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BIOLOGICAL MONITORING AT AIKTAK ISLAND, ALASKA IN 2017

Sarah M. Youngren, Daniel C. Rapp, and Nora A. Rojek

Key words: Aiktak Island, Alaska, Aleutian Islands, ancient murrelet, *Cepphus columba,* common murre, double-crested cormorant, fork-tailed storm-petrel, *Fratercula cirrhata, Fratercula corniculata,* glaucous-winged gull, horned puffin, *Larus glaucescens,* Leach's storm-petrel, *Oceanodroma furcata, Oceanodroma leucorhoa,* pelagic cormorant, *Phalacrocorax auritus, Phalacrocorax pelagicus, Phalacrocorax urile,* pigeon guillemot, population trends, productivity, red-faced cormorant, *Synthliboramphus antiquus,* thick-billed murre, tufted puffin, *Uria aalge, Uria lomvia.*

U.S. Fish and Wildlife Service
Alaska Maritime National Wildlife Refuge
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Homer, AK 99603

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Sarah Youngren and Dan Rapp on New Camp Beach on resupply day, Aiktak Island, Alaska.

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INTRODUCTION

The Alaska Maritime National Wildlife Refuge (AMNWR) conducts annual ecological monitoring at nine 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 divers feeding in both near shore 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 in assessing effects of management.

Aiktak Island, in the eastern Aleutian Islands, has been an annual monitoring site since 1995, with additional seabird data collected on the island since 1981. Brief visits were first made to Aiktak to monitor populations of puffins and storm-petrels from 1981 to 1983 and in 1989 (DeGange et al. 1981; Forsell 1983a,b; Blomstrom and Nault 1989). In 1990, data collection also included counting murres and conducting circumnavigation surveys of the island (O'Daniel et al. 1990). Since 1995, intensive season-long monitoring of most seabird populations at Aiktak has been conducted each year (Dragoo and Woodward 1996; Woodward 1997; Howard and Woodward 1999; Thomson and Smith 2000; Sztukowski and Oleszczuk 2001; Dykstra and Wynn 2002; Helm and Zeman 2005, 2006; Helm et al. 2007; Drummond 2008; Sapora et al. 2009; Hand et al. 2010; Bechaver and Gehrig 2011; Gladics et al. 2013; Howie et al. 2014; Boyd et al. 2015; Youngren et al. 2016, 2017).

The specific monitoring goals in 2017 were to estimate productivity and/or population parameters for 11 indicator species representing three major feeding guilds: 1) diving fish-feeders (pelagic, red-faced and double-crested cormorants [*Phalacrocorax pelagicus, P. urile,* and *P. auritus*], common and thick-billed murres [*Uria aalge* and *U. lomvia*], pigeon guillemots [*Cepphus columba*], horned and tufted puffins [*Fratercula corniculata* and *F. cirrhata*]), 2) diving plankton feeders (ancient murrelets [*Synthliboramphus antiquus*]), and 3) surface plankton feeders (Leach's and fork-tailed storm-petrels [*Oceanodroma furcata* and *O. leucorhoa*]). Similar data were also collected for intertidal-foraging black oystercatchers (*Haematopus bachmani*) and flexible-foraging glaucous-winged gulls (*Larus glaucescens*). Additional monitoring goals include the description of breeding chronology, food habits, and chick growth for one or more of the above species.

Detailed results of the 2017 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. 2017). 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

Aiktak Island (54º11.19'N, 164º49.84'W) is located in the Krenitzin Islands in the eastern Aleutian Islands, Alaska. Aiktak is on the west side of Unimak Pass, with Ugamak Island directly to the north across a 0.8 km channel and Tigalda Island about 5 km to the west. Unimak Pass is the main shipping route between the North Pacific Ocean and the Bering Sea and transiting container ships are often seen on the horizon from the east side of the island.

Aiktak is a small island approximately 2 km long and 1 km wide, encompassing 155 ha and with a circumference of 7.3 km (see Figures 1-3). The low-lying north shore consists of alternating grassy slopes and low rock cliffs (10-15 m) that back a number of small coves with cobble beaches. The south side of the island rises to high, sheer bluffs, the tops of which approach the highest parts of the island. Maximum elevation is 170 m. Several small *Leymus*-covered islets lie just offshore the eastern and western ends of the island. Vegetation is composed of maritime tundra: *Leymus* and *Heracleum* dominate the near-shore edges, while the island's interior is about half covered by *Poa* and *Calamagrostis*, and a quarter composed of a short tundra community of *Empetrum*, lichens, mosses, and *Anemone*. Intermixed within these communities around the island are *Angelica, Claytonia, Frittilaria, Equisetum, Rumex, Conioselinum, Ranunculus, Viola, Pedicularis, Sanguisorba, Geranium, Acontium, Epilobium,* ferns, and several other herbaceous plants.

Arctic foxes were introduced to Aiktak in 1921 and were trapped for pelts (Bureau of Biological Survey 1940) but eventually died off. With no foxes present on the island today, Aiktak has a breeding bird community that is one of the most diverse of any island in the eastern Aleutian Islands. The tufted puffin colony that exists at Aiktak is one of the largest in Alaska, supporting hundreds of thousands of birds. For these reasons, Aiktak Island has been designated as the annual monitoring site in the eastern Aleutian Island portion of the Alaska Maritime National Wildlife Refuge seabird monitoring system.

METHODS

Personnel: The U. S. Fish and Wildlife Service crew at Aiktak Island in 2017 consisted of Sarah Youngren and Dan Rapp (18 May to 1 September).

Data Collection and Analysis: Crew members followed data collection and analysis methods outlined in the annual monitoring camp standardized protocols for 2017 (Alaska Maritime National Wildlife Refuge 2017) with the following exceptions:

Black oystercatcher

- Nest statuses were recorded more frequently than the protocol specifications, excluding periods between nest completion and expected hatch.
- Nests observed pipping one day were not always hatched by the next day.
- We determined that Petrel Valley Cove contained two oystercatcher territories (one on east end and one on west end). This has likely been the case since at least 2015, however it was not recorded as such.

Pigeon guillemot

- Raft counts at pole 77 were conducted from Upland Access Trail due to aggressive bald eagles nesting on second sister of Four Sister formation. All of the count area could be observed as well as from pole 77. This occurred in 2015 and 2016 as well.
- Birds on rocks and in the intertidal were counted during raft counts, as birds move back and forth during counts (also done 2015 and 2016).

Ancient murrelet

- Monitored burrows where chicks fledged or that obviously failed (i.e. repeated cold eggs) were cleaned of membranes and dead eggs primarily in July (as opposed to August) in order to avoid visiting in the period of season when vegetation is thickest and impedes finding nests.

- Seven complete clutches and three single eggs were collected and emptied for an independent research project.

Horned puffin

- Raft counts at pole 77 were conducted from Upland Access Trail due to aggressive bald eagles nesting on second sister of Four Sister formation. All of the count area could be observed as well as from pole 77. This occurred in 2015 and 2016 as well.
- Due to the small number of nests monitored and the inaccessibility of many of the nests, chick growth data were not collected in 2017.
- Abandoned eggs from two nests were collected and emptied for an independent research project.

Tufted puffin

- The colony above New Camp Beach was used for productivity this year with good burrow finding success relative to other plots; this area has been used in the past, we found some old flags marking burrows. Productivity plot B was not used this season for productivity so it could be used for diet collection. Burrows that remained marked from previous year's monitoring aided nest searching; however, many of these burrows were not active in 2017. Flags were left in place at good quality nests at the end of the 2017 season.
- All artificial puffin burrows were refurbished at the beginning of the season (before egg laying) and checked for productivity. Wooden stakes or markers were replaced at many of the artificial burrows and one plastic chamber was replaced. An inventory was created on the quality of all artificial tufted puffin burrows. The larger and thicker chamber pots used for artificial burrows hold up well, the thinner pots are starting to collapse. It is recommended that the thin chamber pots be gradually replaced with the thicker pots. Though the artificial burrows have been mostly not used by tufted puffins this season and the past two seasons, they do provide a critical contingent of the chick growth sample. We did not visit D/B/G again until mid-July as they make good growth burrows, but are hard to get hatch dates from.
- A series of samples were collected from tufted puffins for a genetics special project and two independent research projects (pollutant study; egg study). Genetic samples included 26 chest feather samples collected from live adult birds rescued from trails and creeks, 22 toe samples collected from opportunistically collected dead adult (n = 16) and chick (n = 6) specimens, and eight egg membranes opportunistically collected from burrows. Eleven sets of feathers were collected from opportunistically collected dead birds for an independent research project (pollutant) and nine dead eggs (e.g., abandoned) were collected and emptied for an independent research project
- Food samples were collected by screening burrows during 10 sampling bouts from 8 August to 31 August. For 785 burrows screened we obtained eight samples. We collected the remainder of diet samples opportunistically in tufted puffin colony areas from dropped prey items (full and partial bill loads) found on the surface or in burrows.
    - New areas used this season that were favorable for screening included areas above (54°11'00.82" N, 164°49'42.01" W) and below (54°10'58.66" N, 164°49'52.08" W) tufted puffin population plot 16.
    - Large screens were made pre-season that made screening the larger burrow entrances much easier (these screens could be made slightly smaller and they would be perfect). Many of the screens on island could be replaced.
- After the final nest check we screened remaining active productivity nests and other active nests in area on New Camp Beach, Out-G, and Little West, for 18 burrows we obtained most of our samples for the season (six of the eight).

Glaucous-winged gull

- Productivity plots were searched for nests up to 30 m from poles, with some nests followed up to 50 m away from poles.
- In order to obtain a large enough sample size for productivity and chronology, nests were added to the sample that already had egg(s): of the 278 marked nests 181 started as an empty nest and 97 started with an egg(s). Of the nests that started empty 44 (24%) were eventually laid in of which only 18 hatched.
- Some nests were added just prior to hatching, these nests currently contribute to reproductive success figures and tables.
- Productivity nests that had no eggs were no longer monitored two weeks after last clutch was initiated for all plots (4 July). Last check of empty nests was on 18 July; however, we stopped following nests that no longer contained nest structures (i.e., not going to be laid in) after two consecutive checks without a nest structure.
- No regurgitation samples were collected directly from chicks in 2017, but instead adult wet regurgitations found near nests with chicks were collected.

Storm-petrels

- Storm-petrel nests were monitored every five to seven days for chronology plots and every 12-15 days for productivity plots in 2017. All artificial burrows were located but only plots A1 and A4 were followed consistently during the season. Nests in artificial burrows and outside of plots were excluded from analysis.
- Plot maps were updated this season and digitized for used in future years.
- For population, we noted size of burrow entrances during field-work, but during analysis included all burrows found in storm petrel plots (large burrows were not excluded).
- We generally stopped measuring chicks after that had received four feather measurements.
- Mass and wing chord measurements for chick growth were taken and recorded twice in succession, the value to use was chosen in the field.
- No tarsus measurements of chicks were recorded in 2017.
- Towards the end of the field season we removed and discarded eggs that were ejected, dead, or obviously abandoned eggs. We examined most discard eggs by carefully opening them and found that many of these eggs were clearly underdeveloped and uniformly off colored and lacking any normal egg formations (obviously long failed).
- Mist-netting for diet samples was conducted at the South end of Petrel Valley using a single 12 m net and without the aid of spotlights or call playback. This location proved productive for diet collection and it is recommended this location continues to be used.

Cormorant

- Boom-or-bust productivity was employed this season because individual nest monitoring was not possible (observed from pole 6 and pole 51).

Other surveys

- Marine debris standing stock surveys were not conducted in 2017.
- Seven COASST survey replicates were completed on Old-New Camp Beach in 2017.

Time zone

- During the 2017 season all times were recorded in Alaska Daylight Time (AKDT) (GMT-8). Population count data was entered into the population database and this report in Hawaii-Aleutian Standard Time (HAST) (GMT-9), according to protocol.

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

- In Figures 7 and 8 and Tables 5 and 6 black oystercatcher diet data was added from 2014.
- In Figure 51 and Table 81 storm-petrel density data were revised. In Tables 82-84 storm-petrel occupancy was updated for years 2010-2012 and 2015-2017 and data for years prior to 2010 were removed and are currently under review, to be updated in a future report.
- In Table 97 circumnavigation survey data was revised.

Reproductive success and chronology data for murres, puffins, and storm petrels were summarized using the AMNWR productivity database. Reproductive success and chronology data for cormorants, black oystercatchers, ancient murrelets and gulls were summarized by hand.

Population data for murres in 2014-2017 were summarized using the AMNWR population database. Population data for murres in 1995-2013 and all other species in all years have not yet been added to the database and were hand-summarized (these data will be added to and summarized by the database in the future).

Diet data for all species in all years were summarized using the AMNWR diet database (only ongoing diet datasets are presented here; additional diet datasets exist [Appendix A]). Diet is summarized for frequency of occurrence, percent composition and percent biomass for puffins; frequency of occurrence, percent composition and percent volume for gulls; and frequency of occurrence and percent composition for all 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 Aiktak 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 were summarized by hand.

INTERESTING OBSERVATIONS

- No nesting attempts by murres were observed.
- Tufted puffins had the worst reproductive success on record. It was difficult finding active burrows to monitor. Many of the previously used burrows were unoccupied. Of the burrows that were monitored for productivity many failed as eggs, often right after their first check. Many chicks that hatched in productivity burrows died soon after hatching; we suspected that they did not receive any feedings and thus starved. On 9 August and on subsequent checks many burrows showed signs of having been cleaned out by adults.
- Cormorants nested in area 6, but no nests fledged chicks. A bald eagle pair nested very near this location in 2015 and 2016 and potentially prevented cormorant nesting.
- We documented the first active burrows for Cassin's and rhinoceros auklet on Aiktak. Previous records indicated these species were likely breeding; however, this season we found pre-fledging chicks in burrows.
- We documented the first glaucous gull ever recorded on Aiktak.
- An unidentified hummingbird was observed on 27 August.
- Songbird numbers seemed low prior to appearance of fledglings.

- Large flying swarms of an unknown dark fly-like insect were observed on multiple occasions in the middle of the season (2 to 14 July). Typically these insects were only observed in good numbers on warm, sunny, low wind days. Photos are available.
- Vegetation was just beginning to green up upon arrival to island.
- On 16 June there was less lupine than the same time the previous year, however other flowering plants were more abundant.
- There were many dead patches of crowberry that persisted through the season.
- Mean weekly sea surface temperature (measured nearshore with a data logger) was higher than the historic means for nearly the entire season.
- During the 2017 season cabin maintenance included touching up the exterior paint.

<u>Dead things</u>

- Upon arrival to island on 18 May a dead unknown age Northern fur seal individual was found at the winter wrack line near Pleasure Point on Old Camp Beach. Identification was confirmed by Marc Webber via photo. The skull of this individual was recovered and brought back to FWS offices for Marc Webber for educational purposes.
- The dead sperm whale that washed into Tower Cove during the 2016 field season was found on 19 May as bones spread across Tower Cove, Rural Juror, and Ivory Cove. Two teeth were recovered and provided to Paul Wade on 5 July when staff of the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA/NMFS) was present in area for sea lion branding on Ugamak Island; teeth will potentially be used for isotope analysis.
- On 5 June a dead orca washed onto shore of Sea Lion Cove. The whale was a 6.8 meter long female (see cetacean stranding form in AMNWR data files for all measurements). The cause of death of the whale was unknown but it appeared the whale had an expulsion of after birth; the jaw was also significantly malformed but this likely came post-mortem (photos available). On 8 June samples were collected from the whale for partners/independent research including skin samples and multiple teeth; additional measurements taken at this time as well. On 10 and 11 June the whale washed out of Sea Lion Cove and became mired in kelp beds off Rocky Platform One. The whale eventually washed back into Sea Lion Cove and then onto rocks of Rocky Platform One just past dike. The whale was last observed in this location on 27 August. Three teeth and two skin samples were collected and provided to Paul Wade on 5 July when NOAA/NMFS was present in area for sea lion branding on Ugamak Island; teeth and tissues will potentially be used for isotope and genetic analysis.
- One sooty shearwater was found on the wrack of Petrel Valley Cove on 25 June; the skull was measured to confirm identity. The bird was fresh and had been scavenged. It's difficult to say if the bird washed in or was brought in by a predator. Photos are available.

<u>Visitors</u>

- On 11 June, USFWS, Marine Mammal Management conducted an aerial sea otter survey by plane for Aiktak, Ugamak, and potentially other nearby islands.
- On 4 July NOAA/NMFS arrived via the R/V *Tiĝlax̂* to brand pups at the sea lion rookery in front and below the cabin on Ugamak Island. On 5 July we helped with the second day of pup branding on Ugamak at a rookery on the southeast corner of Ugamak Island. Though the weather was less than favorable, a total of 100 pups were branded and measured.
- On 6 August a circumnavigation survey of Aiktak was completed while the R/V *Tiĝlax̂* visited the area during the course of conducting nearshore boat surveys in the eastern Aleutians.
- On 25 August NOAA/NMFS conducted an aerial harbor seal survey by plane for Aiktak, Ugamak, and potentially other nearby islands.

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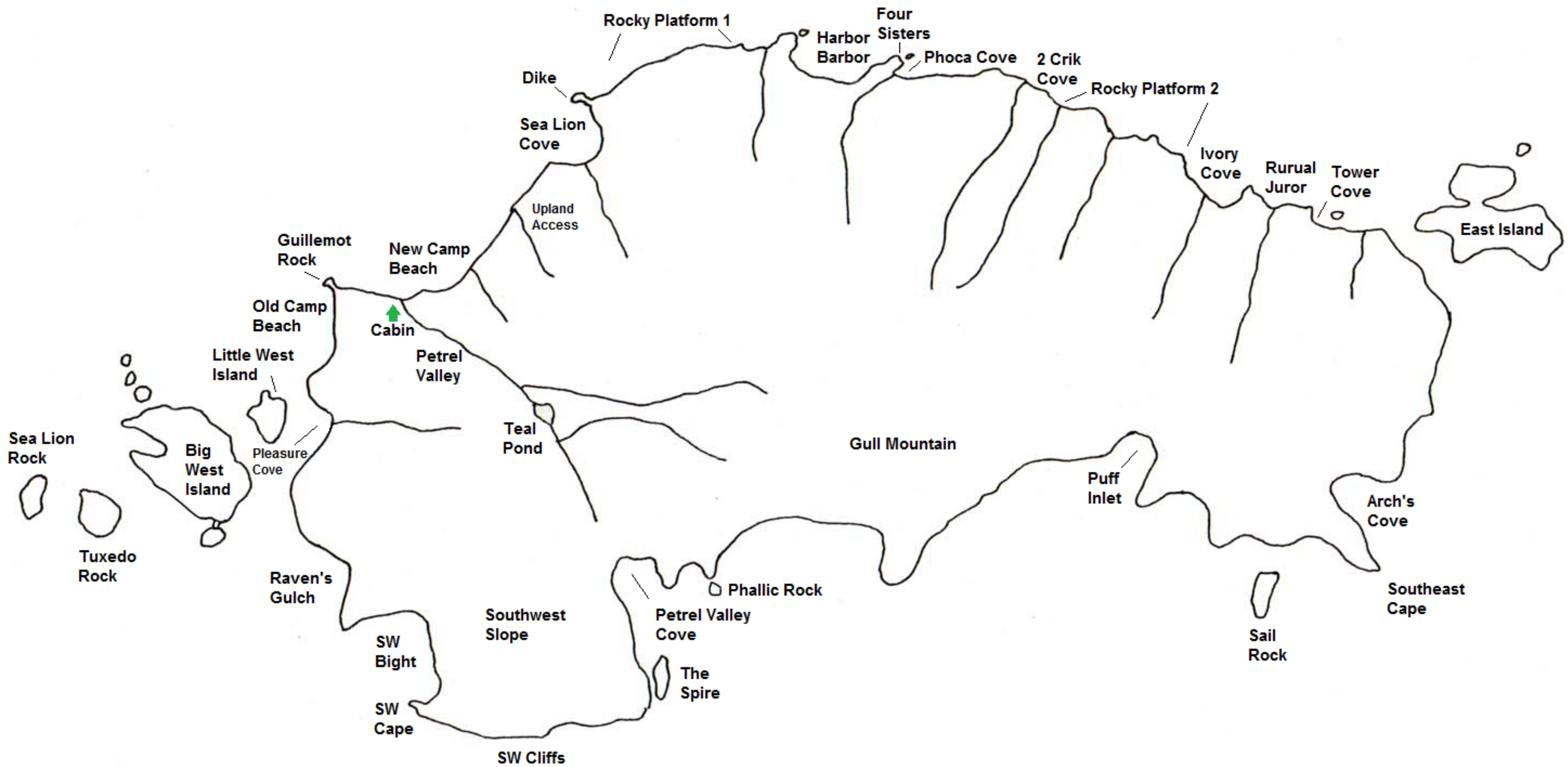

Figure 1. Map of Aiktak Island, Alaska.

Figure 2. Aerial view of Aiktak Island from the west.

Figure 3. Aerial view of Aiktak Island from the east.

FIGURES AND TABLES

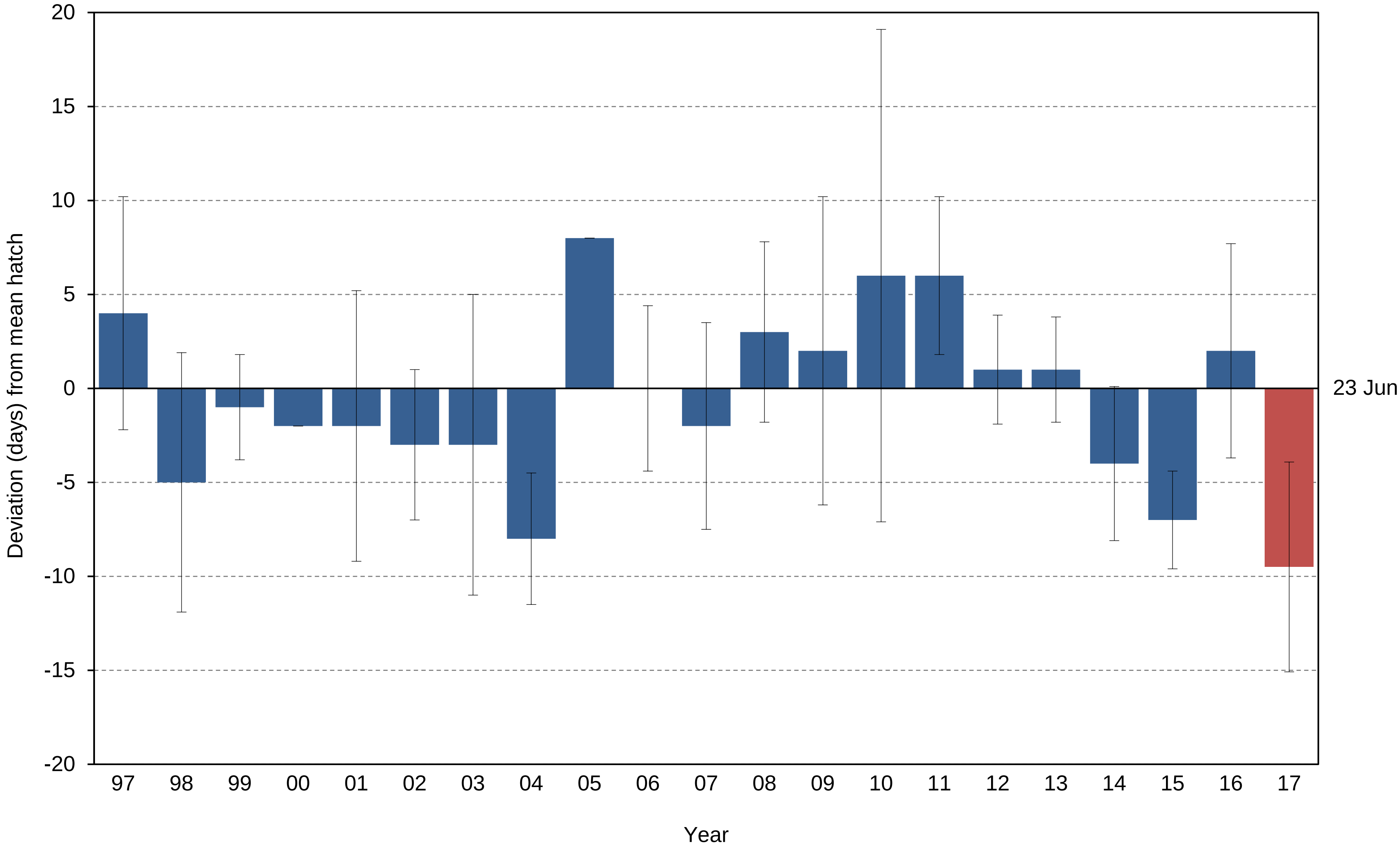

Figure 4. Yearly hatch date deviation (from the 1997-2016 average of 23 June) for black oystercatchers at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year.

Table 1. Breeding chronology of black oystercatchers at Aiktak Island, Alaska. Data represent the date of the first chick hatched in each nest.

Year	Mean hatch	SD	n^a	First hatch	Last hatch
1997	27 Jun	6.2	7	18 Jun	5 Jul
1998	18 Jun	6.9	4	11 Jun	27 Jun
1999	22 Jun	2.8	4	19 Jun	25 Jun
2000	20 Jun	0.0	1	20 Jun	-
2001	21 Jun	7.2	9	15 Jun	6 Jul
2002	20 Jun	4.0	4	14 Jun	22 Jun
2003	20 Jun	8.0	6	13 Jun	5 Jul
2004	14 Jun	3.5	8	10 Jun	19 Jun
2005	1 Jul	0.0	1	1 Jul	-
2006	23 Jun	4.4	10	15 Jun	1 Jul
2007	21 Jun	5.5	5	17 Jun	27 Jun
2008	25 Jun	4.8	10	17 Jun	1 Jul
2009	25 Jun	8.2	9	13 Jun	5 Jul
2010	29 Jun	13.1	3	15 Jun	11 Jul
2011	29 Jun	4.2	3	26 Jun	4 Jul
2012	23 Jun	2.9	3	20 Jun	25 Jun
2013	24 Jun	2.8	5	21 Jun	27 Jun
2014	19 Jun	4.1	10	13 Jun	26 Jun
2015	16 Jun	2.6	7	13 Jun	21 Jun
2016	24 Jun	5.7	7	18 Jun	2 Jul
2017	14 Jun	5.6	10	5 Jun	23 Jun

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 5 days.

Table 2. Frequency distribution of hatch dates for black oystercatchers at Aiktak 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 ≤ 5 days.

