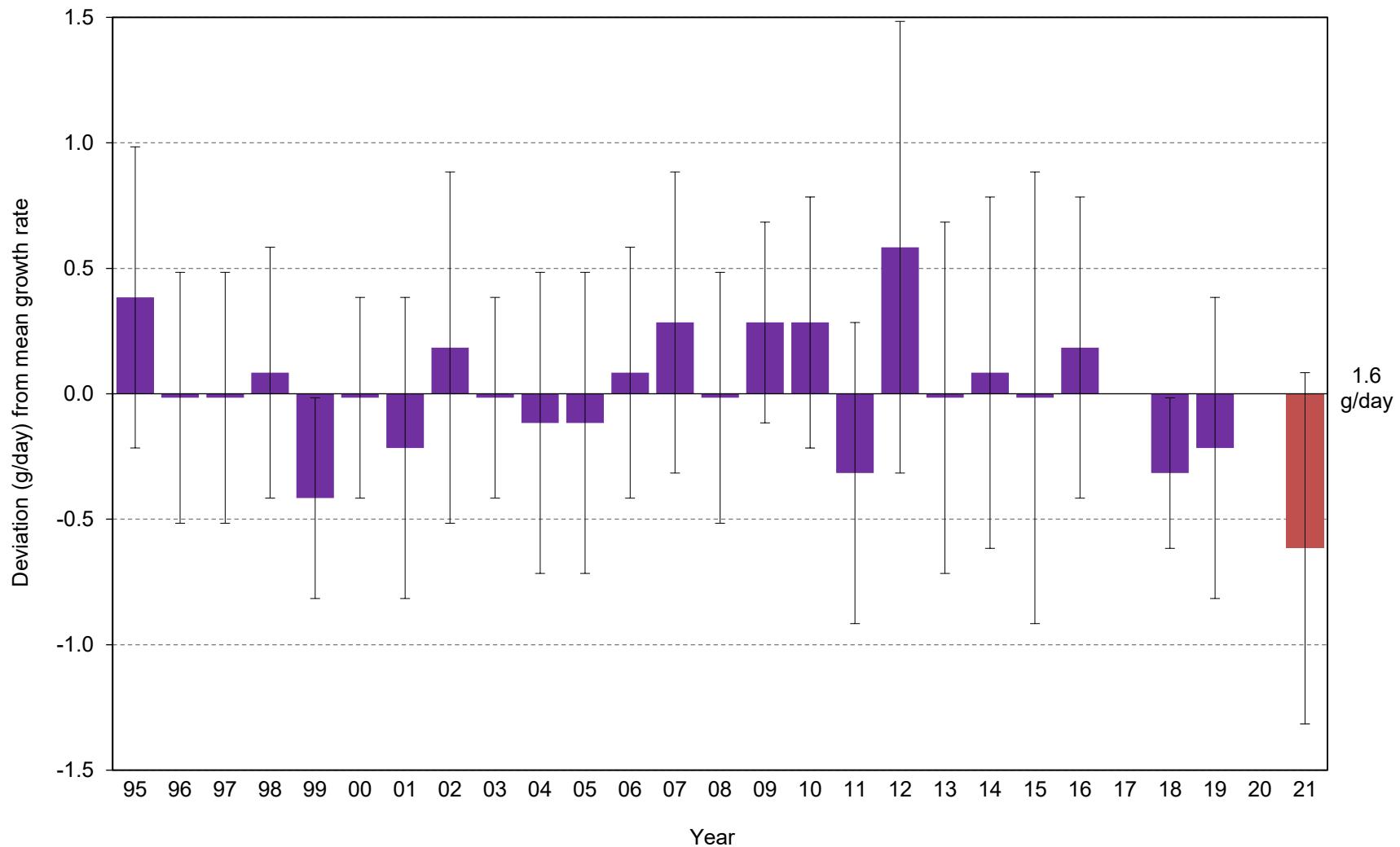


Figure 42. Yearly chick growth (mass) rate deviation (from the 1995-2020 average of 1.6 g/day) for Leach's storm-petrels at St. Lazaria Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate; red highlights the current year. No data were collected in 2017 or 2020.

Table 69. Mean growth rates of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (approximate mass is 10-80g and wing chord is 20-140mm). No data were collected in 2017 or 2020.

Year	Mass (g/day)				Wing chord (mm/day)			
	Mean	SD	Range	n	Mean	SD	Range	n
1995	2.0	0.6	1.0 - 3.0	8	-	-	-	-
1996	1.6	0.5	1.0 - 2.6	31	3.0	-	-	1
1997	1.6	0.5	0.6 - 2.8	33	2.9	0.4	2.4 - 3.4	4
1998	1.7	0.5	1.0 - 3.1	42	3.0	0.3	2.6 - 3.7	19
1999	1.2	0.4	0.5 - 2.0	30	2.5	0.8	0.7 - 3.2	10
2000	1.6	0.4	0.8 - 2.2	24	3.0	0.4	1.9 - 3.4	13
2001	1.4	0.6	0.5 - 2.7	23	2.7	0.4	2.2 - 3.4	18
2002	1.8	0.7	0.4 - 3.5	18	3.0	0.5	2.0 - 4.0	13
2003	1.6	0.4	0.7 - 2.6	30	2.8	0.4	1.9 - 3.5	24
2004	1.5	0.6	0.7 - 2.8	30	3.0	0.3	2.2 - 3.5	24
2005	1.5	0.6	0.6 - 3.3	33	2.7	0.4	1.5 - 3.2	20
2006	1.7	0.5	0.7 - 2.5	22	2.7	0.4	2.4 - 3.6	13
2007	1.9	0.6	1.0 - 3.0	21	-	-	-	-
2008	1.6	0.5	0.7 - 2.6	32	2.9	0.4	1.7 - 3.7	23
2009	1.9	0.4	1.1 - 2.5	17	3.0	0.3	2.6 - 3.5	8
2010	1.9	0.5	1.1 - 3.1	24	3.1	0.3	2.2 - 3.5	28
2011	1.3	0.6	0.8 - 2.2	8	2.4	0.7	1.3 - 3.1	6
2012	2.2	0.9	1.3 - 5.2	18	2.7	0.4	2.2 - 3.5	13
2013	1.6	0.7	0.5 - 3.0	19	3.0	0.5	2.6 - 3.3	2
2014	1.7	0.7	0.5 - 3.3	36	3.0	0.4	1.4 - 3.9	32
2015	1.6	0.9	0.6 - 4.4	19	2.5	0.6	1.7 - 3.9	16
2016	1.8	0.6	0.5 - 3.2	24	3.2	0.3	2.8 - 4.1	20
2018	1.3	0.3	0.8 - 1.7	18	2.5	0.4	1.5 - 3.2	17
2019	1.4	0.6	-0.1 - 3.0	25	2.9	0.5	2.2 - 3.5	12
2021	1.0	0.7	-0.7 - 2.4	20	2.3	0.4	1.7 - 2.7	8

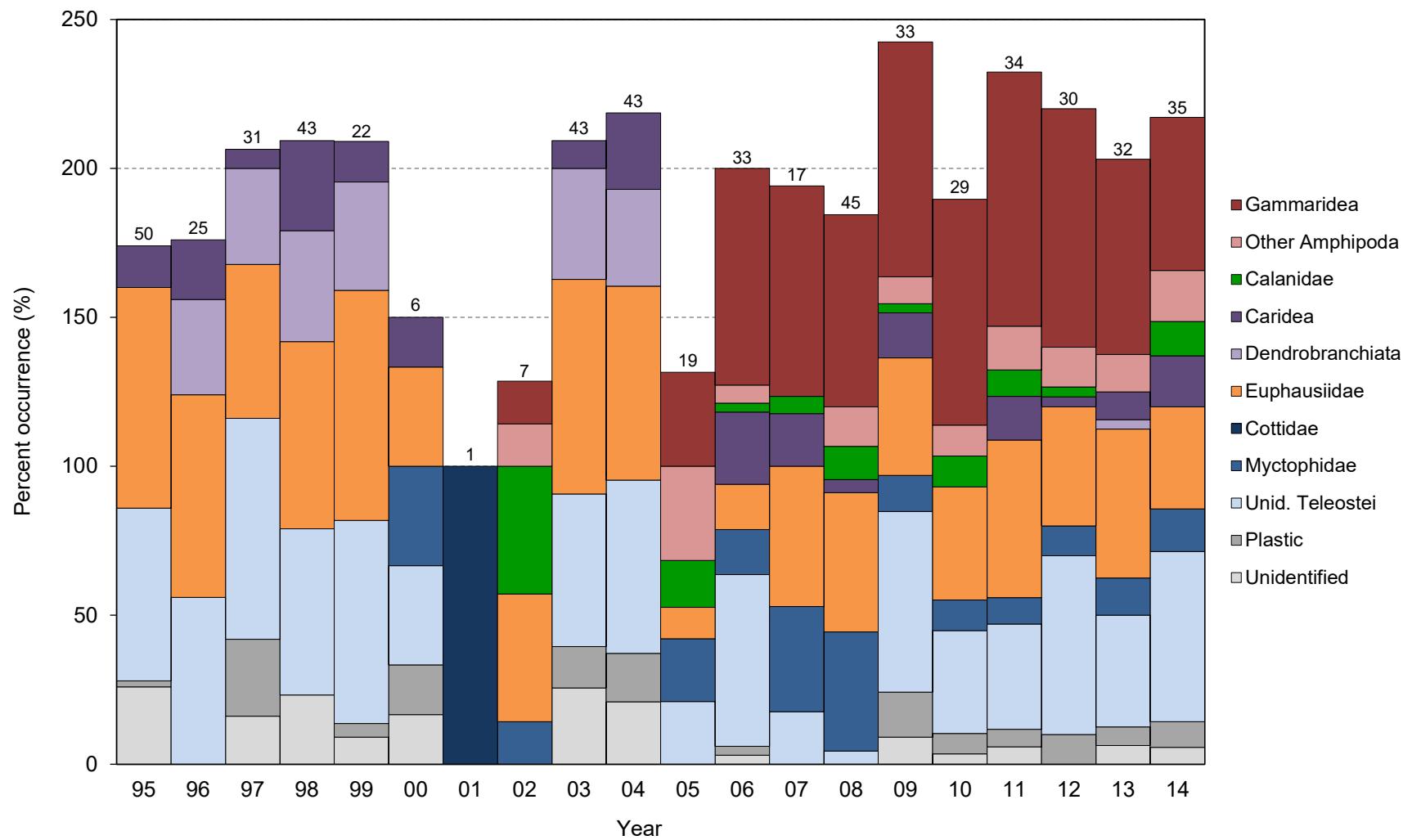


Figure 43. Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. Numbers above columns indicates sample sizes. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed.

Table 70. Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. samples	50	25	31	43	22 <sup>a</sup>	6	1	7	43	43	19	33	17
<b>Invertebrates</b>	<b>74.0</b>	<b>88.0</b>	<b>77.4</b>	<b>86.0</b>	<b>90.9</b>	<b>50.0</b>	-	<b>71.4</b>	<b>88.4</b>	<b>83.7</b>	<b>84.2</b>	<b>87.9</b>	<b>100.0</b>
<b>Amphipoda</b>	-	-	-	-	-	-	-	<b>28.6</b>	-	-	<b>63.2</b>	<b>78.8</b>	<b>70.6</b>
<b>Gammaridea</b>	-	-	-	-	-	-	-	<b>14.3</b>	-	-	<b>31.6</b>	<b>72.7</b>	<b>70.6</b>
<i>Calliopius</i> spp.	-	-	-	-	-	-	-	-	-	-	-	15.2	-
<i>Lysianassidae</i>	-	-	-	-	-	-	-	-	-	-	31.6	-	17.6
<i>Paracallisoma coecum</i>	-	-	-	-	-	-	-	-	-	-	-	69.7	52.9
Other Gammaridea	-	-	-	-	-	-	-	14.3	-	-	-	6.1	5.9
Other Amphipoda	-	-	-	-	-	-	-	14.3	-	-	31.6	6.1	-
<b>Copepoda</b>	-	-	-	-	-	-	-	<b>42.9</b>	-	-	<b>15.8</b>	<b>3.0</b>	<b>5.9</b>
<b>Calanidae</b>	-	-	-	-	-	-	-	<b>42.9</b>	-	-	<b>15.8</b>	<b>3.0</b>	<b>5.9</b>
<i>Neocalanus cristatus</i>	-	-	-	-	-	-	-	42.9	-	-	10.5	3.0	5.9
Other Calanidae	-	-	-	-	-	-	-	-	-	-	5.3	-	-
Other Copepoda	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Decapoda</b>	<b>14.0</b>	<b>48.0</b>	<b>38.7</b>	<b>58.1</b>	<b>45.5</b>	<b>16.7</b>	-	-	<b>41.9</b>	<b>44.2</b>	-	<b>24.2</b>	<b>17.6</b>
<b>Caridea</b>	<b>14.0</b>	<b>20.0</b>	<b>6.5</b>	<b>30.2</b>	<b>13.6</b>	<b>16.7</b>	-	-	<b>9.3</b>	<b>25.6</b>	-	<b>24.2</b>	<b>17.6</b>
Pandalidae	-	12.0	-	20.9	13.6	16.7	-	-	9.3	25.6	-	-	5.9
Other Caridea	14.0	8.0	6.5	9.3	-	-	-	-	-	2.3	-	24.2	11.8
<b>Dendrobranchiata</b>	-	<b>32.0</b>	<b>32.3</b>	<b>37.2</b>	<b>36.4</b>	-	-	-	<b>37.2</b>	<b>32.6</b>	-	-	-
<i>Litopenaeus vannamei</i>	-	32.0	32.3	37.2	36.4	-	-	-	37.2	32.6	-	-	-
Other Dendrobranchiata	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	2.3	-	-	-	-
<b>Euphausiacea</b>	<b>74.0</b>	<b>68.0</b>	<b>51.6</b>	<b>62.8</b>	<b>77.3</b>	<b>33.3</b>	-	<b>42.9</b>	<b>72.1</b>	<b>65.1</b>	<b>10.5</b>	<b>15.2</b>	<b>47.1</b>
<b>Euphausiidae</b>	<b>74.0</b>	<b>68.0</b>	<b>51.6</b>	<b>62.8</b>	<b>77.3</b>	<b>33.3</b>	-	<b>42.9</b>	<b>72.1</b>	<b>65.1</b>	<b>10.5</b>	<b>15.2</b>	<b>47.1</b>
<i>Thysanoessa</i> spp.	-	-	-	-	-	-	-	14.3	-	-	-	6.1	11.8
Unid. Euphausiidae	74.0	68.0	51.6	62.8	77.3	33.3	-	42.9	72.1	65.1	10.5	3.0	35.3
Other Euphausiidae	-	-	-	-	-	-	-	-	-	-	-	6.1	-
Other Invertebrates	-	4.0	22.6	-	-	-	-	-	9.3	4.7	-	-	-
<b>Fish</b>	<b>58.0</b>	<b>56.0</b>	<b>74.2</b>	<b>55.8</b>	<b>68.2</b>	<b>66.7</b>	<b>100.0</b>	<b>28.6</b>	<b>51.2</b>	<b>58.1</b>	<b>47.4</b>	<b>75.8</b>	<b>52.9</b>
<b>Teleostei</b>	<b>58.0</b>	<b>56.0</b>	<b>74.2</b>	<b>55.8</b>	<b>68.2</b>	<b>66.7</b>	<b>100.0</b>	<b>28.6</b>	<b>51.2</b>	<b>58.1</b>	<b>47.4</b>	<b>75.8</b>	<b>52.9</b>
<b>Cottidae</b>	-	-	-	-	-	-	<b>100.0</b>	-	-	-	-	-	-
Unid. Cottidae	-	-	-	-	-	-	<b>100.0</b>	-	-	-	-	-	-
<b>Myctophidae</b>	-	-	-	-	-	-	<b>33.3</b>	-	<b>14.3</b>	-	-	<b>21.1</b>	<b>15.2</b>
Unid. Myctophidae	-	-	-	-	-	-	33.3	-	-	-	-	21.1	15.2
Other Myctophidae	-	-	-	-	-	-	-	-	14.3	-	-	-	-
Unid. Teleostei	58.0	56.0	74.2	55.8	68.2	33.3	-	-	51.2	58.1	21.1	57.6	17.6
Other Teleostei	-	-	3.2	-	-	-	-	<b>14.3</b>	-	-	5.3	3.0	-

Table 70 (continued). Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	45	33 <sup>b</sup>	29	34	30 <sup>b</sup>	32	35	57	30	40	43	41
<b>Invertebrates</b>	<b>91.1</b>	<b>93.9</b>	<b>93.1</b>	<b>97.1</b>	<b>96.7</b>	<b>90.6</b>	<b>88.6</b>	pending	pending	pending	pending	pending
<b>Amphipoda</b>	<b>77.8</b>	<b>87.9</b>	<b>79.3</b>	<b>88.2</b>	<b>83.3</b>	<b>71.9</b>	<b>68.6</b>	-	-	-	-	-
<b>Gammaridea</b>	<b>64.4</b>	<b>78.8</b>	<b>75.9</b>	<b>85.3</b>	<b>80.0</b>	<b>65.6</b>	<b>51.4</b>	-	-	-	-	-
<i>Calliopius</i> spp.	-	24.2	-	35.3	16.7	25.0	22.9	-	-	-	-	-
<i>Lysianassidae</i>	51.1	-	-	-	-	-	2.9	-	-	-	-	-
<i>Paracallisoma coecum</i>	15.6	72.7	65.5	73.5	73.3	50.0	34.3	-	-	-	-	-
Other Gammaridea	-	9.1	13.8	14.7	13.3	18.8	11.4	-	-	-	-	-
Other Amphipoda	13.3	9.1	10.3	14.7	13.3	12.5	17.1	-	-	-	-	-
<b>Copepoda</b>	<b>11.1</b>	<b>3.0</b>	<b>10.3</b>	<b>8.8</b>	<b>13.3</b>	-	<b>11.4</b>	-	-	-	-	-
<b>Calanidae</b>	<b>11.1</b>	<b>3.0</b>	<b>10.3</b>	<b>8.8</b>	<b>3.3</b>	-	<b>11.4</b>	-	-	-	-	-
<i>Neocalanus cristatus</i>	8.9	-	10.3	5.9	3.3	-	11.4	-	-	-	-	-
Other Calanidae	4.4	3.0	3.4	2.9	-	-	-	-	-	-	-	-
Other Copepoda	-	-	-	-	10.0	-	-	-	-	-	-	-
<b>Decapoda</b>	<b>4.4</b>	<b>15.2</b>	-	<b>14.7</b>	<b>10.0</b>	<b>12.5</b>	<b>20.0</b>	-	-	-	-	-
<b>Caridea</b>	<b>4.4</b>	<b>15.2</b>	-	<b>14.7</b>	<b>3.3</b>	<b>9.4</b>	<b>17.1</b>	-	-	-	-	-
Pandalidae	-	-	-	-	-	-	-	-	-	-	-	-
Other Caridea	4.4	15.2	-	14.7	3.3	9.4	17.1	-	-	-	-	-
<b>Dendrobranchiata</b>	-	-	-	-	-	<b>3.1</b>	-	-	-	-	-	-
<i>Litopenaeus vannamei</i>	-	-	-	-	-	-	-	-	-	-	-	-
Other Dendrobranchiata	-	-	-	-	-	3.1	-	-	-	-	-	-
Other Decapoda	-	-	-	-	6.7	-	2.9	-	-	-	-	-
<b>Euphausiacea</b>	<b>46.7</b>	<b>39.4</b>	<b>37.9</b>	<b>52.9</b>	<b>40.0</b>	<b>50.0</b>	<b>34.3</b>	-	-	-	-	-
<b>Euphausiidae</b>	<b>46.7</b>	<b>39.4</b>	<b>37.9</b>	<b>52.9</b>	<b>40.0</b>	<b>50.0</b>	<b>34.3</b>	-	-	-	-	-
<i>Thysanoessa</i> spp.	33.3	9.1	10.3	8.8	23.3	15.6	17.1	-	-	-	-	-
Unid. Euphausiidae	8.9	30.3	17.2	23.5	13.3	21.9	17.1	-	-	-	-	-
Other Euphausiidae	4.4	-	13.8	23.5	10.0	25.0	-	-	-	-	-	-
Other Invertebrates	-	9.1	6.9	2.9	13.3	3.1	11.4	-	-	-	-	-
<b>Fish</b>	<b>44.4</b>	<b>72.7</b>	<b>44.8</b>	<b>44.1</b>	<b>70.0</b>	<b>53.1</b>	<b>71.4</b>	-	-	-	-	-
<b>Teleostei</b>	<b>44.4</b>	<b>72.7</b>	<b>44.8</b>	<b>44.1</b>	<b>70.0</b>	<b>53.1</b>	<b>71.4</b>	-	-	-	-	-
<b>Cottidae</b>	-	-	-	-	-	-	-	-	-	-	-	-
Unid. Cottidae	-	-	-	-	-	-	-	-	-	-	-	-
<b>Myctophidae</b>	<b>40.0</b>	<b>12.1</b>	<b>10.3</b>	<b>8.8</b>	<b>10.0</b>	<b>12.5</b>	<b>14.3</b>	-	-	-	-	-
Unid. Myctophidae	33.3	12.1	10.3	8.8	10.0	12.5	14.3	-	-	-	-	-
Other Myctophidae	6.7	-	-	-	-	-	-	-	-	-	-	-
Unid. Teleostei	4.4	60.6	34.5	35.3	60.0	37.5	57.1	-	-	-	-	-
Other Teleostei	-	-	-	-	-	3.1	-	-	-	-	-	-

Table 70 (continued). Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Other</b>	<b>26.0</b>	-	<b>32.3</b>	<b>23.3</b>	<b>13.6</b>	<b>33.3</b>	-	-	<b>34.9</b>	<b>34.9</b>	-	<b>9.1</b>	-
Plastic	2.0	-	25.8	-	4.5	16.7	-	-	14.0	16.3	-	3.0	-
Unidentified	26.0	-	16.1	23.3	9.1	16.7	-	-	25.6	20.9	-	3.0	-
Other	-	-	3.2	-	-	-	-	-	-	4.7	-	3.0	-

Table 70 (continued). Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2018	2019	2021
<b>Other</b>	-	<b>24.2</b>	<b>20.7</b>	<b>26.5</b>	<b>10.0</b>	<b>18.8</b>	<b>14.3</b>	-	-	-	-	-	-
Plastic	-	15.2	6.9	5.9	10.0	6.3	8.6	-	-	-	-	-	-
Unidentified	-	9.1	3.4	5.9	-	6.3	5.7	-	-	-	-	-	-
Other	-	-	6.9	14.7	-	6.3	-	-	-	-	-	-	-

<sup>a</sup>Data for 25 additional samples are currently lost.