Julian	No. nests hatching on Julian date																				
date[a]	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
156	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
158	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
161	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
162	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1
163	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
164	-	-	-	-	-	-	1	2	-	-	-	-	1	-	-	-	-	1	1	-	-
165	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
166	-	1	-	-	2	-	-	-	-	1	-	-	-	1	-	-	-	1	4	-	-
167	-	-	-	-	1	-	2	1	-	-	-	-	1	-	-	-	-	1	-	-	-
168	-	-	-	-	1	-	1	1	-	-	3	-	-	-	-	-	-	-	-	-	2
169	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	1	-	-
170	-	-	1	-	-	-	-	1	-	1	-	-	1	-	-	-	-	1	-	2	-
171	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
172	1	-	1	1	-	-	-	-	-	-	-	1	-	-	-	1	2	1	1	-	-
173	-	-	-	-	-	3	-	-	-	3	-	1	1	-	-	-	-	-	-	-	-
174	-	-	-	-	1	-	1	-	-	2	-	-	-	-	-	-	-	-	-	2	1
175	-	-	1	-	-	-	-	-	-	1	-	-	1	-	-	-	-	2	-	-	-
176	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-
177	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2	1	1	-	-	-
178	1	1	-	-	2	-	-	-	-	-	2	1	-	-	-	-	1	-	-	1	-
179	1	-	-	-	-	-	-	-	-	1	-	2	-	-	1	-	-	-	-	-	-
180	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
181	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
182	-	-	-	-	-	-	-	-	1	1	-	1	1	1	-	-	-	-	-	-	-
183	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-
184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
185	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
186	1	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-
187	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
n	7	4	4	1	9	4	6	8	1	10	5	10	9	3	3	3	5	10	7	7	10

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

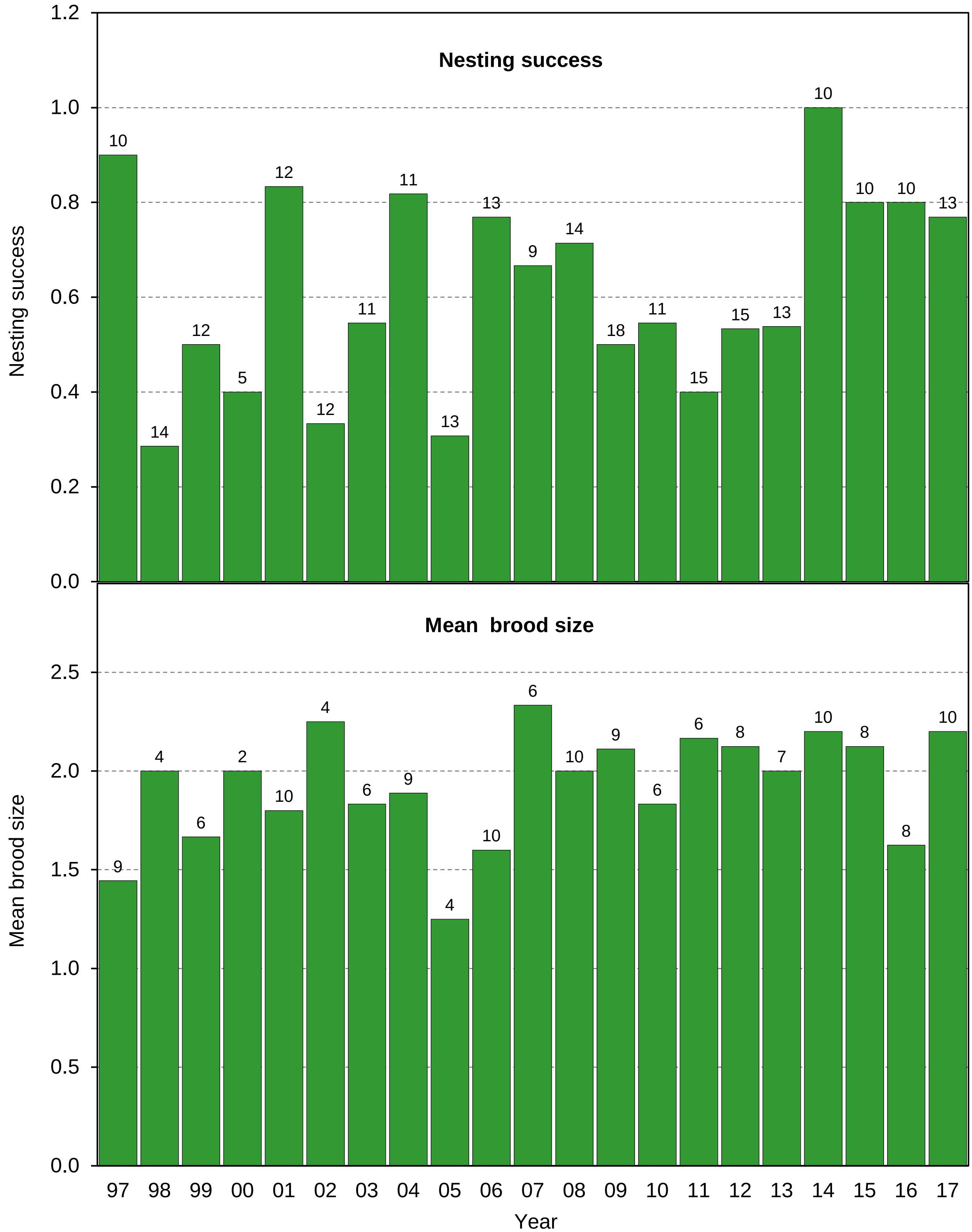

Figure 5. Reproductive performance of black oystercatchers at Aiktak Island, Alaska. Nesting success=D/B; Mean brood size=E/D; where B=nest sites with eggs, D=nest sites with chicks; E=total chicks. Numbers above columns indicate sample sizes ([B] for nesting success, [D] for brood size).

Table 3. Reproductive performance of black oystercatchers at Aiktak Island, Alaska.

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)
1997	10	0	7	3	23	9	13	-	-	2.3	1.4	0.90	0.57	-	-	-	-
1998	14	4	2	8	32	4	8	-	-	2.3	2.0	0.29	0.25	-	-	-	-
1999	12	0	5	7	31	6	10	-	-	2.6	1.7	0.50	0.32	-	-	-	-
2000	5	1	1	3	12	2	4	-	-	2.4	2.0	0.40	0.33	-	-	-	-
2001	12	2	5	5	27	10	18	-	-	2.3	1.8	0.83	0.67	-	-	-	-
2002	12	1	2	9	32	4	9	-	-	2.7	2.3	0.33	0.28	-	-	-	-
2003	11	1	4	6	27	6	11	-	-	2.5	1.8	0.55	0.41	-	-	-	-
2004	11	1	2	8	29	9	17	-	-	2.6	1.9	0.82	0.59	-	-	-	-
2005[a]	13	2	7	4	28	4	5	-	-	2.2	1.3	0.31	0.18	-	-	-	-
2006	13	0	6	7	33	10	16	-	-	2.5	1.6	0.77	0.48	-	-	-	-
2007	9	0	4	5	23	6	14	-	-	2.6	2.3	0.67	0.61	-	-	-	-
2008	14	1	5	8	35	10	20	-	-	2.5	2.0	0.71	0.57	-	-	-	-
2009	18	3	8	7	40	9	19	-	-	2.2	2.1	0.50	0.48	-	-	-	-
2010	11	1	8	2	23	6	11	-	-	2.1	1.8	0.55	0.48	-	-	-	-
2011	15	1	6	8	37	6	13	-	-	2.5	2.2	0.40	0.35	-	-	-	-
2012	15	1	8	6	35	8	17	-	-	2.3	2.1	0.49	0.53	-	-	-	-
2013	13	0	5	8	34	7	14	-	-	2.6	2.0	0.54	0.38	-	-	-	-
2014	10	1	3	6	25	10	22	-	-	2.5	2.2	1.00	0.88	-	-	-	-
2015	10	1	2	7	26	8	17	6	9	2.6	2.1	0.80	0.65	0.53	0.35	0.75	0.60
2016	10	1	6	3	22	8	13	2	3	2.2	1.6	0.80	0.59	0.23	0.14	0.25	0.20
2017	13	0	3	10	36	10	22	6	9	2.8	2.2	0.77	0.61	0.41	0.25	0.60	0.46

[a]In 2005, an early-season storm on 27 May pushed kelp over many nests, causing a large number of pairs to relay.

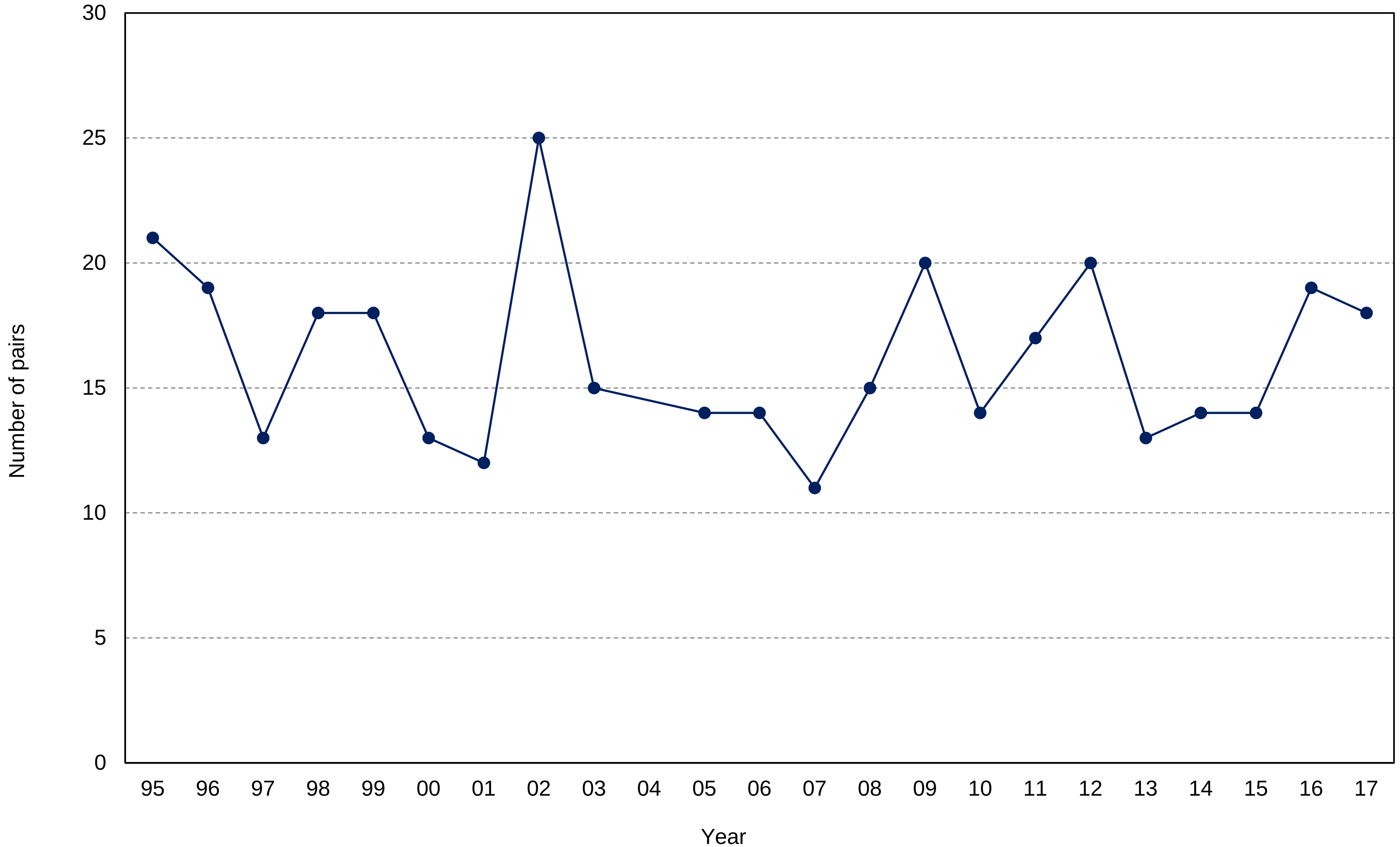

Figure 6. Numbers of black oystercatcher breeding pairs at Aiktak Island, Alaska. Values are based on the total number of nests, territories, and/or breeding pairs counted on the island throughout the year.

Table 4. Numbers of black oystercatchers breeding at Aiktak Island, Alaska. Values are based on the total number of nests, territories, and/or breeding pairs counted on the island throughout the year; numbers of breeding birds are estimated by doubling territory numbers. Data do not include flocks of migratory birds passing through the area in the fall.

Year	No. nests/ territories	Estimated no. breeding birds
1995	21	42
1996	19	38
1997	13	26
1998	18	36
1999	18	36
2000	13	26
2001	12	24
2002	25	50
2003	15	30
2004[a]	$\geq$10	$\geq$20
2005	14	28
2006	14	28
2007	11	22
2008	15	30
2009	20	40
2010	14	28
2011	17	34
2012	20	40
2013	13	26
2014	14	28
2015	14	28
2016	19	38
2017	18	36

[a]No data on the total number or distribution of breeding pairs were recorded for 2004; numbers represents minimum number of breeding pairs and birds from those nests monitored for productivity.

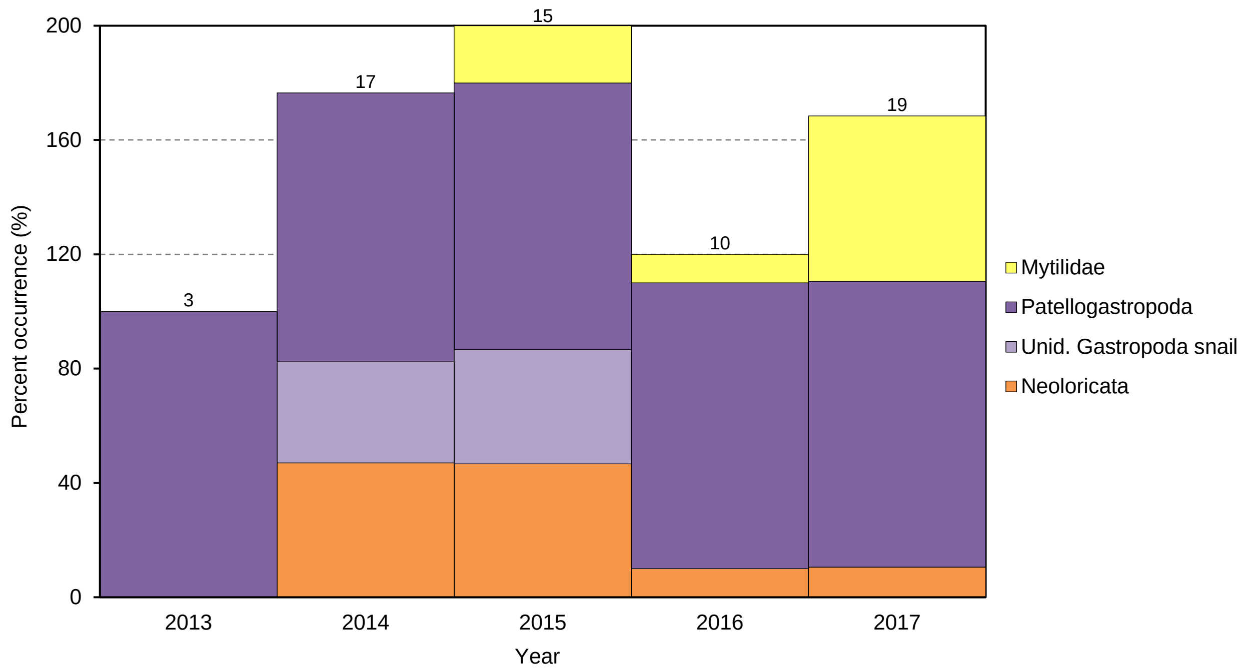

Figure 7. Frequency of occurrence of major prey items in diets of black oystercatcher chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence 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 2013.

Table 5. Frequency of occurrence of major prey items in diets of black oystercatcher chicks at Aiktak 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 2013. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2013	2014	2015	2016	2017
No. samples	3	17	15	10	19
Invertebrates	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Bivalvia	**-**	**5.9**	**20.0**	**10.0**	**57.9**
Mytilidae	**-**	**-**	**20.0**	**10.0**	**57.9**
Unid. Mytilidae	-	-	20.0	10.0	57.9
Other Bivalvia	-	5.9	-	-	-
Gastropoda	**100.0**	**94.1**	**93.3**	**100.0**	**100.0**
Patellogastropoda	100.0	94.1	93.3	100.0	100.0
Unid. Gastropoda snail	-	35.3	40.0	-	-
Other Gastropoda	-	-	-	-	15.8
Polyplacophora	**-**	**47.1**	**46.7**	**10.0**	**10.5**
Neoloricata	-	47.1	46.7	10.0	10.5
Other Invertebrates	-	5.9	-	10.0	-

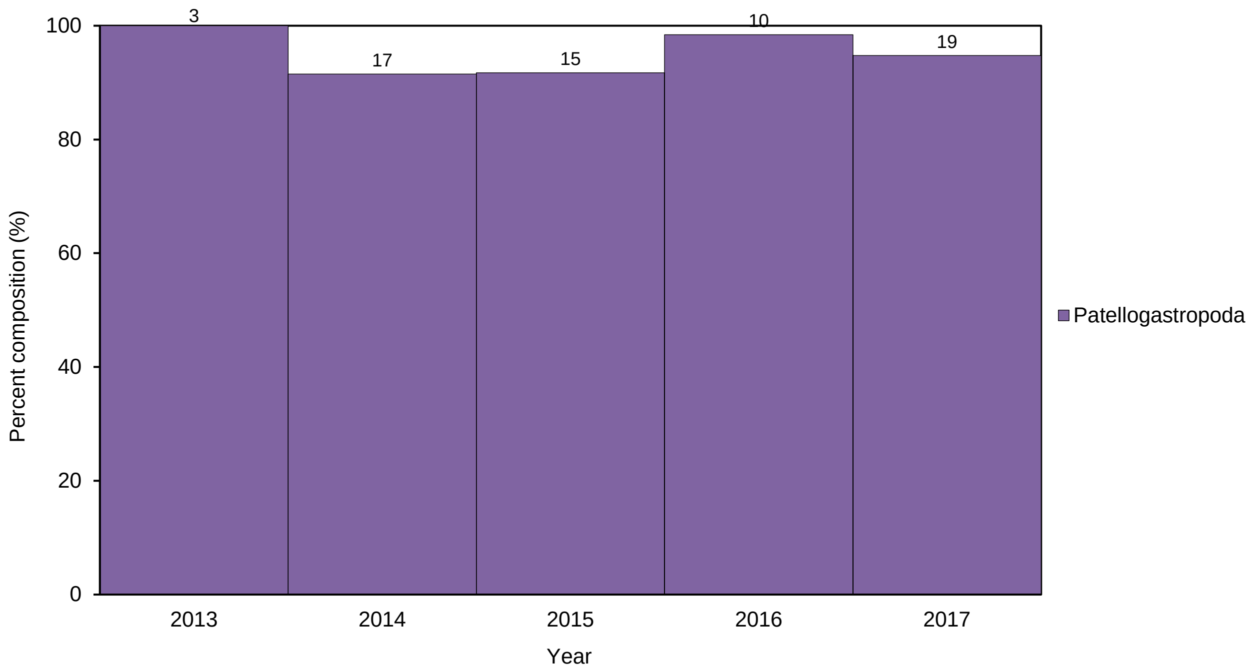

Figure 8. Percent composition of major prey items in diets of black oystercatcher chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition 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 2013.

Table 6. Percent composition of major prey items in diets of black oystercatcher chicks at Aiktak 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 2013. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2013	2014	2015	2016	2017
No. samples	3	17	15	10	19
No. individuals	10	658	1186	499	687
Invertebrates	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Gastropoda	**100.0**	**95.0**	**97.7**	**98.4**	**94.8**
Patellogastropoda	100.0	91.5	91.7	98.4	94.8
Other Gastropoda	-	3.5	6.0	-	0.4
Other Invertebrates	-	5.0	2.3	1.6	5.2

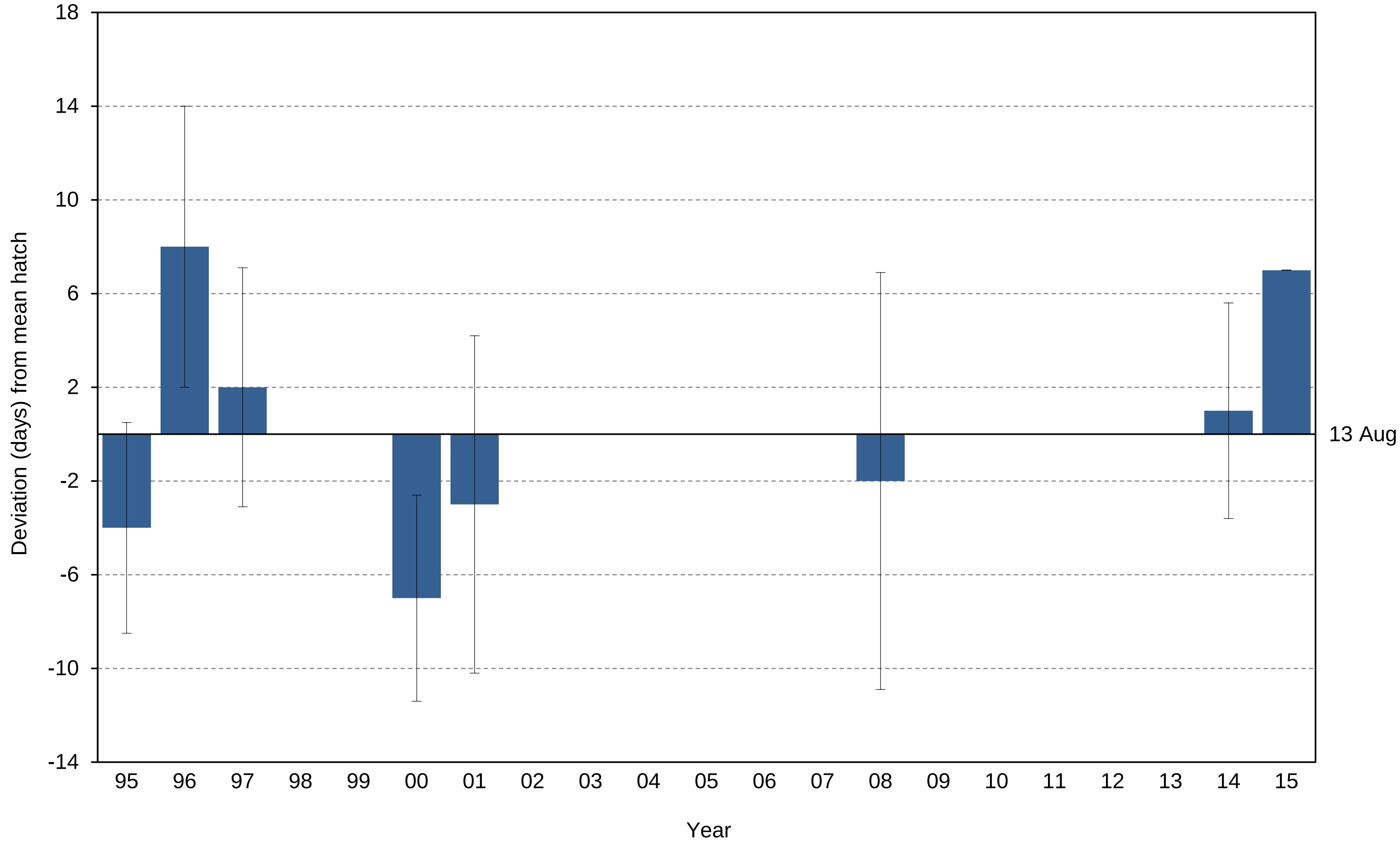

Figure 9. Yearly hatch date deviation (from the 1995-2015 average of 13 August) for common murres at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2006 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, 2007, 2009-2013, or 2017.

Table 7. Breeding chronology of common murres at Aiktak Island, Alaska. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2006 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, 2007, 2009-2013, or 2017.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First "jump"[b]
1995	9 Aug	4.5	13	31 Jul	14 Aug	22 Aug
1996	20 Aug	6.0	45	5 Aug	8 Sep	25 Aug
1997	15 Aug	5.1	39	4 Aug	26 Aug	22 Aug
2000	7 Aug	4.4	10	2 Aug	15 Aug	17 Aug
2001	10 Aug	7.2	13	2 Aug	23 Aug	11 Aug
2008	10 Aug	8.9	4	30 Jul	24 Aug	>26 Aug
2014	14 Aug	4.6	8	8 Aug	24 Aug	>28 Aug
2015	20 Aug	0.0	2	20 Aug	20 Aug	24 Aug

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

[b]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 8. Frequency distribution of hatch dates for common murres at Aiktak Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval in 2006 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, 2007, 2009-2013, or 2017.

Julian date[a]	No. nests hatching on Julian date							
	95	96	97	00	01	08	14	15
212	1	-	-	-	-	1	-	-
213	-	-	-	-	-	-	-	-
214	-	-	-	-	3	-	-	-
215	-	-	-	4	-	-	-	-
216	-	-	3	-	2	-	-	-
217	-	-	-	-	-	-	-	-
218	6	2	-	-	-	-	-	-
219	-	-	2	-	-	-	-	-
220	-	-	-	-	3	-	1	-
221	-	-	1	-	-	-	-	-
222	1	-	2	4	-	2	2	-
223	-	-	-	-	-	-	-	-
224	-	-	1	1	-	-	-	-
225	-	1	-	-	-	-	-	-
226	5	2	8	-	1	-	4	-
227	-	-	2	-	1	-	-	-
228	-	6	2	1	-	-	-	-
229	-	-	-	-	-	-	-	-
230	-	1	9	-	-	-	-	-
231	-	1	2	-	1	-	-	-
232	-	3	5	-	1	-	-	2
233	-	-	-	-	-	-	-	-
234	-	18	1	-	-	-	-	-
235	-	-	-	-	1	-	-	-
236	-	1	-	-	-	-	1	-
237	-	-	-	-	-	1	-	-
238	-	4	1	-	-	-	-	-
239	-	-	-	-	-	-	-	-
240	-	2	-	-	-	-	-	-
241	-	2	-	-	-	-	-	-
242	-	-	-	-	-	-	-	-
243	-	-	-	-	-	-	-	-
244	-	1	-	-	-	-	-	-
245	-	-	-	-	-	-	-	-
246	-	-	-	-	-	-	-	-
247	-	-	-	-	-	-	-	-
248	-	-	-	-	-	-	-	-
249	-	-	-	-	-	-	-	-
250	-	-	-	-	-	-	-	-
251	-	-	-	-	-	-	-	-
252	-	1	-	-	-	-	-	-
n	13	45	39	10	13	4	8	2

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

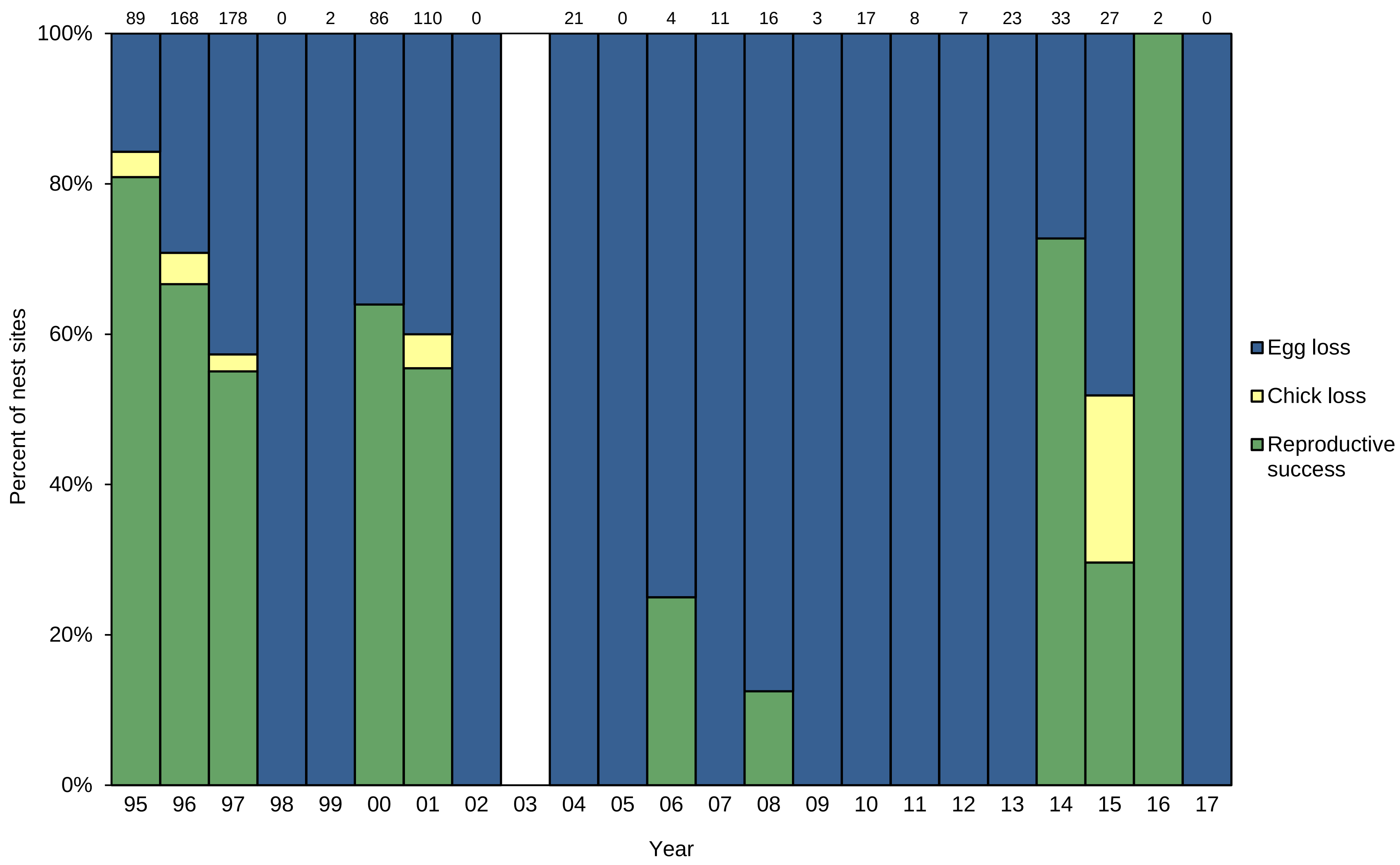

Figure 10. Reproductive performance of common murres at Aiktak Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Failure in years when no eggs were laid is considered 100% egg loss. Numbers above columns indicate sample sizes (B). No data were collected in 2003.

Table 9. Reproductive performance of common murres at Aiktak Island, Alaska. No data were collected in 2003.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential reproductive success[d] [(F+H)/(B+H)]
1995	89	75	72	10	0.84	0.96	0.81	0.83
1996	168	119	112	4	0.71	0.94	0.67	0.67
1997	178	102	98	25	0.57	0.96	0.55	0.61
1998	0	0	0	0	0.00	0.00	0.00	0.00
1999	2	0	0	0	0.00	0.00	0.00	0.00
2000	86	55	55	2	0.64	1.00	0.64	0.65
2001	110	66	61	8	0.60	0.92	0.55	0.58
2002	0	0	0	0	0.00	0.00	0.00	0.00
2004	21	0	0	0	0.00	0.00	0.00	0.00
2005	0	0	0	0	0.00	0.00	0.00	0.00
2006	4	1	1	1	0.25	1.00	0.25	0.40
2007	11	0	0	0	0.00	0.00	0.00	0.00
2008	16	2	2	3	0.13	1.00	0.13	0.26
2009	3	0	0	0	0.00	0.00	0.00	0.00
2010	17	0	0	2	0.00	0.00	0.00	0.11
2011	8	0	0	0	0.00	0.00	0.00	0.00
2012	7	0	0	0	0.00	0.00	0.00	0.00
2013	23	0	0	0	0.00	0.00	0.00	0.00
2014	33	24	24	7	0.73	1.00	0.73	0.78
2015	27	14	8	0	0.52	0.57	0.30	0.30
2016	2	2	2	0	1.00	1.00	1.00	1.00
2017	0	0	0	0	0.00	0.00	0.00	0.00

[a]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.

[b]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).

[c]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).

[d]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.

Table 10. Standard deviation in reproductive performance parameters of common murres at Aiktak Island, Alaska. Sampling for murres is clustered by plot except when sample sizes per plot are too small or plot data are not available. No data were collected in 1998, 2002, 2003, 2005, or 2017.

Year	No. plots[a]	Nest sites w/ eggs	Sampling design[b]	Nesting success	Fledging success	Reproductive success	Max. potential reproductive success
1995	5	89	Cluster by plot	0.02	0.02	0.03	0.03
1996	7	168	Cluster by plot	0.10	0.04	0.08	0.08
1997	9	178	Cluster by plot	0.12	0.02	0.11	0.11
1999	2	2	Simple random	0.00	-	0.00	0.00
2000	6	86	Cluster by plot	0.14	0.00	0.14	0.13
2001	7	110	Cluster by plot	0.12	0.04	0.12	0.11
2004	1	21	Simple random	0.00	0.00	0.00	0.00
2006	1	4	Simple random	0.22	0.00	0.22	0.22
2007	4	11	Simple random	0.00	-	0.00	0.00
2008	5	16	Simple random	0.08	0.00	0.08	0.10
2009	1	3	Simple random	0.00	-	0.00	0.00
2010	4	17	Simple random	0.00	-	0.00	0.07
2011	3	8	Simple random	0.00	-	0.00	0.00
2012	3	7	Simple random	0.00	-	0.00	0.00
2013	1	23	Simple random	0.00	-	0.00	0.00
2014	6	39	Simple random	0.08	0.00	0.08	0.07
2015	2	27	Simple random	0.10	0.13	0.09	0.09
2016	1	2	Simple random	0.00	0.00	0.00	0.00

[a]Plots that are combined for analysis are counted as a single "plot".

[b]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 ρ is the success rate and n is the sample size of individual nests.

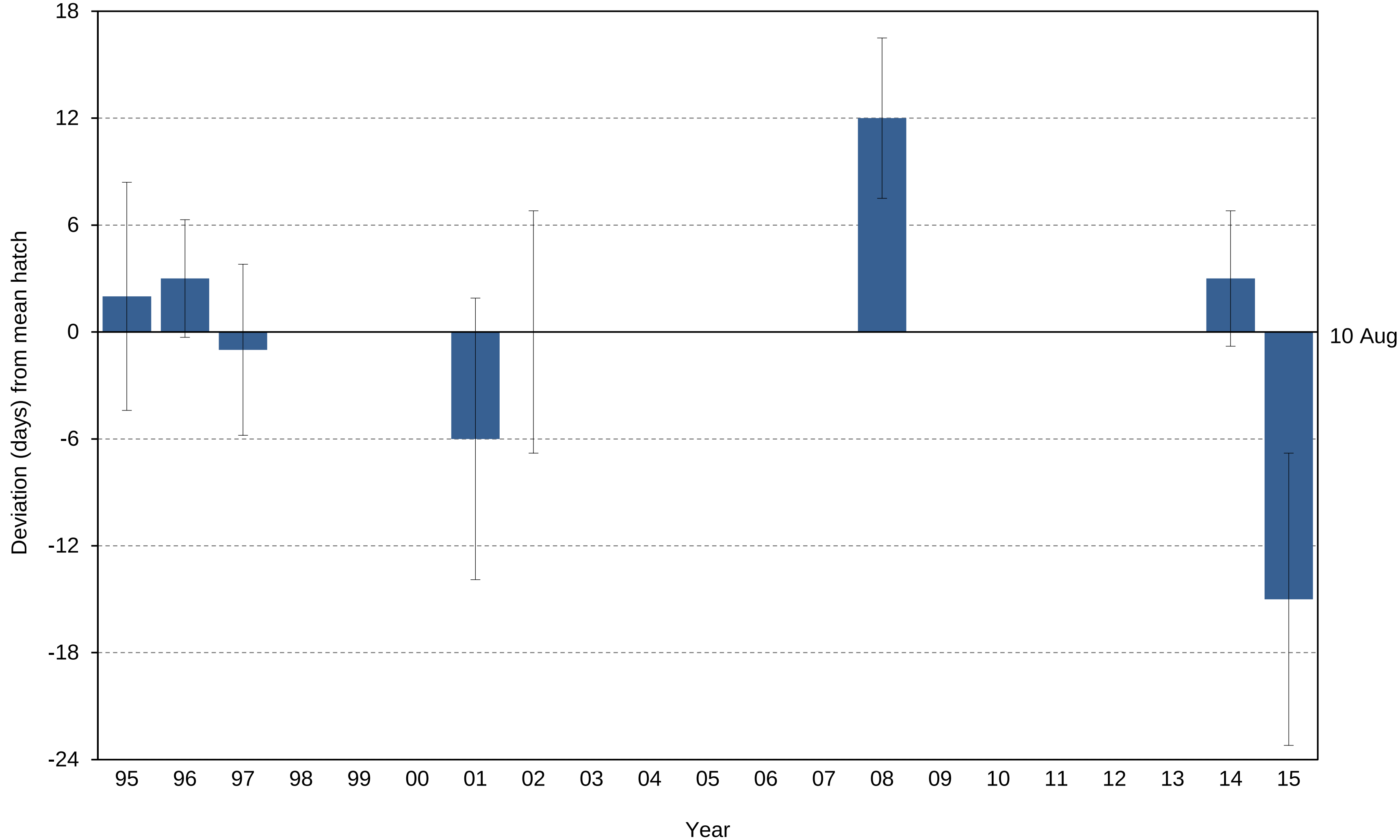

Figure 11. Yearly hatch date deviation (from the 1995-2015 average of 10 August) for thick-billed murres at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2006-2007 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, 2009-2013, or 2017.

Table 11. Breeding chronology of thick-billed murres at Aiktak Island, Alaska. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2006-2007 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, 2009-2013, or 2017.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First "jump"[b]
1995	12 Aug	6.4	8	6 Aug	27 Aug	26 Aug
1996	12 Aug	3.3	9	5 Aug	17 Aug	25 Aug
1997	9 Aug	4.8	15	4 Aug	22 Aug	22 Aug
2000	3 Aug	7.9	9	23 Jul	11 Aug	11 Aug
2001	10 Aug	6.8	6	2 Aug	23 Aug	11 Aug
2008	21 Aug	4.5	2	16 Aug	25 Aug	-
2014	13 Aug	3.8	4	8 Aug	18 Aug	>28 Aug
2015	26 Jul	8.2	4	19 Jul	8 Aug	24 Aug

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

[b]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 12. Frequency distribution of hatch dates for thick-billed murres at Aiktak Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2003 and no hatch dates were recorded with the appropriate egg to chick interval in 2006-2007 or 2016; no eggs hatched in plots in 1998-1999, 2002, 2004-2005, or 2009-2013.

Julian date[a]	No. nests hatching on Julian date							
	95	96	97	00	01	08	14	15
200	-	-	-	-	-	-	-	2
201	-	-	-	-	-	-	-	-
202	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-
205	-	-	-	3	-	-	-	-
206	-	-	-	-	-	-	-	1
207	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-
209	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-
211	-	-	-	-	-	-	-	-
212	-	-	-	-	-	-	-	-
213	-	-	-	-	-	-	-	-
214	-	-	-	-	1	-	-	-
215	-	-	-	-	-	-	-	-
216	-	-	4	-	1	-	-	-
217	-	-	-	-	-	-	-	-
218	2	1	1	-	-	-	-	-
219	-	-	3	1	-	-	-	-
220	-	-	-	1	2	-	1	1
221	-	-	3	-	-	-	-	-
222	3	2	-	3	-	-	1	-
223	-	-	-	-	-	-	-	-
224	-	-	1	1	1	-	-	-
225	-	-	-	-	-	-	-	-
226	1	5	2	-	-	-	1	-
227	-	-	-	-	-	-	-	-
228	1	-	-	-	-	1	-	-
229	-	-	-	-	-	-	-	-
230	-	1	-	-	-	-	1	-
231	-	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-
234	-	-	1	-	-	-	-	-
235	-	-	-	-	1	-	-	-
236	-	-	-	-	-	-	-	-
237	-	-	-	-	-	1	-	-
238	-	-	-	-	-	-	-	-
239	1	-	-	-	-	-	-	-
n	8	9	15	9	6	2	4	4

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

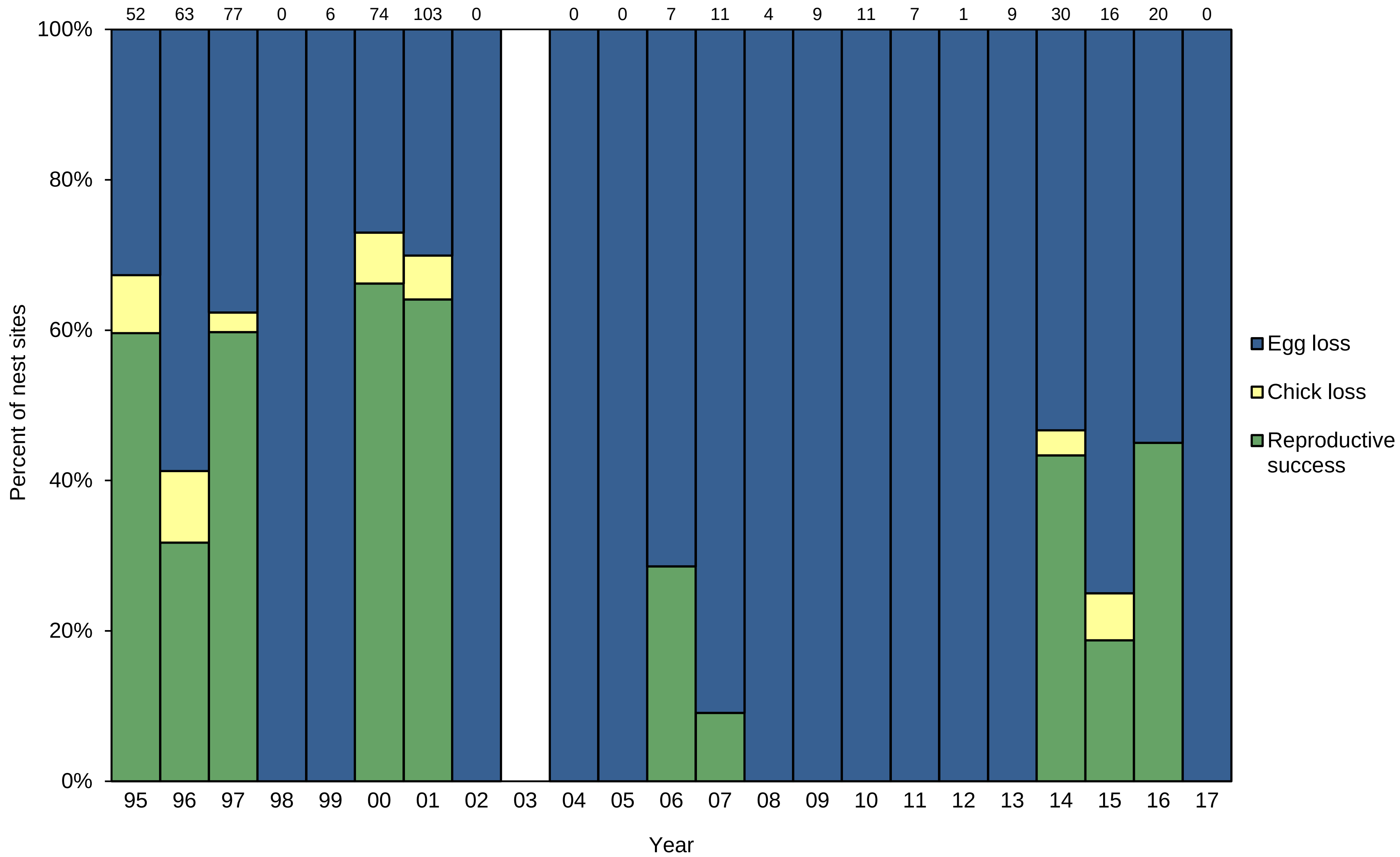

Figure 12. Reproductive performance of thick-billed murres at Aiktak Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Failure in years when no eggs were laid is considered 100% egg loss. Numbers above columns indicate sample sizes (B). No data were collected in 2003.

Table 13. Reproductive performance of thick-billed murres at Aiktak Island, Alaska. No data were collected in 2003.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential reproductive success[d] [(F+H)/(B+H)]
1995	52	35	31	5	0.67	0.89	0.60	0.63
1996	63	26	20	0	0.41	0.77	0.32	0.32
1997	77	48	46	7	0.62	0.96	0.60	0.63
1998	0	0	0	0	0.00	0.00	0.00	0.00
1999	6	0	0	0	0.00	0.00	0.00	0.00
2000	74	54	49	0	0.73	0.91	0.66	0.66
2001	103	72	66	0	0.70	0.92	0.64	0.64
2002	0	0	0	0	0.00	0.00	0.00	0.00
2004	0	0	0	0	0.00	0.00	0.00	0.00
2005	0	0	0	0	0.00	0.00	0.00	0.00
2006	7	2	2	1	0.29	1.00	0.29	0.38
2007	11	1	1	0	0.09	1.00	0.09	0.09
2008	4	0	0	2	0.00	0.00	0.00	0.33
2009	9	0	0	0	0.00	0.00	0.00	0.00
2010	11	0	0	1	0.00	0.00	0.00	0.08
2011	7	0	0	0	0.00	0.00	0.00	0.00
2012	1	0	0	0	0.00	0.00	0.00	0.00
2013	9	0	0	0	0.00	0.00	0.00	0.00
2014	30	14	13	5	0.47	0.93	0.43	0.51
2015	16	4	3	0	0.25	0.75	0.19	0.19
2016	20	9	9	2	0.45	1.00	0.45	0.50
2017	0	0	0	0	0.00	0.00	0.00	0.00

[a]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.

[b]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).

[c]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).

[d]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.

Table 14. Standard deviation in reproductive performance parameters of thick-billed murres at Aiktak Island, Alaska. Sampling for murres is clustered by plot except when sample sizes per plot are too small or plot data are not available. No data were collected in 1998, 2002-2005, or 2017.

Year	No. plots[a]	Nest sites w/ eggs	Sampling design[b]	Nesting success	Fledging success	Reproductive success	Max. potential reproductive success
1995	6	52	Cluster by plot	0.06	0.04	0.04	0.02
1996	5	63	Cluster by plot	0.11	0.03	0.09	0.09
1997	5	77	Cluster by plot	0.06	0.02	0.06	0.06
1999	3	6	Simple random	0.00	-	0.00	0.00
2000	3	74	Cluster by plot	0.06	0.03	0.06	0.06
2001	6	103	Cluster by plot	0.11	0.05	0.13	0.13
2006	1	7	Simple random	0.17	0.00	0.17	0.17
2007	2	11	Simple random	0.09	0.00	0.09	0.09
2008	3	4	Simple random	0.00	-	0.00	0.19
2009	1	9	Simple random	0.00	-	0.00	0.00
2010	3	11	Simple random	0.00	-	0.00	0.08
2011	3	7	Simple random	0.00	-	0.00	0.00
2012	1	1	Simple random	-	-	-	-
2013	4	9	Simple random	0.00	-	0.00	0.00
2014	3	30	Simple random	0.09	0.05	0.09	0.09
2015	2	16	Simple random	0.11	0.22	0.10	0.10
2016	2	20	Simple random	0.11	0.00	0.11	0.11

[a]Plots that are combined for analysis are counted as a single "plot".

[b]For sampling clustered by plot, values are calculated based on plot as a sample unit; for simple random sampling, values are calculated using $\sqrt{\rho * (1-\rho)/n}$, where ρ is the success rate and n is the sample size of individual nests.

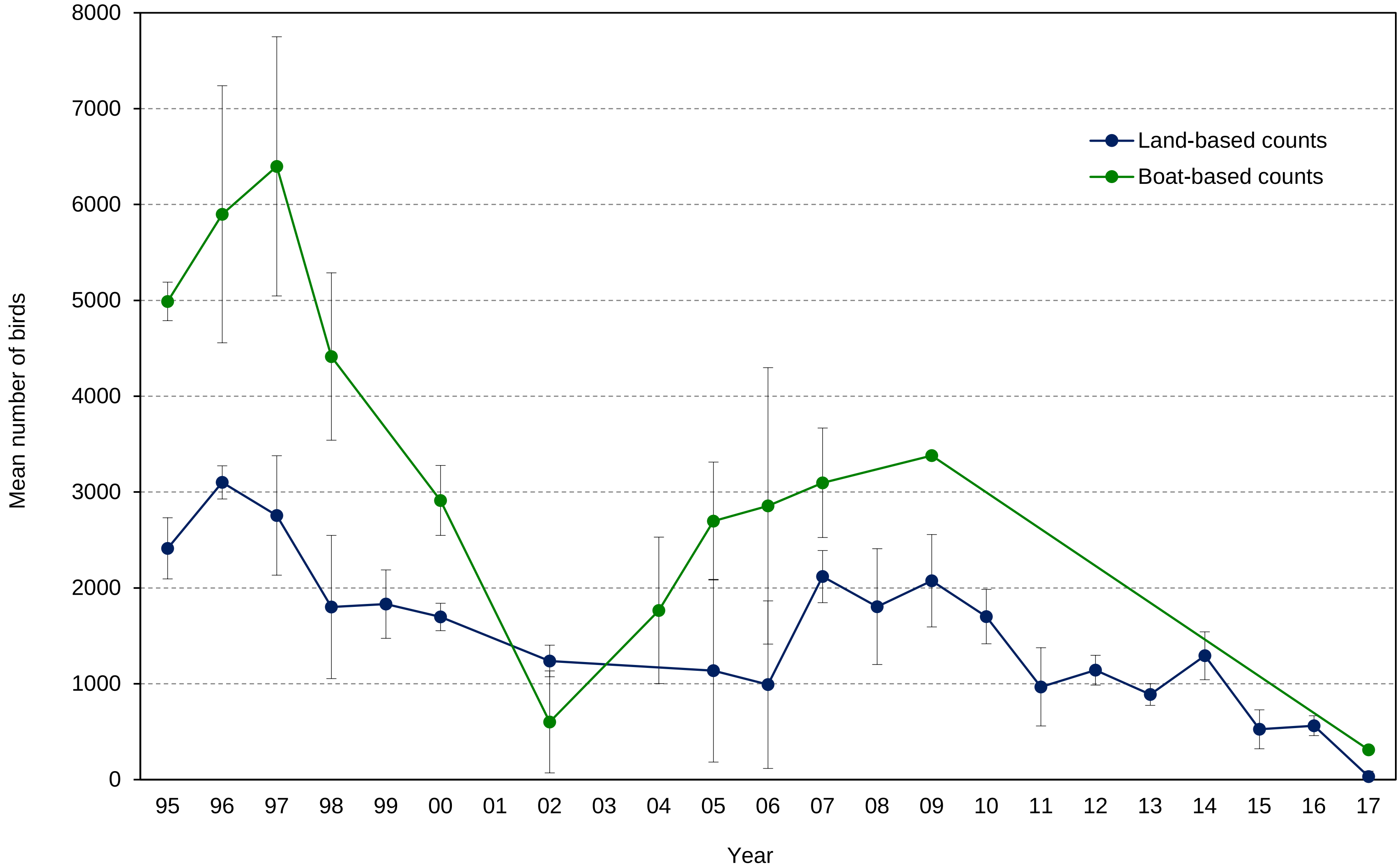

Figure 13. Mean numbers of murres (includes common, thick-billed, and unknown murres) counted on land-based index plots and during boat-based circumnavigations at Aiktak Island, Alaska. Land-based counts represent the number of murres attending cliffs and do not include rafting birds; boat based-counts include all murres attending cliffs and rafting on the water. Error bars represent standard deviation. No land-based counts were conducted in 2001 or 2003-2004; no boat-based counts were conducted in 1999, 2001, 2003, 2008, 2010-2016.

Table 15. Numbers of murres (includes common, thick-billed, and unknown murres) counted on land-based index plots at Aiktak Island, Alaska. No counts were conducted in 2001 or 2003-2004.

Replicate	1995	1996	1997	1998	1999	2000	2002	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	2597	2873	2553	1840	1566	1761	1240	370	511	1775	1117	2498	1283	1031	959	881	913	324	585	15
2	2591	2897	1836	581	1518	1726	1471	276	837	1944	1215	1441	1899	763	1243	701	1166	398	666	0
3	1937	3190	2310	894	2272	1601	1115	2147	1966	2222	2293	2396	1767	1351	1296	1000	1445	431	587	115
4	2528	3168	3148	1335	1969	1819	1127	1749	268	2403	2419	1965	1854	236	1071	927	1422	491	588	0
5	-	3193	3414	1617	-	1841	-	-	178	2454	1975	-	-	1423	-	929	1516	889	388	-
6	-	3286	3273	2581	-	1426	-	-	2186	2332	-	-	-	1163	-	-	-	614	-	-
7	-	-	-	2554	-	1702	-	-	-	-	-	-	-	812	-	-	-	-	-	-
8	-	-	-	2350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	2455	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	2413	3101	2756	1801	1831	1697	1238	1136	991	2118	1805	2075	1701	968	1142	888	1292	525	563	33
n	4	6	6	9	4	7	4	4	6	6	5	4	4	7	4	5	5	6	5	4
SD	319	173	623	747	357	143	165	953	874	272	604	482	284	408	155	113	250	203	104	55
First count	17 Jul	17 Jul	21 Jul	22 Jul	24 Jul	10 Jul	10 Jul	10 Jul	14 Jul	28 Jul	16 Jul	24 Jul	22 Jul	17 Jul	27 Jul	2 Aug	16 Jul	17 Jul	22 Jul	1 Aug
Last count	28 Jul	7 Aug	12 Aug	11 Aug	20 Aug	22 Aug	5 Aug	1 Aug	5 Aug	18 Aug	6 Aug	6 Aug	10 Aug	5 Aug	8 Aug	25 Aug	14 Aug	11 Aug	8 Aug	20 Aug

Table 16. Numbers of murres counted on land-based index plots at Aiktak Island, Alaska in 2017.

Plot	Species	Date				Mean	SD
		1 Aug	10 Aug	15 Aug	20 Aug		
1	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
2	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
3	COMU	0	0	0	0	-	-
	TBMU	15	0	0	0	-	-
	UNMU	0	0	0	0	-	-
4	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
5	COMU	0	0	2	0	-	-
	TBMU	0	0	43	0	-	-
	UNMU	0	0	0	0	-	-
6	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	70	0	-	-
7	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
8	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
9	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
10	COMU	0	0	0	0	-	-
	TBMU	0	0	0	0	-	-
	UNMU	0	0	0	0	-	-
Rafts[a]	UNMU	NC	NC	NC	NC	-	-
Total[a]	COMU	0	0	2	0	1	1
	TBMU	15	0	43	0	15	20
	UNMU	0	0	70	0	18	35
	ALL	15	0	115	0	33	55

[a]Murres rafting below cliffs were not counted (NC) in 2017.

Table 17. Numbers of murres (includes common, thick-billed, and unknown murres) counted during boat-based circumnavigation surveys at Aiktak Island, Alaska. No counts were conducted in 1999, 2001, 2003, 2008, or 2010-2016.

Replicate	1995	1996	1997	1998	2000	2002	2004	2005	2006	2007	2009	2017
1	4800	6124	7095	5031	2790	81	2756	2619	1836	2486	3380[a]	312
2	5200	3752	4839	3796	2307	73	1234	3348	3875	3617	-	-
3	4968	6022	7259	-	3023	998	2116	2126	-	3187	-	-
4	-	7692	-	-	3142	1256	957	-	-	-	-	-
5	-	-	-	-	3304	-	-	-	-	-	-	-
Mean	4989	5898	6398	4414	2913	602	1766	2698	2856	3097	3380[a]	312
n	3	4	3	2	5	4	4	3	2	3	1	1
SD	201	1341	1352	873	365	532	764	615	1442	571	-	-
First count	25 Jun	21 Jul	23 Jul	27 Jul	9 Jul	26 May	22 Jul	22 Jul	21 Jul	22 Jul	25 Jul	6 Aug
Last count	5 Aug	15 Aug	9 Aug	3 Aug	11 Aug	18 Jul	10 Aug	14 Aug	27 Aug	20 Aug	-	-

[a]Murres rafting below cliffs were not counted in 2009 due to rough sea-conditions.

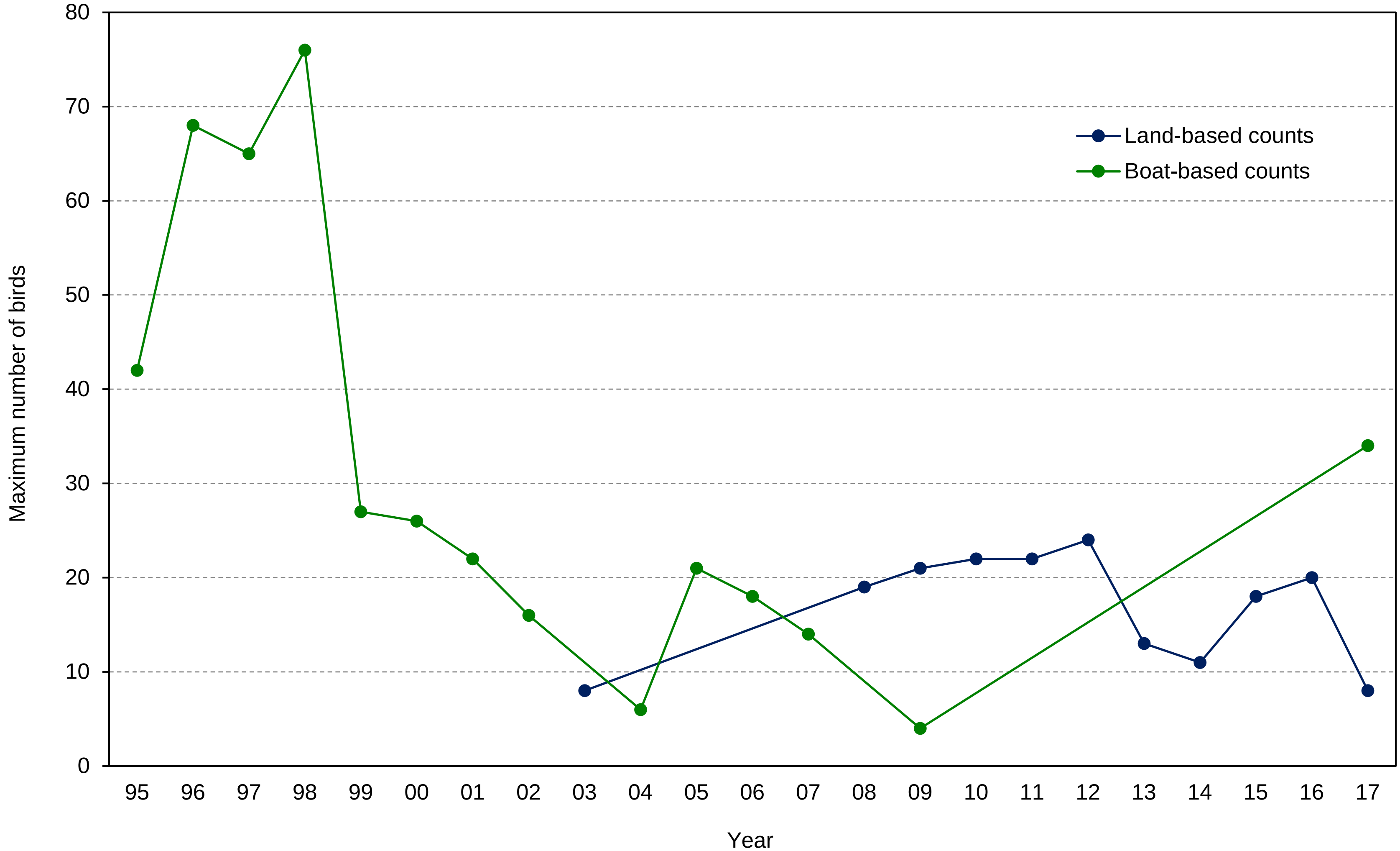

Figure 14. Maximum numbers of pigeon guillemots counted from land-based observation points and during boat-based circumnavigation surveys at Aiktak Island, Alaska. Values represent the highest count of individuals each year. Land-based counts all occurred during a standardized count window but times of day and seasons of boat-based counts vary (see circumnavigation tables for exact times). No land-cased counts were conducted in 2004-2006 and data do not include counts in 2000-2002 or 2004-2007 due to differences in observation points, times of day, and times of season. No boat-based counts were conducted in 2003, 2008, or 2010-2016.