<sup>b</sup>One additional sample is still pending analysis.

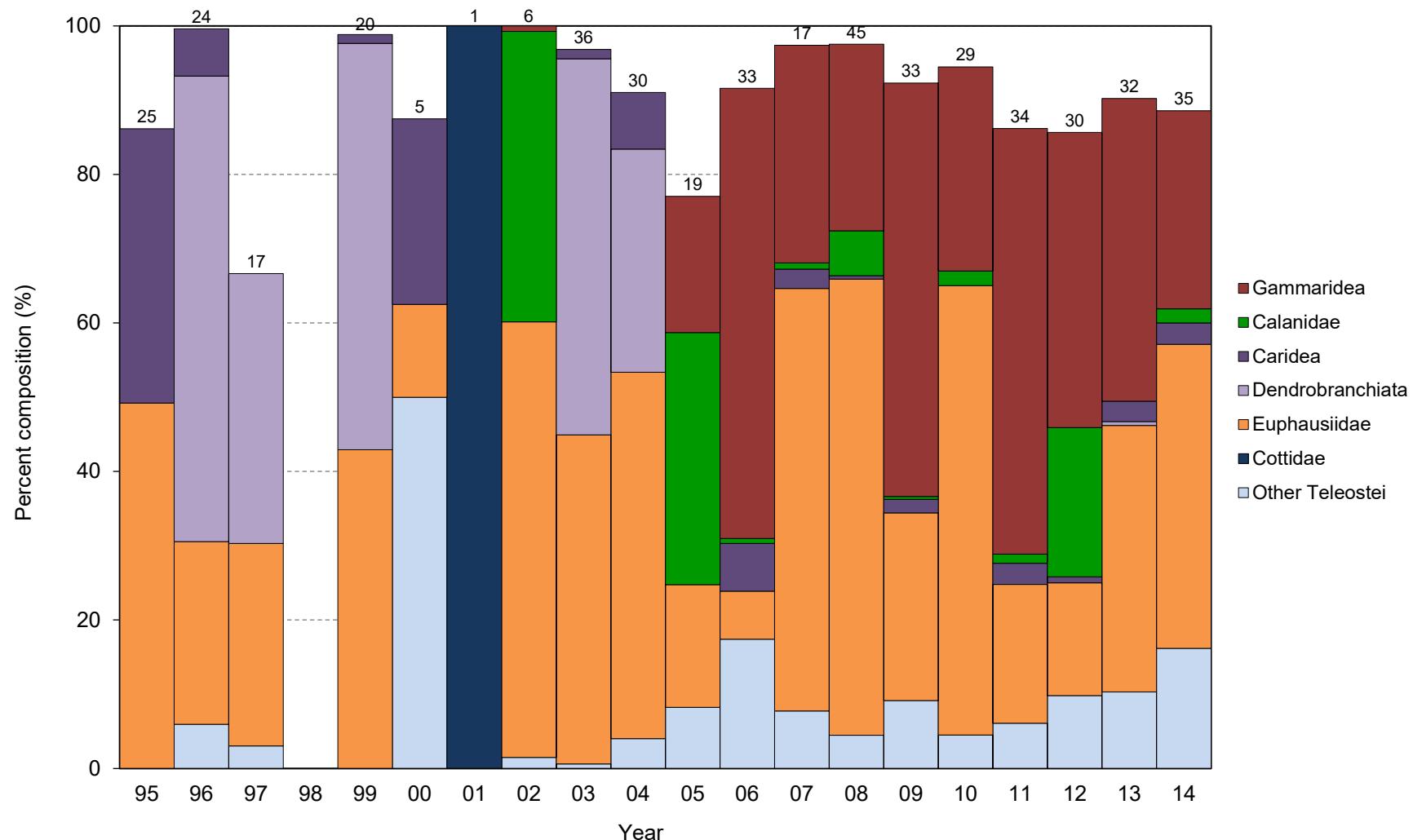


Figure 44. Percent composition of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. Numbers above columns indicates sample sizes. No count data exist for 1998 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed.

Table 71. Percent composition of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No count data exist for 1998 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	1996	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007
No. samples	25	24	17	20	5	1	6	36	30	19	33	17
No. individuals	130	252	66	170	8	1	133	158	223	109	155	116
<b>Invertebrates</b>	<b>90.0</b>	<b>94.0</b>	<b>69.7</b>	<b>98.8</b>	<b>37.5</b>	-	<b>98.5</b>	<b>96.8</b>	<b>89.2</b>	<b>91.7</b>	<b>80.0</b>	<b>92.2</b>
<b>Amphipoda</b>	-	-	-	-	-	-	<b>0.8</b>	-	-	<b>40.4</b>	<b>63.2</b>	<b>29.3</b>
<b>Gammaridea</b>	-	-	-	-	-	-	<b>0.8</b>	-	-	<b>18.3</b>	<b>60.6</b>	<b>29.3</b>
<i>Paracallisoma coecum</i>	-	-	-	-	-	-	-	-	-	-	52.9	22.4
Other Gammaridea	-	-	-	-	-	-	0.8	-	-	18.3	7.7	6.9
Other Amphipoda	-	-	-	-	-	-	-	-	-	22.0	2.6	-
<b>Copepoda</b>	-	-	-	-	-	-	<b>39.1</b>	-	-	<b>33.9</b>	<b>0.6</b>	<b>0.9</b>
Calanidae	-	-	-	-	-	-	39.1	-	-	33.9	0.6	0.9
<b>Decapoda</b>	<b>36.9</b>	<b>69.0</b>	<b>36.4</b>	<b>55.9</b>	<b>25.0</b>	-	-	<b>51.9</b>	<b>37.7</b>	-	<b>6.5</b>	<b>2.6</b>
Caridea	36.9	6.3	-	1.2	25.0	-	-	1.3	7.6	-	6.5	2.6
<b>Dendrobranchiata</b>	-	<b>62.7</b>	<b>36.4</b>	<b>54.7</b>	-	-	-	<b>50.6</b>	<b>30.0</b>	-	-	-
<i>Litopenaeus vannamei</i>	-	62.7	36.4	54.7	-	-	-	50.6	30.0	-	-	-
Other Dendrobranchiata	-	-	-	-	-	-	-	-	-	-	-	-
Other Decapoda	-	-	-	-	-	-	-	-	-	-	-	-
<b>Euphausiacea</b>	<b>49.2</b>	<b>24.6</b>	<b>27.3</b>	<b>42.9</b>	<b>12.5</b>	-	<b>58.6</b>	<b>44.3</b>	<b>49.3</b>	<b>16.5</b>	<b>6.5</b>	<b>56.9</b>
<b>Euphausiidae</b>	<b>49.2</b>	<b>24.6</b>	<b>27.3</b>	<b>42.9</b>	<b>12.5</b>	-	<b>58.6</b>	<b>44.3</b>	<b>49.3</b>	<b>16.5</b>	<b>6.5</b>	<b>56.9</b>
Unid. Euphausiidae	49.2	24.6	27.3	42.9	12.5	-	57.9	44.3	49.3	16.5	0.6	39.7
Other Euphausiidae	-	-	-	-	-	-	0.8	-	-	-	5.8	17.2
Other Invertebrates	3.8	0.4	6.1	-	-	-	-	0.6	2.2	0.9	3.2	2.6
<b>Fish</b>	-	<b>6.0</b>	<b>3.0</b>	-	<b>50.0</b>	<b>100.0</b>	<b>1.5</b>	<b>0.6</b>	<b>4.0</b>	<b>8.3</b>	<b>17.4</b>	<b>7.8</b>
<b>Teleostei</b>	-	<b>6.0</b>	<b>3.0</b>	-	<b>50.0</b>	<b>100.0</b>	<b>1.5</b>	<b>0.6</b>	<b>4.0</b>	<b>8.3</b>	<b>17.4</b>	<b>7.8</b>
<b>Cottidae</b>	-	-	-	-	-	<b>100.0</b>	-	-	-	-	-	-
Unid. Cottidae	-	-	-	-	-	100.0	-	-	-	-	-	-
Other Teleostei	-	6.0	3.0	-	50.0	-	1.5	0.6	4.0	8.3	17.4	7.8
Other	10.0	-	27.3	-	-	-	-	2.5	6.7	-	2.6	-

Table 71 (continued). Percent composition of major prey items in diets of Leach's storm-petrel chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of regurgitations collected from adults returning to the colony to feed chicks or from chicks themselves. No count data exist for 1998 and no diet samples were collected in 2017 or 2020; samples were collected in 2015-2016, 2018-2019, and 2021 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
No. samples	45	33 <sup>b</sup>	29	34	30 <sup>b</sup>	32	35	57	30	40	43	41
No. individuals	446	273	309	246	244	184	210	pending	pending	pending	pending	pending
<b>Invertebrates</b>	<b>95.5</b>	<b>86.8</b>	<b>93.9</b>	<b>84.6</b>	<b>88.9</b>	<b>86.4</b>	<b>81.4</b>	-	-	-	-	-
<b>Amphipoda</b>	<b>26.5</b>	<b>56.8</b>	<b>28.8</b>	<b>60.2</b>	<b>41.8</b>	<b>42.9</b>	<b>31.9</b>	-	-	-	-	-
<b>Gammaridea</b>	<b>25.1</b>	<b>55.7</b>	<b>27.5</b>	<b>57.3</b>	<b>39.8</b>	<b>40.8</b>	<b>26.7</b>	-	-	-	-	-
<i>Paracallisoma coecum</i>	2.7	31.5	25.9	40.2	32.4	25.0	15.7	-	-	-	-	-
Other Gammaridea	22.4	24.2	1.6	17.1	7.4	15.8	11.0	-	-	-	-	-
Other Amphipoda	1.3	1.1	1.3	2.8	2.0	2.2	5.2	-	-	-	-	-
<b>Copepoda</b>	<b>6.1</b>	<b>0.4</b>	<b>1.9</b>	<b>1.2</b>	<b>21.7</b>	-	<b>1.9</b>	-	-	-	-	-
Calanidae	6.1	0.4	1.9	1.2	20.1	-	1.9	-	-	-	-	-
<b>Decapoda</b>	<b>0.4</b>	<b>1.8</b>	-	<b>2.8</b>	<b>1.6</b>	<b>3.3</b>	<b>3.3</b>	-	-	-	-	-
Caridea	0.4	1.8	-	2.8	0.8	2.7	2.9	-	-	-	-	-
<b>Dendrobranchiata</b>	-	-	-	-	-	<b>0.5</b>	-	-	-	-	-	-
<i>Litopenaeus vannamei</i>	-	-	-	-	-	-	-	-	-	-	-	-
Other Dendrobranchiata	-	-	-	-	-	0.5	-	-	-	-	-	-
Other Decapoda	-	-	-	-	0.8	-	0.5	-	-	-	-	-
<b>Euphausiacea</b>	<b>61.4</b>	<b>25.3</b>	<b>60.5</b>	<b>18.7</b>	<b>15.2</b>	<b>35.9</b>	<b>41.0</b>	-	-	-	-	-
<b>Euphausiidae</b>	<b>61.4</b>	<b>25.3</b>	<b>60.5</b>	<b>18.7</b>	<b>15.2</b>	<b>35.9</b>	<b>41.0</b>	-	-	-	-	-
Unid. Euphausiidae	48.7	23.1	46.9	7.3	2.9	12.5	12.4	-	-	-	-	-
Other Euphausiidae	12.8	2.2	13.6	11.4	12.3	23.4	28.6	-	-	-	-	-
Other Invertebrates	1.1	2.6	2.6	1.6	8.6	4.3	3.3	-	-	-	-	-
<b>Fish</b>	<b>4.5</b>	<b>9.2</b>	<b>4.5</b>	<b>6.1</b>	<b>9.8</b>	<b>10.3</b>	<b>16.2</b>	-	-	-	-	-
<b>Teleostei</b>	<b>4.5</b>	<b>9.2</b>	<b>4.5</b>	<b>6.1</b>	<b>9.8</b>	<b>10.3</b>	<b>16.2</b>	-	-	-	-	-
<b>Cottidae</b>	-	-	-	-	-	-	-	-	-	-	-	-
Unid. Cottidae	-	-	-	-	-	-	-	-	-	-	-	-
Other Teleostei	4.5	9.2	4.5	6.1	9.8	10.3	16.2	-	-	-	-	-
Other	-	4.0	1.6	9.3	1.2	3.3	2.4	-	-	-	-	-

<sup>a</sup>Data for 25 additional samples are currently lost.

<sup>b</sup>One additional sample is still pending analysis.

Table 72. Morphological measurements of adult Leach's storm-petrels at St. Lazaria Island, Alaska. No data were collected in 2017 or 2020.

Year	Mass (g)				Wing chord (mm)				Diagonal tarsus (mm)			
	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range	n
2003	40	4.8	27 - 49	44	151	4.2	143 - 162	42	-	-	-	-
2004	xx <sup>a</sup>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2005	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2006	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2007	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2008	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2009	41	3.8	25 - 48	45	148	3.4	140 - 154	42	-	-	-	-
2010	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2011	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2012	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2013	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2014	42	3.6	32 - 51	124	150	3.4	141 - 159	127	23.5	0.8	21.7 - 26.5	127
2015	42	5.0	31 - 55	98	152	3.3	144 - 158	73	23.7	0.7	22.0 - 25.3	99
2016	43	4.3	35 - 55	133	151	3.2	143 - 161	134	23.5	0.9	21.0 - 25.8	106
2018	41	3.2	36 - 50	56	152	3.0	145 - 158	46	23.9	1.0	21.9 - 25.6	49
2019	42	5.6	33 - 52	17	147	3.2	142 - 152	17	23.4	0.7	21.4 - 24.6	17
2021	41	4.2	33 - 50	23	148	3.1	143 - 152	23	23.4	0.8	22.2 - 25.2	23

<sup>a</sup>xx indicates data potentially exist but have not yet been incorporated.

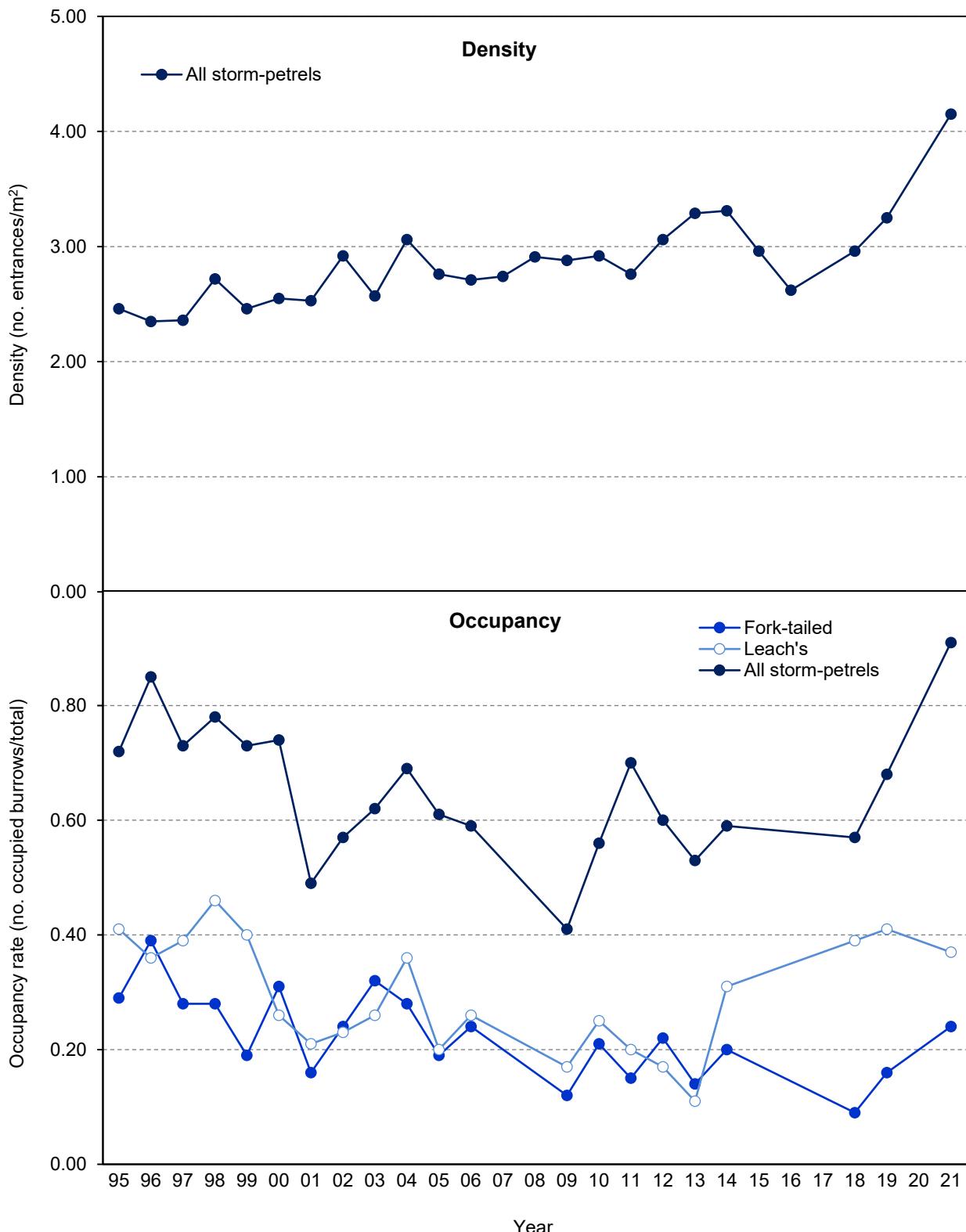


Figure 45. Burrow entrance densities and chamber occupancy rates of storm-petrels on index plots at St. Lazaria Island, Alaska. Values are shown only for years in which data exist for all plots (plots 5, 6, 9, 11, and 14 for density and plots 9, 11, and 14 for occupancy). No data were collected in 2017 or 2020.