Table 18. Maximum numbers of pigeon guillemots counted from land-based observation points at Aiktak Island, Alaska. Data represent the highest single daily count of individuals each year. No counts were conducted in 2004-2006; data do not include counts made in 2000-2002 or 2004-2007 due to differences in observation points, times of day, and times of season.

Observation point	2003	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pleasure Cove	2	1	0	0	0	2	0	2	0	0	0
Old Camp Beach	1	5	5	0	3	5	0	1	0	0	0
New Camp Beach	2	3	0	0	2	0	0	0	0	0	0
4 Sisters	2	0	0	0	0	0	0	1	0	0	0
Ivory Cove	0	0	0	0	0	0	0	1	2	0	0
Tower Cove	1	0	0	0	0	1	1	0	2	0	2
Arch's Cove	0	6	15	22	17	1	12	5	14	20	6
Petrel Valley Cove	0	4	1	0	0	15	0	1	0	0	0
Total	8	19	21	22	22	24	13	11	18	20	8
Date of max. count	21 Jun	19 Jun	12 Jun	5 Jun	13 Jun	28 Jun	1 Jul[a]	16 Jun	1 Jul	17 Jun	26 Jun
Start time (ALST)[b]	0845	0930	0830	0800	0620	0704	0808	0717	0700	0700	0818
End time (ALST)[b]	1110	1045	1030	1005	0811	0850	1100	0830	0840	0855	0954

[a]Maximum count occurred on two days in 2013 (13 birds) and 2017(8 birds); by convention, plot data from the earlier date are reported.
[b]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

Table 19. Numbers of pigeon guillemots counted from land-based observation points at Aiktak Island, Alaska in 2017.

Observation point	Date					Mean	SD	Max.
	13 Jun	15 Jun	18 Jun	26 Jun	1 Jul			
Pleasure Cove	0	0	0	0	0	-	-	-
Old Camp Beach	0	0	0	0	0	-	-	-
New Camp Beach	0	0	1	0	0	-	-	-
4 Sisters	0	0	0	0	0	-	-	-
Ivory Cove	0	0	0	0	0	-	-	-
Tower Cove	0	0	0	2	0	-	-	-
Arch's Cove	4	2	4	6	8	-	-	-
Petrel Valley Cove	0	0	0	0	0	-	-	-
Total	4	2	5	8	8	5	3	8
Start time (ALST)[a]	0740	0832	0811	0818	0840	-	-	-
End time (ALST)[a]	0955	0949	0932	0954	1000	-	-	-

[a]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

Table 20. Maximum numbers of pigeon guillemots counted during boat-based circumnavigation surveys at Aiktak Island, Alaska. Data represent the highest single daily count of individuals each year. Count time varied among years; morning counts may not be comparable with afternoon counts. No counts were conducted in 2003, 2008, or 2010-2016.

Segment	1995	1996	1997	1998	1999	2000	2001	2002	2004	2005	2006	2007	2009	2017
1-2	-	2	6	14	3	4	12	12	2	4	2	0	1	4
3-5	-	8	0	0	0	2	0	0	0	2	0	2	1	5
6	-	8	20	19	4	2	0	2	0	3	1	5	0	0
7-10	-	3	0	0	2	0	0	0	2	0	7	0	1	0
11-12	-	25	21	22	11	13	0	0	0	10	3	6	1	19
13	-	13	17	12	4	4	8	2	1	1	0	0	0	0
14	-	9	1	9	3	0	2	0	1	1	5	1	0	6
Total	42	68	65	76	27	26	22	16	6	21	18	14	4	34
Date of max. count	5 Aug	22 Jul	26 Jul	28 Jun	5 Jul	19 Jul	18 Jun	26 May	22 Jul	22 Jul	21 Jul	8 Aug	25 Jul	6 Aug
Start time[a]	1230	0640	0659	0625	0726	0700	0550	1200	1000	1100	1500	1430	1300	0830
End time[a]	1630	0830	0800	0755	0844	0810	0650	1730	1400	1330	1640	1630	1800	1021

[a]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

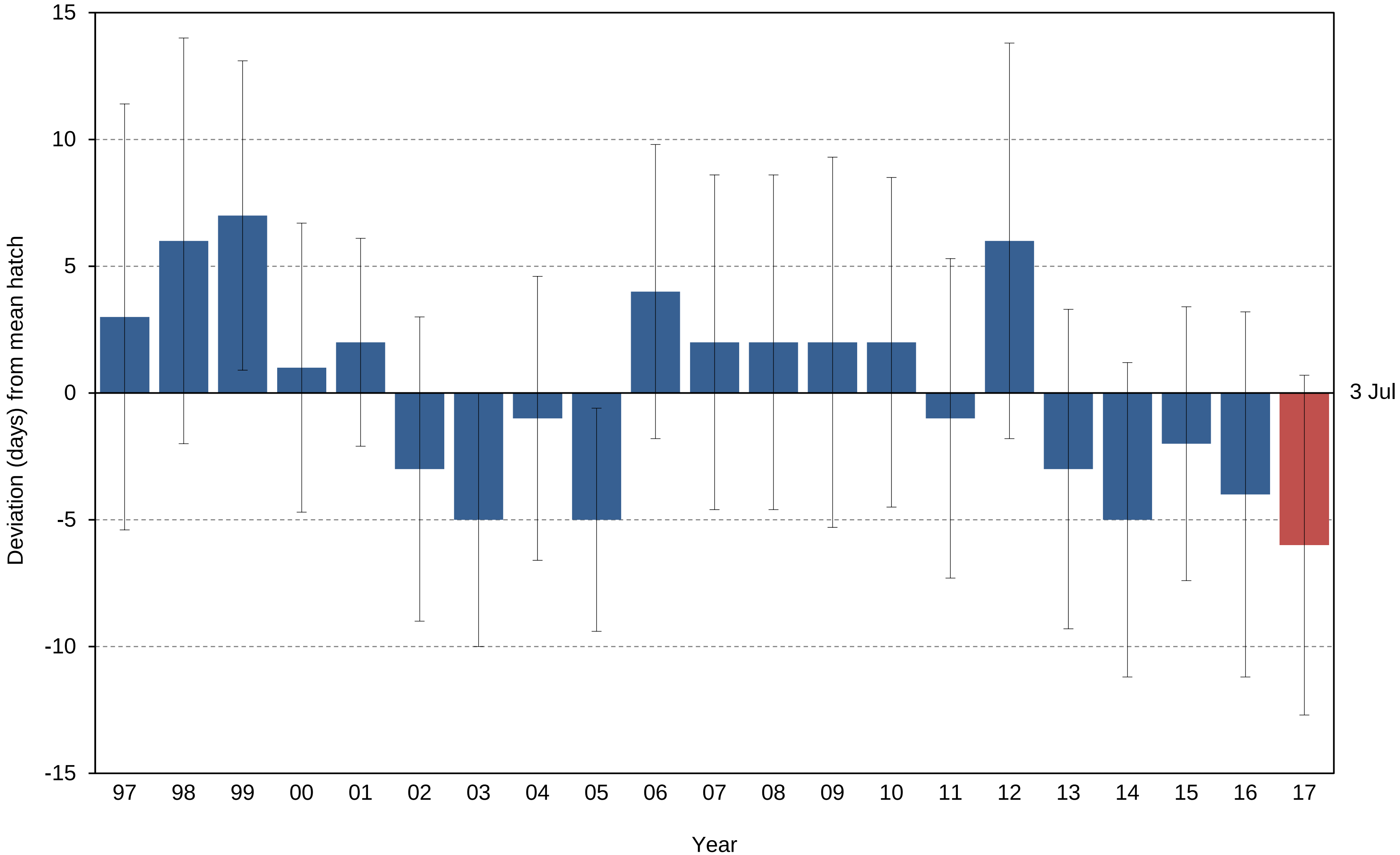

Figure 15. Yearly hatch date deviation (from the 1997-2016 average of 3 July) for ancient murrelets at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year.

Table 21. Breeding chronology of ancient murrelets at Aiktak Island, Alaska. Data represent the date of the first chick hatched in each nest.

Year	Mean hatch	SD	n[a]	First hatch	Last hatch
1997	6 Jul	8.4	8	29 Jun	22 Jul
1998	10 Jul	8.0	12	27 Jun	25 Jul
1999	11 Jul	6.1	21	29 Jun	23 Jul
2000	3 Jul	5.7	23	26 Jun	14 Jul
2001	29 Jun	4.1	22	26 Jun	14 Jul
2002	1 Jul	6.0	33	25 Jun	16 Jul
2003	27 Jun	5.0	21	19 Jun	5 Jul
2004	30 Jun	5.6	23	20 Jun	12 Jul
2005	28 Jun	4.4	27	19 Jun	5 Jul
2006	7 Jul	5.8	41	29 Jun	23 Jul
2007	5 Jul	6.6	41	23 Jun	23 Jul
2008	4 Jul	6.6	37	20 Jun	21 Jul
2009	5 Jul	7.3	83	18 Jun	22 Jul
2010	5 Jul	6.5	50	21 Jun	25 Jul
2011	2 Jul	6.3	43	21 Jun	19 Jul
2012	8 Jul	7.8	60	24 Jun	26 Jul
2013	30 Jun	6.3	36	22 Jun	21 Jul
2014	28 Jun	6.2	74	17 Jun	20 Jul
2015	1 Jul	5.4	77	15 Jun	9 Jul
2016	28 Jun	7.2	89	16 Jun	24 Jul
2017	27 Jun	6.7	89	17 Jun	17 Jul

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

Table 22. Frequency distribution of hatch dates for ancient murrelets at Aiktak 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.

Julian date[a]	No. nests hatching on Julian date																				
	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
166	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
168	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	1	10
169	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170	-	-	-	-	-	-	3	-	1	-	-	-	3	-	1	-	-	-	-	-	4
171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
172	-	-	-	-	1	-	-	1	-	-	-	1	-	1	-	-	-	-	-	23	-
173	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
174	-	-	-	-	-	-	-	1	5	-	2	-	-	-	-	-	1	2	5	4	24
175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-
176	-	-	-	-	1	10	9	-	-	-	-	-	12	-	10	6	-	-	4	6	11
177	-	-	-	-	1	-	-	3	9	-	-	-	-	-	-	-	-	-	-	-	-
178	-	1	-	6	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	18	-
179	-	-	-	1	-	8	-	5	-	-	-	-	-	-	2	-	-	-	-	-	-
180	1	1	1	-	10	-	5	-	-	6	11	-	-	13	-	-	27	1	7	6	-
181	1	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
182	1	-	-	-	-	-	-	5	8	-	-	-	-	-	17	12	-	21	28	4	-
183	1	1	-	2	-	4	-	-	-	-	-	-	-	5	-	-	1	-	1	-	-
184	1	-	1	-	6	1	-	3	-	-	1	14	33	-	-	-	-	-	5	5	8
185	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186	1	-	-	5	-	-	4	-	4	18	13	1	-	7	1	-	-	-	7	13	-
187	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
188	-	1	6	-	1	1	-	-	-	1	-	1	-	8	-	-	-	1	8	-	7
189	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	19	-	-	6	-	-
190	-	-	1	3	-	-	-	-	-	-	2	9	22	-	9	-	-	4	2	-	3
191	-	3	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	4	3	-	-	-	-	-	12	8	-	-	9	-	-	-	-	-	3	-
193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
194	-	-	3	-	-	-	-	2	-	-	-	-	1	3	-	-	-	1	-	5	1
195	-	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	2	1	-	-	-	-	-	-	-	-	-	-	3	17	3	2	-	-	-
197	1	-	-	-	-	1	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
198	-	-	-	-	-	-	-	-	-	2	3	-	11	3	-	-	-	-	-	-	1
199	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
202	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	5	1	-	-	-	-
203	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
204	-	-	1	-	-	-	-	-	-	2	1	-	1	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
206	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-
207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
n	8	12	21	23	22	33	21	23	27	41	41	37	83	50	43	60	36	74	77	89	89

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

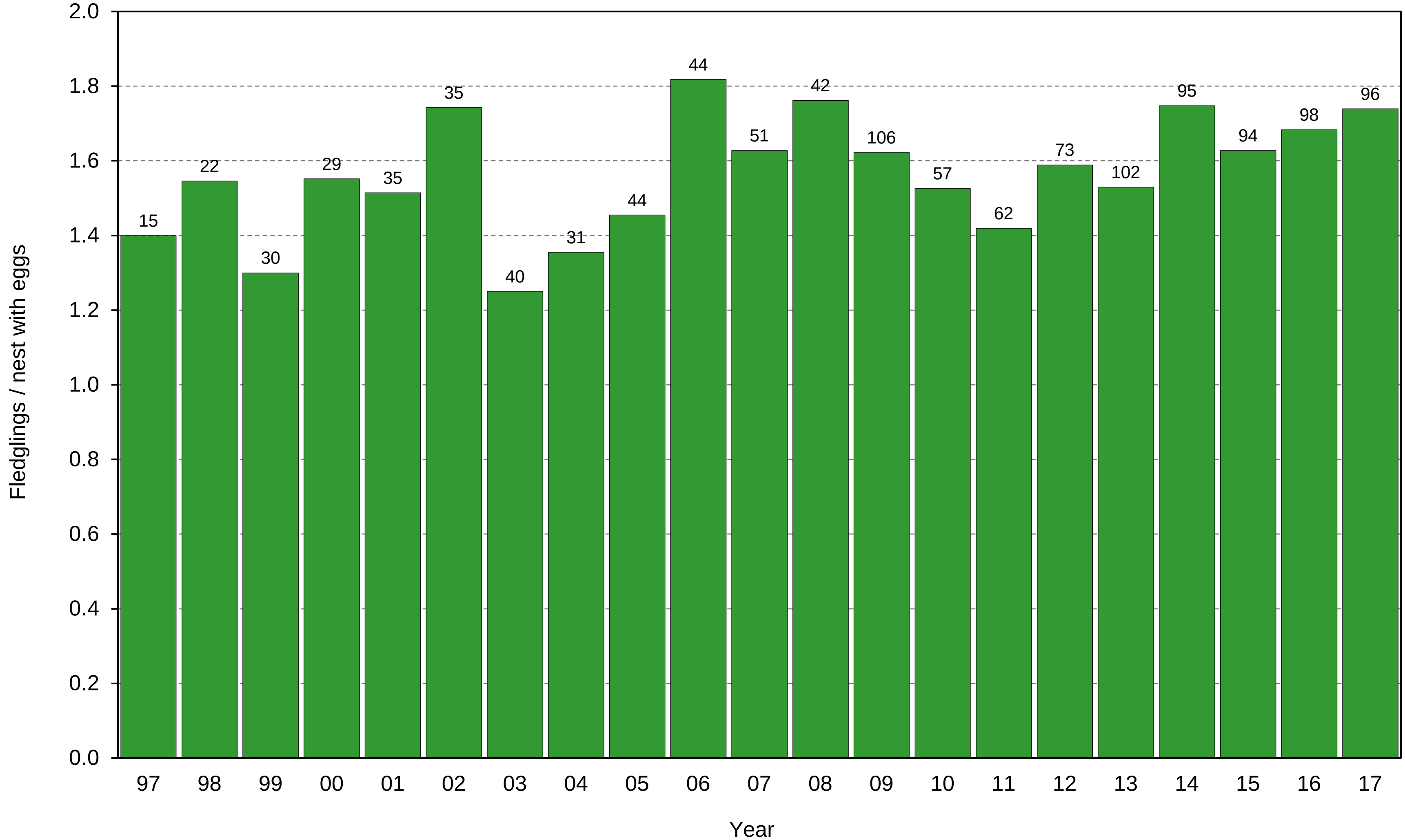

Figure 16. Reproductive performance of ancient murrelets at Aiktak Island, Alaska. Success is measured by the number of chicks fledged per nests with eggs (G/B), where G=total chicks fledged and B=nest sites w/ eggs. Numbers above columns indicate sample sizes (B).

Table 23. Reproductive performance of ancient murrelets at Aiktak Island.

Year	Nest sites w/ eggs (B)	Total eggs (C)	Nest sites w/ chicks (D)	Total chicks (E)	Nest sites w/ chicks fledged (F)	Total chicks fledged (G)	Mean clutch size (C/B)	Mean brood size (E/D)	Nesting success (D/B)	Hatching success (E/C)	Chick success (G/E)	Egg success (G/C)	Fledging success (F/D)	Reprod. success (F/B)	Fledglings/ nest w/ eggs (G/B)
1997	15	29	13	21	13	21	1.9	1.6	0.87	0.72	1.00	0.72	1.00	0.87	1.40
1998	22	44	19	35	19	34	2.0	1.8	0.86	0.80	0.97	0.77	1.00	0.86	1.55
1999	30	57	22	39	22	39	1.9	1.8	0.73	0.68	1.00	0.68	1.00	0.73	1.30
2000	29	58	24	45	24	45	2.0	1.9	0.83	0.78	1.00	0.78	1.00	0.83	1.55
2001	35	67	29	53	29	53	1.9	1.8	0.83	0.79	1.00	0.79	1.00	0.83	1.51
2002	35	70	33	61	33	61	2.0	1.8	0.94	0.87	1.00	0.87	1.00	0.94	1.74
2003	40	75	28	51	27	50	1.9	1.8[a]	0.70[a]	0.68[a]	0.98[a]	0.67[a]	0.96[a]	0.68[a]	1.25[a]
2004	31	60	23	42	23	42	1.9	1.8	0.74	0.70	1.00	0.70	1.00	0.74	1.35
2005	44	88	33	65	33	64	2.0	2.0	0.75	0.74	0.98	0.73	1.00	0.75	1.45
2006	44	88	41	80	41	80	2.0	2.0	0.93	0.91	1.00	0.91	1.00	0.93	1.82
2007	51	100	45	83	45	83	2.0	1.8	0.88	0.83	1.00	0.83	1.00	0.88	1.63
2008	42	84	37	74	37	74	2.0	2.0	0.88	0.88	1.00	0.88	1.00	0.88	1.76
2009	106	209	92	173	91	172	2.0	1.9	0.87	0.83	0.99	0.82	0.99	0.86	1.62
2010	57	108	48	87	48	87	1.9	1.8	0.84	0.81	1.00	0.81	1.00	0.84	1.53
2011	62	120	47	88	47	88	1.9	1.9	0.76	0.73	1.00	0.73	1.00	0.76	1.42
2012	73	143	61	116	61	116	2.0	1.9	0.84	0.81	1.00	0.81	1.00	0.84	1.59
2013	102	202	84	162	84	156	2.0	1.9	0.82	0.80	0.96	0.77	1.00	0.82	1.53
2014	95	189	89	169	88	166	2.0	1.9	0.94	0.89	0.98	0.88	0.99	0.93	1.75
2015	94	186	80	154	79	153	2.0	1.9	0.85	0.83	0.99	0.82	0.99	0.84	1.63
2016	98	192	90	166	90	165	2.0	1.8	0.92	0.86	0.99	0.86	1.00	0.92	1.68
2017	96	192	90	169	89	167	2.0	1.9	0.94	0.88	0.99	0.87	0.99	0.93	1.74

[a]In 2003, values of success represent a maximum estimate because there were still burrows with eggs at the time of field crew departure in mid July.

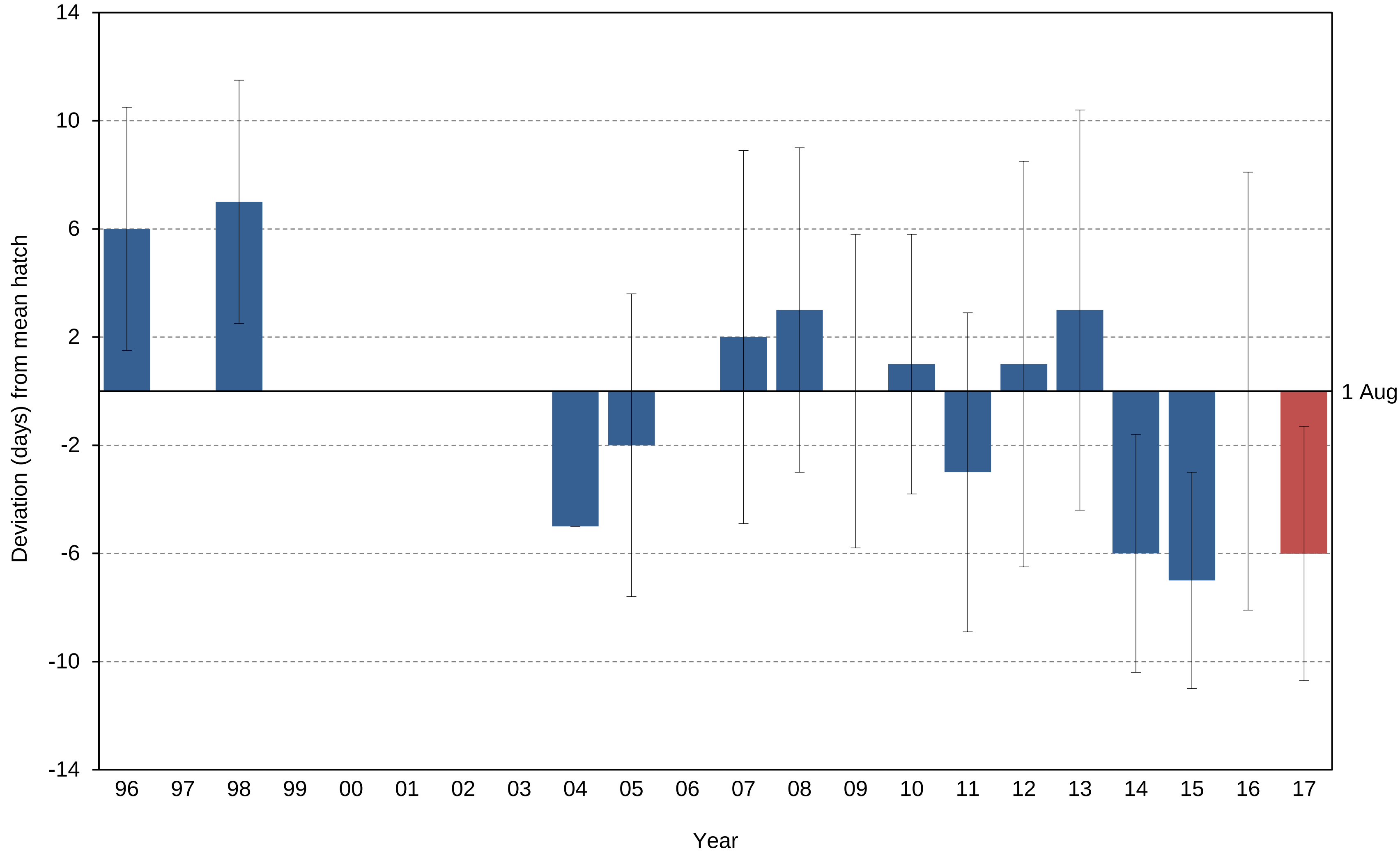

Figure 17. Yearly hatch date deviation (from the 1996-2016 average of 1 August) for horned puffins at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1997, 1999, 2001, or 2003; no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2000 or 2006.

Table 24. Breeding chronology of horned puffins at Aiktak Island, Alaska. No data were collected in 1997, 1999, 2001, or 2003; no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 2000 or 2006.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1996	6 Aug	4.5	2	1 Aug	10 Aug	>13 Aug
1998	8 Aug	4.5	2	3 Aug	12 Aug	>31 Aug
2002	1 Aug	0.0	1	1 Aug	-	-
2004	26 Jul	0.0	4	26 Jul	-	>27 Aug
2005	30 Jul	5.6	4	25 Jul	8 Aug	>30 Aug
2006	-	-	-	-	-	>2 Sep
2007	3 Aug	6.9	4	26 Jul	13 Aug	>28 Aug
2008	3 Aug	6.0	8	28 Jul	15 Aug	>29 Aug
2009	1 Aug	5.8	15	20 Jul	14 Aug	>3 Sep
2010	2 Aug	4.8	5	27 Jul	6 Aug	>1 Sep
2011	29 Jul	5.9	8	21 Jul	10 Aug	>2 Sep
2012	1 Aug	7.5	11	22 Jul	19 Aug	29 Aug
2013	4 Aug	7.4	6	27 Jul	18 Aug	29 Aug
2014	26 Jul	4.4	10	19 Jul	4 Aug	>28 Aug
2015	25 Jul	4.0	4	21 Jul	31 Jul	>28 Aug
2016	31 Jul	8.1	6	23 Jul	17 Aug	> 1 Sep
2017	26 Jul	4.7	3	19 Jul	29 Jul	>31 Aug

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

[b]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 25. Frequency distribution of hatch dates for horned puffins at Aiktak Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1997, 1999, 2001, or 2003; no hatch dates were recorded with the appropriate egg to chick interval in 2000 or 2006.

Julian date[a]	No. nests hatching on Julian date																
	96	98	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17
200	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
201	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
202	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
204	-	-	-	-	-	-	-	-	-	-	-	1	-	3	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
206	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-
207	-	-	-	-	-	-	1	-	-	-	4	-	-	-	-	1	-
208	-	-	-	4	2	-	-	-	-	2	1	3	2	3	1	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	1	3	4	-	-	-	-	1	-	-	2
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
212	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	2	-
213	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	1	-	-	-	-	-	-	2	5	-	-	1	-	-	-	1	-
215	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
216	-	-	-	-	-	-	1	-	-	-	1	1	-	1	-	-	-
217	-	-	-	-	-	-	-	-	-	1	-	1	2	-	-	-	-
218	-	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-
219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	1	-	-	2	2	-	-	2	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
222	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
223	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
224	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
225	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
n	2	2	1	4	4	-	4	8	15	5	8	11	6	10	4	6	3

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

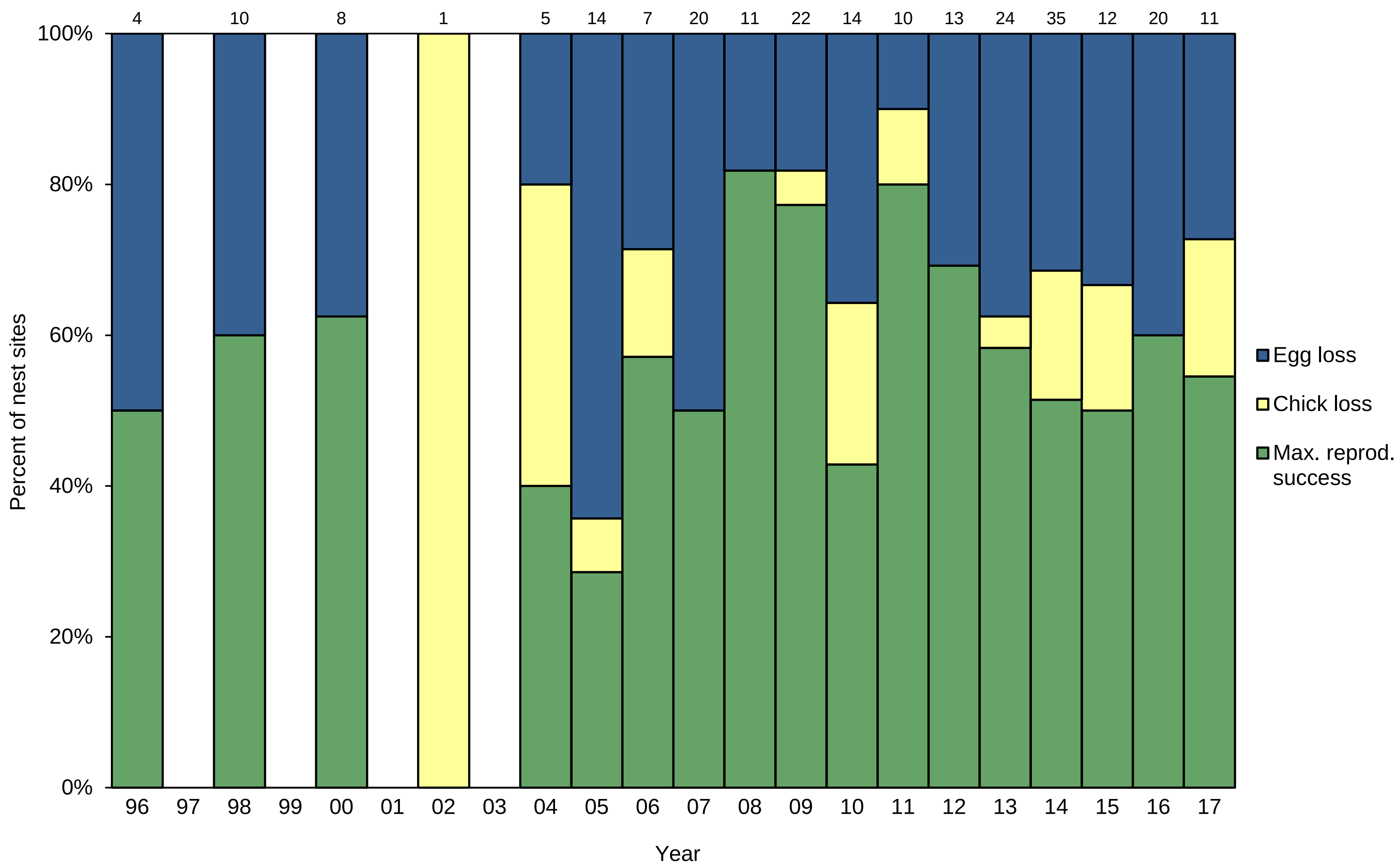

Figure 18. Maximum potential reproductive performance of horned puffins at Aiktak Island, Alaska. Values include nest sites with chicks still present but too young to consider fledged at the last check. Egg loss=[(B+H)-D+H]/(B+H); Chick loss=[(D+H)-F+H]/(B+H); Maximum potential reproductive success=[(F+H)/(B+H)], where B=nest sites with eggs; D=nest site with chicks; F=nest sites with chicks fledged; H=nest sites with young chicks still present. Numbers above columns indicate sample sizes (B+H). No data were collected in 1997, 1999, or 2003.

Table 26. Reproductive performance of horned puffins at Aiktak Island, Alaska. No data were collected in 1997, 1999, or 2003.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential nesting success[d] [(D+H)/(B+H)]	Max. potential fledging success[d] [(F+H)/(D+H)]	Max. potential reproductive success[d] [(F+H)/(B+H)]
1996	2	0	0	2	0.00	0.00	0.00	0.50	1.00	0.50
1998	7	3	3	3	0.43	1.00	0.43	0.60	1.00	0.60
2000	5	2	2	3	0.40	1.00	0.40	0.63	1.00	0.63
2002	1	1	0	0	1.00	0.00	0.00	1.00	0.00	0.00
2004	5	4	2	0	0.80	0.50	0.40	0.80	0.50	0.40
2005	13	4	3	1	0.31	0.75	0.23	0.36	0.80	0.29
2006	5	3	2	2	0.60	0.67	0.40	0.71	0.80	0.57
2007	16	6	6	4	0.38	1.00	0.38	0.50	1.00	0.50
2008	6	4	4	5	0.67	1.00	0.67	0.82	1.00	0.82
2009	18	14	13	4	0.78	0.93	0.72	0.82	0.94	0.77
2010	9	4	1	5	0.44	0.25	0.11	0.64	0.67	0.43
2011	8	7	6	2	0.88	0.86	0.75	0.90	0.89	0.80
2012	11	7	7	2	0.64	1.00	0.64	0.69	1.00	0.69
2013	11	2	1	13	0.18	0.50	0.09	0.63	0.93	0.58
2014	29	18	12	6	0.62	0.67	0.41	0.69	0.75	0.51
2015	10	6	4	2	0.60	0.67	0.40	0.67	0.75	0.50
2016	15	7	7	5	0.47	1.00	0.47	0.60	1.00	0.60
2017	11	8	6	0	0.73	0.75	0.55	0.73	0.75	0.55

[a]Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present ≥30 d for horned puffins). 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.

[b]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).

[c]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).

[d]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.

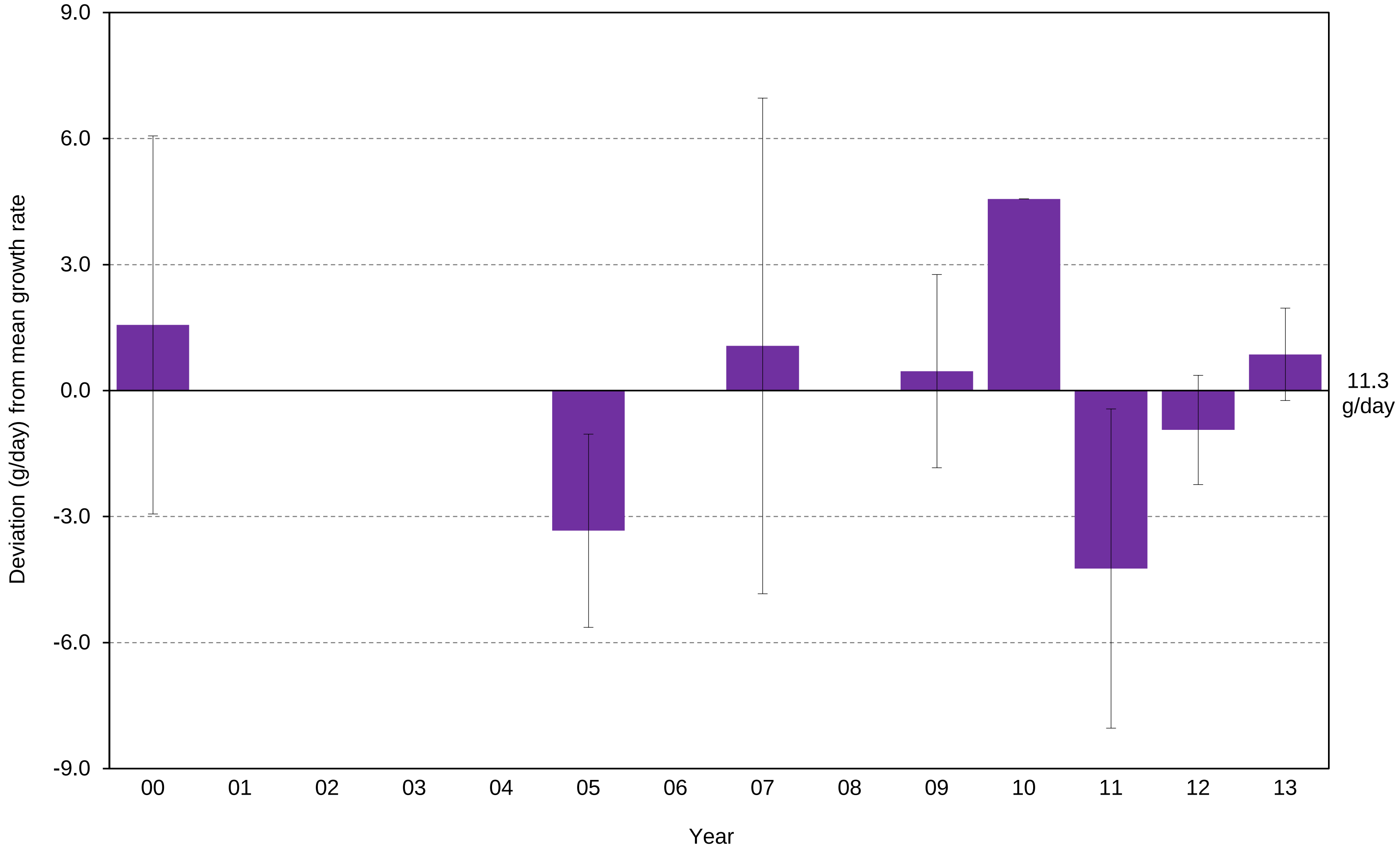

Figure 19. Yearly chick growth rate deviation (from the 1995-2013 average of 11.3 g/day) for horned puffins at Aiktak Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate; red highlights the current year. Error bars represent standard deviation around each year's mean growth rate. No chicks were measured in 2001-2004, 2006, 2008, or 2014-2017.

Table 27. Mean growth rates of horned puffin chicks at Aiktak Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (up to approximately 450g); chicks that died were excluded. No chicks were measured in 2001-2004, 2006, 2008, or 2014-2017.

Year	Mass (g/day)				Wing chord (mm/day)			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*
2000	12.9	4.5	7.9 - 18.3	6	3.6	0.9	2.7 - 4.5	6
2005	8.0	2.3	5.7 - 10.2	3	3.4	0.2	3.2 - 3.6	3
2007	12.4	5.9	4.7 - 22.3	6	3.4	0.6	2.6 - 4.4	6
2009	11.8	2.3	9.6 - 15.5	5	4.0	0.6	3.3 - 5.0	5
2010	15.9	-	-	1	3.3	-	-	1
2011	7.1	3.8	4.4 - 11.4	3	2.8	0.1	2.8 - 2.9	3
2012	10.4	1.3	8.5 - 11.7	4	4.2	0.6	3.7 - 5.3	5
2013	12.2	1.1	11.4 - 12.9	2	4.0	0.3	3.8 - 4.2	2

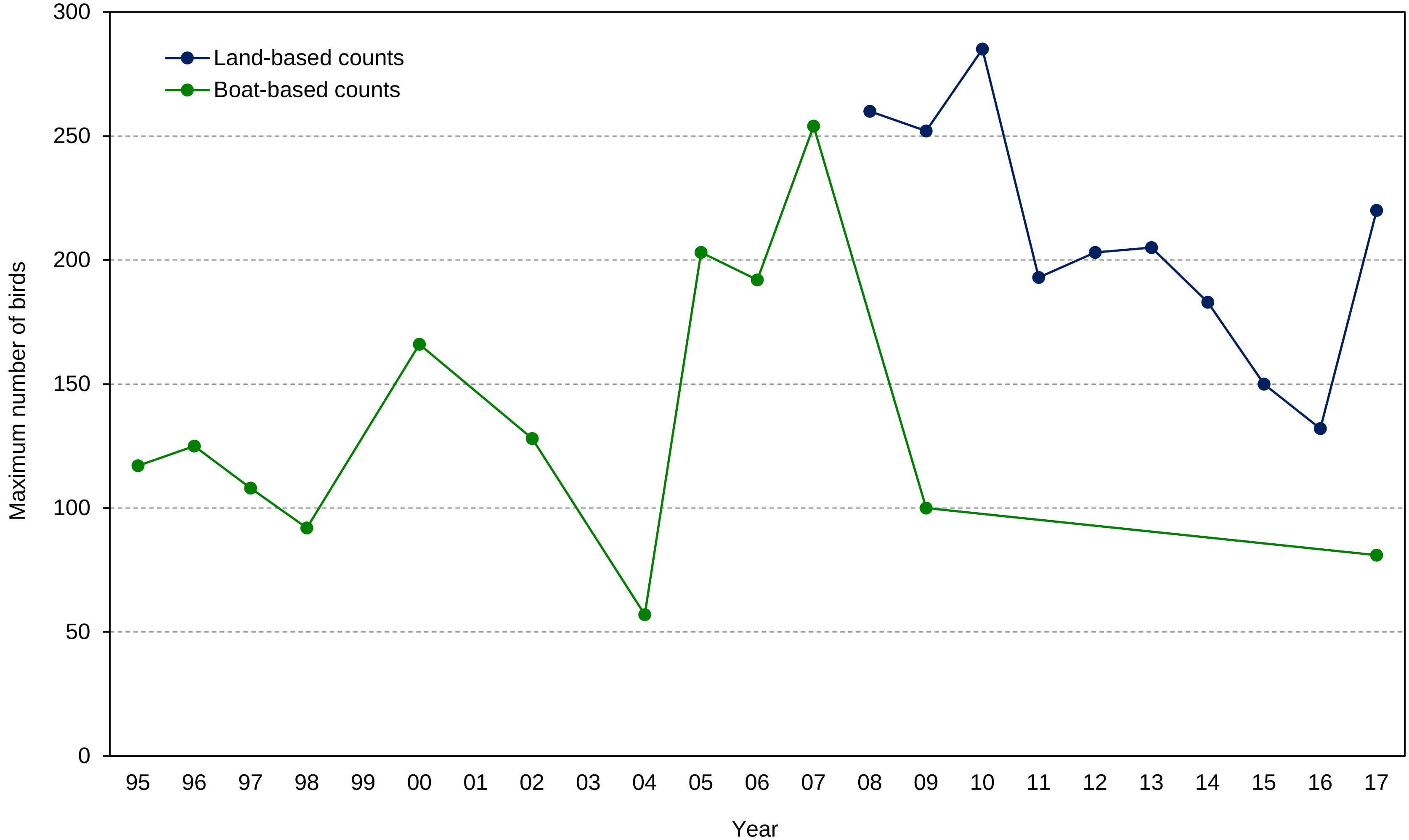

Figure 20. Maximum numbers of horned puffins counted from land-based observation points and during boat-based circumnavigation surveys at Aiktak Island, Alaska. Values represent the highest count of individuals each year. Land-based counts all occurred during a standardized count window but times of day and seasons of boat-based counts vary (see Tables 28 and 30 for times). Land-based count data do not include counts in 2000-2007 due to differences in observation points, times of day, and times of season; no boat-based counts were conducted in 1999, 2003, 2008, or 2010-2016.

Table 28. Maximum numbers of horned puffins counted from land-based observation points at Aiktak Island, Alaska. Data represent the highest single daily count of individuals each year. Data do not include counts in 2000-2007 due to differences in observation points, times of day, and times of season.

Observation point	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Pleasure Cove	4	10	0	0	4	2	4	0	1	0
Old Camp Beach	25	25	18	19	37	17	34	17	14	30
New Camp Beach	2	2	6	5	0	4	21	19	1	9
4 Sisters	42	47	49	33	24	32	5	22	19	15
Ivory Cove	6	18	10	6	6	14	8	10	7	9
Tower Cove	10	20	17	26	35	5	10	4	23	20
Arch’s Cove	17	16	24	12	7	12	0	14	14	25
Petrel Valley Cove	154	119	161	92	90	119	101	64	53	112
Total	260	252	285	193	203	205	183	150	132	220
Date of max. count	7 Jul	19 Jul	20 Jul	16 Jul	5 Jul	8 Jul	10 Jul	27 Jul	11 Jul	11 Jul
Start time (ALST)[a]	1550	1630	1600	1556	1530	1412	1510	1530	1506	1535
End time (ALST)[a]	1630	1800	1720	1739	1723	1748	1720	1825	1715	1815

[a]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

Table 29. Numbers of horned puffins counted from land-based observation points at Aiktak Island, Alaska in 2017.

Observation point	Date					Mean	SD	Max.
	2 Jul	9 Jul	10 Jul	11 Jul	18 Jul			
Pleasure Cove	0	0	6	0	0	-	-	-
Old Camp Beach	20	20	12	30	36	-	-	-
New Camp Beach	21	0	3	9	3	-	-	-
4 Sisters	19	15	11	15	25	-	-	-
Ivory Cove	3	5	7	9	1	-	-	-
Tower Cove	12	16	11	20	17	-	-	-
Arch's Cove	12	8	16	25	29	-	-	-
Petrel Valley Cove	99	69	83	112	101	-	-	-
Total	186	133	149	220	212	180	38	220
Start time (ALST)[a]	1622	1538	1500	1535	1509	-	-	-
End time (ALST)[a]	1757	1754	1634	1815	1708	-	-	-

[a]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

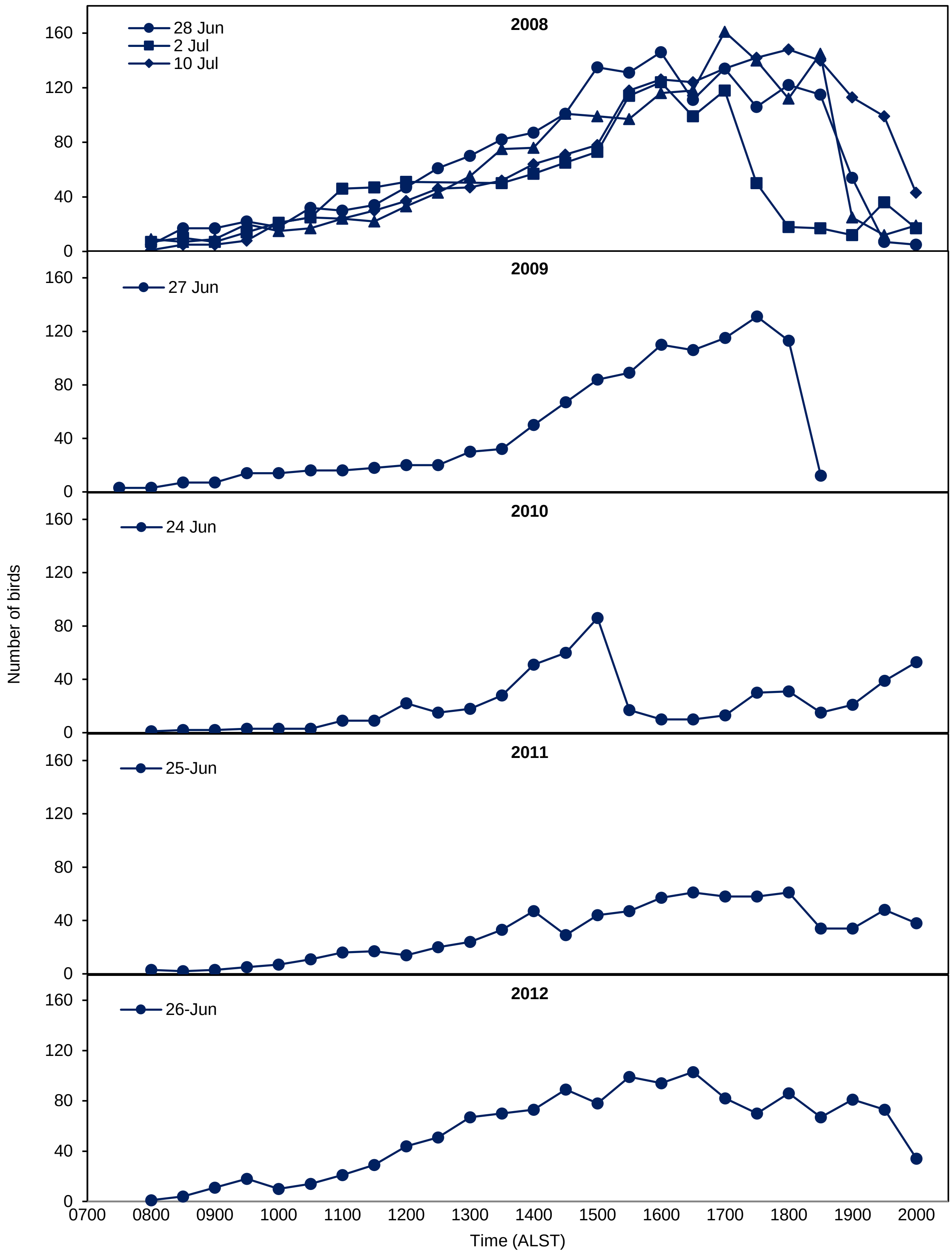

Figure 21. Attendance patterns of horned puffins on the water in Petrel Valley Cove during the incubation period at Aiktak Island, Alaska. No all-day counts were conducted before 2008 or after 2012.

Table 30. Numbers of horned puffins counted during boat-based circumnavigation surveys at Aiktak Island, Alaska. Count time varied among years; morning counts may not be comparable with afternoon counts. No counts were conducted in 1999, 2003, 2008, or 2010-2016.

Replicate	1995	1996	1997	1998	2000	2002	2004	2005	2006	2007	2009	2017
1	99	113	108	11	89	67	36	63	191	165	100	81
2	59	62	88	92	166	48	30	203	192	254	85	-
3	117	125	24	-	161	119	57	156	-	167	-	-
4	-	65	-	-	85	128	38	-	-	-	-	-
5	-	-	-	-	74	-	-	-	-	-	-	-
Mean	92	91	73	52	115	91	40	141	192	195	93	81
Max.	117	125	108	92	166	128	57	203	192	254	100	81
n	3	4	3	2	5	4	4	3	2	3	2	1
SD	30	32	44	57	45	39	12	71	1	51	11	-
Date of max. count	5 Aug	2 Aug	23 Jul	3 Aug	4 Aug	18 Jul	4 Aug	4 Aug	21 Jul	8 Aug	25 Jul	6 Aug
Start time (ALST)[a]	1230	1115	1100	1230	1230	1600	1500	1450	1500	1430	1400	0830
End time (ALST)[a]	1630	1330	1430	1545	1430	2000	1730	1900	1640	1630	1900	1021

[a]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

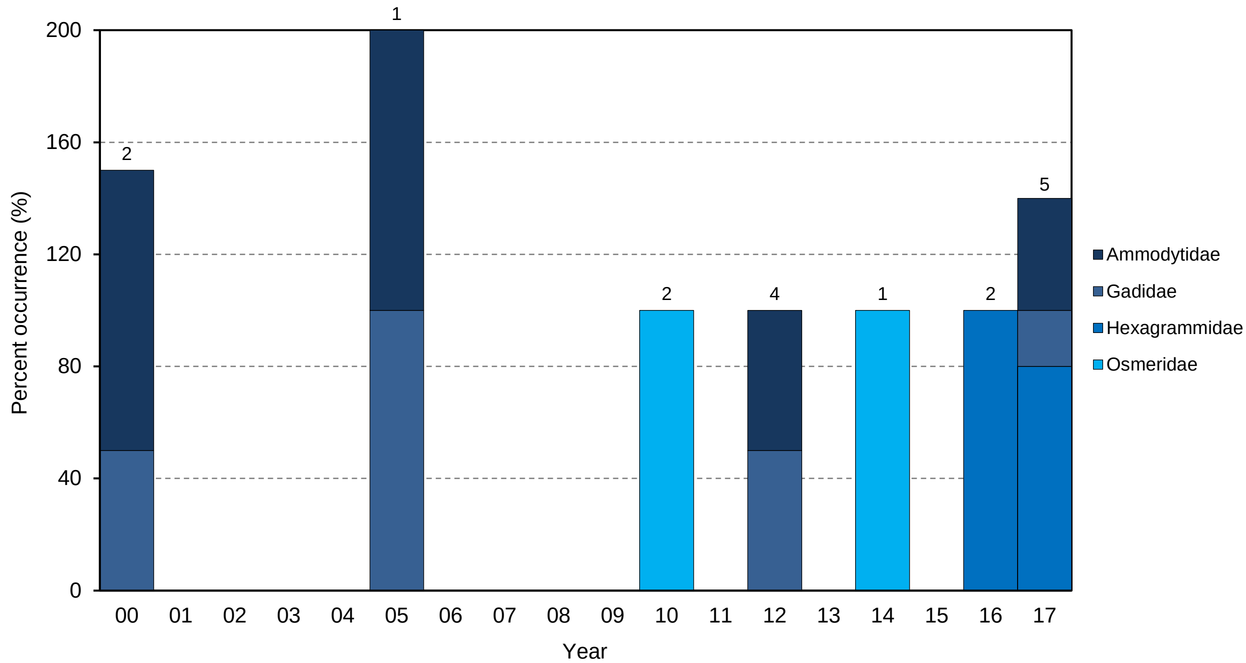

Figure 22. Frequency of occurrence of major prey items in diets of horned puffin chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2001-2004, 2006-2009, 2011, 2013, or 2015.

Table 31. Frequency of occurrence of major prey items in diets of horned puffin chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. 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 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 2001-2004, 2006-2009, 2011, 2013, or 2015. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2000	2005	2010	2012	2014	2016	2017
No. samples	2	1	2	4	1	2	5
Fish	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Teleostei	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Ammodytidae	**100.0**	**100.0**	**-**	**50.0**	**-**	**-**	**40.0**
Ammodytes spp.	100.0	100.0	-	50.0	-	-	40.0
Gadidae	**50.0**	**100.0**	**-**	**50.0**	**-**	**-**	**20.0**
Gadus chalcogrammus	**-**	100.0	-	50.0	-	-	20.0
Microgadus proximus	50.0	-	-	-	**-**	**-**	**-**
Hexagrammidae	**-**	**-**	**-**	**-**	**-**	**100.0**	**80.0**
Pleurogrammus monopterygius	-	-	-	-	-	100.0	80.0
Osmeridae	**-**	**-**	**100.0**	**-**	**100.0**	**-**	**-**
Mallotus villosus	-	-	100.0	-	100.0	-	-

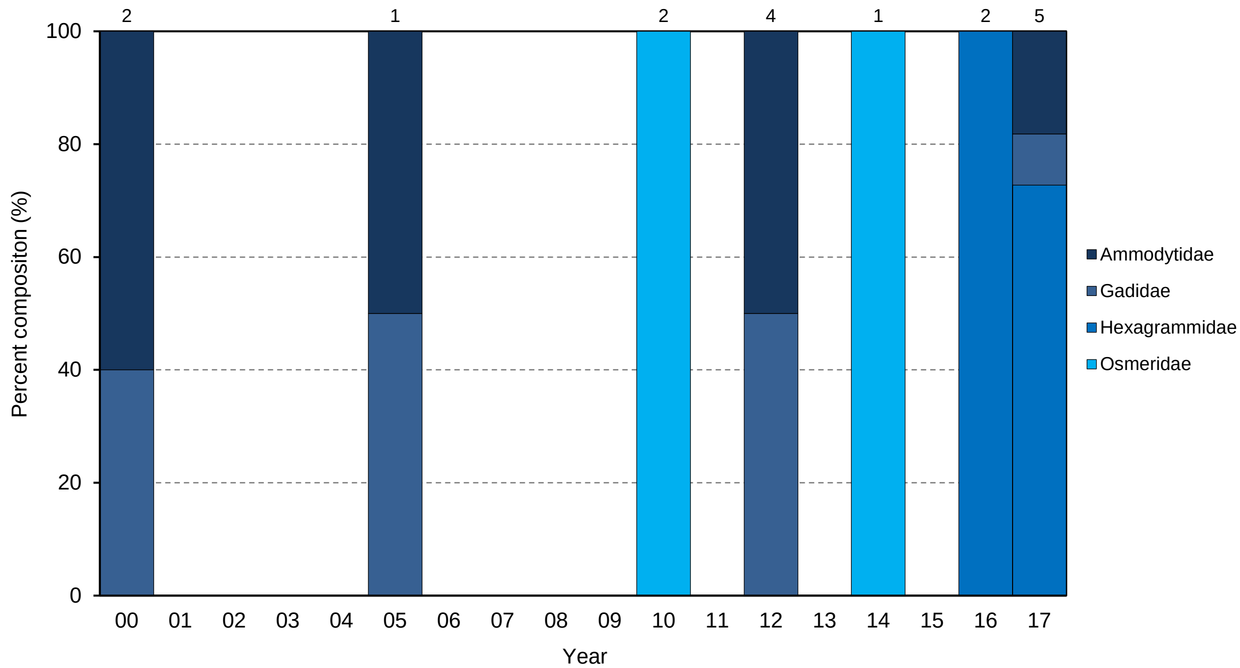

Figure 23. Percent composition of major prey items in diets of horned puffin chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition 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 2001-2004, 2006-2009, 2011, 2013, or 2015.

Table 32. Percent composition of major prey items in diets of horned puffin chicks at Aiktak 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. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2001-2004, 2006-2009, 2011, 2013, or 2015. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2000	2005	2010	2012	2014	2016	2017
No. samples	2	1	2	4	1	2	5
No. individuals	5	4	2	8	1	6	11
Fish	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Teleostei	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Ammodytidae	**60.0**	**50.0**	**-**	**50.0**	**-**	**-**	**18.2**
Ammodytes spp.	60.0	50.0	-	50.0	-	-	18.2
Gadidae	**40.0**	**50.0**	**-**	**50.0**	**-**	**-**	**9.1**
Gadus chalcogrammus	-	50.0	-	50.0	-	-	9.1
Microgadus proximus	40.0	-	-	-	-	-	-
Hexagrammidae	**-**	**-**	**-**	**-**	**-**	**100.0**	**72.7**
Pleurogrammus monopterygius	-	-	-	-	-	100.0	72.7
Osmeridae	**-**	**-**	**100.0**	**-**	**100.0**	**-**	**-**
Mallotus villosus	-	-	100.0	-	100.0	-	-

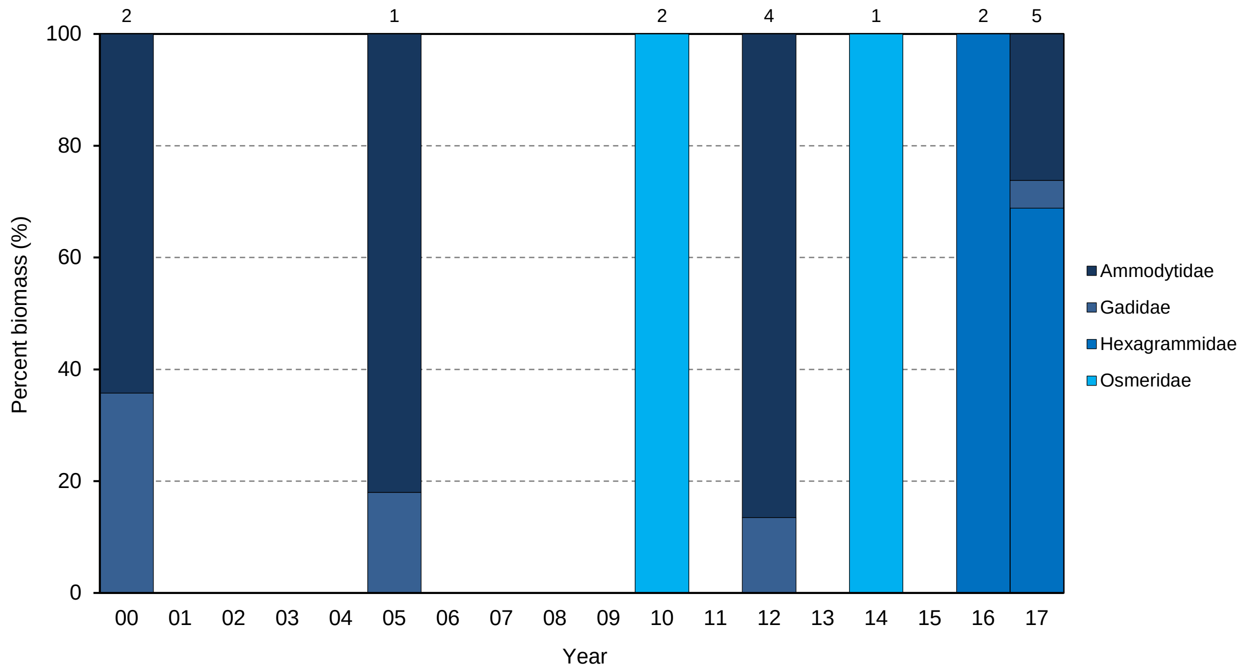

Figure 24. Relative biomass of major prey items in diets of horned puffin chicks at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2001-2004, 2006-2009, 2011, 2013, or 2015.