Table 73. Burrow entrance densities of storm-petrels on index plots at St. Lazaria Island, Alaska. Density is expressed as the number of small/medium burrow entrances (<14.5 cm diameter) per m<sup>2</sup>. Summary statistics are calculated only for years in which data exist for plots 5, 6, 9, 11, and 14 (plot 3 is no longer monitored due to its fragility and instability). No data were collected in 2017 or 2020.

Year	Plot						Total	Mean	SD
	3	5	6	9 <sup>a</sup>	11 <sup>b</sup>	14 <sup>b</sup>			
1993	-	2.72	1.49	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1994	-	2.84	1.12	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1995	1.13	3.18	1.31	2.83	2.47	2.55	2.46	2.47	0.71
1996	1.06	2.58	1.34	3.01	2.39	2.55	2.35	2.37	0.62
1997	1.38	2.90	1.34	2.83	2.31	2.39	2.36	2.35	0.62
1998	1.38	3.54	1.52	3.22	2.63	2.55	2.72	2.69	0.77
1999	1.56	2.97	1.45	2.97	2.39	2.47	2.46	2.45	0.62
2000	1.56	3.22	1.38	3.22	2.47	2.23	2.55	2.50	0.77
2001	1.38	2.90	1.34	3.29	2.79	2.39	2.53	2.54	0.74
2002	1.10	3.68	1.73	3.75	2.55	2.39	2.92	2.82	0.87
2003	1.06	3.33	1.49	3.08	2.55	2.15	2.57	2.52	0.74
2004	0.88	4.78	1.59	3.26	2.63	2.47	3.06	2.94	1.18
2005	0.57	3.54	1.59	3.29	2.87	2.31	2.76	2.72	0.78
2006	0.92	3.47	1.63	3.43	2.23	2.31	2.71	2.61	0.81
2007	1.24	3.50	1.56	3.22	2.71	2.63	2.74	2.72	0.75
2008	0.92	3.75	1.73	3.82	2.23	2.31	2.91	2.77	0.95
2009	0.74	3.79	1.52	3.61	2.87	2.23	2.88	2.80	0.95
2010	-	4.07	1.56	3.57	2.47	2.39	2.92	2.81	1.00
2011	0.81	3.40	1.66	3.68	2.31	2.15	2.76	2.64	0.86
2012	0.50	4.99	1.42	3.82	2.0	1.67	3.06	2.79	1.55
2013	1.17	5.31	1.20	4.07	2.31	2.71	3.29	3.12	1.60
2014	0.81	5.24	1.24	4.14	2.39	2.71	3.31	3.14	1.56
2015	-	3.26	1.63	4.28	2.63	2.63	2.96	2.88	0.97
2016	-	2.51	1.27	4.21	2.47	2.47	2.62	2.59	1.05
2018	-	3.18	1.66	4.31	2.54	2.78	2.96	2.89	0.97
2019	-	3.92	1.94	4.28	2.62	2.94	3.25	3.14	0.95
2021	-	6.54	2.40	4.73	2.62	2.94	4.15	3.85	1.76
Plot area (m <sup>2</sup> )	28.3	28.3	28.3	28.3	12.6	12.6	110.1	-	-

<sup>a</sup>Plot established late in 1994.

<sup>b</sup>Plot established in 1995.

<sup>c</sup>Summary statistics are not calculated in years when not all plots are monitored.

Table 74. Occupancy rates of fork-tailed storm-petrels on index plots at St. Lazaria Island, Alaska. Occupancy is expressed as the number of occupied burrows divided by the number of burrows with known contents. Summary statistics are calculated only for plots 6, 9, 11, and 14 (plots 3 and 5 are no longer monitored in all years due to their fragility and instability). No data were collected in 2017 or 2020.

Year	Plot						Total	Mean	SD
	3	5	6	9 <sup>a</sup>	11 <sup>b</sup>	14 <sup>b</sup>			
1993	0.09	0.05	0.06	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1994	0.20	0.32	0.31	0.15	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1995	0.59	0.28	0.35	0.28	0.31	0.26	0.29	0.30	0.04
1996	0.48	0.38	0.41	0.40	0.37	0.35	0.39	0.38	0.02
1997	0.27	0.14	0.32	0.23	0.31	0.36	0.28	0.30	0.05
1998	0.38	0.23	0.21	0.28	0.23	0.42	0.28	0.28	0.10
1999	0.29	0.10	0.21	0.15	0.22	0.21	0.19	0.19	0.03
2000	0.29	0.36	0.31	0.31	0.26	0.35	0.31	0.31	0.04
2001	-	0.08	0.07	0.14	0.19	0.31	0.16	0.18	0.10
2002	-	0.21	0.18	0.20	0.25	0.43	0.24	0.27	0.11
2003	-	0.26	0.27	0.29	0.34	0.44	0.32	0.34	0.08
2004	-	0.29	0.17	0.27	0.34	0.37	0.28	0.29	0.09
2005	-	0.16	0.13	0.11	0.33	0.33	0.19	0.23	0.12
2006	-	0.13	0.18	0.20	0.33	0.32	0.24	0.26	0.08
2007	-	-	0.06	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2008	-	-	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>
2009	-	-	0.12	0.11	0.13	0.16	0.12	0.13	0.02
2010	-	-	0.11	0.20	0.21	0.42	0.21	0.24	0.13
2011	-	-	0.00	0.11	0.24	0.33	0.15	0.17	0.15
2012	-	-	0.38	0.18	0.20	0.30	0.22	0.26	0.09
2013	-	-	0.06	0.17	0.07	0.22	0.14	0.13	0.08
2014	-	-	0.05	0.18	0.23	0.35	0.20	0.20	0.12
2015	-	-	-	0.17	0.42	0.40	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2016	-	-	-	0.03	0.04	0.20	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2018	-	-	0.06	0.05	0.22	0.19	0.09	0.13	0.09
2019	-	-	0.08	0.16	0.18	0.25	0.16	0.17	0.07
2021	-	-	0.24	0.12	0.48	0.27	0.24	0.28	0.15

<sup>a</sup>Plot established in 1994.

<sup>b</sup>Plot established in 1995.

<sup>c</sup>Summary statistics are not calculated in years when not all plots (plots 6, 9, 11, and 14) are monitored.

<sup>d</sup>Summary data from 2008 are missing and need to be recalculated from raw values.

Table 75. Occupancy rates of Leach's storm-petrels on index plots at St. Lazaria Island, Alaska. Occupancy is expressed as the number of occupied burrows over the number of burrows with known contents. Summary statistics are calculated only for plots 6, 9, 11, and 14 (plots 3 and 5 are no longer monitored in all years due to their fragility and instability). No data were collected in 2017 or 2020.

Year	Plot						Total	Mean	SD
	3	5	6	9 <sup>a</sup>	11 <sup>b</sup>	14 <sup>b</sup>			
1993	0.09	0.05	0.03	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1994	0.14	0.29	0.31	0.50	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1995	0.22	0.35	0.42	0.43	0.47	0.29	0.41	0.40	0.08
1996	0.29	0.30	0.41	0.37	0.43	0.19	0.36	0.35	0.11
1997	0.16	0.33	0.42	0.41	0.48	0.21	0.39	0.38	0.12
1998	0.17	0.37	0.55	0.53	0.52	0.16	0.46	0.44	0.19
1999	0.07	0.34	0.38	0.39	0.53	0.28	0.40	0.39	0.10
2000	0.06	0.15	0.28	0.27	0.44	0.10	0.26	0.27	0.14
2001	-	0.18	0.23	0.19	0.31	0.12	0.21	0.21	0.08
2002	-	0.19	0.26	0.23	0.32	0.11	0.23	0.23	0.09
2003	-	0.18	0.31	0.30	0.24	0.11	0.26	0.24	0.09
2004	-	0.31	0.37	0.42	0.34	0.23	0.36	0.34	0.08
2005	-	0.10	0.17	0.26	0.17	0.08	0.20	0.17	0.07
2006	-	0.23	0.29	0.28	0.29	0.18	0.26	0.26	0.05
2007	-	-	0.00	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2008	-	-	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>
2009	-	-	0.19	0.15	0.27	0.08	0.17	0.17	0.08
2010	-	-	0.08	0.32	0.32	0.17	0.25	0.22	0.12
2011	-	-	0.17	0.27	0.20	0.05	0.20	0.17	0.09
2012	-	-	0.00	0.21	0.24	0.11	0.17	0.14	0.11
2013	-	-	0.12	0.14	0.11	0.04	0.11	0.10	0.04
2014	-	-	0.20	0.36	0.46	0.08	0.31	0.27	0.17
2015	-	-	-	0.42	0.47	0.15	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2016	-	-	-	0.34	0.17	0.12	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2018	-	-	0.33	0.52	0.44	0.06	0.39	0.34	0.20
2019	-	-	0.36	0.50	0.55	0.20	0.41	0.39	0.14
2021	-	-	0.38	0.46	0.26	0.20	0.37	0.33	0.12

<sup>a</sup>Plot established in 1994.

<sup>b</sup>Plot established in 1995.

<sup>c</sup>Summary statistics are not calculated in years when not all plots (plots 6, 9, 11, and 14) are monitored.

<sup>d</sup>Summary data from 2008 are missing and need to be recalculated from raw values.

Table 76. Occupancy rates of all storm-petrels (includes fork-tailed, Leach's, and unknown species) on index plots at St. Lazaria Island, Alaska. Occupancy is expressed as the number of occupied burrows over the number of burrows with known contents. Summary statistics are calculated only for plots 6, 9, 11, and 14 (plots 3 and 5 are no longer monitored in all years due to their fragility and instability). No data were collected in 2017 or 2020.

Year	Plot						Total	Mean	SD
	3	5	6	9 <sup>a</sup>	11 <sup>b</sup>	14 <sup>b</sup>			
1993	0.35	0.18	0.09	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1994	0.43	0.61	0.61	0.71	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
1995	0.81	0.72	0.77	0.75	0.78	0.55	0.72	0.71	0.11
1996	0.86	0.77	0.94	0.89	0.87	0.61	0.85	0.83	0.15
1997	0.43	0.55	0.81	0.70	0.90	0.57	0.73	0.74	0.14
1998	0.67	0.68	0.76	0.85	0.77	0.65	0.78	0.76	0.09
1999	0.39	0.59	0.71	0.71	0.88	0.62	0.73	0.73	0.11
2000	0.48	0.75	0.69	0.73	0.93	0.65	0.74	0.75	0.12
2001	-	0.36	0.43	0.43	0.63	0.58	0.49	0.52	0.10
2002	-	0.53	0.55	0.49	0.68	0.71	0.57	0.61	0.10
2003	-	0.52	0.62	0.61	0.69	0.59	0.62	0.63	0.04
2004	-	0.64	0.60	0.75	0.69	0.67	0.69	0.68	0.06
2005	-	0.41	0.50	0.57	0.73	0.71	0.61	0.63	0.11
2006	-	0.48	0.54	0.54	0.75	0.64	0.59	0.62	0.10
2007	-	-	0.25	-	-	-	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2008	-	-	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>	- <sup>d</sup>
2009	-	-	0.40	0.40	0.46	0.38	0.41	0.41	0.03
2010	-	-	0.32	0.58	0.75	0.67	0.56	0.58	0.18
2011	-	-	0.50	0.78	0.72	0.67	0.70	0.67	0.12
2012	-	-	0.62	0.62	0.56	0.59	0.60	0.60	0.03
2013	-	-	0.41	0.60	0.41	0.57	0.53	0.50	0.10
2014	-	-	0.25	0.61	0.81	0.58	0.59	0.56	0.23
2015	-	-	-	0.67	0.95	0.60	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2016	-	-	-	0.43	0.43	0.48	- <sup>c</sup>	- <sup>c</sup>	- <sup>c</sup>
2018	-	-	0.44	0.59	0.77	0.50	0.57	0.59	0.13
2019	-	-	0.60	0.75	0.77	0.50	0.68	0.66	0.13
2021	-	-	0.83	0.96	0.96	0.87	0.91	0.90	0.07

<sup>a</sup>Plot established in 1994.

<sup>b</sup>Plot established in 1995.

<sup>c</sup>Summary statistics are not calculated in years when not all plots (plots 6, 9, 11, and 14) are monitored.

<sup>d</sup>Summary data from 2008 are missing and need to be recalculated from raw values.

Table 77. Burrow entrance densities and chamber occupancy rates of storm-petrels on index plots at St. Lazaria Island, Alaska in 2021. Density was not surveyed on plot 3, and occupancy was not assessed on plots 3 and 5. Summary statistics are calculated only for plots 5, 6, 9, 11, and 14 for density; and plots 6, 9, 11, and 14 for occupancy.

Parameter	Plot						Total	Mean	SD
	3	5	6	9	11	14			
<b>Density<sup>a</sup></b>									
No. burrow entrances <sup>b</sup>	-	185	68	134	33	37	457	-	-
Total area (m <sup>2</sup> )	-	28.3	28.3	28.3	12.6	12.6	110.1	-	-
Density of burrow entrances	-	6.54	2.40	4.73	2.62	2.94	4.15	3.85	1.76
<b>Occupancy</b>									
No. burrows occupied (O) <sup>c</sup> by:									
Fork-tailed storm-petrels	-	-	7	6	11	4	28	-	-
Leach's storm-petrels	-	-	11	23	6	3	43	-	-
All storm-petrels <sup>d</sup>	-	-	24	48	22	13	107	-	-
Total no. burrows w/ known contents (N) <sup>e</sup>	-	-	29	50	23	15	117	-	-
Occupancy rate (O/N) of:									
Fork-tailed storm-petrels	-	-	0.24	0.12	0.48	0.27	0.24	0.28	0.15
Leach's storm-petrels	-	-	0.38	0.46	0.26	0.20	0.37	0.33	0.12
All storm-petrels <sup>d</sup>	-	-	0.83	0.96	0.96	0.87	0.91	0.90	0.07

<sup>a</sup>Density is expressed as the number of small/medium burrow entrances per m<sup>2</sup>.

<sup>b</sup>Number of burrow entrances comprise all small/medium entrances viewable from the outside, regardless of the presence of a chamber or numerous branching tunnels further in. Numbers of small and medium entrances were combined since small entrances have been artificially enlarged by arms reaching in to check burrow contents.

<sup>c</sup>For occupancy, burrows are those with a chamber that, at some point in the season, contained an adult with unknown status (BU) on two consecutive checks or an egg, fresh membrane/eggshell fragments, or chick on at least one check; nest does not have to have known reproductive fate. Nests with multiple chambers are counted as separate "burrows".

<sup>d</sup>Includes fork-tailed, Leach's, and unknown species.

<sup>e</sup>Burrows with known contents are those with a chamber that were either occupied (see definition above) or confirmed empty (burrow ends could be reached).

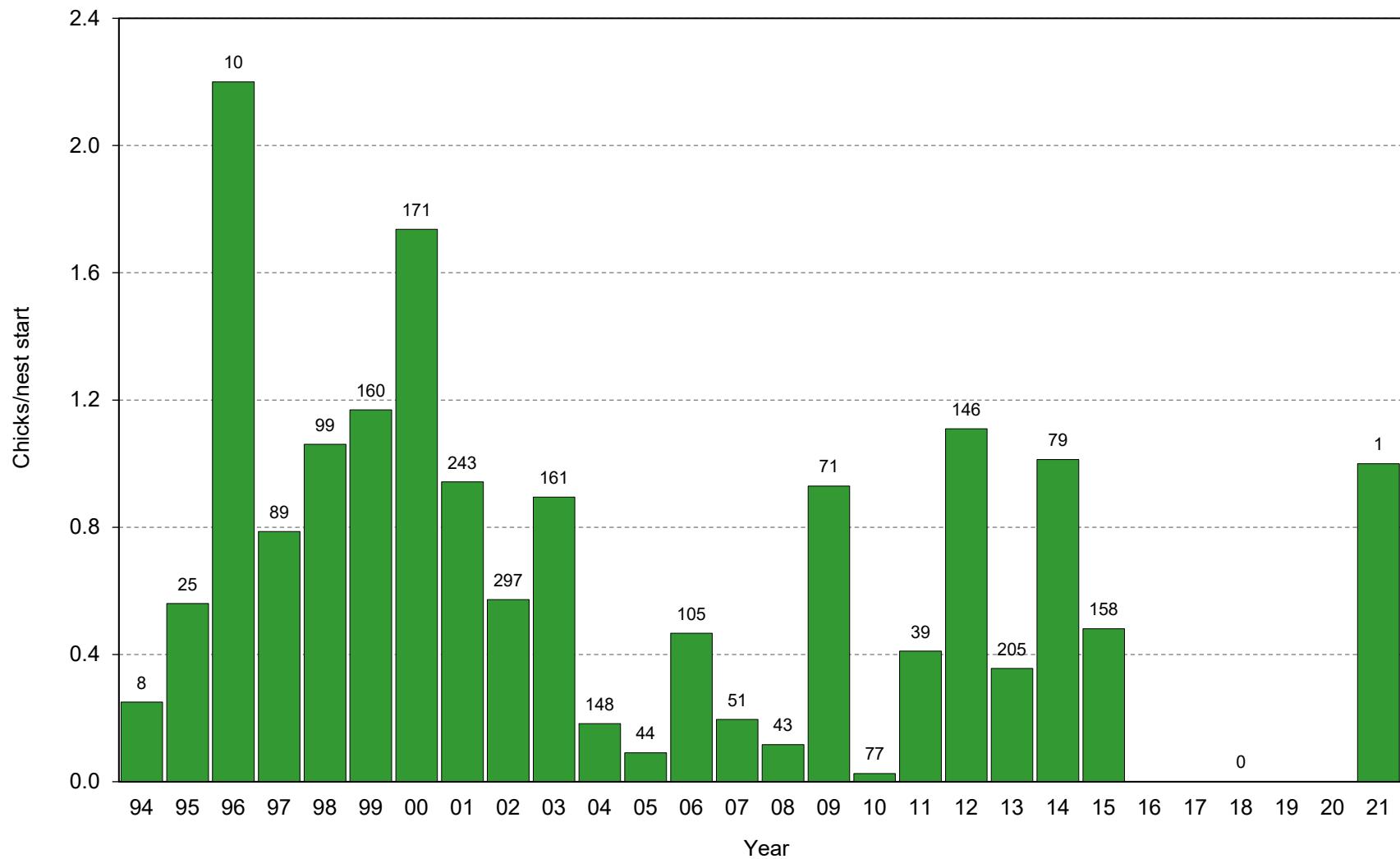


Figure 46. Reproductive performance of pelagic cormorants at St. Lazaria Island, Alaska, as determined by a Boom-or-Bust methodology. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). No data were collected in 2017 or 2020; no pelagic cormorants nested on St. Lazaria in 2018.

Table 78. Reproductive performance of pelagic cormorants at St. Lazaria Island, Alaska, as determined by a Boom-or-Bust methodology. Measures of success are based on a count of nests (or maximum of several counts) conducted early in the nesting period and a count of large chicks (or maximum of several counts) conducted late in the nesting period. No data were collected in 2017 or 2020; no pelagic cormorants nested on St. Lazaria in 2018.