Table 33. Relative biomass of major prey items in diets of horned puffin chicks at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples 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 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. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2001-2004, 2006-2009, 2011, 2013, or 2015. More detailed diet data and prey identifications are available, contact refuge biologists for details

Prey	2000	2005	2010	2012	2014	2016	2017
No. samples	2	1	2	4	1	2	5
Total mass (g)	22	17	23	36	2	14	26
Fish	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Teleostei	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Ammodytidae	**64.3**	**82.0**	**-**	**86.6**	-	-	**26.2**
Ammodytes spp.	64.3	82.0	-	86.6	-	-	26.2
Gadidae	35.7	**18.0**	**-**	**13.4**	-	-	**5.0**
Gadus chalcogrammus	-	18.0	-	13.4	-	-	5.0
Microgadus proximus	35.7	-	-	-	-	-	-
Hexagrammidae	-	-	-	-	-	**100.0**	**68.8**
Pleurogrammus monopterygius	-	-	-	-	-	100.0	68.8
Osmeridae	-	-	**100.0**	-	**100.0**	-	**-**
Mallotus villosus	-	-	100.0	-	100.0	-	-

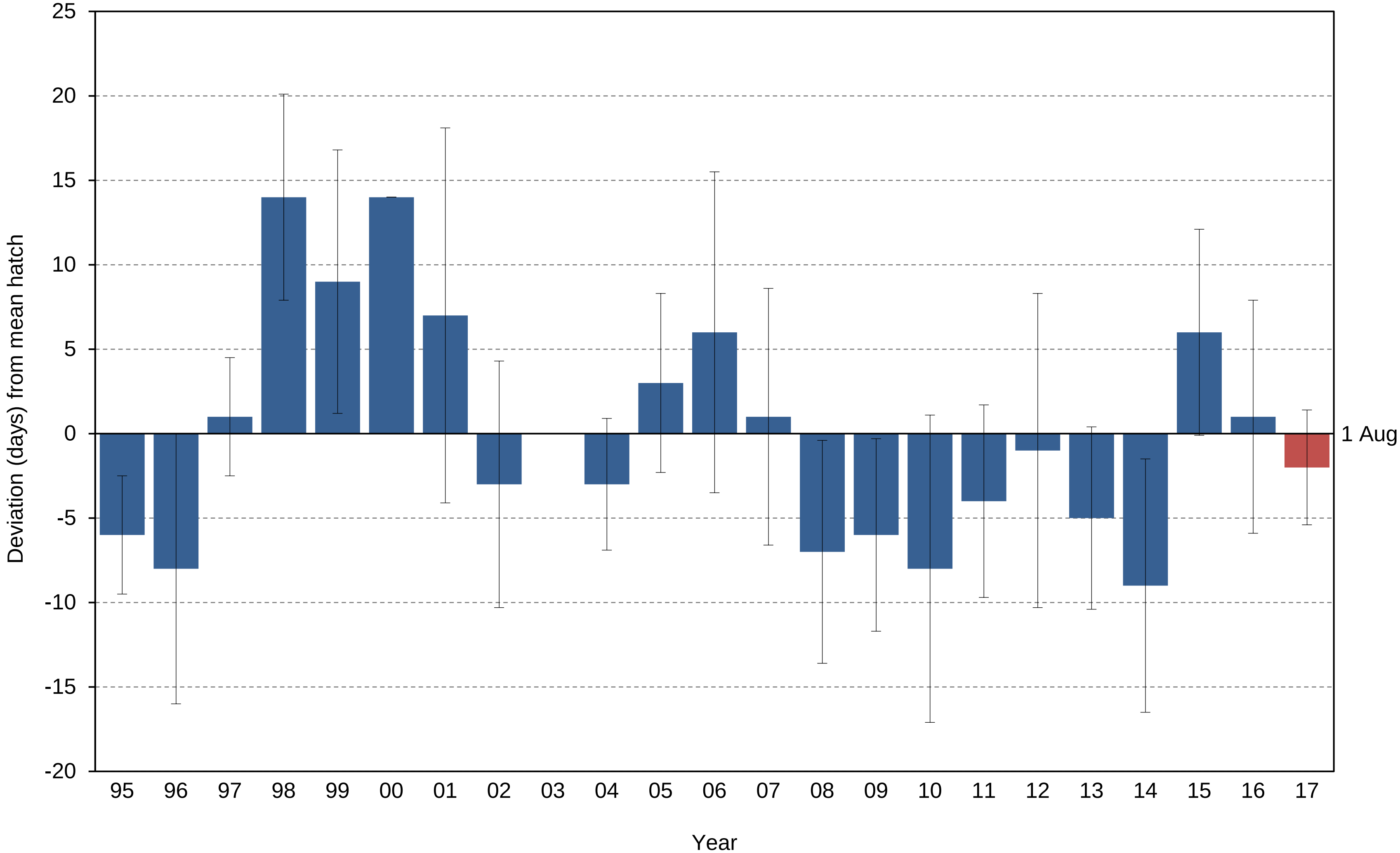

Figure 25. Yearly hatch date deviation (from the 1995-2016 average of 1 August) for tufted puffins at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 2003.

Table 34. Breeding chronology of tufted puffins at Aiktak Island, Alaska. No data were collected in 2003.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1995	26 Jul	3.4	17	21 Jul	31 Jul	>31 Aug
1996	23 Jul	8.0	24	8 Jul	12 Aug	27 Aug
1997	2 Aug	3.5	24	27 Jul	8 Aug	>2 Sep
1998	15 Aug	6.1	5	8 Aug	24 Aug	>3 Sep
1999	10 Aug	7.8	6	3 Aug	27 Aug	>3 Sep
2000	14 Aug	0.0	1	14 Aug	-	27 Aug
2001	8 Aug	11.1	5	19 Jul	21 Aug	30 Aug
2002	29 Jul	7.3	16	21 Jul	18 Aug	1 Sep
2004	28 Jul	3.9	43	26 Jul	17 Aug	>27 Aug
2005	4 Aug	5.3	10	27 Jul	14 Aug	>30 Aug
2006	7 Aug	9.5	12	25 Jul	24 Aug	>2 Sep
2007	2 Aug	7.6	9	26 Jul	19 Aug	>27 Aug
2008	24 Jul	6.6	54	12 Jul	15 Aug	21 Aug
2009	26 Jul	5.7	53	18 Jul	11 Aug	31 Aug
2010	24 Jul	9.1	25	13 Jul	20 Aug	24 Aug
2011	28 Jul	5.7	15	21 Jul	10 Aug	>2 Sep
2012	30 Jul	9.3	16	18 Jul	17 Aug	28 Aug
2013	27 Jul	5.4	23	19 Jul	10 Aug	>29 Aug
2014	23 Jul	7.5	47	11 Jul	15 Aug	21 Aug
2015	7 Aug	6.1	11	31 Jul	16 Aug	> 28 Aug
2016	1 Aug	6.9	25	20 Jul	13 Aug	> 1 Sep
2017	30 Jul	3.4	4	27 Jul	5 Aug	> 31Aug

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]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 35. Frequency distribution of hatch dates for tufted puffins at Aiktak Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 2003.

Julian date[a]	No. nests hatching on Julian date																					
	95	96	97	98	99	00	01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17
190	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
194	-	1	-	-	-	-	-	-	-	-	-	-	1	-	3	-	-	-	1	-	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-
197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
198	-	5	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-
199	-	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-
200	-	-	-	-	-	-	1	-	-	-	-	-	12	-	7	-	1	4	3	-	-	-
201	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	1	-	1	-	-	-
202	2	1	-	-	-	-	-	4	-	-	-	-	2	-	2	1	-	-	-	-	3	-
203	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	-	-	1	-	-	-
204	4	3	-	-	-	-	-	-	-	-	-	-	16	-	2	-	2	-	1	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	5	-	-	-
206	4	-	-	-	-	-	-	2	-	-	2	-	-	13	-	-	-	11	13	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	5	-	-	-	-	-	-
208	-	3	4	-	-	-	-	4	32	1	-	2	1	1	6	1	-	-	2	-	4	1
209	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
210	4	-	-	-	-	-	-	-	-	-	-	-	7	5	-	-	4	3	1	-	-	2
211	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
212	2	1	4	-	-	-	-	1	2	1	3	2	-	-	-	1	-	2	-	1	4	-
213	-	3	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	1	2	2	-
214	-	-	-	-	-	-	-	3	8	6	-	1	5	8	-	-	1	-	2	-	-	-
215	-	-	2	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
216	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	3	-	2	-	4	3	-
217	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	1
218	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-	1	-	-	-
219	-	-	1	-	3	-	-	-	-	-	1	-	-	1	-	-	2	-	-	-	-	-
220	-	-	2	1	-	-	-	1	-	-	-	-	2	-	-	-	-	-	-	-	3	-
221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
223	-	-	-	2	1	-	-	-	-	-	-	-	-	1	2	-	1	-	-	-	1	-
224	-	-	-	-	-	-	1	-	-	-	1	1	-	-	-	-	-	-	1	-	-	-
225	-	1	-	-	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	1	-	-
226	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2	-
227	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	2	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	1	1	-	2	-	-	-	-	-	2	-	-	-	-	-
231	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
232	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
233	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
234	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
235	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
236	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
238	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
239	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n	17	24	24	5	6	1	5	16	43	10	12	9	54	53	25	15	16	23	47	11	25	4

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

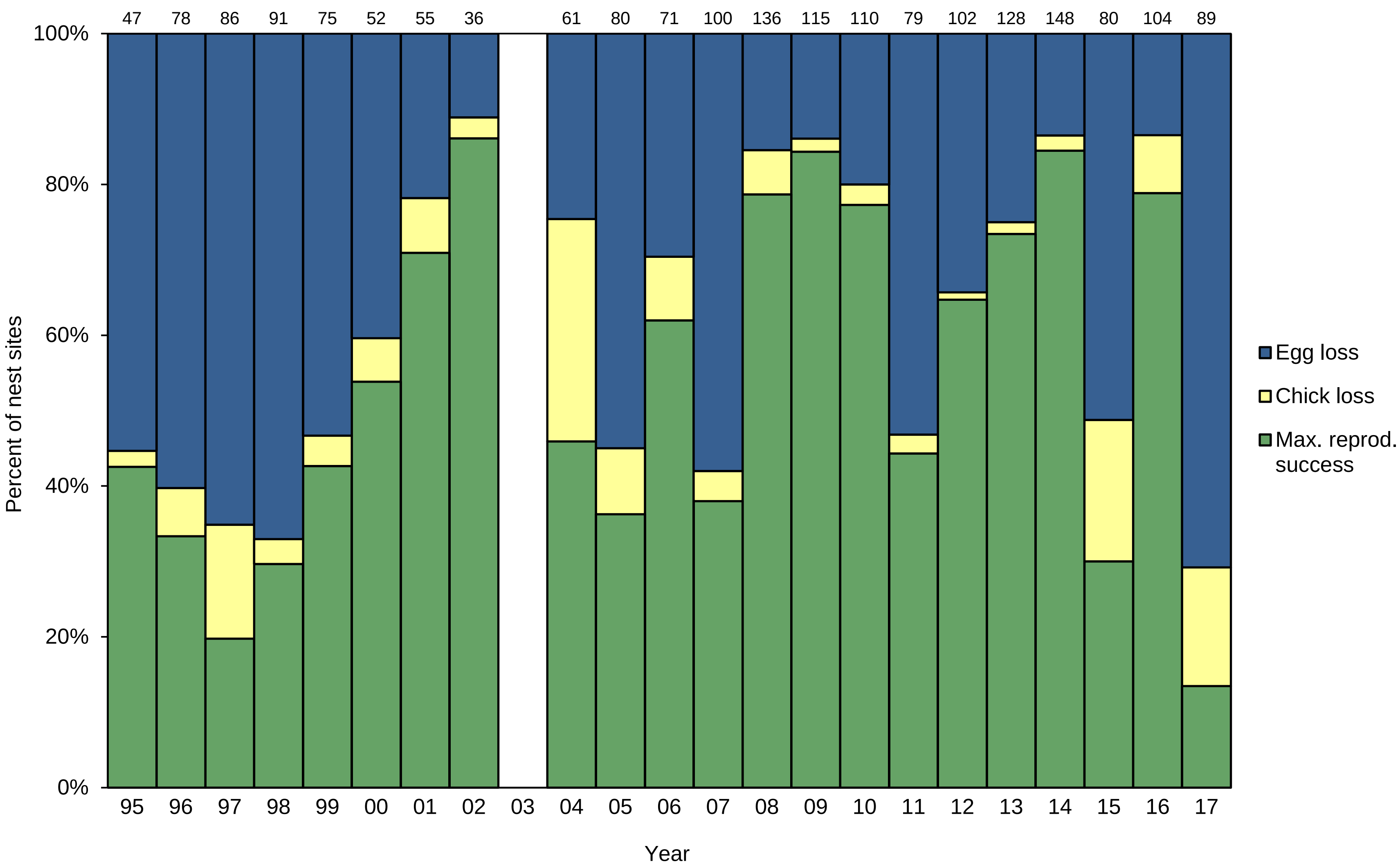

Figure 26. Maximum potential reproductive performance of tufted puffins at Aiktak Island, Alaska. Values include nest sites with chicks still present but too young to consider fledged at the last check. Egg loss=[(B+H)-D+H]/(B+H); Chick loss=[(D+H)-F+H]/(B+H); Maximum potential reproductive success=[(F+H)/(B+H)], where B=nest sites with eggs; D=nest site with chicks; F=nest sites with chicks fledged; H=nest sites with young chicks still present. Numbers above columns indicate sample sizes (B+H). No data were collected in 2003.

Table 36. Reproductive performance of tufted puffins in artificial and natural burrows at Aiktak Island, Alaska. No data were collected in 2003.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential nesting success[d] [(D+H)/(B+H)]	Max. potential fledging success[d] [(F+H)/(D+H)]	Max. potential reproductive success[d] [(F+H)/(B+H)]
1995	43	17	16	4	0.40	0.94	0.37	0.45	0.95	0.43
1996	76	29	24	2	0.38	0.83	0.32	0.40	0.84	0.33
1997	71	15	2	15	0.21	0.13	0.03	0.35	0.57	0.20
1998	68	7	4	23	0.10	0.57	0.06	0.33	0.90	0.30
1999	44	4	1	31	0.09	0.25	0.02	0.47	0.91	0.43
2000	48	27	24	4	0.56	0.89	0.50	0.60	0.90	0.54
2001	44	32	28	11	0.73	0.88	0.64	0.78	0.91	0.71
2002	29	25	24	7	0.86	0.96	0.83	0.89	0.97	0.86
2004	33	18	0	28	0.55	0.00	0.00	0.75	0.61	0.46
2005	55	11	4	25	0.20	0.36	0.07	0.45	0.81	0.36
2006	39	18	12	32	0.46	0.67	0.31	0.70	0.88	0.62
2007	62	4	0	38	0.06	0.00	0.00	0.42	0.90	0.38
2008	96	75	67	40	0.78	0.89	0.70	0.85	0.93	0.79
2009	94	78	76	21	0.83	0.97	0.81	0.86	0.98	0.84
2010	96	74	71	14	0.77	0.96	0.74	0.80	0.97	0.77
2011	61	19	17	18	0.31	0.89	0.28	0.47	0.95	0.44
2012	81	46	45	21	0.57	0.98	0.56	0.66	0.99	0.65
2013	76	44	42	52	0.58	0.95	0.55	0.75	0.98	0.73
2014	80	60	57	68	0.75	0.95	0.71	0.86	0.98	0.84
2015	56	15	0	24	0.27	0.00	0.00	0.49	0.62	0.30
2016	64	50	42	40	0.78	0.84	0.66	0.87	0.91	0.79
2017	82	19	5	7	0.23	0.26	0.06	0.29	0.46	0.13

[a]Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present $\geq$33 d for tufted puffins). 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.

[b]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).

[c]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).

[d]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.

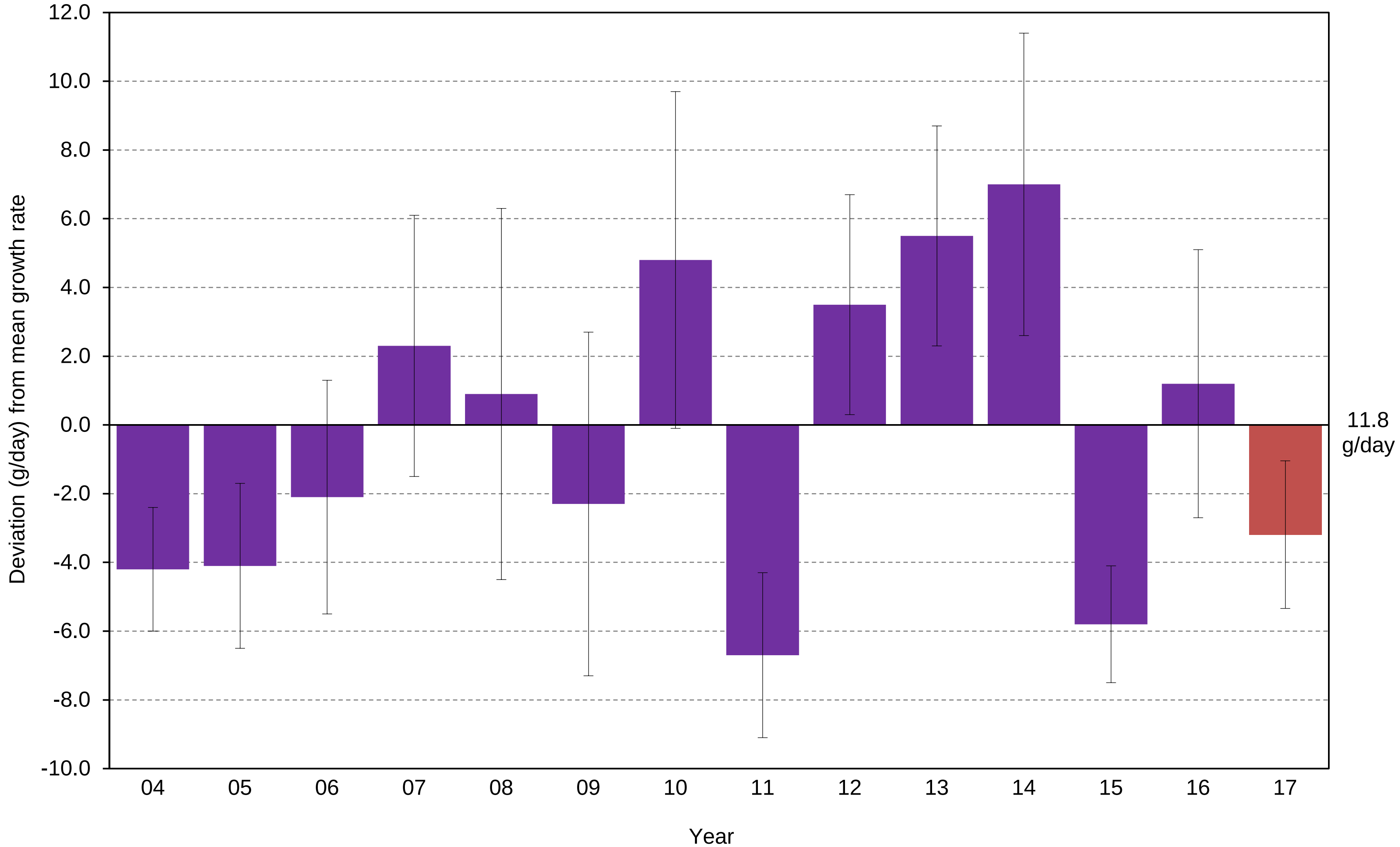

Figure 27. Yearly chick growth rate deviation (from the 2004-2016 average of 11.8 g/day) for tufted puffins at Aiktak Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate; red highlights the current year. No chicks were measured in 2003; data potentially exist in 1996-2002 but have not yet been summarized.

Table 37. Mean growth rates of tufted puffin chicks at Aiktak Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (up to approximately 450g); chicks that died were excluded. No chicks were measured in 2003.

Year	Mass (g/day)				Wing chord (mm/day)[a]			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1996	xx[b]	xx	xx - xx	xx	xx	xx	xx - xx	xx
1997	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
1998	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
1999	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
2000	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
2001	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
2002	xx	xx	xx - xx	xx	xx	xx	xx - xx	xx
2004	7.6	1.8	3.0 - 11.4	23	2.0	1.1	0.6 - 4.7	25
2005	7.7	2.4	3.4 - 14.5	23	2.8	0.4	1.8 - 3.5	23
2006	9.7	3.4	5.1 - 18.3	20	2.8	0.4	2.0 - 3.5	15
2007	14.1	3.8	9.7 - 23.5	13	3.8	0.6	3.1 - 5.0	11
2008	12.7	5.4	0.9 - 20.1	17	3.4	0.7	2.0 - 4.6	17
2009	9.5	5.0	2.3 - 22.7	28	3.1	0.9	1.1 - 5.8	28
2010	16.6	4.9	5.7 - 31.3	21	3.3	0.6	1.6 - 4.0	21
2011	5.1	2.4	1.4 - 10.2	15	2.6	0.9	0.6 - 4.1	15
2012	15.3	3.2	11.9 - 22.4	13	3.6	0.4	3.0 - 4.5	13
2013	17.3	3.2	11.6 - 22.2	12	3.6	1.1	1.2 - 6.1	14
2014	18.8	4.4	10.8 - 34.8	24	3.7	0.5	1.9 - 4.7	24
2015	6.0	1.7	3.7 - 8.3	7	1.8	0.4	1.1 - 2.5	7
2016	13.0	3.9	6.3 - 20.8	13	3.0	0.7	1.4 - 3.7	13
2017	8.6	2.1	6.4 - 12.0	5	2.7	0.5	2.3 - 3.3	5

[a]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.
[b]xx indicates data potentially exist but have not yet been summarized.

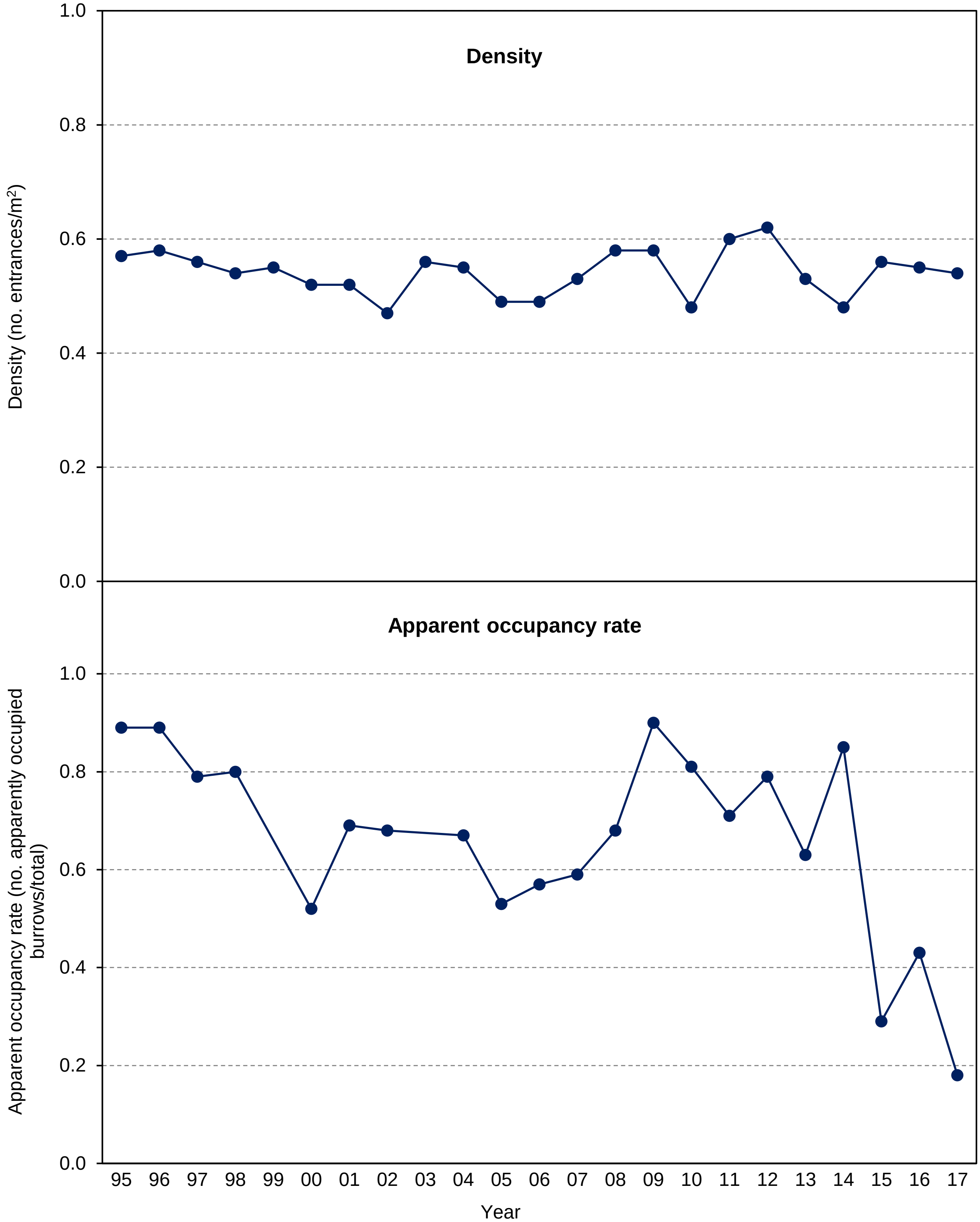

Figure 28. Burrow entrance densities and apparent occupancy rates of tufted puffins on index plots at Aiktak Island, Alaska.

Table 38. Burrow entrance densities of tufted puffins on index plots at Aiktak Island, Alaska. Density is expressed as the number of large (>14.5 cm) burrow entrances per m^2 and is assessed in late May or early June, before laying.

Year	Plot										Total	Mean	SD
	1	2	3	4	5	6	7	8	9	10			
1995	0.41	0.52	0.92	0.86	0.33	0.29	0.89	0.22	0.77	0.44	0.57	0.57	0.27
1996	0.39	0.63	0.93	0.87	0.36	0.31	0.85	0.18	0.72	0.43	0.58	0.57	0.27
1997	0.39	0.56	0.97	0.76	0.37	0.28	0.83	0.08	0.74	0.43	0.56	0.54	0.28
1998	0.35	0.54	0.92	0.76	0.37	0.31	0.74	0.20	0.81	0.36	0.54	0.54	0.25
1999	0.34	0.54	0.87	0.79	0.40	0.35	0.79	0.16	0.82	0.44	0.55	0.55	0.25
2000	0.32	0.47	0.83	0.78	0.38	0.30	0.81	0.22	0.73	0.29	0.52	0.51	0.24
2001	0.33	0.50	0.83	0.76	0.30	0.35	0.84	0.18	0.79	0.35	0.52	0.52	0.26
2002	0.22	0.45	0.66	0.59	0.39	0.34	0.73	0.24	0.83	0.40	0.47	0.49	0.21
2003	0.36	0.55	0.98	0.64	0.39	0.37	0.86	0.21	0.91	0.37	0.56	0.56	0.27
2004	0.33	0.47	0.90	0.76	0.40	0.35	0.85	0.20	0.86	0.42	0.55	0.55	0.26
2005	0.29	0.39	0.80	0.68	0.36	0.36	0.71	0.21	0.78	0.36	0.49	0.49	0.22
2006	0.29	0.42	0.75	0.72	0.32	0.32	0.79	0.21	0.77	0.32	0.49	0.49	0.23
2007	0.31	0.38	0.91	0.76	0.38	0.36	0.86	0.18	0.85	0.36	0.53	0.54	0.28
2008	0.33	0.46	0.98	0.83	0.35	0.43	0.95	0.23	0.90	0.34	0.58	0.58	0.30
2009	0.34	0.45	0.97	0.77	0.36	0.48	0.87	0.21	1.07	0.38	0.58	0.59	0.30
2010	0.25	0.39	0.67	0.84	0.22	0.40	0.76	0.19	0.81	0.31	0.48	0.49	0.26
2011	0.33	0.48	1.02	0.85	0.46	0.45	0.78	0.28	1.01	0.34	0.60	0.60	0.29
2012	0.31	0.45	1.00	0.87	0.51	0.50	0.85	0.37	1.01	0.42	0.62	0.63	0.26
2013	0.27	0.44	0.77	0.79	0.35	0.42	0.91	0.17	0.96	0.31	0.53	0.54	0.27
2014	0.32	0.34	0.88	0.66	0.38	0.54	0.81	0.19	0.68	0.14	0.48	0.49	0.24
2015	0.30	0.38	0.99	0.81	0.37	0.48	0.78	0.18	0.90	0.32	0.56	0.55	0.29
2016	0.27	0.36	0.92	0.82	0.46	0.49	0.72	0.19	0.91	0.35	0.55	0.55	0.27
2017	0.28	0.35	0.95	0.80	0.40	0.45	0.75	0.15	0.92	0.27	0.54	0.53	0.29
Plot area (m^2)	314.2	314.2	314.2	314.2	314.2	314.2	150.0	98.5	98.5	98.5	2330.5	-	-

Table 39. Apparent occupancy rates of tufted puffins on index plots at Aiktak Island, Alaska. Apparent occupancy rate is expressed as the proportion of 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. Apparent occupancy rate is assessed in mid to late August, towards the end of the chick-rearing period.