Year	Total nest starts (A)	Nest sites w/ x chicks <sup>a</sup> :				Nest sites w/ chicks (D)	Total chicks (E)	Mean brood size (E/D)		Prop. nest sites w/ chicks (D/A) <sup>b</sup>		Chicks/nest start (E/A) <sup>b</sup>		Date(s) of max. nest count	Date(s) of max. chick count	Sampling design <sup>c</sup>
		1	2	3	4			Total	SD <sup>d</sup>	Total	SD	Total	SD <sup>d</sup>			
1994	8	0	1	0	0	1	2	2.0	0.00	0.13	0.12	0.3	0.23	xx <sup>e</sup>	xx	Simple random
1995	25	3	4	1	0	8	14	1.8	0.24	0.32	0.09	0.6	0.18	xx	xx	Simple random
1996	10	0	5	4	0	9	22	2.4	0.17	0.90	0.09	2.2	0.28	xx	xx	Simple random
1997	89	-	-	-	-	36	70	1.9	-	0.40	0.05	0.8	-	xx	xx	Simple random
1998	99	12	27	13	0	52	105	2.0	0.10	0.53	0.05	1.0	0.11	xx	xx	Simple random
1999	160	48	49	7	5	109	187	1.7	0.07	0.68	0.04	1.2	0.08	xx	xx	Simple random
2000	171	-	-	-	-	297	1.8 <sup>f</sup>	-	-	-	-	1.7	-	xx	21 Sep	Simple random
2001	243	-	-	-	-	229	-	-	-	-	-	0.9	-	xx	4 Sep	Simple random
2002	297	29	40	18	1	88	170	1.9	0.08	0.29	0.03	0.6	0.06	xx	xx	Simple random
2003	161	25	33	15	2	75	144	1.9	0.09	0.47	0.04	0.9	0.09	xx	3 Sep	Simple random
2004	148	12	6	1	0	19	27	1.4	0.13	0.13	0.03	0.2	0.04	9+29 Jul	29 Aug	Simple random
2005	44	4	0	0	0	4	4	1.0	0.00	0.09	0.04	0.1	0.04	15+26 Jul	7 Sep	Simple random
2006	105	7	15	4	0	26	49	1.9	0.12	0.25	0.04	0.5	0.09	3 Jul-10 Aug	3 Sep	Simple random
2007	51	2	4	0	0	6	10	1.7	0.19	0.12	0.05	0.2	0.08	19 Jun-30 Jul	27 Aug+9 Sep	Simple random
2008	43	1	2	0	0	3	5	1.7	0.27	0.07	0.04	0.1	0.07	15 Jul+9 Aug	2 Sep	Simple random
2009	71	14	14	8	0	36	66	1.8	0.13	0.51	0.06	0.9	0.13	6-31 Jul	8 Sep	Simple random
2010	77	-	-	-	-	-	2	-	-	-	-	<0.1	0.02	xx	xx	Simple random
2011	39	3	2	3	0	8	16	2.0	0.31	0.21	0.07	0.4	0.14	9-23 Jul	10 Aug	Simple random
2012	146	9	32	27	2	70	162	2.3	0.09	0.48	0.04	1.1	0.10	20Jun+14Jul	9 Aug	Simple random
2013	205	9	20	8	0	37	73	2.0	0.11	0.18	0.03	0.4	0.06	28 Jul	6 Sep	Simple random
2014	79	16	29	5	0	50	80	1.6	0.09	0.63	0.05	1.0	0.11	20 Aug, 5, 9 Sep	4, 5 Sep	Simple random
2015	158	28	16	4	1	49	76	1.6	0.10	0.31	0.04	0.5	0.07	22 Jun, 1, 11Jul	3 Sep	Simple random
2016	189	0	0	0	0	0	-	-	0.00	0.00	0.0	0.00	0.00	16 Jun	-	Simple random
2019	130	0	0	0	0	0	-	-	0.00	0.00	0.0	0.00	0.00	16 Jun-6 Aug	-	Simple random
2021	1	1	0	0	0	1	1	1.0	-	1.00	-	1.0	-	29 Jun-9 Jul	27 Aug	Simple random

<sup>a</sup>Numbers of chicks may represent a minimum count as not all may have been visible.

<sup>b</sup>Proportion of nest sites with chicks (D/A) and chicks/nest start (E/A) may be considered maximum potential values of productivity (F/A) and fledglings/nest start (G/A), respectively, based on the assumption that all chicks counted eventually fledge.

<sup>c</sup>Sampling for cormorants with Boom-or-Bust methodology is based on nests as the sample unit. For simple random sampling, standard deviation values are calculated using  $\sqrt{\rho * (1 - \rho) / n}$ , where  $\rho$  is the success rate and  $n$  is the sample size of individual nests.

<sup>d</sup>Standard deviation values for reproductive success parameters that can exceed 1 are calculated by non-parametric bootstrapping.

<sup>e</sup>xx indicates data potentially exist but have not yet been summarized.

<sup>f</sup>Brood size data from a subset of 103 nests with 194 chicks.

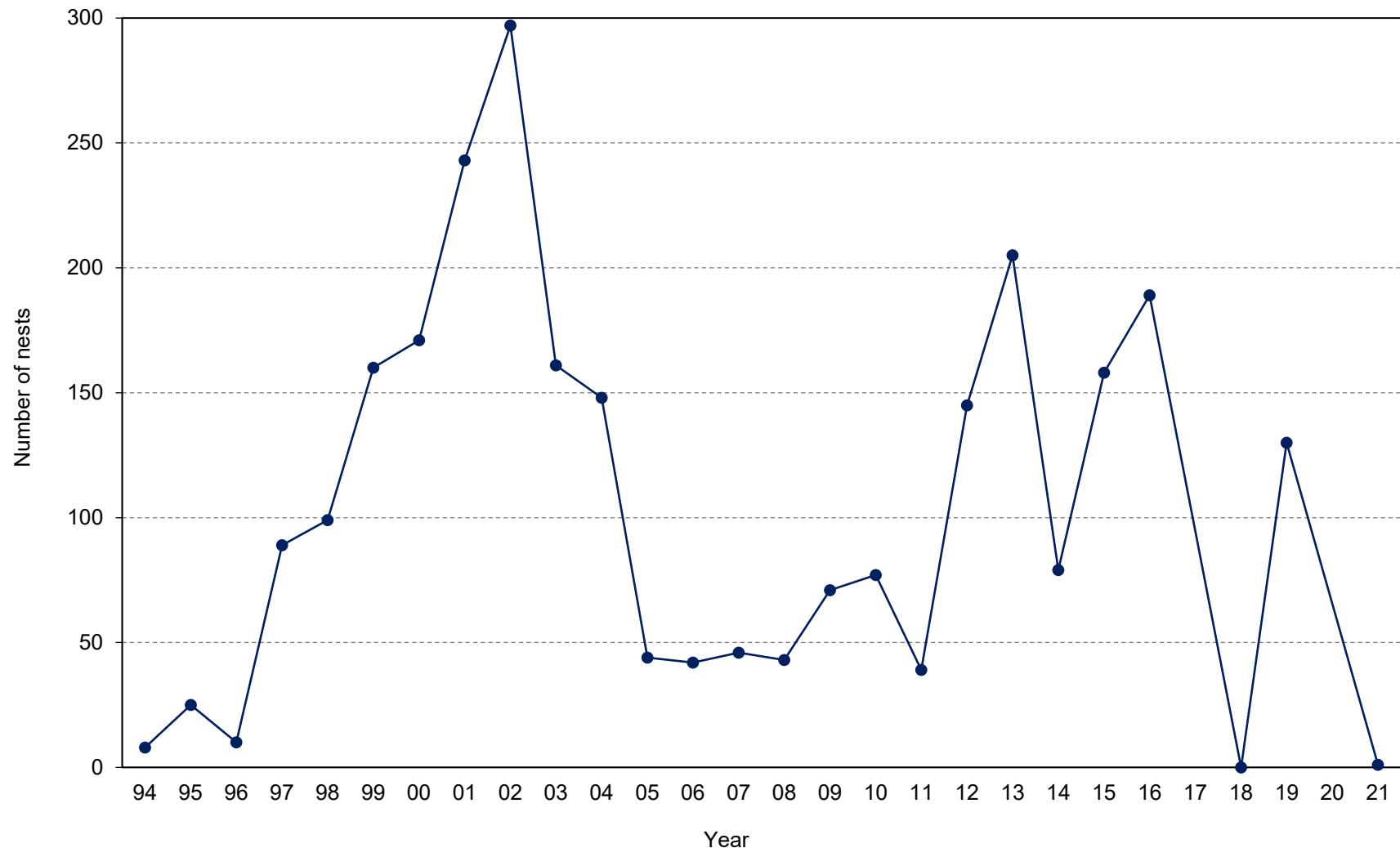


Figure 47. Numbers of pelagic cormorant nests counted at St. Lazaria Island, Alaska. Each year's value is the sum of maximum nest counts of all locations and plots throughout the breeding season. No data were collected in 2017 or 2020.

Table 79. Numbers of pelagic cormorant nests at St. Lazaria Island, Alaska. Values are derived by summing maximum nest counts across all locations or plots throughout the breeding season; numbers of breeding birds are calculated by doubling nest numbers. No data were collected in 2017 or 2020.

Year	No. nests	Estimated no. breeding birds
1994	8	16
1995	25	50
1996	10	20
1997	89	178
1998	99	198
1999	160	320
2000	171	342
2001	243	486
2002	297	594
2003	161	322
2004	148	296
2005	44	88
2006	42	84
2007	46	92
2008	43	86
2009	71	142
2010	77	154
2011	39	78
2012	145	290
2013	205	410
2014	79	158
2015	158	316
2016	189	378
2018	0	0
2019	130	260
2021	1	2

Table 80. Numbers of pelagic cormorants counted during circumnavigation surveys at St. Lazaria Island, Alaska, in 2021.

Plot	Date	Mean	SD
	4 Jul		
NE – NW	11	11	-
NW – SW	0	0	-
SW – SE	1	1	-
SE – NE	0	0	-
Total	12	12	-

Table 81. Numbers of pelagic cormorant nests counted during circumnavigation surveys at St. Lazaria Island, Alaska, in 2021.

Plot	Date	Mean	SD	Max.
	4 Jul			
NE – NW	1	1	-	1
NW – SW	0	0	-	0
SW – SE	0	0	-	0
SE – NE	0	0	-	0
Total	1	1	-	1

Table 81. Numbers of pelagic cormorant nests counted from land at St. Lazaria, Alaska in 2021. Total nest number on the island is the sum of maximum nest counts across all locations or plots.

Plot	Date		Max.
	29 Jun	9 Jul	
Dropzone	1	1	1
Total	1	1	1

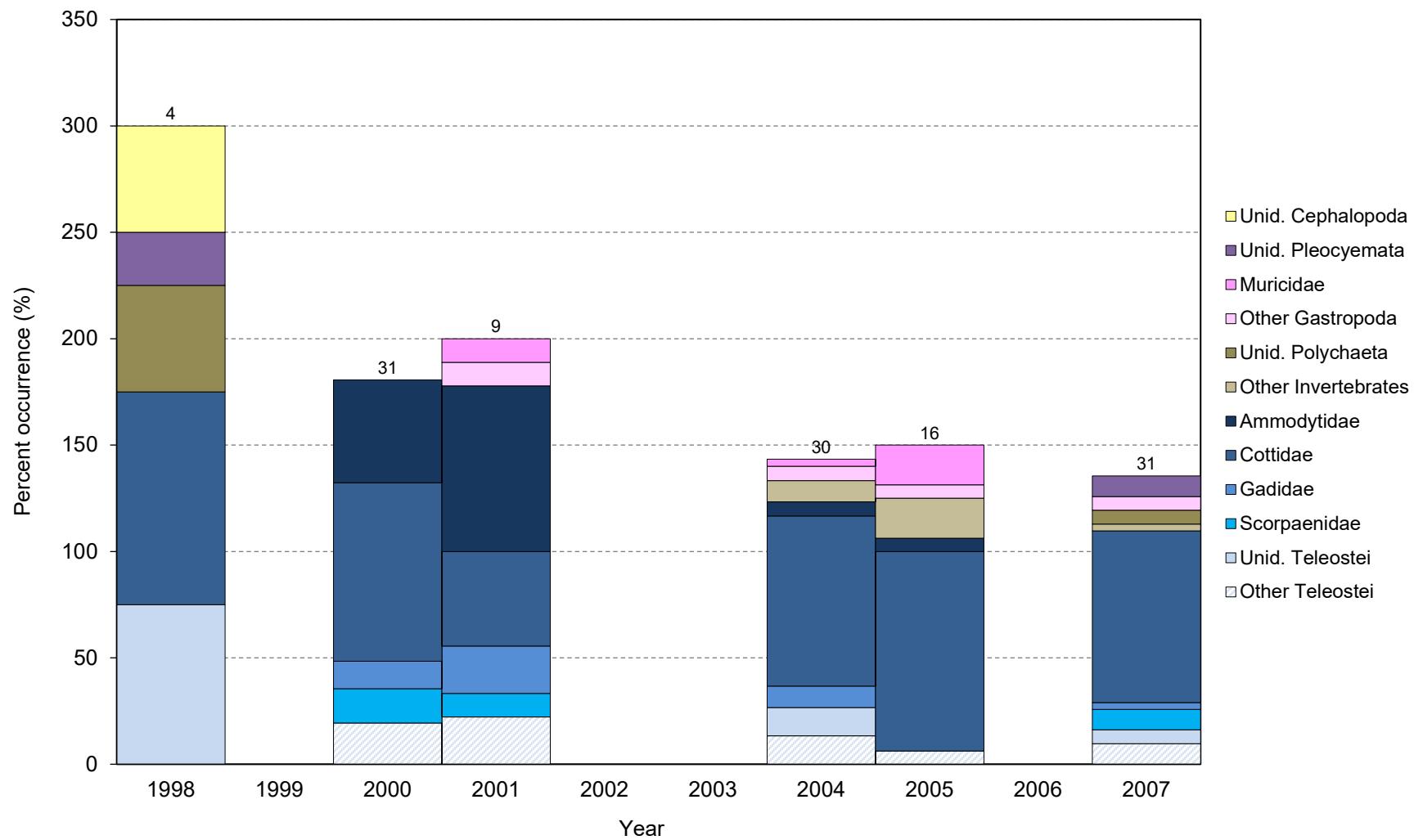


Figure 48. Frequency of occurrence of major prey items in diets of pelagic cormorant chicks at St. Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of boluses collected from adults returning to the colony to feed chicks and from chicks themselves. Numbers above columns indicates sample sizes. No diet samples were collected in 1999, 2002-2003, 2010-2013, or 2016-2021; samples were collected in 2006, 2008-2009, and 2014-2015 but have not yet been analyzed.

Table 83. Frequency of occurrence of major prey items in diets of pelagic cormorant chicks at St Lazaria Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was measured and identified in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of boluses collected from adults returning to the colony to feed chicks and from chicks themselves. No diet samples were collected in 1999, 2002-2003, 2010-2013, or 2016-2021; samples were collected in 2006, 2008-2009, and 20014-2015 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2000	2001	2004	2005	2006	2007	2008	2009	2014	2015
No. samples	4	31	9	30	16	52	31	104	89	4	6
<b>Invertebrates</b>	<b>50.0</b>	-	<b>33.3</b>	<b>33.3</b>	<b>43.8</b>	pending	<b>25.8</b>	pending	pending	pending	pending
<b>Cephalopoda</b>	<b>50.0</b>	-	-	<b>3.3</b>	-	-	-	-	-	-	-
Unid. Decabrachia	50.0	-	-	-	-	-	-	-	-	-	-
Other Decabrachia	-	-	-	3.3	-	-	-	-	-	-	-
<b>Decapoda</b>	<b>25.0</b>	-	<b>11.1</b>	-	-	-	<b>9.7</b>	-	-	-	-
Unid. Pleocyemata	25.0	-	-	-	-	-	9.7	-	-	-	-
Other Decapoda	-	-	<b>11.1</b>	-	-	-	-	-	-	-	-
<b>Gastropoda</b>	-	-	<b>22.2</b>	<b>10.0</b>	<b>25.0</b>	-	<b>6.5</b>	-	-	-	-
<b>Muricidae</b>	-	-	<b>11.1</b>	<b>3.3</b>	<b>18.8</b>	-	-	-	-	-	-
<i>Nucella</i> spp.	-	-	11.1	3.3	18.8	-	-	-	-	-	-
Other Gastropoda	-	-	11.1	6.7	6.3	-	6.5	-	-	-	-
<b>Polychaeta</b>	<b>50.0</b>	-	-	<b>10.0</b>	<b>6.3</b>	-	<b>6.5</b>	-	-	-	-
Unid. Polychaeta	50.0	-	-	-	-	-	6.5	-	-	-	-
Other Polychaeta	-	-	-	10.0	6.3	-	-	-	-	-	-
Other Invertebrates	-	-	-	10.0	18.8	-	3.2	-	-	-	-
<b>Fish</b>	<b>100.0</b>	<b>100.0</b>	<b>88.9</b>	<b>100.0</b>	<b>100.0</b>	-	<b>96.8</b>	-	-	-	-
<b>Teleostei</b>	<b>100.0</b>	<b>100.0</b>	<b>88.9</b>	<b>100.0</b>	<b>100.0</b>	-	<b>96.8</b>	-	-	-	-
<b>Ammodytidae</b>	-	<b>48.4</b>	<b>77.8</b>	<b>6.7</b>	<b>6.3</b>	-	-	-	-	-	-
<i>Ammodytes</i> spp.	-	48.4	77.8	6.7	6.3	-	-	-	-	-	-
<b>Cottidae</b>	<b>100.0</b>	<b>83.9</b>	<b>44.4</b>	<b>80.0</b>	<b>93.8</b>	-	<b>80.6</b>	-	-	-	-
<i>Hemilepidotus jordani</i>	-	80.6	22.2	-	-	-	-	-	-	-	-
<i>Hemilepidotus</i> spp.	100.0	-	-	36.7	12.5	-	22.6	-	-	-	-
<i>Icelinus borealis</i>	-	9.7	-	3.3	37.5	-	-	-	-	-	-
Unid. Cottidae	-	51.6	44.4	60.0	81.3	-	64.5	-	-	-	-
Other Cottidae	-	-	-	-	6.3	-	9.7	-	-	-	-
<b>Gadidae</b>	-	<b>12.9</b>	<b>22.2</b>	<b>10.0</b>	-	-	<b>3.2</b>	-	-	-	-
Unid. Gadidae	-	6.5	22.2	6.7	-	-	3.2	-	-	-	-
Other Gadidae	-	6.5	-	3.3	-	-	-	-	-	-	-
<b>Scorpaenidae</b>	-	<b>16.1</b>	<b>11.1</b>	-	-	-	<b>9.7</b>	-	-	-	-
Unid. Scorpaenidae	-	16.1	11.1	-	-	-	-	-	-	-	-
Other Scorpaenidae	-	-	-	-	-	-	9.7	-	-	-	-
Unid. Teleostei	75.0	-	-	13.3	-	-	6.5	-	-	-	-
Other Teleostei	-	19.4	22.2	13.3	6.3	-	9.7	-	-	-	-