Year	Plot										Total	Mean	SD
	1	2	3	4	5	6	7	8	9	10			
1995	0.82	0.80	0.86	0.97	0.93	1.00	0.85	0.86	0.96	0.93	0.89	0.90	0.07
1996	0.87	0.95	0.85	0.96	0.67	0.96	0.90	0.62	0.95	0.81	0.89	0.85	0.12
1997	0.71	0.74	0.78	0.88	0.70	0.82	0.89	0.67	0.77	0.55	0.79	0.75	0.10
1998	0.70	0.82	0.83	0.81	0.77	0.81	0.87	0.69	0.74	0.63	0.80	0.77	0.07
1999	0.74	0.66	0.71	0.71	0.76	0.82	-	0.53	-	0.73	-[a]	-	-
2000	0.54	0.36	0.56	0.52	0.51	0.64	0.55	0.63	0.49	0.56	0.52	0.54	0.08
2001	0.78	0.73	0.55	0.77	0.70	0.75	0.69	0.57	0.69	0.56	0.69	0.68	0.09
2002	0.60	0.62	0.81	0.61	0.78	0.75	0.52	0.65	0.77	0.62	0.68	0.67	0.10
2003	*no data*	-	-	-	-	-	-	-	-	-	-	-	-
2004	0.39	0.56	0.74	0.57	0.83	0.83	0.66	0.60	0.79	0.76	0.67	0.67	0.14
2005	0.60	0.50	0.37	0.69	0.58	0.63	0.51	0.35	0.63	0.39	0.53	0.53	0.12
2006	0.53	0.46	0.46	0.69	0.63	0.70	0.54	0.52	0.57	0.56	0.57	0.57	0.08
2007	0.52	0.64	0.51	0.53	0.61	0.69	0.76	0.53	0.66	0.41	0.59	0.59	0.10
2008	0.73	0.70	0.57	0.79	0.69	0.70	0.65	0.71	0.69	0.56	0.68	0.68	0.07
2009	0.89	0.86	0.95	0.95	0.77	0.94	0.92	0.70	0.96	0.67	0.90	0.86	0.11
2010	0.87	0.87	0.86	0.89	0.78	0.68	0.67	0.90	0.76	0.66	0.81	0.79	0.10
2011	0.74	0.83	0.55	0.77	0.79	0.71	0.74	0.65	0.80	0.78	0.71	0.74	0.08
2012	0.78	0.64	0.74	0.92	0.82	0.79	0.77	0.58	0.87	0.58	0.79	0.75	0.12
2013	0.74	0.57	0.56	0.73	0.59	0.69	0.62	0.64	0.61	0.30	0.63	0.60	0.12
2014	0.93	0.84	0.87	0.84	0.79	0.95	0.85	0.87	0.84	0.50	0.85	0.83	0.12
2015	0.41	0.12	0.24	0.33	0.25	0.30	0.39	0.07	0.31	0.46	0.29	0.29	0.12
2016	0.50	0.38	0.36	0.53	0.45	0.38	0.46	0.28	0.47	0.33	0.43	0.41	0.08
2017	0.35	0.19	0.10	0.16	0.15	0.27	0.23	0.08	0.26	0.00	0.18	0.18	0.10

[a]Summary statistics are not calculated in years when all plots are not surveyed.

Table 40. Burrow entrance densities and apparent occupancy rates of tufted puffins on index plots at Aiktak Island, Alaska in 2017. Density is expressed as the number of large (>14.5 cm) burrow entrances per m^2. Apparent occupancy rate is expressed as the proportion of 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 May to early June, before laying, whereas apparent occupancy rate is assessed in mid to late August, towards 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 refound later in the season.

Parameter	Plot										Total	Mean	SD
	1	2	3	4	5	6	7	8	9	10			
Density													
Number of burrow entrances													
Small (<9.5 cm)	2	2	4	4	22	1	0	1	6	2	44	4.40	6.4
Medium (9.5-14.5 cm)	6	7	7	11	34	5	10	1	5	10	96	9.60	9.1
Large (>14.5 cm)	88	109	299	250	125	141	112	15	91	27	1257	125.7	88.7
Plot area (m^2)	314.16	314.16	314.16	314.16	314.16	314.16	150	98.5	98.5	98.5	2330.5	-	-
Density of large burrows	0.28	0.35	0.95	0.80	0.40	0.45	0.75	0.15	0.92	0.27	0.54	0.53	0.29
Survey date	20 May	20 May	20 May	20 May	26 May	22 May	22 May	20 May	22 May	22 May	-	-	-
Apparent occupancy													
Large (>14.5 cm) burrows w/ apparent occupancy	26	17	27	35	16	38	23	1	20	0	203	20	13
Total large (>14.5 cm) burrow entrances	74	91	272	220	105	140	99	13	76	26	1116	112	81
Apparent occupancy rate of large burrows	0.35	0.19	0.10	0.16	0.15	0.27	0.23	0.08	0.26	0.00	0.18	0.18	0.10
Survey date	9 Aug	10 Aug	12 Aug	15-16 Aug	11 Aug	18 Aug	17 Aug	8 Aug	17 Aug	17 Aug	-	-	-

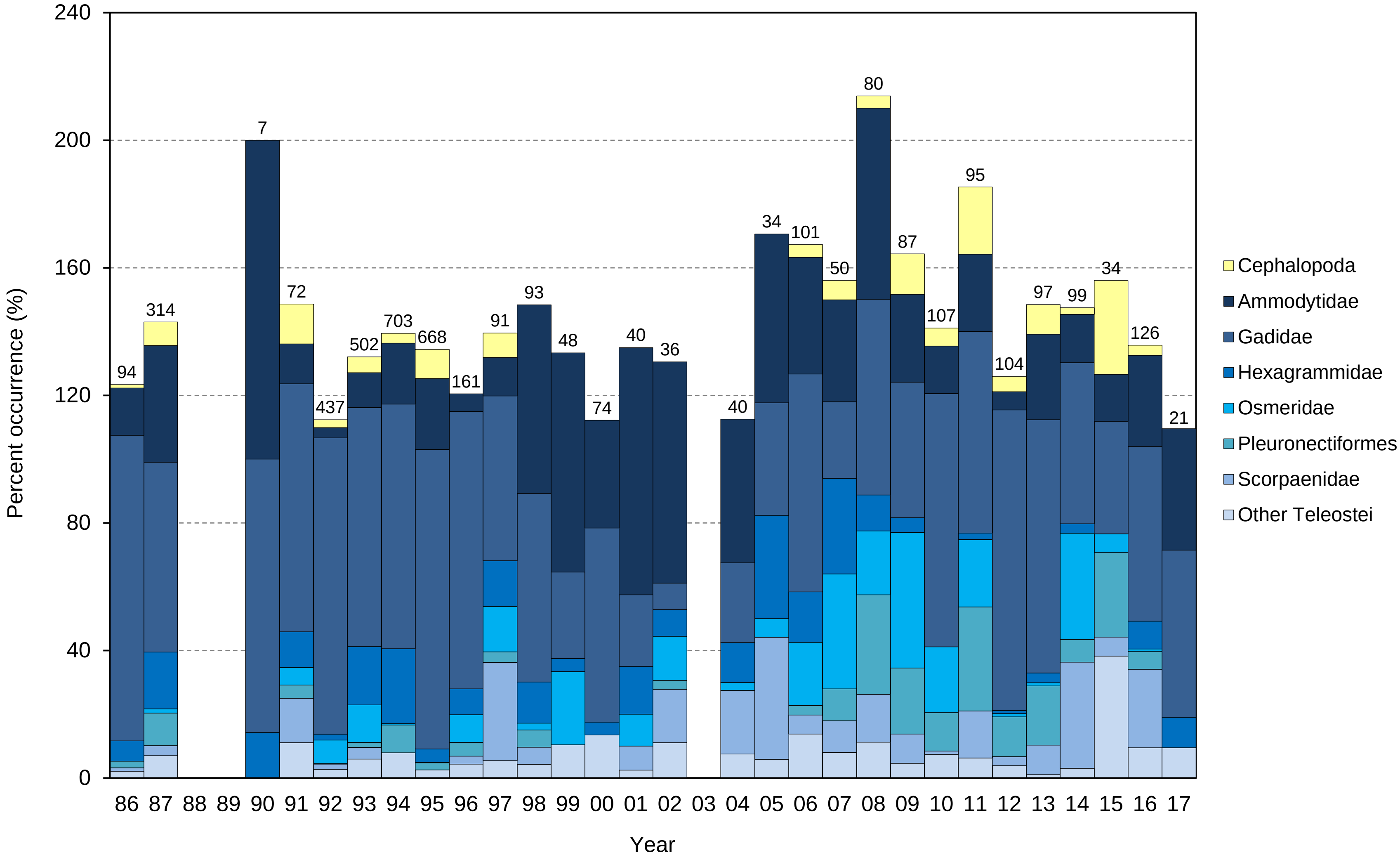

Figure 29. Frequency of occurrence of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1988-1989 or 2003.

Table 41. Frequency of occurrence of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory (1986-1994, 2000-2016) or the field (1996-1999) 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 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 1988-1989 or 2003. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1986	1987	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
No. samples	94	314	7	72	437	502	703	668	161	91	93	48	74	40	36
Invertebrates	**2.1**	**11.1**	**-**	**12.5**	**2.7**	**6.6**	**4.3**	**9.9**	**1.2**	**12.1**	**5.4**	**12.5**	**2.7**	**-**	**-**
Cephalopoda	1.1	7.3	-	12.5	2.5	5.0	3.0	9.1	-	7.7	-	-	-	-	-
Other Invertebrates	1.1	4.5	-	1.4	0.2	1.8	1.4	0.9	1.2	4.4	5.4	12.5	2.7	-	-
Fish	**100.0**	**96.8**	**100.0**	**98.6**	**99.5**	**97.4**	**98.7**	**99.6**	**100.0**	**94.5**	**100.0**	**95.8**	**97.3**	**100.0**	**100.0**
Teleostei	**100.0**	**96.8**	**100.0**	**98.6**	**99.5**	**97.4**	**98.7**	**99.6**	**100.0**	**94.5**	**100.0**	**95.8**	**97.3**	**100.0**	**100.0**
Ammodytidae	**14.9**	**36.6**	**100.0**	**12.5**	**3.2**	**11.0**	**19.2**	**22.3**	**5.6**	**12.1**	**59.1**	**68.8**	**33.8**	**77.5**	**69.4**
Ammodytes spp.	14.9	36.6	100.0	12.5	3.2	11.0	19.2	22.3	5.6	12.1	59.1	68.8	33.8	77.5	69.4
Gadidae	**95.7**	**59.6**	**85.7**	**77.8**	**92.9**	**74.9**	**76.7**	**93.9**	**87.0**	**51.6**	**59.1**	**27.1**	**60.8**	**22.5**	**-**
Gadus chalcogrammus	88.3	59.2	85.7	37.5	91.1	65.7	66.0	86.1	83.9	47.3	58.1	25.0	40.5	20.0	-
G. macrocephalus	34.0	0.3	-	4.2	5.0	15.5	6.5	43.1	18.6	11.0	4.3	-	-	5.0	-
Unid. Gadidae	1.1	-	-	9.7	8.9	8.2	26.0	12.4	-	2.2	1.1	8.3	18.9	-	-
Other Gadidae	-	0.3	-	50.0	-	-	-	-	-	-	-	-	1.4	-	-
Hexagrammidae	**6.4**	**17.8**	**14.3**	**11.1**	**1.8**	**18.3**	**23.5**	**4.2**	**8.1**	**14.3**	**12.9**	**4.2**	**4.1**	**15.0**	**-**
Hexagrammos decagrammus	-	-	-	-	0.5	14.3	22.6	-	7.5	14.3	12.9	4.2	2.7	15.0	-
Other Hexagrammidae	6.4	17.8	14.3	11.1	1.4	4.0	1.1	4.2	0.6	-	-	-	1.4	-	-
Osmeridae	**-**	**1.3**	**-**	**5.6**	**7.3**	**11.8**	**0.4**	**0.1**	**8.7**	**14.3**	**2.2**	**22.9**	**-**	**10.0**	**-**
Mallotus villosus	-	1.3	-	5.6	7.3	11.6	0.4	0.1	8.7	14.3	2.2	22.9	-	10.0	-
Other Osmeridae	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
Pleuronectiformes	2.1	10.2	-	4.2	0.2	1.6	8.7	2.2	4.3	3.3	5.4	-	-	-	-
Scorpaenidae	**1.1**	**3.2**	**-**	**13.9**	**1.6**	**3.6**	**-**	**-**	**2.5**	**30.8**	**5.4**	**-**	**-**	**7.5**	**-**
Sebastes spp.	1.1	-	-	-	-	-	-	-	0.6	30.8	-	-	-	-	-
Other Scorpaenidae	-	3.2	-	13.9	1.6	3.6	-	-	1.9	-	5.4	-	-	7.5	-
Other Teleostei	2.1	7.0	-	11.1	2.7	6.0	8.0	2.5	4.3	5.5	4.3	10.4	13.5	2.5	44.4
Other	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-

Table 41 (continued). Frequency of occurrence of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory (1986-1994, 2000-2016) or the field (1996-1999) 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 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 1988-1989 or 2003. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	40	34	101	50	80	87	107	95	104	97	99	34	126	21
Invertebrates	**2.5**	**-**	**6.9**	**8.0**	**8.8**	**25.3**	**10.3**	**38.9**	**9.6**	**13.4**	**3.0**	**29.4**	**4.8**	**-**
Cephalopoda	-	-	4.0	6.0	3.8	12.6	5.6	21.1	4.8	9.3	2.0	29.4	3.2	-
Other Invertebrates	2.5	-	3.0	2.0	5.0	19.5	4.7	31.6	5.8	4.1	1.0	-	1.6	-
Fish	**100.0**	**100.0**	**97.0**	**100.0**	**100.0**	**94.3**	**99.1**	**91.6**	**98.1**	**96.9**	**100.0**	**85.3**	**98.4**	**100.0**
Teleostei	**100.0**	**100.0**	**97.0**	**100.0**	**100.0**	**94.3**	**99.1**	**91.6**	**98.1**	**96.9**	**100.0**	**85.3**	**98.4**	**100.0**
Ammodytidae	**45.0**	**52.9**	**36.6**	**32.0**	**60.0**	**27.6**	**15.0**	**24.2**	**5.8**	**26.8**	**15.2**	**14.7**	**28.6**	**38.1**
Ammodytes spp.	45.0	52.9	36.6	32.0	60.0	27.6	15.0	24.2	5.8	26.8	15.2	14.7	28.6	38.1
Gadidae	**25.0**	**35.3**	**68.3**	**24.0**	**61.3**	**42.5**	**79.4**	**63.2**	**94.2**	**79.4**	**50.5**	**35.3**	**54.8**	**52.4**
Gadus chalcogrammus	25.0	29.4	18.8	18.0	21.3	32.2	54.2	50.5	87.5	52.6	50.5	32.4	54.0	42.9
G. macrocephalus	-	-	4.0	-	22.5	17.2	52.3	17.9	9.6	54.6	2.0	5.9	-	9.5
Unid. Gadidae	-	8.8	50.5	6.0	16.3	8.0	22.4	10.5	7.7	17.5	1.0	2.9	0.8	-
Other Gadidae	-	-	-	6.0	31.3	4.6	18.7	18.9	1.0	-	-	-	-	4.8
Hexagrammidae	**12.5**	**32.4**	**15.8**	**30.0**	**11.3**	**4.6**	**-**	**2.1**	**1.0**	**3.1**	**3.0**	**-**	**8.7**	**9.5**
Hexagrammos decagrammus	12.5	32.4	10.9	24.0	8.8	3.4	-	1.1	1.0	-	-	-	-	-
Other Hexagrammidae	-	-	5.0	18.0	2.5	1.1	-	1.1	-	3.1	3.0	-	8.7	9.5
Osmeridae	**2.5**	**5.9**	**19.8**	**36.0**	**20.0**	**42.5**	**20.6**	**21.1**	**1.0**	**1.0**	**33.3**	**5.9**	**0.8**	**-**
Mallotus villosus	2.5	5.9	19.8	36.0	20.0	42.5	20.6	21.1	1.0	1.0	33.3	**5.9**	0.8	-
Other Osmeridae	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Pleuronectiformes	-	-	5.0	10.0	32.5	23.0	14.0	33.7	12.5	18.6	7.1	26.5	5.6	-
Scorpaenidae	**20.0**	**38.2**	**5.9**	**10.0**	**15.0**	**9.2**	**0.9**	**14.7**	**2.9**	**9.3**	**33.3**	**6.0**	**24.6**	**-**
Sebastes spp.	20.0	38.2	2.0	-	-	-	-	-	-	-	33.3	20.6	24.6	-
Other Scorpaenidae	-	-	4.0	10.0	15.0	9.2	0.9	14.7	2.9	9.3	-	-	-	-
Other Teleostei	7.5	5.9	13.9	8.0	11.3	4.6	7.5	6.3	3.8	1.0	3.0	38.2	9.5	9.5
Other	-	-	3.0	-	-	1.1	-	-	-	-	-	-	-	-

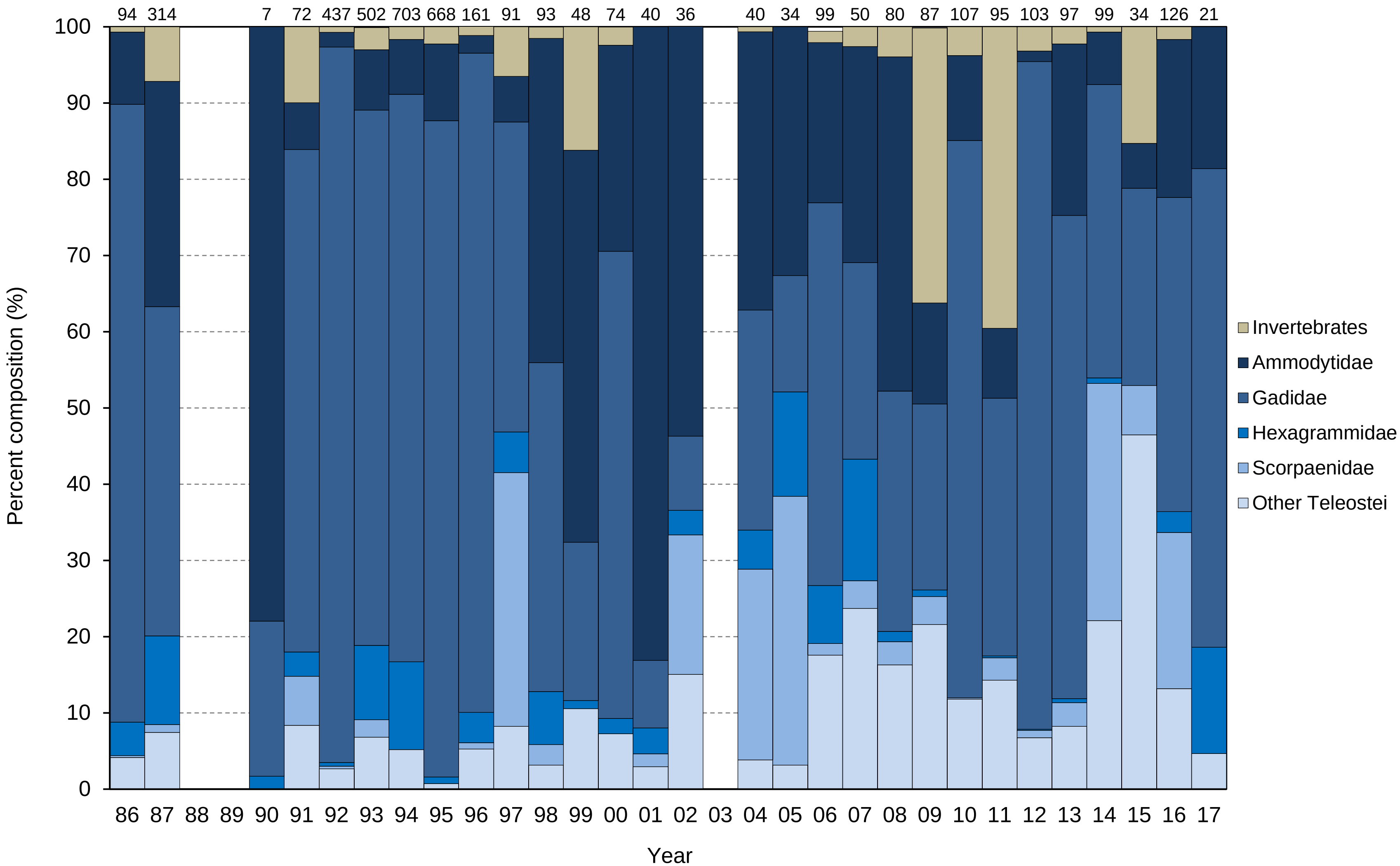

Figure 30. Percent composition of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition 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 1988-1989 or 2003.

Table 42. Percent composition of major prey items in diets of tufted puffin chicks at Aiktak 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 (1986-1994, 2000-2016) or the field (1996-1999) 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 bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1988-1989 or 2003. More detailed diet data and prey identifications are available, contact refuge biologists for details

Prey	1986	1987	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
No. samples	94	314	7	72	437	502	703	668	161	91	93	48	74	40	36
No. individuals	433	1144	59	311	2299	1937	3587	5789	777	433	475	284	248	237	81
Invertebrates	0.7	7.2	-	10.0	0.7	2.9	1.7	2.3	1.2	6.5	1.5	16.2	2.4	-	-
Fish	**99.3**	**92.8**	**100.0**	**90.0**	**99.3**	**97.0**	**98.3**	**97.7**	**98.8**	**93.5**	**98.5**	**83.8**	**97.6**	**100.0**	**100.0**
Teleostei	**99.3**	**92.8**	**100.0**	**90.0**	**99.3**	**97.0**	**98.3**	**97.7**	**98.8**	**93.5**	**98.5**	**83.8**	**97.6**	**100.0**	**100.0**
Ammodytidae	**9.5**	**29.5**	**78.0**	**6.1**	**1.9**	**8.0**	**7.2**	**10.1**	**2.3**	**6.0**	**42.5**	**51.4**	**27.0**	**83.1**	**53.8**
Ammodytes spp.	9.5	29.5	78.0	6.1	1.9	8.0	7.2	10.1	2.3	6.0	42.5	51.4	27.0	83.1	53.8
Gadidae	**81.1**	**43.2**	**20.3**	**65.9**	**93.9**	**70.2**	**74.4**	**86.1**	**86.5**	**40.6**	**43.2**	**20.8**	**61.3**	**8.9**	**9.7**
Gadus chalcogrammus	68.1	43.0	20.3	27.3	90.6	58.9	63.8	66.7	80.8	36.5	41.7	16.9	50.0	8.0	9.7
G. macrocephalus	12.7	0.1	-	1.3	1.4	8.6	2.7	15.8	5.7	3.7	1.3	-	-	0.8	-
Other Gadidae	0.2	0.1	-	37.3	1.9	2.8	7.9	3.5	-	0.5	0.2	3.9	11.3	-	-
Hexagrammidae	4.4	11.6	1.7	3.2	0.5	9.8	11.5	0.9	4.0	5.3	6.9	1.1	2.0	3.4	3.2
Scorpaenidae	**0.2**	**1.0**	**-**	**6.4**	**0.3**	**2.3**	**-**	**-**	**0.8**	**33.3**	**2.7**	-	-	**1.7**	**18.3**
Sebastes spp.	0.2	-	-	-	-	-	-	-	0.1	33.3	-	-	-	-	18.3
Other Scorpaenidae	-	1.0	-	6.4	0.3	2.3	-	-	0.6	0.1	2.7	-	-	1.7	-
Other Teleostei	4.2	7.4	-	8.4	2.7	6.8	5.2	0.7	5.3	8.2	3.2	10.6	7.3	3.0	15.1
Other	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-

Table 42 (continued). Percent composition of major prey items in diets of tufted puffin chicks at Aiktak 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 (1986-1994, 2000-2016) or the field (1996-1999) 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 bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1988-1989 or 2003. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	40	34	99	50	80	87	107	95	103	97	99	34	126	21
No. individuals	156	190	460	194	657	574	610	820	712	582	408	170	478	43
Invertebrates	0.6	-	1.5	2.6	4.0	36.1	3.8	39.6	3.2	2.2	0.7	15.3	1.7	**-**
Fish	**99.4**	**100.0**	**97.9**	**97.4**	**96.0**	**63.8**	**96.2**	**60.4**	**96.8**	**97.8**	**99.3**	**84.7**	**98.3**	**100.0**
Teleostei	**99.4**	**100.0**	**97.9**	**97.4**	**96.0**	**63.8**	**96.2**	**60.4**	**96.8**	**97.8**	**99.3**	**84.7**	**98.3**	**100.0**
Ammodytidae	**36.5**	**32.6**	**21.0**	**28.4**	**43.8**	**13.2**	**11.1**	**9.2**	**1.4**	**22.5**	**6.9**	**5.9**	**20.7**	**18.6**
Ammodytes spp.	36.5	32.6	21.0	28.4	43.8	13.2	11.1	9.2	1.4	22.5	6.9	5.9	20.7	18.6
Gadidae	**28.8**	**15.3**	**50.2**	**25.8**	**31.5**	**24.4**	**73.1**	**33.8**	**87.6**	**63.4**	**38.5**	**25.9**	**41.2**	**62.8**
Gadus chalcogrammus	28.8	12.6	12.9	16.5	5.5	16.0	32.6	20.5	78.5	35.4	37.7	24.1	41.0	55.8
G. macrocephalus	-	-	1.9	-	8.8	5.7	24.6	4.9	4.3	24.7	0.5	1.2	-	4.7
Other Gadidae	-	2.6	35.4	9.3	17.2	2.6	15.9	8.4	4.8	3.3	0.2	0.6	0.2	2.3
Hexagrammidae	5.1	13.7	7.6	16.0	1.4	0.9	-	0.2	0.1	0.5	0.7	-	2.7	14.0
Scorpaenidae	**25.0**	**35.3**	**1.5**	**3.6**	**3.0**	**3.7**	**0.2**	**2.9**	**1.0**	**3.1**	**31.1**	**6.5**	**20.5**	**-**
Sebastes spp.	25.0	35.3	0.6	-	-	-	-	-	-	-	31.1	6.5	20.5	-
Other Scorpaenidae	-	-	0.8	3.6	3.0	3.7	0.2	2.9	1.0	3.1	-	-	-	-
Other Teleostei	3.8	3.2	17.6	23.7	16.3	21.6	11.8	14.3	6.8	8.2	22.1	46.5	13.2	4.7
Other	-	-	0.6	-	-	0.2	-	-	-	-	-	-	-	-

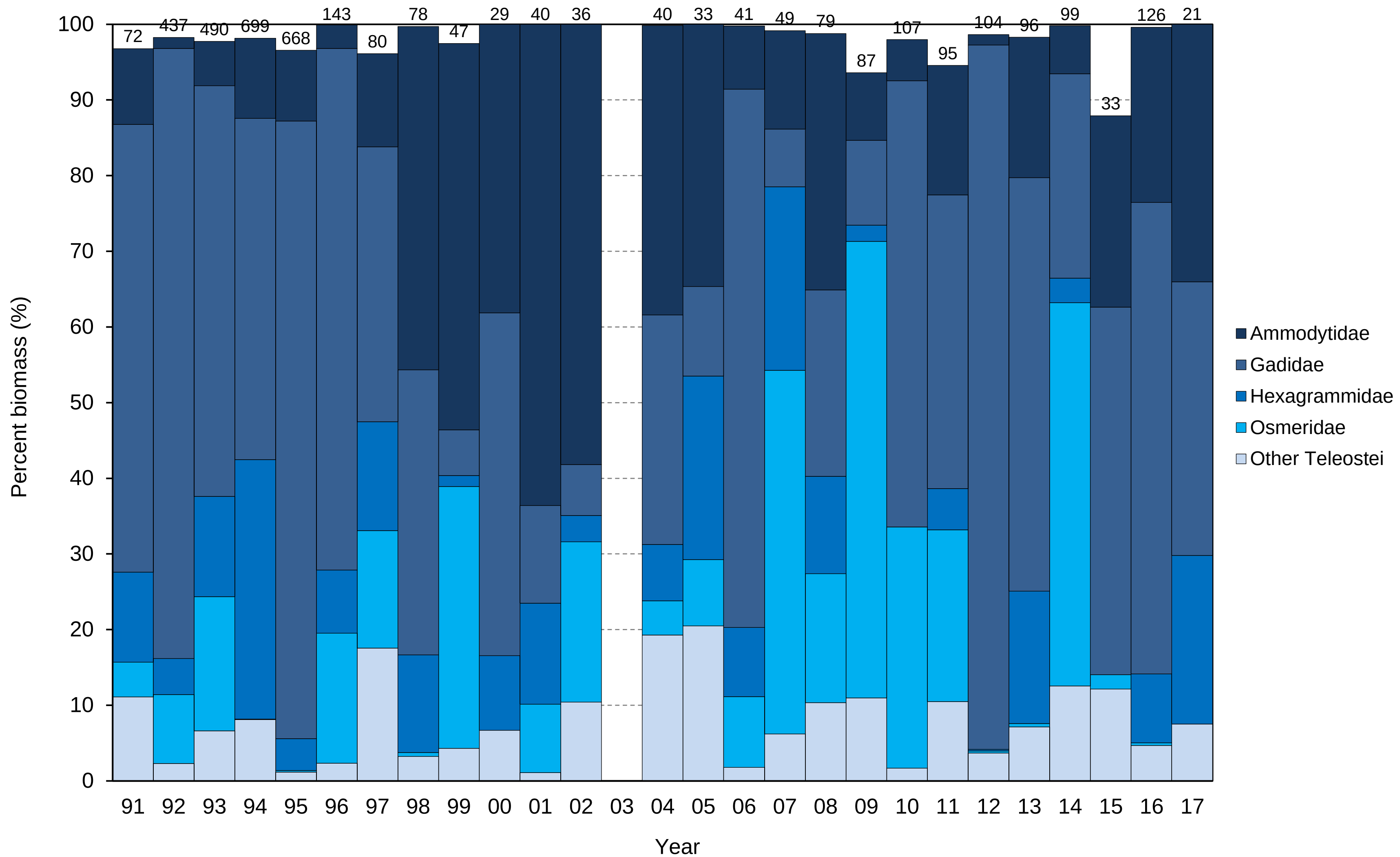

Figure 31. Relative biomass of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1988-1989 or 2003 and no mass data exist in 1990.