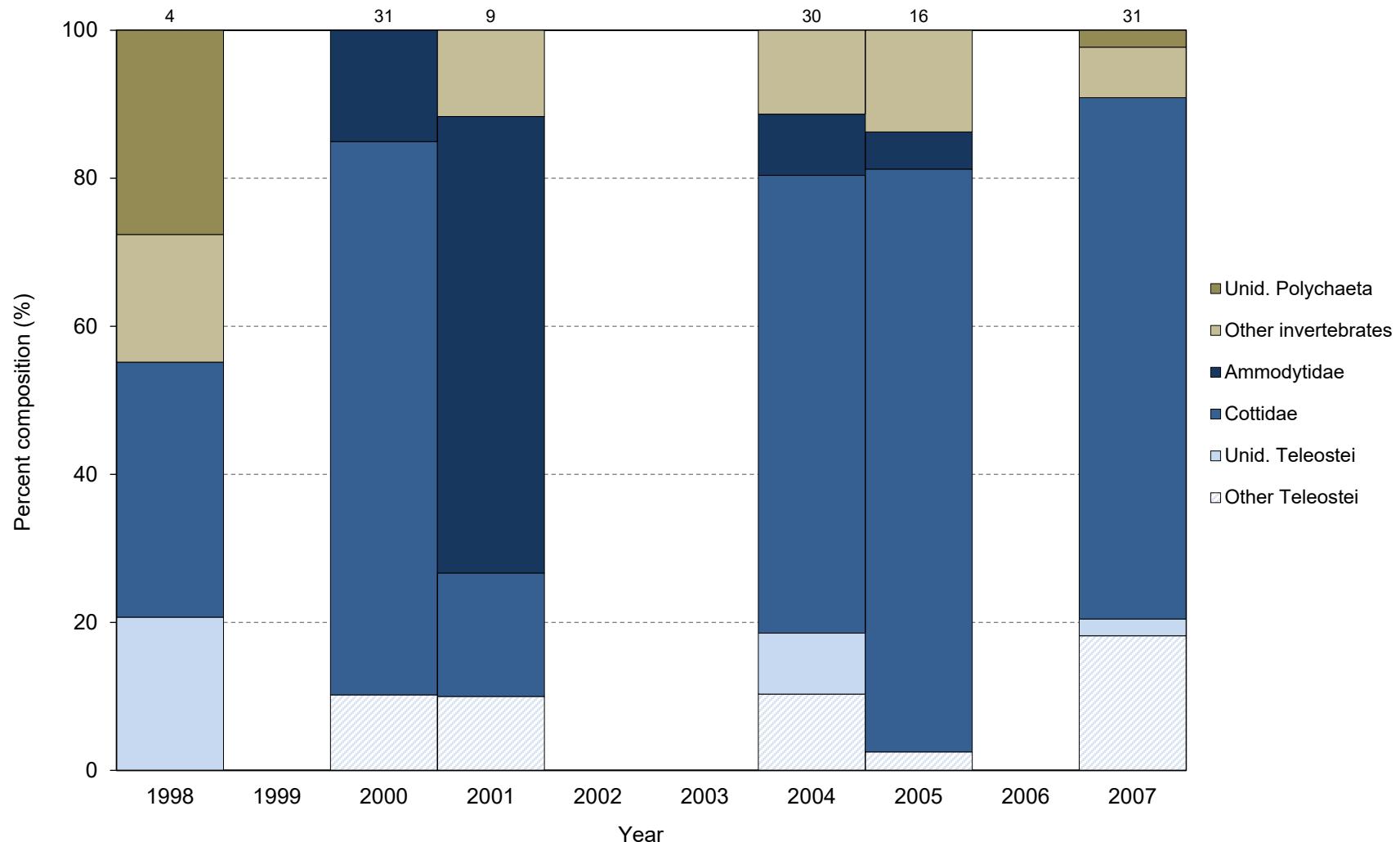


Figure 49. Percent composition of major prey items in diets of pelagic cormorant chicks at St. Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of boluses collected from adults returning to the colony to feed chicks and from chicks themselves. Numbers above columns indicates sample sizes. No diet samples were collected in 1999, 2002-2003, 2010-2013, or 2016-2021; samples were collected in 2006, 2008-2009, and 2014-2015 but have not yet been analyzed.

Table 84. Percent composition of major prey items in diets of pelagic cormorant chicks at St Lazaria Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as “others” in their respective taxonomic group with values in bold showing totals for those taxa. Count data are not always available for all samples or prey items so sample sizes for percent composition may not equal those for frequency of occurrence and some prey types may not appear in percent composition data although they were present in diet samples. Samples consist of boluses collected from adults returning to the colony to feed chicks and from chicks themselves. No diet samples were collected in 1999, 2002-2003, 2010-2013, or 2016-2021; samples were collected in 2006, 2008-2009, and 2014-2015 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2000	2001	2004	2005	2006	2007	2008	2009	2014	2015
No. samples	4	31	9	30	16	52	31	104	89	4	6
No. individuals	29	186	60	97	80	pending	88	pending	pending	pending	pending
<b>Invertebrates</b>	<b>44.8</b>	-	<b>11.7</b>	<b>11.3</b>	<b>13.8</b>	-	<b>9.1</b>	-	-	-	-
<b>Polychaeta</b>	<b>27.6</b>	-	-	-	-	-	<b>2.3</b>	-	-	-	-
Unid. Polychaeta	27.6	-	-	-	-	-	2.3	-	-	-	-
Other Polychaeta	-	-	-	4.1	3.8	-	-	-	-	-	-
Other Invertebrates	17.2	-	11.7	11.3	13.8	-	6.8	-	-	-	-
<b>Fish</b>	<b>55.2</b>	<b>100.0</b>	<b>88.3</b>	<b>88.7</b>	<b>86.3</b>	-	<b>90.9</b>	-	-	-	-
<b>Teleostei</b>	<b>55.2</b>	<b>100.0</b>	<b>88.3</b>	<b>88.7</b>	<b>86.3</b>	-	<b>90.9</b>	-	-	-	-
<b>Ammodytidae</b>	-	<b>15.1</b>	<b>61.7</b>	<b>8.2</b>	<b>5.0</b>	-	-	-	-	-	-
<i>Ammodytes</i> spp.	-	15.1	61.7	8.2	5.0	-	-	-	-	-	-
<b>Cottidae</b>	<b>34.5</b>	<b>74.7</b>	<b>16.7</b>	<b>61.9</b>	<b>78.8</b>	-	<b>70.5</b>	-	-	-	-
<i>Hemilepidotus jordani</i>	-	36.6	3.3	-	-	-	-	-	-	-	-
<i>Hemilepidotus</i> spp.	34.5	-	-	23.7	3.8	-	25.0	-	-	-	-
<i>Icelinus borealis</i>	-	11.8	-	5.2	38.8	-	-	-	-	-	-
Unid. Cottidae	-	26.3	13.3	33.0	36.3	-	45.5	-	-	-	-
Other Cottidae	-	-	-	-	-	-	-	-	-	-	-
Unid. Teleostei	20.7	-	-	8.2	-	-	2.3	-	-	-	-
Other Teleostei	-	10.2	10.0	10.3	2.5	-	18.2	-	-	-	-

Table 85. Numbers of birds detected during off-road point count survey (route 01) at St. Lazaria Island, Alaska. Data represent only individuals observed from survey points and do not include birds flying over census area; asterisks indicate species observed between points along the route but not at actual survey points. Data do not include birds counted after the 5-minute time limit in some years (2002, 2011 and 2012). No counts were conducted in 1995-1999, 2003-2010, 2013, 2017, or 2020.

Species	94	00	01	02	11	12	14	15	16	18	19	21
Green-winged teal	0	0	0	2*	0	0	0	0	0	0	0	0
Rufous hummingbird	<1	0	0	1	1*	1*	0	1	0	0	0	0
Black oystercatcher	1*	0	1	P* <sup>a</sup>	0	4*	3	8*	4*	4*	0	2
Thick-billed murre	0	0	0	P*	0	0	0	0	0	0	0	0
Pigeon guillemot	0	0	0	P*	0	0	0	7*	5*	5*	0	0
Marbled murrelet	1*	0	0	0	0	0	0	0	0	0	0	0
Tufted puffin	0	0	0	P*	0	0	0	0	0	0	0	0
Glaucous-winged gull	<1	0	1	2	0	0	100*	200*	200*	100*	2	1
Fork-tailed storm-petrel	3	0	0	2	0	0	4	1	1	6	0	1
Leach's storm-petrel	1	0	0	2	1	0	3	1	2	3	2	7
Pelagic cormorant	0	0	20-35	<1	0	0	0	0	10*	0	0	0
Bald eagle	2	1	5	1	1	3	4	2	4	7	1	5
Great horned owl	0	0	0	0	0	0	0	1*	0	0	0	0
Peregrine falcon	1	0	0	<1	0	0	0	1	0	0	1	0
Northwestern crow	7	6	6	10	1	10	12	16	7	20	7	16
Common raven	1	0	8	<1	4	0	3	0	0	0	0	1
Tree swallow	1	0	0	0	0	0	0	0	0	0	0	0
Brown creeper	1	0	0	0	1*	0	1	0	0	0	0	0
Pacific wren	2	5	7	6	8	3	4	12	6	8	5	4
Golden-crowned kinglet	4	0	1	0	2	2	2	3	0	5	0	4
Ruby-crowned kinglet	0	0	3	2	0	1	0	1	0	0	0	0
Swainson's thrush	3	3	6	5	8	5	3	9	3	8	3	9
Hermit thrush	<1	1	1	0	0	1	0	4	0	2	0	0
Varied thrush	0	0	0	0	0	3	0	0	0	0	0	0
Red crossbill	2	0	0	0	0	0	0	0	0	0	0	0
Pine siskin	0	0	1	0	0	4	0	6	0	2*	1	3
Fox sparrow	6	9	3	4	9	11	4	15	6	14	6	7
Song sparrow	1	2	1	1	4	0	2	7	3*	3	1	1
Unid. sparrow	0	0	0	0	0	0	0	0	1	0	0	0
Dark-eyed junco	0	0	0	0	0	0	0	2*	0	9	0	0
Orange-crowned warbler	5	4	3	4	6	6	6	8	3	0	5	5
Yellow warbler	0	0	0	0	1*	2	0	0	0	0	0	1
Townsend's warbler	1	0	1	0	3	0	0	0	0	0	1	2
Wilson's warbler	0	0	0	0	0	3	0	0	0	0	0	0
Date	16-30 Jun <sup>b</sup>	18, 20 Jun <sup>c</sup>	17, 25 Jun <sup>c</sup>	18, 28 Jun <sup>c</sup>	27 Jun	22 Jun	26 Jun	24 Jun	24 Jun	14 Jun	13 Jun	14 Jun
Survey design <sup>d</sup>	A	A	A	B	B	A	A	A	A	A	A	A

<sup>a</sup>P=species recorded as present but not counted.

<sup>b</sup>Data represent mean of four complete counts (16, 20, 29, 30 June).

<sup>c</sup>Data represent mean of two complete counts.

<sup>d</sup>A=5-minute counts, < and > 50m; B=5-minute counts, distance estimation out to 400m.

Table 86. Numbers of birds detected during off-road point count survey (route 01) at St. Lazaria Island, Alaska on 14 June 2021. Data represent only individuals observed from survey points and do not include birds flying over census area.

Species	Survey point			Total individuals <sup>a</sup>	% of total <sup>b</sup>	% of points <sup>c</sup>	Between points <sup>d</sup>
	1	2	3				
Black oystercatcher	1	0	0	1	1.5	33	-
Pigeon guillemot	0	0	0	0	-	-	P
Glaucous-winged gull	0	1	1	2	3.0	66	-
Fork-tailed storm-petrel	0	0	1	1	1.5	33	-
Leach's storm-petrel	2	1	4	7	10.4	100	-
Bald eagle	1	1	3	5	7.5	100	-
Northwestern crow	8	4	4	16	23.9	100	-
Common raven	0	1	0	1	1.5	33	-
Pacific wren	1	1	2	4	6.0	100	-
Golden-crowned kinglet	0	1	1	2	3.0	66	-
Swainson's thrush	1	4	4	9	13.4	100	-
Pine siskin	0	0	3	3	4.5	33	-
Fox sparrow	4	1	2	7	10.4	100	-
Song sparrow	1	0	0	1	1.5	33	-
Orange-crowned warbler	3	2	0	5	7.5	66	-
Yellow warbler	1	0	0	1	1.5	33	-
Townsend's warbler	0	2	0	2	3.0	33	-

<sup>a</sup>Total number of individuals detected at survey points (not including those observed between points).

<sup>b</sup>Represents the relative abundance of species, calculated as the percentage of the total number of all individual birds detected on survey.

<sup>c</sup>Percentage of survey points at which species was detected.

<sup>d</sup>Additional species observed between points along the route but not at actual survey points. P represents species that were present but not counted.

Table 87. Mean numbers of individuals found and encounter rates during Coastal Observation and Seabird Survey Team (COASST) surveys along Kruzof SE, Kruzof Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and do not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.5 km for Kruzof SE) divided by the number of surveys. No COASST surveys were conducted in 2015-2021.

Species	2006		2007		2008		2009		2010		2011		2012		2013		2014	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
All species	0.0	0.0	xx <sup>a</sup>	xx	0.0	0.0	0.0	0.0	xx	xx	xx	xx	0.0	0.0	0.0	0.0	0.0	0.0
n	2		xx		4		2		xx		xx		3		1		3	
First survey	7 Jun		xx		1 Jun		8 Jun		xx		xx		5 Jun		10 Jun		5 Jun	
Last survey	7 Jul		xx		29 Aug		15 Aug		xx		xx		30 Aug		-		18 Jul	

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

Table 88. Mean numbers of individuals found and encounter rates during COASST surveys along Kruzof SW, Kruzof Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and do not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.7 km for Kruzof SW) divided by the number of surveys. No COASST surveys were conducted in 2015-2021.

Species	2006		2007		2008		2009		2010		2011		2012		2013		2014	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Leach's storm-petrel	-	-	xx <sup>a</sup>	xx	-	-	0.5	1.0	xx	xx	xx	xx	-	-	-	-	-	-
All species	0.0	0.0	xx	xx	0.0	0.0	0.5	1.0	xx	xx	xx	xx	0.0	0.0	0.0	0.0	0.0	0.0
n	2		xx		4		2		xx		xx		3		1		3	
First survey	7 Jun		xx		1 Jun		8 Jun		xx		xx		5 Jun		10 Jun		5 Jun	
Last survey	7 Jul		xx		29 Aug		15 Aug		xx		xx		30 Aug		-		18 Jul	

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

Table 89. Results of beach oil surveys at St. Lazaria Island, Alaska. No oil surveys were conducted in 2017 or 2020.

Type of oil/oil products detected	Year												
	94	95	96	97	98	99	00	01	02	03	04	05	06
Sheen	0 <sup>a</sup>	0	0	0	0	0	0	0	0	0	0	0	0
Mousse	0	0	0	0	0	0	0	0	0	0	0	0	0
Tar ball <10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Tar ball ≥10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Patty <10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Patty ≥10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Survey date(s)	xx <sup>b</sup>	xx											

Table 89 (continued). Results of beach oil surveys at St. Lazaria Island, Alaska. No oil surveys were conducted in 2017 or 2020.

Type of oil/oil products detected	Year												
	07	08	09	10	11	12	13	14	15	16	18	19	21
Sheen	0	0	0	0	0	0	0	0	0	0	0	0	0
Mousse	0	0	0	0	0	0	0	0	0	0	0	0	0
Tar ball <10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Tar ball ≥10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Patty <10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Patty ≥10 cm diameter	0	0	0	0	0	0	0	0	0	0	0	0	0
Survey date(s)	xx	xx	xx	xx	xx	xx	xx	7 Jun	11 Jun 5 Jun, 31 Aug				

<sup>a</sup>'0' indicates no oil detected.

<sup>b</sup>xx indicates data potentially exist but have not yet been summarized.

Abundance categories were defined as follows:

Abundant: annual, sure to see many  
Common: annual, sure to see some  
Uncommon: annual, likely to see some  
Rare: annual but not guaranteed to see any  
Irregular: not annual but numerous records  
Casual: not annual, only a few records  
Accidental: only one or two records ever

Status categories are defined as follows:

Breeder: evidence breeding, either **confirmed** (observations of current nests, eggs, or chicks; adults carrying nesting materials or food to nests or chicks; recently fledged young; distraction displays) or **probable** (observations of pairs or territorial behavior)  
Resident non-breeder: occurs throughout season but does not breed at site  
Migrant: through-migrant, recorded regularly but only during migratory period  
Vagrant: recorded outside known breeding, wintering, and migrating range (category added in 2012)

Note that categories are general and should not change based on deviations in a single year.

## BIRDS

**Blue-winged teal** (*Spatula discors*). Casual migrant. Two birds were observed dabbling in intertidal pools on the edges of the gull colony on 30 May, 1 June, and 2 June.

**Northern shoveler** (*Spatula clypeata*). Casual migrant. A single bird was observed on 17 May in a tidepool in the gull colony. Northern shovelers have been recorded in seven of the 25 years for which records exist.

**American wigeon** (*Mareca americana*). Casual migrant. This species was observed for two consecutive days in a tidepool in the gull colony from 13-14 June.

**Mallard** (*Anas platyrhynchos*). Rare migrant. This species was observed on seven separate occasions throughout the season, both in tidepools and in the water off the north side of the island. Mallards are seen most years on St. Lazaria.

**Northern pintail** (*Anas acuta*). Rare migrant. One individual was observed in a pool in the gull colony on three occasions in May, and one in September. Northern pintails are recorded most years on St. Lazaria.

**Green-winged teal** (*Anas crecca*). Uncommon migrant. In 2021 green-winged teals were observed 11 days throughout the season, mostly in mid-May. Birds were mainly observed in pools in the gull colony, with a high count of seven individuals on 20 May. This is the most commonly detected dabbling duck on St. Lazaria, with sightings in most years.

**Harlequin duck** (*Histrionicus histrionicus*). Common resident non-breeder. Birds were seen almost every day from when the crew arrived through June and about half the days in July. All observations were of one to 55 individuals along the northern coast of the island.

**Surf scoter** (*Melanitta perspicillata*). Irregular migrant. Groups of migrating birds were seen off the south side of the island on two days in June, with a high count of 12 birds on 6 June.

**Merganser sp.** (*Mergus sp.*). One individual, not identified to species due to distance and brevity of observation, was observed flying by the island on 1 September.

**Red-necked grebe** (*Podiceps grisegena*). Irregular migrant. One individual was seen off the south side of the island on 6 June, flying by at a distance. This species has only been recorded on St. Lazaria four previous times, mostly recently in 2010, but is seen regularly during winter and migration in the greater Sitka area.

**Anna's hummingbird** (*Calypte anna*). Accidental vagrant. This individual, a female, was seen by both crew members and photographed at our hummingbird feeder in camp on 4 July. This species has had very few confirmed sightings in the greater Sitka area, and this is the first sighting recorded on St. Lazaria.

**Rufous hummingbird** (*Selasphorus rufus*). Common breeder. Birds were seen most days through June and July but not detected after 9 August. There was no evidence of breeding observed in 2021.

**Black oystercatcher** (*Haematopus bachmani*). Common breeder. In 2021 six pairs nested on St. Lazaria, all between the east and west hills of the island, amongst the gull colony. Chicks hatched in early June and of the six nests monitored, three fledged one chick each. The crew encountered a territorial pair on Howling Dog beach but could not locate a nest or chick(s) before the pair eventually stopped attending the area. However, the birds' behavior at Howling Dog suggested there was hatching success but no fledging success.

**Whimbrel** (*Numenius phaeopus*). Rare migrant. In 2021, this species was observed on eight days in May in groups ranging from one to six individuals, all in tidepools around the gull colony.

**Black turnstone** (*Arenaria melanocephala*). Common migrant. This species was observed on seven days over the 2021 season. Birds were first recorded on 8 July and observed sporadically throughout the rest of the season, in groups of one to five individuals.

**Red knot** (*Calidris canutus*). Accidental migrant. One individual, seen foraging with two short-billed dowitchers, was observed on 20 May in a large tidepool near the south edge of the island, just north of Guano Ridge. This is the first sighting recorded on St. Lazaria.



**Least sandpiper** (*Calidris minutilla*). Common migrant. Birds were observed on seven occasions in 2021, with a high count of three individuals on 20 July. All observations were made in various pools in the gull colony.

**Sandpiper sp.** (*Calidris* sp.). Common migrant. Peeps are most often encountered in the gull colony where it is frequently too loud to hear and therefore identify them. This happened on two occasions in 2021. It is likely that small *Calidris* sandpipers are least sandpipers but a semipalmated sandpiper has also been recorded on St. Lazaria on at least three occasions.

**Short-billed dowitcher** (*Limnodromus griseus*). Casual migrant. Birds were seen twice in 2021, in the intertidal pools surrounding the gull colony, once on 20 May (two individuals) and again on 19 July (one individual).

**Spotted sandpiper** (*Actitis macularius*). Common migrant. Birds were observed on 14 days in 2021, in nearly all non-forested areas of the island. It is possible that they bred on the island because recently fledged young were observed during mid-June, but no nests or further evidence of breeding were found.

**Wandering tattler** (*Tringa incana*). Common migrant. Birds were observed on six days in 2021 throughout the season. All observations were of single birds, foraging on the south side of the island near the landing. This species has been noted in most years on St. Lazaria.

**Lesser yellowlegs** (*Tringa flavipes*). Rare migrant. In 2021 this species was observed on three occasions in July, either singly or associating with greater yellowlegs, in the tidepools in the gull colony.

**Greater yellowlegs** (*Tringa melanoleuca*). Irregular migrant. Birds were observed 13 days throughout the 2021 season, sometimes associating with lesser yellowlegs or other shorebirds or small, visiting gulls. This species is recorded the majority of years on St. Lazaria.

**Tringa sp.** (*Tringa* sp.). One unidentified yellowlegs was seen on 20 July in the intertidal pools associated with the gull colony.

**Common murre** (*Uria aalge*). Abundant breeder. Birds were seen daily throughout the season. In 2021, ravens were observed preying upon the murre colony, and as a result, birds that nested on the edge of the colony suffered high rates of egg loss. However, unlike in other years, eagles and falcons were not observed at the colony, possibly contributing to higher chick survival. Five nests believed to be mixed-species nests (a common murre breeding with a thick-billed murre, or a common murre breeding with a hybrid murre) were monitored in 2021.

**Thick-billed murre** (*Uria lomvia*). Abundant breeder. Similar to common murres, thick-billed murres had high chick survival, possibly due to absence of heavy predation pressure by eagles or falcons. Five nests believed to be mixed-species nests (a common murre breeding with a thick-billed murre, or a common murre breeding with a hybrid murre) were monitored in 2021.

**Pigeon guillemot** (*Cephus columba*). Common breeder. Birds were observed throughout the season. Most of the pigeon guillemot nests are along the northern shoreline of the island, especially near the arch and on the northern part of the rock formation that makes the Big Grassy gull plot. There is an additional small colony on the SW murre cliff. Though many adults holding fish were observed, “first fish” dates were not noted in 2021.

**Marbled murrelet** (*Brachyramphus marmoratus*). Uncommon resident non-breeder. Birds were observed regularly from late June through the end of July in groups of two to four individuals off the south side of the island, loosely associating with the other alcids on the water.

**Ancient murrelet** (*Synthliboramphus antiquus*). Common breeder. Birds were heard on the one nocturnal attempt to detect them (14 June), and over a dozen carcasses total were found either singly or cached by a mink on both the west and east sides of the island. Adults were also seen on the south side on four occasions in July. A dead fledgling was observed on one occasion floating off the south side of the island sometime mid-season.

**Cassin's auklet** (*Ptychoramphus aleuticus*). Casual non-breeder. One individual was detected by AAE on 6 June off the south side of the island during a particularly birdy migratory push of waterbirds, but we did not detect any evidence of breeding in 2021. This species was confirmed breeding on St. Lazaria in 1999 but not in years since; no birds have been detected at all since 2013.

**Rhinoceros auklet** (*Cerorhinca monocerata*). Common breeder. Rhinoceros auklets breed around the periphery of the island but are concentrated most densely above the high cliffs on the northwest corner of the island. Adults were seen at night on the trail near BN2, at Random Chinup, and on the trail between Random Bridge the turnoff for BN8. Outside of research activities, adults were observed flying offshore and participating in feeding flocks throughout the season, in pairs and small groups. During the tufted puffin quadrat surveys more than 20 dead rhinoceros auklets, mostly chicks and some adults, were observed around the periphery of the tufted puffin colony.



**Tufted puffin** (*Fratercula cirrhata*). Common breeder. Birds were seen daily throughout the season, but high counts were not performed in 2021. Nelson et al. (1987) mapped this species as nesting along both the western and eastern sides of the island as well as the area on the west side of the island above the large tidepools. In addition to the mapped puffin colony area, hundreds of adults in total were observed loafing on the top of Big Grassy, on the periphery of the SW Murre colony, along the top of the vegetated spire on the NE corner of the island and the top of the vegetated spire near BN5. Additionally, though there is not a great view of the cliffs below BN15, puffins with bill loads circled by many times, indicating nesting activity below that plot.

**Sabine's gull** (*Xema sabini*). Accidental migrant. One hatch year bird was detected associating with a Bonaparte's gull on 24 July. This is the first sighting recorded on St. Lazaria.



**Bonaparte's gull** (*Chroicocephalus philadelphia*). Casual migrant. In 2021, a hatch-year individual was detected on four out of five consecutive days between 20-24 July, the last day of which it was accompanied by another migratory small gull.



**Short-billed gull** (previously mew gull) (*Larus brachyrhynchus*). Casual migrant. Adult in breeding plumage were seen five times throughout the season, but it is likely that younger birds of this species were also present but unidentified. Prior to 2021, mew gull (*Larus canus brachyrhynchus*), established throughout North America, was considered one of four subspecies of the near-holarctic *Larus canus* (widely known in modern times as common gull in the Old World and previously called mew gull). The American Ornithological Society (AOS) officially split and re-named *branchyrhynchus* birds as short-billed gull in 2021.

**Herring gull** (*Larus argentatus*). Irregular migrant. In 2021, one adult bird in breeding plumage was identified on 7 August. However, this was likely not the only individual of its species to visit St. Lazaria this year, as several suspected but non-definitively identified sub-adults were seen in August.

**Glaucous-winged gull** (*Larus glaucescens*). Abundant breeder. Glaucous-winged gulls experienced record hatch success (0.80) and tied with 2001 for record clutch size (2.9) on St. Lazaria in 2021. Though a record 293 nest starts (which hatched a record 487 chicks) were monitored by the 2021 crew, there was a decrease in nests and chicks within the unchanging boundaries of population plots. However, the decrease is not substantial and seems to fall along the general upward trends for these plots.

**Glaucous gull** (*Larus hyperboreus*). Accidental vagrant. One immature individual was seen and photographed on 21 July, loafing with glaucous-winged gulls on an offshore rock on the north side of the island.



**Red-throated loon** (*Gavia stellata*). Accidental migrant. June 6. One individual was seen flying by the south side of the island on 6 June. This is the first sighting recorded on St. Lazaria.

**Pacific loon** (*Gavia pacifica*). Uncommon migrant. Birds were seen on three days in June 2021, with a high count of 15 individuals seen from one of the storm-petrel productivity plots on the east side (BN15) on 6 June.

**Loon sp.** (*Gavia sp.*). Four loons, unidentified to species due to distance and the brevity of the observation, were seen off the south side on 12 June.

**Fork-tailed storm-petrel** (*Hydrobates furcatus*). Abundant breeder. Birds were seen regularly during research activities (phenology, chick growth, productivity, and diet sampling) and were observed flying and heard calling around camp at night.

**Leach's storm-petrel** (*Hydrobates leucorhous*). Abundant breeder. Birds were seen regularly during research activities (phenology, chick growth, productivity, and diet sampling) and observed flying and heard calling around camp at night. There was a higher density of this species compared to fork-tailed storm-petrels virtually everywhere on the island this year except for the salmonberry thicket area including plots BN1 and BN2.

**Unidentified shearwater** (*Ardenna* spp.). Uncommon migrant. In 2021 dark shearwaters representing either short-tailed or sooty shearwaters were frequently observed offshore in mid-August, with a high count of 40 on 17 August. One individual was seen sitting on the water in the intertidal pools and just off the island near the landing on 16 and 17 August, apparently exhausted but not in obvious distress. Sooty shearwaters have been observed the majority of years on St. Lazaria.

**Pelagic cormorant** (*Uria pelagicus*). Abundant breeder. The crew in 2021 only noted one nesting attempt by pelagic cormorants in the area known as “Dropzone”, and a circumnavigation on 4 July did not find any additional nests. Old nesting structures in “Cormorant Cathedral” languished, and a peregrine falcon was seen regularly flying in that area and occasionally perching in old nests with avian prey. After no nesting attempts on the northeast shore of the island were noted by mid-July, the crew stopped checking the area for new nests. The one nest produced two chicks, one of which was found dead while searching for boluses below the nest. Upon departure, one chick remained in the nest.

**Double-crested cormorant** (*Nannopterum auritum*). Irregular resident non-breeder. In 2021, this species was seen four times sporadically across the season, with a high count of eight individuals flying together on 6 June.

**Great blue heron** (*Ardea herodias*). Uncommon migrant. Birds were seen on four occasions in 2021 and once detected aurally at night while conducting rhinoceros auklet diet collection, on the northwest side of the island. This species has been seen almost annually on St. Lazaria.

**Sharp-shinned hawk** (*Accipiter striatus*). Casual migrant. These small accipiters were detected four times in 2021, three times in August and once in September, often in conflict with crows, ravens, and the peregrine, on both the east and west sides of the island. This species has been recorded in the majority of years on St. Lazaria.

**Bald eagle** (*Haliaeetus leucocephalus*). Common breeder. Bald eagles were present on the island throughout the 2021 field season, with around 10 seen most days through June and early July and smaller numbers for the rest of the season, when the decrease can be attributed to all the subadults leaving the area, leaving the six adults behind to continue to defend their territories. There are three known nests on the island but in 2021 we did not confirm any active nests.

**Belted kingfisher** (*Megaceryle alcyon*). Uncommon migrant. Birds were seen on four days throughout the later half of the 2021 field season, most frequently in intertidal areas but also in forested parts of the island on more than one occasion. This species has been recorded almost annually on St. Lazaria.

**Peregrine falcon** (*Falco peregrinus pealei*). Common breeder. A falcon pair nested on the northwest corner of the island below the rhinoceros auklet colony. The nest fledged at least one chick sometime in early July.

**American crow** (*Corvus brachyrhynchos*). Common breeder. Crows were seen daily, and hatch year crows were seen daily beginning mid-July. Crow nests were frequently predated by ravens and though nests were not directly observed, guarding behavior by a crow likely perched above or near their nest and incubating mate was observed nearly every day in the first half of the season. In 2021, the AOS decided to consider, based on genetic evidence of extensive hybridization between Northwestern and American Crow, that Northwestern Crow does not warrant species status and should be lumped with American Crow.

**Common raven** (*Corvus corax*). Uncommon breeder. Ravens were seen most days of the 2021 season. The crew suspected a nest was present where the trail dogs right past Random Bridge towards BN8 and BN16 on the west side of the island but no nests were found in 2021. Fledglings were observed by crews in 2013 and 2014.

**Tree swallow** (*Tachycineta bicolor*). Uncommon migrant. Groups of one to three individuals were observed on twelve occasions throughout June and early July.

**Golden-crowned kinglet** (*Regulus satrapa*). Common breeder. Birds were seen and heard frequently on the west side of the island and towards the end of the season frequently in the forest above the cabin.

**Pacific wren** (*Troglodytes pacificus*). Common breeder. Birds were seen daily throughout the season.

**Mountain bluebird** (*Sialia currucoides*). Accidental vagrant. This female individual was seen and photographed by both crew members on 17 May and 18 May, foraging for insects off the steep cliffs near intertidal pools by the arch. This is the first time this species has been observed on St. Lazaria Island.

**Swainson's thrush** (*Catharus ustulatus*). Common breeder. Birds were observed daily through June and early August but only detected sporadically after that. Multiple singing males were documented in various parts of the island. Recently fledged young were observed on multiple occasions in August.

**Hermit thrush** (*Catharus guttatus*). Common breeder. Birds were detected sporadically on the west side of the island through the early part of the season. The species was most frequently heard singing in the area where the trail forks to go to the rhinoceros auklet colony. There was no evidence of successful breeding observed in 2021.

**Varied thrush** (*Ixoreus naevius*). Uncommon migrant. One individual was heard vocalizing near the cabin in the evening of 24 May.

**Red crossbill** (*Loxia curvirostra*). Common resident non-breeder. In 2021 this species was only detected twice, on 29 June and 30 August.

**Pine siskin** (*Spinus pinus*). Common resident breeder. Birds were detected beginning 11 June and then daily through late July, after which they were only sporadically heard through mid August and thereafter not detected at all. We did not find hard evidence of breeding but the timing suggests that this species bred on St. Lazaria in 2021.

**Fox sparrow** (*Passerella iliaca*). Common breeder. Probably the most abundant passerine on the island, this species was seen daily throughout the season. Several nests with young were found throughout the island, and many adults carrying insects were seen throughout the majority of June and July, along with associated fledglings.

**Golden-crowned sparrow** (*Zonotrichia atricapilla*). Rare migrant. This species was seen on nine days in May, with a high count of 15 individuals on 18 May. It is possible that the low number of previous detections is due to the typically later start date of the field season.

**Savannah sparrow** (*Passerculus sandwichensis*). Common migrant. This species was observed daily in May through early June, then not again until the last day of August, when this species was again observed

daily until the crew departed on 4 September. This species was mostly commonly detected in the intertidal area, foraging on insects associated with tidepools.

**Song sparrow** (*Melospiza melodia*). Common breeder. Birds were seen daily throughout the season. Several nests with young were found throughout the island, and many adults carrying insects were seen throughout the majority of June and July, along with associated fledglings.

**Orange-crowned warbler** (*Oreothlypis celata*). Common breeder. Birds were seen daily throughout the season until late August. Adults delivering food to either a nest or fledglings were observed throughout the island beginning mid June.

**Yellow warbler** (*Setophaga petechia*). Common migrant. Birds were observed near-daily beginning late May through mid June, when detections promptly stopped and did not resume for the remainder of the field season.

**Townsend's warbler** (*Setophaga townsendi*). Common breeder. Singing adults were detected frequently when the crew visited the west side of the island until mid-July, but no evidence of breeding was detected.

**Wilson's warbler** (*Cardellina pusilla*). Uncommon migrant. Birds were detected regularly from the beginning of the field season in mid-May through early June, after which no detections occurred. This species has been recorded almost every year since 1994.

## MAMMALS

**Sea otter** (*Enhydra lutris*). Common resident. Multiple sightings of sea otters were recorded, most on the island's north side. On 29 May, about half a dozen adults with pups were seen on the north side of the island in the kelp beds. A high count of 14 individuals was recorded on that same day, and groups of one to eight were seen throughout the season.

**River otter** (*Lontra canadensis*). Rare resident non-breeder. A single sighting of river otter was recorded, on 15 May during an exploratory hike on offload day, near BN2 where the otter was startled out of salmonberry bushes and into the puffin colony. Evidence, in the form of feces, was detected in multiple locations on the island beginning in mid-May and throughout the rest of the season, but the feces were indistinguishable from mink feces.

**Mink** (*Neogale vison*). Common resident non-breeder. Multiple sporadic sightings of mink were made throughout the season. Animals were always seen alone. All sightings were around the tent platform area, where the mink was seen coming and going from beneath the tent platform, where it had cached about a dozen seabird carcasses. It seemed cautious of but largely unafraid of humans, as it was willing to jump onto the tent platform while one of the crew was already sitting or laying on the platform, at least twice throughout the season.

**Steller sea lion** (*Eumetopias jubatus*). Common resident non-breeder. Multiple sporadic sightings of sea lions were made throughout the study period. Animals were always seen alone. One bull was seen hauled out on the bedrock just below the steep trail leading to the west side of the island, on the north side, on 27 May. On 1 and 3 September, fast-moving females were seen swimming by the island along the north shore.

**Harbor seal** (*Phoca vitulina*). Common resident non-breeder. Seals were seen multiple times, often when popping their heads out of the water along the north side of the island. One or two seals were seen once in June and once in August, as well as on most days in July.

**Humpback whale** (*Megaptera novaeangliae*). Common resident. Whale sightings were notably low this year. Typically one individual was spotted at a time although 10 were seen on 17 July. Sightings occurred on both the south and north side of the island. Whales were seen on 23 occasions during the season, but most frequently seen in August.

Table 90. Observations and breeding status of birds and selected mammals at St. Lazaria Island, Alaska. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). Data represent observations made each year and therefore may not necessarily match general breeding status categories reported in the annotated list. No data were collected in 2017 or 2020.

Species	Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder X/B?=bred in other years but not specified in current year												
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Greater white-fronted goose	-	-	-	-	X	-	-	-	-	-	-	-	-
Brant	-	-	X	-	-	-	-	-	-	X	-	-	-
Cackling goose	-	-	-	-	-	-	-	-	-	-	-	-	-
Canada goose	-	-	-	-	-	X	-	-	-	-	-	-	X
Unid. goose	-	-	-	X	-	-	-	-	-	-	-	-	-
Blue-winged teal	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern shoveler	-	-	-	-	-	X	-	-	-	-	-	-	-
Gadwall	X	-	-	-	-	-	-	-	-	-	-	-	-
American wigeon	X	-	X	-	-	-	-	-	-	-	X	-	-
Mallard	-	-	-	X	-	X	X	X	X	X	X	X	X
Northern pintail	-	x	X	-	X	X	X	X	X	-	-	X	X
Green-winged teal	X	-	X	X	X	X	X	-	X	X	X	X	X
Canvasback	-	-	-	-	-	-	-	-	-	-	-	-	-
Harlequin duck	X	X	X	X	X	X	X	X	X	X	X	X	X
Surf scoter	-	-	-	-	-	-	-	-	X	X	X	X	X
White-winged scoter	X	-	-	-	X	-	X	-	-	X	-	-	X
Black scoter	X	-	-	-	-	-	-	-	-	-	-	-	-
Red-breasted merganser	-	-	-	-	-	-	-	-	-	-	-	-	X
Unid. merganser	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-necked grebe	-	X	-	-	-	-	-	-	-	X	X	-	-
Mourning dove	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. dove	-	-	-	X	-	-	-	-	-	-	-	-	-
Anna's hummingbird	-	-	-	-	-	-	-	-	-	-	-	-	-
Rufous hummingbird	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	B	B	B	B
Sandhill crane	-	-	-	-	-	-	-	-	X	-	-	-	-
Black oystercatcher	B	B	B	B	B	B	B	B	B	B	B	B	B
Semipalmated plover	-	-	X	-	-	-	-	-	-	-	-	-	-
Whimbrel	X	X	X	X	-	X	-	X	X	-	-	X	-
Bar-tailed godwit	-	-	-	-	X	-	-	-	-	-	-	-	-
Ruddy turnstone	-	-	-	-	-	-	-	-	-	X	-	-	-
Black turnstone	X	x	X	X	X	X	X	X	X	-	X	X	X
Red knot	-	-	-	-	-	-	-	-	-	-	-	-	-
Surfbird	X	-	-	X	X	X	-	X	-	-	X	X	X
Stilt sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-
Least sandpiper	X	-	X	-	-	X	X	-	X	-	X	-	X

Table 90 (continued). Observations and breeding status of birds and selected mammals at St. Lazaria Island, Alaska. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). Data represent observations made each year and therefore may not necessarily match general breeding status categories reported in the annotated list. No data were collected in 2017 or 2020.

Species	Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder X/B?=bred in other years but not specified in current year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
Greater white-fronted goose	-	-	-	X	-	-	-	-	-	-	-	-	-
Brant	-	-	-	-	-	-	-	-	-	-	-	-	-
Cackling goose	-	-	-	-	-	-	-	-	-	-	-	X	-
Canada goose	X	-	-	-	-	-	-	-	-	-	-	-	-
Unid. goose	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue-winged teal	-	-	-	-	-	X	-	-	-	X	X	-	X
Northern shoveler	-	X	-	-	-	X	X	-	-	X	-	X	X
Gadwall	-	-	-	-	-	-	-	-	-	-	-	-	-
American wigeon	-	X	-	X	-	-	-	-	-	-	-	-	X
Mallard	-	-	-	X	X	-	-	X	X	X	X	X	X
Northern pintail	-	X	-	X	-	X	X	X	-	X	-	X	X
Green-winged teal	-	X	-	X	X	X	X	X	X	X	X	X	X
Canvasback	-	-	-	X	-	-	-	-	-	-	-	-	-
Harlequin duck	X	X	X	X	X	X	X	X	X	X	X	X	X
Surf scoter	-	X	-	-	-	-	-	-	-	-	-	-	X
White-winged scoter	-	X	-	-	-	-	-	-	-	-	-	-	-
Black scoter	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-breasted merganser	-	-	-	-	-	-	-	-	X	-	X	-	-
Unid. merganser	-	-	-	-	-	-	-	-	-	-	-	-	X
Red-necked grebe	-	-	-	X	-	-	-	-	-	-	-	-	X
Mourning dove	-	-	-	-	-	-	-	-	-	-	X	X	-
Unid. dove	-	-	-	-	-	-	-	-	-	-	-	-	-
Anna's hummingbird	-	-	-	-	-	-	-	-	-	-	-	-	X
Rufous hummingbird	B	B	B	B	B	B	B	B	B	P	B	P	P
Sandhill crane	-	-	-	-	-	-	-	-	-	-	-	-	-
Black oystercatcher	B	B	B	B	B	B	B	B	B	B	B	B	B
Semipalmated plover	-	-	-	-	-	X	-	-	-	-	-	-	-
Whimbrel	-	X	X	-	X	X	X	X	-	X	-	-	X
Bar-tailed godwit	-	-	-	-	-	-	-	-	-	-	-	-	-
Ruddy turnstone	X	-	-	-	-	-	-	-	X	-	-	-	-
Black turnstone	X	X	X	-	X	X	-	X	X	X	X	X	X
Red knot	-	-	-	-	-	-	-	-	-	-	-	-	X
Surfbird	-	X	-	-	-	X	-	X	-	X	-	X	-
Stilt sandpiper	-	-	-	-	-	-	-	-	-	-	-	X	-
Least sandpiper	X	X	-	-	X	X	X	X	X	X	X	X	X

Table 90 (continued). Observations and breeding status of birds and selected mammals at St. Lazaria Island, Alaska. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). Data represent observations made each year and therefore may not necessarily match general breeding status categories reported in the annotated list. No data were collected in 2017 or 2020.

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	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
White-rumped sandpiper	-	X	-	-	-	-	-	-	-	-	-	-	-	
Pectoral sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	
Semipalmated sandpiper	-	-	-	-	-	-	-	-	-	-	X	-	-	
Unid. sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	
Short-billed dowitcher	-	-	-	-	-	X	-	-	-	-	-	-	-	
Long-billed dowitcher	-	-	-	-	-	-	-	-	-	-	X	-	-	
Unid. dowitcher	-	-	-	X	-	-	-	-	-	-	-	-	-	
Wilson's snipe	-	X	X	-	-	-	-	-	-	-	-	-	-	
Spotted sandpiper	X	X	X	X	X	X	X	X	X	X	X	X	X	
Solitary sandpiper	-	-	-	-	-	X	-	-	-	-	-	-	-	
Wandering tattler	X	-	X	-	X	X	X	X	X	X	X	X	X	
Lesser yellowlegs	-	-	-	-	-	-	X	-	-	-	X	-	-	
Greater yellowlegs	X	X	-	-	X	-	-	-	X	-	X	X	-	
Unid. yellowlegs	-	-	-	X	-	X	-	X	X	-	-	-	-	
Wilson's phalarope	-	-	-	-	-	-	-	-	-	-	-	-	-	
Red-necked phalarope	X	X	X	X	-	X	-	X	X	X	X	X	X	
Pomarine jaeger	-	X	X	-	-	-	-	-	X	-	-	-	-	
Common murre	B	B	B	B	B	B	B	B	B	B	B	B	B	
Thick-billed murre	B	B	B	B	B	B	B	B	B	B	B	B	B	
Pigeon guillemot	B	B	B	B	B	B	B	B	B	B	B	B	B	
Marbled murrelet	X	X	X	X	X	X	X	X	X	X	X	X	X	
Kittlitz's murrelet	-	-	-	-	-	-	-	-	X	-	X	-	-	
<i>Brachyramphus</i> murrelet	-	X	-	-	X	-	-	-	-	-	-	-	-	
Ancient murrelet	B	B	B	B	B	B	B	B	B	B	B	B	B	
Cassin's auklet	-	X	-	-	-	B	X	X	-	X	X	X	-	
Parakeet auklet	-	-	-	-	-	X	-	X	-	-	-	-	-	
Rhinoceros auklet	B	B	B	B	B	B	B	B	B	B	B	B	B	
Horned puffin	-	X	X	X	X	X	X	X	X	X	X	X	X	
Tufted puffin	B	B	B	B	B	B	B	B	B	B	B	B	B	
Black-legged kittiwake	X	X	X	X	X	X	X	X	X	X	X	X	-	
Red-legged kittiwake	-	-	-	-	X	-	-	-	-	-	-	-	-	
Sabine's gull	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bonaparte's gull	-	X	-	-	-	-	-	-	-	-	X	-	-	
Heermann's gull	-	X	-	-	-	X	-	-	-	-	-	X	X	
Short-billed gull	-	X	-	-	-	-	X	-	-	-	X	-	-	

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
White-rumped sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-
Pectoral sandpiper	-	-	-	-	-	-	-	-	-	-	X	-	-
Semipalmated sandpiper	-	-	-	-	-	X	X	-	-	-	-	-	-
Unid. sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	X
Short-billed dowitcher	-	-	-	-	X	X	-	-	-	-	X	-	X
Long-billed dowitcher	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. dowitcher	-	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's snipe	-	-	-	-	-	-	-	-	-	-	X	X	-
Spotted sandpiper	X	X	X	X	X	X	X	X	X	X	X	X	P
Solitary sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-
Wandering tattler	X	X	-	X	X	X	X	X	X	-	X	X	X
Lesser yellowlegs	X	-	-	-	X	X	X	X	X	X	X	-	X
Greater yellowlegs	X	X	-	-	-	X	X	X	X	-	X	X	X
Unid. yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	X
Wilson's phalarope	-	-	-	-	X	-	-	-	-	-	-	-	-
Red-necked phalarope	X	X	X	-	-	X	-	X	-	-	-	X	-
Pomarine jaeger	-	-	-	-	-	-	-	X	X	-	-	-	-
Common murre	B	B	B	B	B	B	B	B	B	B	B	B	B
Thick-billed murre	B	B	B	B	B	B	B	B	B	B	B	B	B
Pigeon guillemot	B	B	B	B	B	B	B	B	B	B	B	B	B
Marbled murrelet	X	X	X	X	X	X	X	X	X	X	X	X	X
Kittlitz's murrelet	-	-	-	-	-	-	X	X	-	-	-	-	-
<i>Brachyramphus</i> murrelet	-	-	-	-	-	-	-	-	-	-	-	-	-
Ancient murrelet	B	B	B	B	B	B	B	B	B	X	B	B	B
Cassin's auklet	X	-	X	-	X	P	P	-	-	-	-	-	X
Parakeet auklet	-	-	-	X	-	-	-	-	-	-	-	-	-
Rhinoceros auklet	B	B	B	B	B	B	B	B	B	B	B	B	B
Horned puffin	X	X	X	-	X	X	X	X	X	X	X	X	-
Tufted puffin	B	B	B	B	B	B	B	B	B	B	B	B	B
Black-legged kittiwake	-	X	-	-	-	-	X	X	X	-	X	X	-
Red-legged kittiwake	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabine's gull	-	-	-	-	-	-	-	-	-	-	-	-	X
Bonaparte's gull	-	-	-	-	-	X	X	-	-	-	-	X	X
Heermann's gull	-	-	-	-	-	-	-	-	-	-	-	-	-
Short-billed gull	-	-	-	-	-	-	-	-	-	-	-	X	X

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	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Ring-billed gull	-	-	-	-	-	X	-	-	-	-	-	-	-	
California gull	-	-	-	-	-	-	-	-	-	-	-	-	-	
Herring gull	X	X	X	X	-	X	X	X	X	X	X	X	X	
Glaucous-winged gull	B	B	B	B	B	B	B	B	B	B	B	B	B	
Glaucous gull	-	-	-	X	-	-	-	-	X	-	X	-	-	
Caspian tern	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unid. tern	-	-	X	-	-	-	-	-	-	-	-	-	-	
Red-throated loon	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arctic loon	-	-	-	-	-	-	-	-	-	X	-	X	-	
Pacific loon	X	X	-	-	-	-	X	-	-	-	-	-	-	
Common loon	-	X	X	-	-	-	-	-	X	-	X	-	-	
Yellow-billed loon	-	-	-	-	-	-	-	-	-	X	-	-	-	
Unid. loon	-	-	-	-	-	X	-	X	X	-	-	-	-	
Fork-tailed storm-petrel	B	B	B	B	B	B	B	B	B	B	B	B	B	
Leach's storm-petrel	B	B	B	B	B	B	B	B	B	B	B	B	B	
Northern fulmar	-	-	-	-	-	X	X	-	-	-	-	-	-	
Sooty shearwater	-	-	-	-	X	X	-	X	X	X	X	X	-	
Unid. shearwater	-	X	X	X	X	X	-	-	-	-	-	-	-	
Red-faced cormorant	-	-	-	-	-	X	-	-	-	-	-	-	-	
Pelagic cormorant	B	B	B	B	B	B	B	B	B	B	B	B	B	
Double-crested cormorant	X	X	-	-	X	X	X	-	-	X	-	-	-	
Great blue heron	X	X	X	X	X	X	X	X	X	X	X	-	X	
Sharp-shinned hawk	X	X	-	-	-	X	X	X	X	X	X	-	-	
Cooper's hawk	-	-	-	-	-	X	-	-	-	-	-	-	-	
Bald eagle	X/B?	B	X/B?	X/B?	X/B?	B	B	B	B	X/B?	X/B?	X/B?	X/B?	
Great-horned owl	-	-	-	-	-	-	-	-	-	-	-	-	-	
Belted kingfisher	X	X	X	X	X	X	X	X	X	X	X	X	X	
Yellow-bellied sapsucker	-	-	-	-	-	-	-	-	-	X	-	-	-	
Downy woodpecker	-	-	-	-	-	-	-	X	-	-	-	-	-	
Hairy woodpecker	X	-	-	-	-	-	-	-	-	X	-	X	-	
Northern flicker	-	-	-	-	-	X	-	-	-	-	-	-	-	
American kestrel	-	-	-	-	-	-	-	-	-	-	-	-	-	
Merlin	X	-	-	-	-	-	-	-	-	X	X	-	-	
Peregrine falcon	X/B?	B	X/B?	B	X/B?	X/B?	B	B	B	X/B?	X/B?	X/B?	X/B?	
Eastern kingbird	-	-	-	-	-	-	-	-	-	-	-	-	-	

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
Ring-billed gull	-	-	-	-	-	-	-	-	-	-	-	-	-
California gull	-	-	-	-	-	-	-	-	-	-	X	-	-
Herring gull	-	X	-	-	X	X	X	-	-	X	X	X	X
Glaucous-winged gull	B	B	B	B	B	B	B	B	B	B	B	B	B
Glaucous gull	-	-	-	-	-	-	-	-	X	-	-	-	X
Caspian tern	-	-	-	-	X	X	-	-	-	-	-	-	-
Unid. tern	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-throated loon	-	-	-	-	-	-	-	-	-	-	-	-	X
Arctic loon	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific loon	-	-	-	X	-	-	-	X	-	-	X	X	X
Common loon	-	-	-	-	X	-	-	X	-	-	X	-	-
Yellow-billed loon	-	-	-	-	-	-	-	-	-	-	-	-	-
Unid. loon	-	-	-	-	-	-	-	-	-	-	-	-	X
Fork-tailed storm-petrel	B	B	B	B	B	B	B	B	B	B	B	B	B
Leach's storm-petrel	B	B	B	B	B	B	B	B	B	B	B	B	B
Northern fulmar	-	-	-	-	-	-	-	-	-	-	-	-	-
Sooty shearwater	-	-	-	-	X	X	X	X	X	-	-	-	-
Unid. shearwater	-	-	-	-	-	-	-	-	-	-	-	X	X
Red-faced cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelagic cormorant	B	B	B	B	B	B	B	B	B	B	X	B	B
Double-crested cormorant	-	-	-	X	-	-	X	X	-	X	-	X	X
Great blue heron	-	X	X	X	X	X	X	X	X	X	X	X	X
Sharp-shinned hawk	X	X	X	X	-	-	-	X	-	-	X	X	X
Cooper's hawk	-	X	-	-	-	-	-	-	-	-	-	-	-
Bald eagle	X/B?	X/B?	X/B?	X/B?	X/B?	B	B	B	B	B	B	B	P
Great-horned owl	-	-	-	-	-	-	-	-	X	-	-	-	-
Belted kingfisher	-	-	X	X	X	-	X	X	X	X	X	X	X
Yellow-bellied sapsucker	-	-	-	-	-	-	-	-	-	-	-	-	-
Downy woodpecker	-	-	-	-	-	-	-	X	X	-	-	-	-
Hairy woodpecker	-	-	-	X	X	-	X	-	-	-	-	-	-
Northern flicker	-	-	-	-	-	-	-	-	-	-	-	-	-
American kestrel	-	-	-	-	-	-	-	X	-	-	-	-	-
Merlin	-	X	-	-	-	-	-	-	-	-	X	X	-
Peregrine falcon	X/B?	X/B?	X/B?	X/B?	B	B	X/B?	B	B	B	B	B	B
Eastern kingbird	-	-	-	X	-	-	-	X	-	-	-	-	-

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	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Scissor-tailed flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alder flycatcher	X	-	-	-	X	-	-	-	-	-	-	-	-	-
Pacific-slope flycatcher	X	X	-	-	-	-	-	-	X	-	-	-	-	X
Cordilleran flycatcher	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Unid. flycatcher	-	-	-	X	X	-	-	-	-	-	-	-	-	-
Cassin's vireo	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Northern shrike	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American crow	X/B?	X/B?	X/B?	X/B?	B	X/B?	X/B?	X/B?	X/B?	B	B	B	B	B
Common raven	X	X	X	-	X	X	X	X	X	X	X	X	X	X
Black-capped chickadee	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Chestnut-backed chickadee	X	-	X	-	-	-	-	-	X	-	-	-	-	-
Bank swallow	-	-	-	-	-	-	-	-	-	X	-	-	-	X
Tree swallow	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ruby-crowned kinglet	X	-	-	X	-	X	-	X	X	X	X	X	X	X
Golden-crowned kinglet	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cedar waxwing	-	-	-	-	-	-	-	-	X	-	-	-	-	-
Unid. waxwing	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-breasted nuthatch	X	X	-	-	-	X	X	-	-	-	X	-	-	-
Brown creeper	X	X	X	X	X	X	X	X	-	X	-	X	-	-
Pacific wren	X/B?	X/B?	X/B?	X/B?	B	X/B?	X/B?	X/B?	X/B?	B	B	B	B	B
Mountain bluebird	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swainson's thrush	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hermit thrush	X	X	X	-	X	X	X	X	-	X	X	X	X	X
American robin	-	-	-	-	-	X	X	X	-	X	X	-	X	-
Varied thrush	-	X	X	-	X	X	-	-	-	-	-	-	X	X
American pipit	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pine grosbeak	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Red crossbill	X	X	-	-	X	X	-	X	X	X	X	-	-	-
White-winged crossbill	-	-	-	-	X	-	-	X	-	-	-	-	-	-
Pine siskin	X	X	X	-	X	-	-	X	X	X	X	X	X	-
Fox sparrow	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	B	B	B	B	B
American tree sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dark-eyed junco	-	X	-	X	-	-	X	-	-	X	X	-	-	X
White-crowned sparrow	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Golden-crowned sparrow	-	X	-	-	-	X	-	-	-	-	-	X	-	X

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	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021	
Scissor-tailed flycatcher	-	-	-	-	-	-	-	X	-	-	-	-	-	
Alder flycatcher	-	-	-	-	X	-	-	-	-	-	-	-	-	
Pacific-slope flycatcher	-	-	-	-	-	-	-	X	-	-	X	-	-	
Cordilleran flycatcher	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unid. flycatcher	-	-	-	-	-	-	-	-	-	-	-	X	-	
Cassin's vireo	-	-	-	-	-	-	-	-	-	-	-	-	-	
Northern shrike	-	-	-	-	-	-	-	-	-	-	-	X	-	
American crow	B	B	B	B	B	B	B	B	P	B	B	B	B	
Common raven	X	X	-	X	P	B	X	B	P	B	P	P	P	
Black-capped chickadee	-	-	-	X	X	X	X	X	-	-	-	-	-	
Chestnut-backed chickadee	X	-	-	-	-	-	-	X	-	-	-	-	-	
Bank swallow	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tree swallow	-	-	-	-	X	-	-	-	-	-	X	X	X	
Ruby-crowned kinglet	-	X	-	-	X	X	X	X	B	P	X	X	-	
Golden-crowned kinglet	X	X	X	-	B	P	P	P	P	P	B	B	B	
Cedar waxwing	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unid. waxwing	-	-	-	-	-	-	-	-	-	-	-	-	-	
Red-breasted nuthatch	-	X	-	-	-	-	-	-	X	-	-	X	-	
Brown creeper	-	X	X	-	X	-	-	X	X	X	-	X	-	
Pacific wren	B	B	B	B	B	B	B	B	B	B	B	B	B	
Mountain bluebird	-	-	-	-	-	-	-	-	-	-	-	-	X	
Swainson's thrush	X	X	X	-	B	B	B	B	P	B	P	B	B	
Hermit thrush	X	X	X	-	B	B	B	P	B	P	X	P	P	
American robin	-	X	X	-	X	-	-	X	X	-	X	-	-	
Varied thrush	-	-	-	X	X	-	-	X	X	-	-	-	X	
American pipit	-	-	-	-	-	-	-	X	X	-	-	X	-	
Pine grosbeak	-	-	-	-	-	-	-	-	-	-	-	-	-	
Red crossbill	X	X	-	-	-	-	-	X	X	-	X	X	X	
White-winged crossbill	-	X	-	-	-	-	-	-	-	-	-	-	-	
Pine siskin	-	X	-	-	X	X	-	X	X	-	X	P	P	
Fox sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B	
American tree sparrow	-	-	-	-	-	-	-	-	-	X	-	X	-	
Dark-eyed junco	-	X	-	-	X	-	-	-	X	X	X	-	-	
White-crowned sparrow	-	-	-	-	-	-	-	-	-	X	-	-	-	
Golden-crowned sparrow	-	-	-	-	-	-	-	-	-	X	-	-	X	

Table 90 (continued). Observations and breeding status of birds and selected mammals at St. Lazaria Island, Alaska. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). Data represent observations made each year and therefore may not necessarily match general breeding status categories reported in the annotated list. No data were collected in 2017 or 2020.

Species	Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder X/B?=bred in other years but not specified in current year													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Savannah sparrow	X	X	X	-	X	X	-	X	X	-	X	X	X	
Song sparrow	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	B	B	B	B	
Lincoln's sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	
Red-winged blackbird	-	-	-	-	-	X	-	-	-	-	-	-	-	
Northern waterthrush	-	-	-	-	-	-	-	-	-	-	-	-	-	
Orange-crowned warbler	X/B?	X/B?	X/B?	X/B?	X/B?	B	X/B?	X/B?	X/B?	B	B	B	B	
American redstart	-	-	-	-	-	-	-	-	-	X	-	-	-	
Yellow warbler	X	X	X	X	X	X	X	X	X	X	X	X	X	
Yellow-rumped warbler	-	-	-	-	X	-	-	-	-	-	-	-	-	
Townsend's warbler	X	X	-	-	-	X	-	X	X	X	-	X	-	
Hermit warbler	-	-	-	-	-	X	-	-	-	-	-	-	-	
Wilson's warbler	X	-	X	X	-	X	X	-	X	X	X	-	X	
Sea otter	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	X/B?	P	P	P	P	
River otter	X	X	X	X	X	-	-	X	X	X	X	X	X	
Mink	-	-	-	-	-	-	-	-	-	X	-	-	-	
Steller sea lion	X	X	X	X	X	X	X	X	X	X	X	X	X	
Harbor seal	X	X	X	X	X	X	X	X	X	X	X	X	X	
Brown bear	-	-	-	-	-	X	-	-	-	-	-	-	-	
Sitka black-tailed deer	X	-	X	-	-	-	-	-	-	-	-	-	-	
Minke whale	-	-	X	-	-	-	-	-	-	-	-	-	-	
Humpback whale	X	X	X	X	X	X	X	X	X	X	X	X	X	
Orca	X	-	X	-	-	X	-	X	-	X	-	X	-	
Gray whale	-	-	-	-	-	X	-	-	-	-	-	-	-	
Harbor porpoise	-	X	-	-	-	-	-	-	-	-	-	-	-	
Observation dates	1 Jun-1 Sep	30 May-2 Sep	1 Jun-30 Aug	30 May-6 Sep	30 May-3 Sep	29 May-11 Sep	1 Jul-4 Sep	31 May-13 Sep	31 May-1 Sep	27 May-7 Sep	28 May-8 Sep	28 May-8 Sep	25 May-9 Sep	

Table 90 (continued). Observations and breeding status of birds and selected mammals at St. Lazaria Island, Alaska. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). Data represent observations made each year and therefore may not necessarily match general breeding status categories reported in the annotated list. No data were collected in 2017 or 2020.

Species	Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder X/B?=bred in other years but not specified in current year												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
Savannah sparrow	X	X	X	X	X	X	-	X	X	X	X	X	X
Song sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B
Lincoln's sparrow	-	X	-	-	-	-	-	-	-	-	-	X	-
Red-winged blackbird	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern waterthrush	-	-	-	-	-	-	-	-	-	-	-	X	-
Orange-crowned warbler	B	B	B	B	B	B	B	B	P	B	B	B	B
American redstart	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow warbler	-	X	X	-	P	P	P	X	X	X	X	X	X
Yellow-rumped warbler	-	-	X	-	-	-	-	-	-	-	-	-	-
Townsend's warbler	-	X	-	-	B	P	X	X	X	-	X	B	P
Hermit warbler	-	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's warbler	-	X	X	-	P	X	X	-	-	-	X	X	X
Sea otter	P	P	P	P	P	P	P	B	B	B	B	B	B
River otter	X	X	X	X	X	X	X	X	X	X	X	P	P
Mink	-	-	-	-	X	X	X	X	X	-	-	-	P
Steller sea lion	X	X	X	X	X	X	X	X	X	X	X	X	X
Harbor seal	X	X	X	X	X	X	X	X	X	X	X	X	X
Brown bear	-	-	-	-	-	-	-	-	-	-	-	-	-
Sitka black-tailed deer	-	-	-	-	-	-	-	-	-	-	-	-	-
Minke whale	-	-	-	-	-	-	-	-	-	-	-	-	-
Humpback whale	X	X	X	X	X	X	X	X	X	X	X	X	X
Orca	X	-	-	X	X	P	P	P	X	X	X	-	-
Gray whale	-	-	-	-	-	-	-	-	-	-	-	-	-
Harbor porpoise	-	-	-	-	-	-	-	-	-	-	-	-	-
Observation dates	28 May-3 Sep	29 May-7 Sep	29 May-9 Sep	28 May-6 Sep	29 May-11 Sep	25 May-10 Sep	28 May-7 Sep	28 May-9 Sep	29 May-8 Sep	29 May-11 Sep	29 May-10 Sep	30 May-6 Sep	14 May-4 Sep

Table 91. First flowering dates of plants identified on St. Lazaria Island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Identifications are made by field personnel on-island and have not been confirmed by other authorities. No data were collected in 2017 or 2020.

Family	Species	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cyperaceae	<i>Carex</i> spp.	xx <sup>a</sup>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Liliaceae	<i>Fritillaria camschatcensis</i>	xx	xx	xx	xx	xx	xx	≤1 Jun	xx	xx	xx	xx	xx	xx
	<i>Streptosus amplexifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Streptosus</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Iridaceae	<i>Sisyrinchium littorale</i>	xx	xx	xx	xx	xx	xx	23 Jun	xx	xx	xx	xx	xx	xx
Montiaceae	<i>Claytonia sibirica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Caryophylaceae	<i>Honckenya peploides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculaceae	<i>Ranunculus</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Brassicaceae	<i>Cardamine</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Draba grandis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Cochlearia officinalis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Saxifragaceae	<i>Tiarella trifoliata</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Saxifraga ferruginea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Roseaceae	<i>Rubus spectabilis</i>	xx	xx	xx	xx	xx	xx	≤1 Jun	xx	xx	xx	xx	xx	xx
	<i>Fragaria</i> spp.	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Potentilla villosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Potentilla</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Geraniaceae	<i>Geranium erianthum</i>	xx	xx	xx	xx	xx	xx	5 Jun	xx	xx	xx	xx	xx	xx
Onagraceae	<i>Epilobium angustifolium</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Epilobium ciliatum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Epilobium</i> spp.	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Apiaceae	<i>Heracleum lanatum</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Ligusticum scoticum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Conioselinum gmelinii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Angelica hendersonii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Ericaceae	<i>Empetrum nigrum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Vaccinium</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Primulaceae	<i>Dodecatheon pulchellum</i>	xx	xx	xx	xx	xx	xx	≤1 Jun	xx	xx	xx	xx	xx	xx
	<i>Lysimachia europaea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Phrymaceae	<i>Erythranthe guttata</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Orobanchaceae	<i>Pedicularis verticillata</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Castilleja unalaschcensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Plantaginaceae	<i>Misopates orontium</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
	<i>Veronica americana</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Campanulaceae	<i>Campanula rotundifolia</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Asteraceae	<i>Achillea millefolium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Nabalus alatus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Symphyotrichum foliaceum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Asparagaceae	<i>Maianthemum dilatatum</i>	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Adoxaceae	<i>Sambucus racemosa</i>	xx	xx	xx	xx	xx	xx	≤1 Jun	xx	xx	xx	xx	xx	xx

Table 91 (continued). First flowering dates of plants identified on St. Lazaria Island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Identifications are made by field personnel on-island and have not been confirmed by other authorities. No data were collected in 2017 or 2020.

Family	Species	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2021
Cyperaceae	<i>Carex</i> spp.	xx	xx	xx	xx	xx	late May	≤28 May	<28 May	<29 May	<29 May	<29 May	<6 Jun	-
Liliaceae	<i>Fritillaria camschatcensis</i>	<28 May	xx	xx	xx	xx	early June	-	<28 May	<29 May	<29 May	<29 May	<31 May	20 May
	<i>Streptosus amplexifolius</i>	-	-	-	-	-	-	-	-	-	-	-	-	<28 Jul
	<i>Streptosus</i> spp.	-	-	-	-	-	-	-	-	-	-	-	<2 Jun	-
Iridaceae	<i>Sisyrinchium littorale</i>	20 Jun	xx	xx	xx	xx	-	-	6 Jun	13 Jun	<12 Jun	20 Jun	<8 Jun	<30 Jun
Montiaceae	<i>Claytonia sibirica</i>	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	25 May
Caryophylaceae	<i>Honckenya peploides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
Ranunculaceae	<i>Ranunculus</i> spp.	-	-	-	-	-	-	-	-	-	-	-	<14 Jun	<20 May
Brassicaceae	<i>Cardamine</i> spp.	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	3 Jun
	<i>Draba grandis</i>	-	-	-	-	-	-	-	-	-	-	-	<14 Jul	<18 May
	<i>Cochlearia officinalis</i>	-	-	-	-	-	-	-	-	-	-	-	<13 Jun	<18 May
Saxifragaceae	<i>Tiarella trifoliata</i>	xx	xx	xx	xx	xx	late May	-	11 Jun	3 Jun	<12 Jun	<29 May	<1 Jun	1 Jun
	<i>Saxifraga ferruginea</i>	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	30 May
Roseaceae	<i>Rubus spectabilis</i>	<28 May	xx	xx	xx	xx	late May	-	<28 May	<29 May	<29 May	<29 May	<1 Jun	<15 May
	<i>Fragaria</i> spp.	-	-	-	-	-	-	-	-	-	-	-	<28 May	<31 May
	<i>Potentilla villosa</i>	xx	xx	xx	xx	xx	-	-	<28 May	<29 May	<29 May	<29 May	<28 May	<18 May
	<i>Potentilla</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Geraniaceae	<i>Geranium erianthum</i>	4 Jun	xx	xx	xx	xx	-	-	<28 May	<29 May	<29 May	10 Jun	<1 Jun	11 Jun
Onagraceae	<i>Epilobium angustifolium</i>	xx	xx	xx	xx	xx	xx	-	8 Jul	12 Jul	-	-	<31 Jul	-
	<i>Epilobium ciliatum</i>	-	-	-	-	-	-	-	-	-	-	-	<6 July	28 Jul
	<i>Epilobium</i> spp.	xx	xx	xx	xx	xx	xx	-	-	-	-	29 Jun	<26 Jun	-
Apiaceae	<i>Heracleum lanatum</i>	xx	xx	xx	xx	xx	-	-	6 Jun	<29 May	<29 May	<29 May	<1 Jun	5 Jun
	<i>Ligusticum scoticum</i>	-	-	-	-	-	-	-	-	-	-	-	<30 Jun	22 Jun
	<i>Conioselinum gmelinii</i>	-	-	-	-	-	-	-	-	-	-	-	<23 Jul	<21 Jul
	<i>Angelica hendersonii</i>	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	<17 Jun
Ericaceae	<i>Empetrum nigrum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Vaccinium</i> spp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Primulaceae	<i>Dodecatheon pulchellum</i>	<28 May	xx	xx	xx	xx	late May	-	<28 May	<29 May	<29 May	<29 May	<28 May	19 May
	<i>Lysimachia europaea</i>	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	<18 Jun
Phrymaceae	<i>Erythranthe guttata</i>	28 Jul	xx	xx	xx	xx	-	-	16 Jun	16 Jun	<10 Jul	13 Jun	<17 Jun	29 Jun
Orobanchaceae	<i>Pedicularis verticillata</i>	-	-	-	-	-	-	-	-	-	-	-	<7 July	18 Jul
Plantaginaceae	<i>Castilleja unalascensis</i>	9 Jun	xx	xx	xx	xx	-	-	<30 May	<29 May	<29 May	<29 May	<1 Jun	30 May
	<i>Misopates orontium</i>	xx	xx	xx	xx	xx	xx	-	-	-	-	7 Jul	-	-
	<i>Veronica americana</i>	-	-	-	-	-	-	-	-	-	-	-	<6 Jul	5 Jul
Campanulaceae	<i>Campanula rotundifolia</i>	xx	xx	xx	xx	xx	-	-	25 Jun	27 Jun	<28 Jul	8 Jul	<14 Jun	6 Jul
Asteraceae	<i>Achillea millefolium</i>	-	-	-	-	-	-	-	-	-	-	-	<1 Jun	7 Jun
	<i>Nabalus alatus</i>	-	-	-	-	-	-	-	-	-	-	-	<14 July	26 Jul
	<i>Symphytum foliaceum</i>	-	-	-	-	-	-	-	-	-	-	-	-	24 Jul
Asparagaceae	<i>Maianthemum dilatatum</i>	xx	xx	xx	xx	xx	xx	-	8 Jun	-	-	<29 May	<1 Jun	1 Jun
Adoxaceae	<i>Sambucus racemosa</i>	xx	xx	xx	xx	xx	late May	-	<28 May	<29 May	<29 May	<29 May	<1 Jun	21 May

<sup>a</sup>xx indicates data potentially exist but have not yet been summarized.

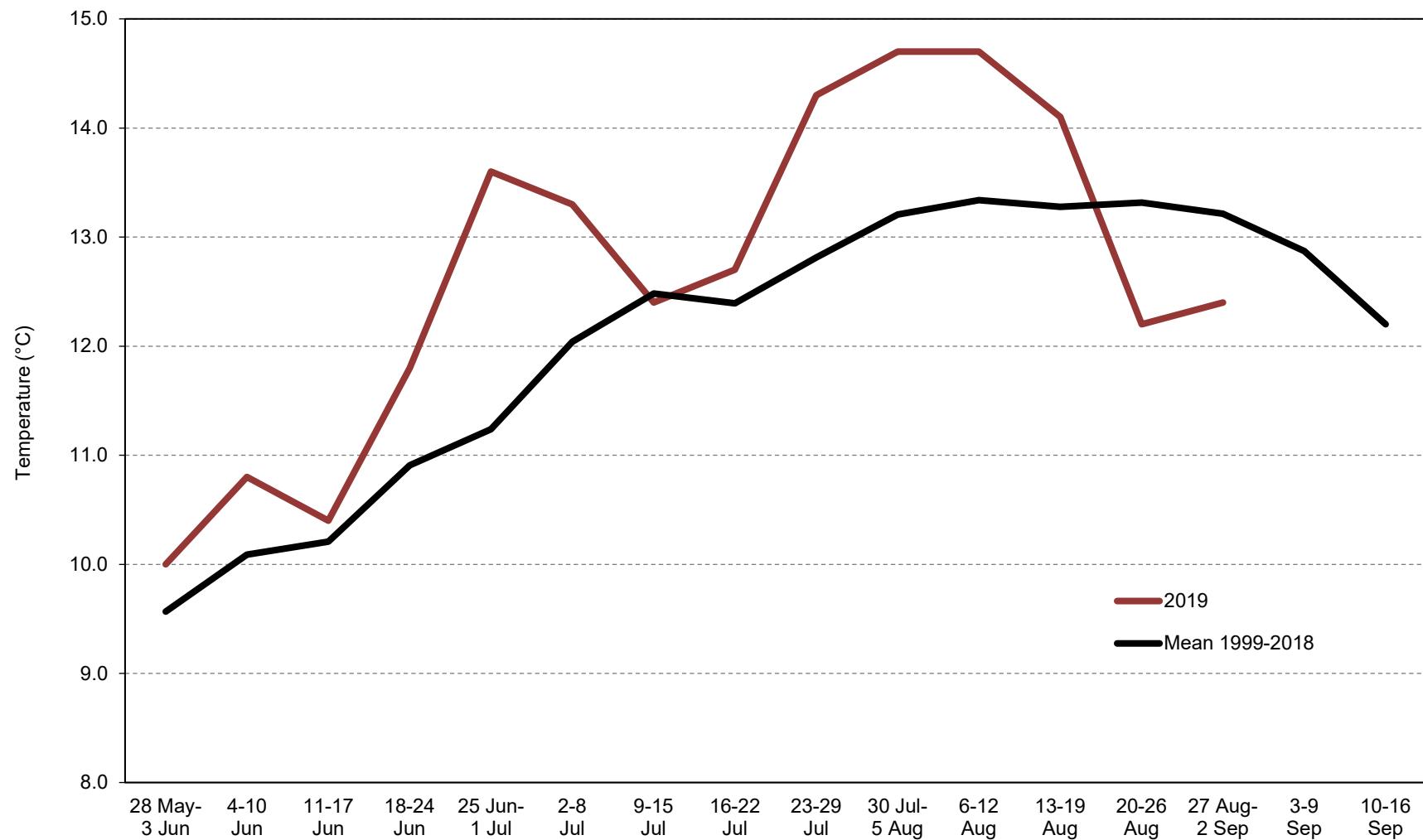


Figure 50. Mean weekly sea surface temperatures (°C) at St. Lazaria Island, Alaska. No data were collected in 2017-2018 or 2020-2021.

Table 92. Mean weekly sea surface temperatures (°C) at St. Lazaria Island, Alaska. No data were collected in 2017-2018 or 2020-2021.

Week	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2019
28 May-3 Jun	-	-	-	8.6	-	-	-	8.4	-	10.6	-	-	9.9	-	-	9.6	10.3	10.0	
4-10 Jun	-	-	-	9.2	-	10.1	-	9.4	10.4	9.9	-	-	9.1	13.0	-	9.3	9.8	10.7	10.8
11-17 Jun	-	-	-	10.5	-	10.3	-	10.1	10.1	8.8	9.0	-	9.7	11.8	-	10.3	10.2	11.5	10.4
18-24 Jun	-	-	10.6	10.0	-	12.0	-	9.9	9.5	9.7	9.7	-	11.1	15.1	-	10.7	10.6	12.0	11.8
25 Jun-1 Jul	-	11.9	11.0	10.5	12.0	11.0	12.5	10.5	10.1	10.2	11.2	-	10.6	12.1	11.0	11.4	11.2	12.6	13.6
2-8 Jul	-	11.6	10.8	11.5	11.8	11.2	13.1	10.8	13.1	10.9	-	-	11.7	13.1	12.0	12.7	13.0	13.3	13.3
9-15 Jul	-	10.5	11.4	12.5	12.1	11.6	13.8	10.9	15.4	11.5	14.5	-	13.0	11.5	12.8	13.2	12.1	12.9	12.4
16-22 Jul	-	11.7	12.1	12.8	12.1	12.2	14.3	11.2	13.3	11.5	12.1	-	12.4	11.1	12.2	13.5	13.6	12.2	12.7
23-29 Jul	-	13.0	11.7	12.8	13.3	-	14.7	13.8	13.3	11.4	11.5	-	12.9	10.6	12.6	13.3	13.7	13.6	14.3
30 Jul-5 Aug	-	13.4	12.3	14.2	13.2	-	15.2	14.0	11.6	11.9	10.9	-	13.0	11.8	13.9	14.5	14.3	13.9	14.7
6-12 Aug	-	13.0	14.3	12.5	13.5	-	15.8	-	13.4	12.0	13.0	-	12.6	12.6	12.9	14.6	-	13.2	14.7
13-19 Aug	-	12.5	13.5	13.0	12.5	-	15.1	-	13.2	12.0	12.9	-	12.8	13.1	13.2	14.6	-	14.2	14.1
20-26 Aug	-	12.6	12.5	12.9	13.0	-	14.5	-	13.9	12.0	12.9	-	-	13	13.5	14.6	-	14.4	12.2
27 Aug-2 Sep	12.8	12.6	12.0	13.1	13.0	-	14.2	-	14.2	12.2	12.9	12.8	-	12.7	13.8	14.4	-	14.3	12.4
3-9 Sep	11.9	12.2	11.5	13.4	13.3	-	14.0	-	13.4	12.1	12.9	13.0	-	12.2	13.9	14.2	-	12.2	-
10-16 Sep	11.8	-	-	-	-	-	-	-	-	-	-	13.2	-	12.0	-	-	-	11.8	-

Appendix A. Diet datasets in the AMNWR diet dataset from St. Lazaria Island, Alaska. Years in parentheses are pending analysis.

Species	Recipient	Diet type	Years	In 2021 annual report
Rhinoceros auklet	Chick	Bill-load	1994-2016, 2018-2019, 2021	Y
Tufted puffin	Chick	Bill-load	1996, 2015	N
Glaucous-winged gull	Adult	Stomach	2003	Y
Glaucous-winged gull	Adult	Pellet	2015-2016, 2018-2019, 2021	Y
Glaucous-winged gull	Chick	Regurgitation	2002, 2006, 2010-2012, 2019, 2021	Y
Fork-tailed storm-petrel	Chick	Regurgitation	1995-2014 (2015-2016, 2018-2019, 2021)	Y
Leach's storm-petrel	Chick	Regurgitation	1995-2014 (2015-2016, 2018-2019, 2021)	Y
Pelagic cormorant	Chick	Bolus	1998, 2000-2001, 2004-2005, (2006), 2007, (2008-2009, 2014-2015)	Y