Table 43. Relative biomass of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory (1991-1994, 2000-2016) or the field (1996-1999) 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 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. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1988-1989 or 2003 and no mass data exist in 1990. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
No. samples	72	437	490	699	668	143	80	78	47	29	40	35
Total mass (g)	497	2903	2405	2748	4673	1448	643	694	396	222	406	346
Invertebrates	3.2	1.7	2.2	1.9	3.4	0.1	3.9	0.3	2.5	-	-	-
Fish	**96.8**	**98.3**	**97.8**	**98.1**	**96.6**	**99.9**	**96.1**	**99.7**	**97.5**	**100.0**	**100.0**	**100.0**
Teleostei	**96.8**	**98.3**	**97.8**	**98.1**	**96.6**	**99.9**	**96.1**	**99.7**	**97.5**	**100.0**	**100.0**	**100.0**
Ammodytidae	**10.0**	**1.4**	**5.9**	**10.6**	**9.3**	**3.1**	**12.3**	**45.4**	**51.1**	**38.1**	**63.6**	**62.9**
Ammodytes spp.	10.0	1.4	5.9	10.6	9.3	3.1	12.3	45.4	51.1	38.1	63.6	62.9
Gadidae	**59.2**	**80.6**	**54.3**	**45.1**	**81.6**	**68.9**	**36.4**	**37.7**	**6.0**	**45.3**	**12.9**	**-**
Gadus chalcogrammus	21.1	77.2	39.9	37.8	54.8	60.9	31.5	35.6	5.0	36.9	10.9	-
G. macrocephalus	1.5	2.5	12.1	3.4	24.4	8.0	4.7	2.1	-	-	2.0	-
Other Gadidae	36.6	0.9	2.3	3.9	2.4	-	0.2	-	1.0	8.4	-	-
Hexagrammidae	**11.9**	**4.8**	**13.2**	**34.3**	**4.2**	**8.3**	**14.4**	**12.9**	**1.4**	**9.9**	**13.3**	**-**
Hexagrammos decagrammus	-	0.3	9.5	31.7	-	8.1	14.4	12.9	1.4	4.4	13.3	-
Other Hexagrammidae	11.9	4.5	3.7	2.6	4.2	0.3	-	-	-	5.4	-	-
Osmeridae	**4.6**	**9.1**	**17.8**	**0.1**	**0.2**	**17.2**	**15.5**	**0.5**	**34.6**	-	**9.0**	-
Mallotus villosus	4.6	9.1	17.7	0.1	0.2	17.2	15.5	0.5	34.6	-	9.0	-
Other Osmeridae	-	-	<0.1	-	-	-	-	-	-	-	-	-
Other Teleostei	11.1	2.3	6.6	8.1	1.2	2.3	17.6	3.2	4.3	6.7	1.1	-
Other	-	-	0.1	-	-	-	-	-	-	-	-	37.1

Table 43 (continued). Relative biomass of major prey items in diets of tufted puffin chicks at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory (1991-1994, 2000-2016) or the field (1996-1999) 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 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. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1988-1989 or 2003 and no mass data exist in 1990. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	40	33	41	49	79	87	107	95	104	96	99	33	126	21
Total mass (g)	145	197	1037	333	506	541	771	455	777	590	895	170	1022	77
Invertebrates	0.2	-	0.2	0.8	1.2	6.4	2.0	5.5	1.4	1.7	0.2	12.0	0.4	-
Fish	**99.8**	**100.0**	**99.8**	**99.2**	**98.8**	**93.6**	**98.0**	**94.5**	**98.6**	**98.3**	**99.8**	**87.9**	**99.6**	**100.0**
Teleostei	**99.8**	**100.0**	**99.8**	**99.2**	**98.8**	**93.6**	**98.0**	**94.5**	**98.6**	**98.3**	**99.8**	**87.9**	**99.6**	**100.0**
Ammodytidae	**38.2**	**34.7**	**8.3**	**13.0**	**33.9**	**8.9**	**5.4**	**17.1**	**1.4**	**18.5**	**6.4**	**25.3**	**23.2**	**34.0**
Ammodytes spp.	38.3	34.7	8.3	13.0	33.9	8.9	5.4	17.1	1.4	18.5	6.4	25.3	23.2	34.0
Gadidae	**30.3**	**11.8**	**71.2**	**7.6**	**24.6**	**11.2**	**59.0**	**38.8**	**93.1**	**54.7**	**27.0**	**48.6**	**62.3**	**36.2**
Gadus chalcogrammus	30.3	11.6	67.3	4.3	2.9	6.7	25.0	17.8	86.9	31.2	26.8	46.4	62.2	23.4
G. macrocephalus	-	-	1.9	-	8.0	2.7	19.5	7.4	4.0	21.9	0.2	1.9	-	12.2
Other Gadidae	-	0.3	1.9	3.3	13.7	1.8	14.5	13.6	2.3	1.6	0.1	0.3	0.1	0.6
Hexagrammidae	**7.5**	**24.3**	**9.1**	**24.2**	**12.9**	**2.1**	**-**	**5.5**	**0.2**	**17.5**	**3.2**	**-**	**9.1**	**22.3**
Hexagrammos decagrammus	7.5	24.3	8.4	13.4	2.5	1.6	-	0.4	0.2	-	-	-	**-**	**-**
Other Hexagrammidae	-	-	0.7	10.9	10.3	0.5	-	5.1	0.0	17.5	3.2	-	9.1	22.3
Osmeridae	**4.5**	**8.7**	**9.4**	**48.1**	**17.0**	**60.3**	**31.9**	**22.7**	**0.3**	**0.5**	**50.7**	**1.9**	**0.4**	**-**
Mallotus villosus	4.5	8.7	9.4	48.1	17.0	60.3	31.9	22.7	0.3	0.5	50.7	1.9	0.4	-
Other Osmeridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Teleostei	19.3	20.5	1.8	6.2	10.4	11.0	1.7	10.5	3.7	7.1	12.6	12.1	4.7	7.5
Other	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-

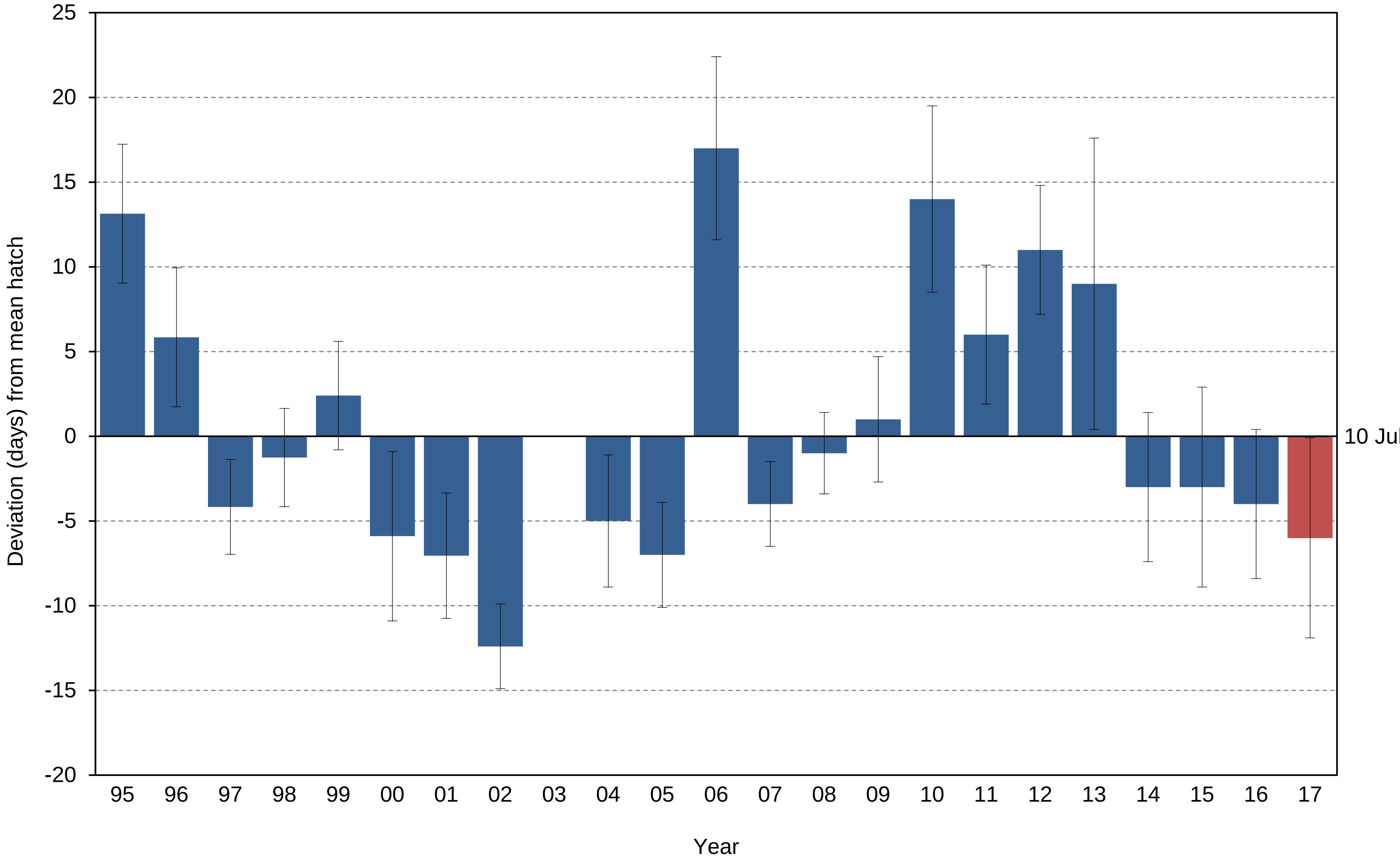

Figure 32. Yearly hatch date deviation (from the 1995-2016 average of 10 July) for glaucous-winged gulls at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year.

Table 44. Breeding chronology of glaucous-winged gulls at Aiktak Island, Alaska.

Year	Mean lay[a]	SD	*n*[b]	Mean hatch	SD	*n*[c]	First lay[a]	First hatch	Last hatch
1995	xx[d]	xx	xx	23 Jul	4.1	43	20 Jun	17 Jul	1 Aug
1996	xx	xx	xx	15 Jul	4.1	76	13 Jun	10 Jul	26 Jul
1997	xx	xx	xx	6 Jul	2.8	95	1 Jun	28 Jun	14 Jul
1998	xx	xx	xx	9 Jul	2.9	90	6 Jun	3 Jul	17 Jul
1999	xx	xx	xx	12 Jul	3.2	50	10 Jun	7 Jul	19 Jul
2000	xx	xx	xx	3 Jul	5.0	70	31 May	7 Jun	19 Jul
2001	xx	xx	xx	3 Jul	3.7	38	1 Jun	28 Jun	14 Jul
2002	xx	xx	xx	28 Jun	2.5	95	26 May	22 Jun	3 Jul
2003	xx	xx	xx	29 Jun	3.2	93	23 May	19 Jun	>5 Jul[e]
2004	xx	xx	xx	4 Jul	3.9	85	29 May	25 Jun	12 Jul
2005	xx	xx	xx	3 Jul	3.1	79	31 May	27 Jun	11 Jul
2006	xx	xx	xx	27 Jul	5.4	10[f]	24 Jun	21 Jul	4 Aug
2007	xx	xx	xx	6 Jul	2.5	36	1 Jun	28 Jun	10 Jul
2008	xx	xx	xx	8 Jul	2.4	40	3 Jun	30 Jun	12 Jul
2009	xx	xx	xx	11 Jul	3.7	38	7 Jun	4 Jul	19 Jul
2010	xx	xx	xx	24 Jul	5.5	7[f]	28 Jun	18 Jul	3 Aug
2011	xx	xx	xx	16 Jul	4.1	5[f]	4 Jun	11 Jul	22 Jul
2012	20 Jun	5.4	44	20 Jul	3.8	3[f]	10 Jun	17 Jul	24 Jul
2013	-	-	-	19 Jul	8.6	5[f]	<4 Jun	11 Jul	30 Jul
2014	-	-	-	7 Jul	4.4	80	<29 May	29 Jun	21 Jul
2015	-	-	-	7 Jul	5.9	107	<1 Jun	25 Jun	24 Jul
2016	-	-	-	5 Jul	4.4	112	<26 May	27 Jun	16 Jul
2017	4 Jun	7.9	44	4 Jul	5.9	77	20 May	23 Jun	20 Jul

[a]In years when birds are already on eggs at the first visit, mean lay date is not calculated and date of first lay is listed as < the date of first nest check.

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

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

[d]xx indicates data potentially exist but have not yet been summarized.

[e]In 2003, four nests had yet to hatch before researchers departed the island early on 10 July.

[f]In 2006 and 2010-2013, sample sizes were small and recorded hatch dates were late due to high rates of egg loss during the early egg-laying period.

Table 45. Frequency distribution of hatch dates for glaucous-winged gulls at Aiktak 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 ≤ 5 days.

Julian date[a]	No. nests 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	17
170	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
173	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
175	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
176	-	-	-	-	-	-	-	7	25	-	-	-	-	-	-	-	-	-	-	-	4	-	-
177	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	**3**
178	-	-	-	-	-	-	-	39	4	-	2	-	-	-	-	-	-	-	-	-	-	-	**5**
179	-	-	1	-	-	11	7	-	4	-	3	-	1	-	-	-	-	-	-	-	1	5	-
180	-	-	-	-	-	-	-	18	43	6	10	-	-	-	-	-	-	-	-	2	11	5	20
181	-	-	-	-	-	-	2	4	1	-	5	-	-	-	-	-	-	-	-	-	1	-	-
182	-	-	-	-	-	22	3	10	-	-	11	-	-	1	-	-	-	-	-	2	4	21	1
183	-	-	13	-	-	-	7	3	1	-	8	-	1	-	-	-	-	-	-	1	8	-	7
184	-	-	2	3	-	-	4	2	4	30	12	-	-	-	-	-	-	-	-	5	-	1	6
185	-	-	-	-	-	-	5	-	-	-	4	-	15	1	1	-	-	-	-	14	1	8	1
186	-	-	44	2	-	16	1	-	10	-	14	-	-	1	3	-	-	-	-	13	24	9	5
187	-	-	-	-	-	2	2	-	-	25	3	-	8	2	-	-	-	-	-	3	-	1	8
188	-	-	20	39	6	11	4	-	-	-	2	-	-	10	7	-	-	-	-	-	6	30	-
189	-	-	-	8	-	-	1	-	-	2	1	-	8	-	-	-	-	-	-	11	13	-	1
190	-	-	-	5	1	-	-	-	-	5	2	-	-	6	2	-	-	-	-	11	13	6	7
191	-	-	8	21	-	2	1	-	-	5	-	-	3	11	4	-	-	-	-	-	-	10	-
192	-	18	4	-	22	-	-	-	-	-	2	-	-	5	9	-	1	-	1	5	-	5	2
193	-	-	-	-	-	-	-	-	-	7	-	-	-	2	2	-	-	-	-	2	2	3	2
194	-	4	2	7	1	1	-	-	-	2	-	-	-	1	4	-	-	-	1	4	2	5	3
195	-	13	1	-	-	1	1	-	-	-	-	-	-	-	-	-	1	-	-	2	3	2	1
196	-	5	-	-	16	1	-	-	-	-	-	-	-	-	-	-	1	-	-	2	9	-	1
197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	1	-	-	-	1
198	7	19	-	5	1	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	1	1	-
199	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-
200	-	3	-	-	3	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	1
201	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
202	14	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	2	2	-	-
203	1	8	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	-	-	-	-	-
204	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
205	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-
206	9	1	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
208	8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
213	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
216	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
n	43	76	95	90	50	70	38	95	93	85	79	10	36	40	38	7	5	3	5	80	107	112	77

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

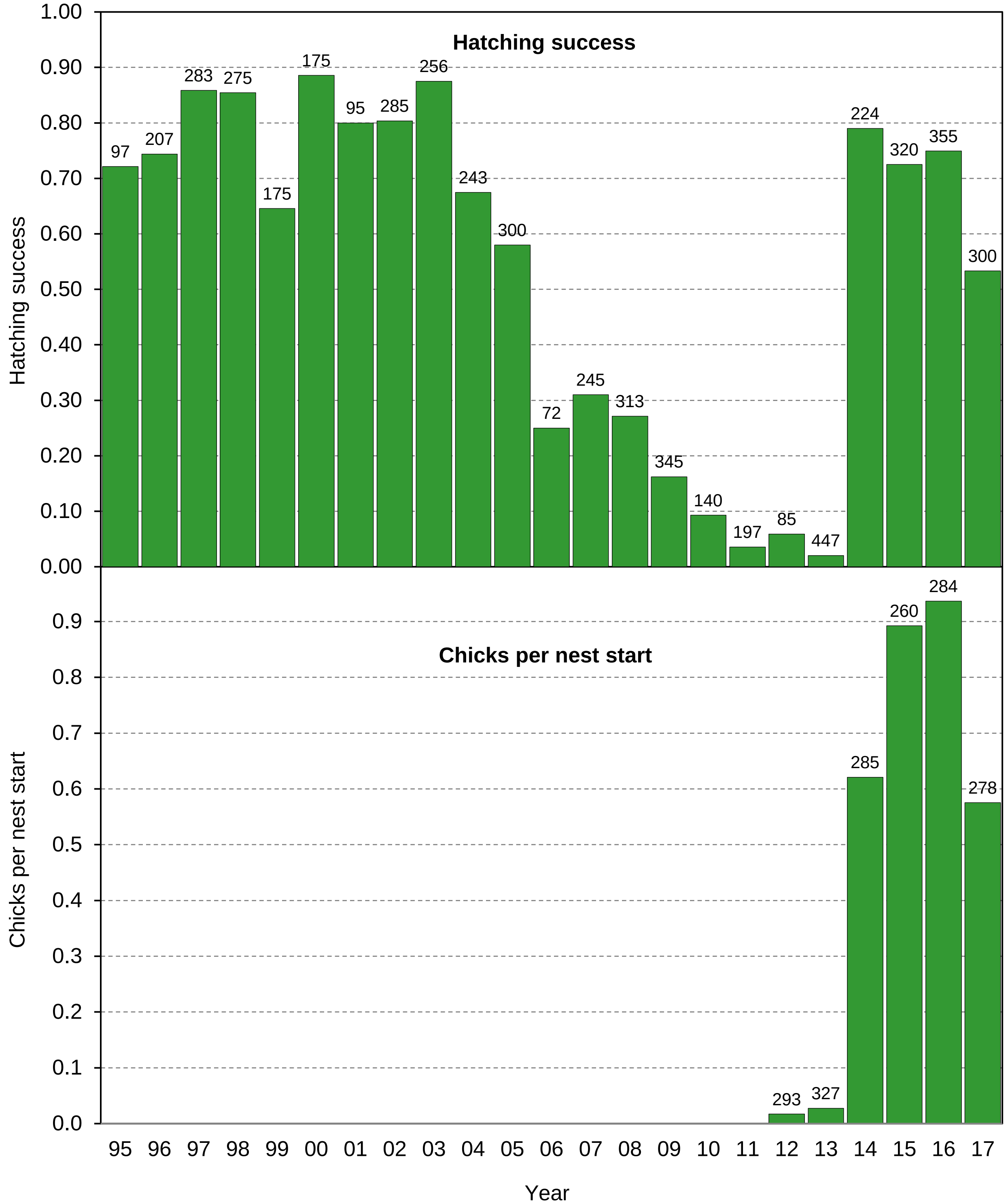

Figure 33. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska. Hatching success=E/C; Chicks per nest start=E/A; where A=total nest starts, C=total eggs; E=total chicks. Numbers above columns indicate sample sizes ([C] for hatching success, [A] for chicks per nest start).

Table 46. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska, as determined by a nest-monitoring methodology. Measures of success are based on frequent monitoring of individual nests.

Year	Total nest starts	Nest sites w/ x eggs:					Nest sites w/ eggs	Total eggs	Nest sites w/ x chicks:				Nest sites w/ chicks	Total chicks	Laying success	Mean clutch size	Mean brood size	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/ nest start
	(A)[a]	0	1	2	3	4	(B)	(C)	1	2	3	4	(D)	(E)	(B/A)	(C/B)	(E/D)	(D/B)	(E/C)	(D/A)[a]	(E/A)[a]
1995	-	-	11	25	12	0	48	97	9	20	7	0	36	70	-	2.0	1.9	0.75	0.72	-	-
1996	-	-	17	38	38	0	93	207	19	33	23	0	75	154	-	2.2	2.1	0.81	0.74	-	-
1997	-	-	9	17	80	0	106	283	3	30	60	0	93	243	-	2.7	2.6	0.88	0.86	-	-
1998	-	-	11	21	74	0	106	275	4	30	57	0	91	235	-	2.6	2.6	0.86	0.85	-	-
1999	-	-	16	27	35	0	78	175	7	23	20	0	50	113	-	2.2	2.3	0.64	0.65	-	-
2000	-	-	6	17	45	0	68	175	11	21	34	0	66	155	-	2.6	2.4	0.97	0.89	-	-
2001	-	-	2	21	17	0	40	95	8	22	8	0	38	76	-	2.4	2.0	0.95	0.80	-	-
2002	-	-	1	13	86	0	100	285	7	42	46	0	95	229	-	2.9	2.4	0.95	0.80	-	-
2003	-	-	8	23	66	1	98	256	13	30	49	1	93	224	-	2.6	2.4	0.95	0.88	-	-
2004	-	-	13	33	52	2	100	243	27	37	21	0	85	164	-	2.4	1.9	0.85	0.67	-	-
2005	-	-	15	33	73	0	117	300	16	31	32	0	79	174	-	2.6	2.2	0.68	0.58	-	-
2006	-	-	26	17	4	0	47	72	2	8	0	0	10	18	-	1.5	1.8	0.21	0.25	-	-
2007	-	-	43	20	54	0	117	245	8	16	12	0	36	76	-	2.1	2.1	0.30	0.31	-	-
2008	-	-	48	63	45	1	157	313	9	17	14	0	40	85	-	2.0	2.1	0.25	0.27	-	-
2009	-	-	93	69	38	0	200	345	21	16	1	0	38	56	-	1.7	1.5	0.18	0.16	-	-
2010	-	-	78	25	4	0	107	140	2	4	1	0	7	13	-	1.3	1.9	0.07	0.09	-	-
2011	-	-	80	42	11	0	133	197	3	2	0	0	5	7	-	1.5	1.4	0.04	0.04	-	-
2012	293	240	28	18	7	0	53	85	2	0	1	0	3	5	0.18	1.6	1.7	0.06	0.06	0.01	0.02
2013	327	49	149	89	40	0	278	447	1	4	0	0	5	9	0.85	1.6	1.8	0.02	0.02	0.02	0.03
2014	285	186	23	27	49	0	99	224	12	39	29	0	80	177	0.35	2.3	2.2	0.81	0.79	0.28	0.62
2015	260	127	21	40	74	0	135	320	24	38	44	0	106	232	0.52	2.4	2.2	0.79	0.72	0.41	0.89
2016	284	142	21	30	90	1	142	355	15	40	57	0	112	266	0.50	2.5	2.4	0.79	0.75	0.39	0.94
2017	278	165	50	41	66	0	157	300	21	37	28	0	86	160	0.56	1.9	1.9	0.55	0.53	0.31	0.58

[a]In 1995 to 2011, sampling at Aiktak included only nests with eggs so total nest starts (A), laying success (B/A), proportion of nest sites with chicks (D/A) and chicks per nest start (E/A) cannot be estimated.

Table 47. Standard deviation in reproductive performance parameters of glaucous-winged gulls at Aiktak Island, Alaska. Sampling for gulls is clustered by plot except when sample sizes per plot are too small or plot data are not available.

Year	No. plots[a]	Total nest starts	Sampling design[b]	Laying success	Mean clutch size	Mean brood size	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/ nest start
1995	xx[c]	-	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	4	-	Cluster by plot	-	0.16	0.13	0.12	0.12	-	-
2000	3	-	Cluster by plot	-	0.06	0.13	0.01	0.04	-	-
2001	2	-	Cluster by plot	-	0.16	0.13	0.01	<0.01	-	-
2002	4	-	Cluster by plot	-	0.02	0.04	0.01	0.02	-	-
2003	4	-	Cluster by plot	-	0.11	0.09	0.03	0.04	-	-
2004	4	-	Cluster by plot	-	0.13	0.19	0.03	0.07	-	-
2005	4	-	Cluster by plot	-	0.12	0.15	0.09	0.09	-	-
2006	4	-	Cluster by plot	-	0.03	0.20	0.04	0.04	-	-
2007	4	-	Cluster by plot	-	0.14	0.09	0.13	0.11	-	-
2008	4	-	Cluster by plot	-	0.08	0.08	0.05	0.05	-	-
2009	4	-	Cluster by plot	-	0.11	0.03	0.03	0.02	-	-
2010	4	-	Cluster by plot	-	0.05	0.32	0.02	0.03	-	-
2011	4	-	Cluster by plot	-	0.07	0.07	0.02	0.02	-	-
2012	4	-	Cluster by plot	0.07	0.14	0.00	0.07	0.06	0.01	0.00
2013	4	327	Cluster by plot	0.11	0.14	0.22	<0.01	<0.01	<0.01	<0.01
2014	4	285	Cluster by plot	0.05	0.15	0.10	0.06	0.04	0.06	0.16
2015	4	260	Cluster by plot	0.08	0.03	0.11	0.05	0.06	0.08	0.21
2016	4	284	Cluster by plot	0.07	0.05	0.06	0.06	0.06	0.07	0.19
2017	4	278	Cluster by plot	0.14	0.11	0.15	0.13	0.10	0.15	0.25

[a]Plots that are combined for analysis are counted as a single "plot".
[b]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 ρ is the success rate and n is the sample size of individual nests.
[c]xx indicates data potentially exist but have not yet been summarized.

Table 48. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska in 2017, as determined by a nest-monitoring methodology. Data come from frequent monitoring of individual nests.

Parameter		Plot				Total	SD[a]
		40 [a]	41 [b]	42 [c]	43 [d]		
Total nest starts (A)		58	44	91	85	278	-
Nest sites w/ x eggs:	0	21	29	58	57	165	-
	1	11	5	18	16	50	-
	2	7	5	24	5	41	-
	3	19	5	35	7	66	-
	4	0	0	0	0	0	-
Nest sites w/ eggs (B)		37	15	77	28	157	-
Total eggs (C)		82	30	141	47	300	-
Nest sites w/ x chicks:	1	3	3	14	1	21	-
	2	8	2	24	3	37	-
	3	7	4	17	0	28	-
Nest sites w/ chicks (D)		18	9	55	4	86	-
Total chicks (E)		40	19	94	7	160	-
Laying success (B/A)		0.64	0.34	0.85	0.33	0.56	0.14
Mean clutch size (C/B)		2.2	2.0	1.8	1.7	1.9	0.11
Mean brood size (E/D)		2.2	2.1	1.7	1.8	1.9	0.15
Nesting success (D/B)		0.49	0.60	0.71	0.14	0.55	0.13
Hatching success (E/C)		0.49	0.63	0.67	0.15	0.53	0.10
Prop. nest sites w/ chicks (D/A)		0.31	0.20	0.60	0.05	0.31	0.15
Chicks/nest start (E/A)		0.69	0.43	1.03	0.08	0.58	0.25

[a]Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit.

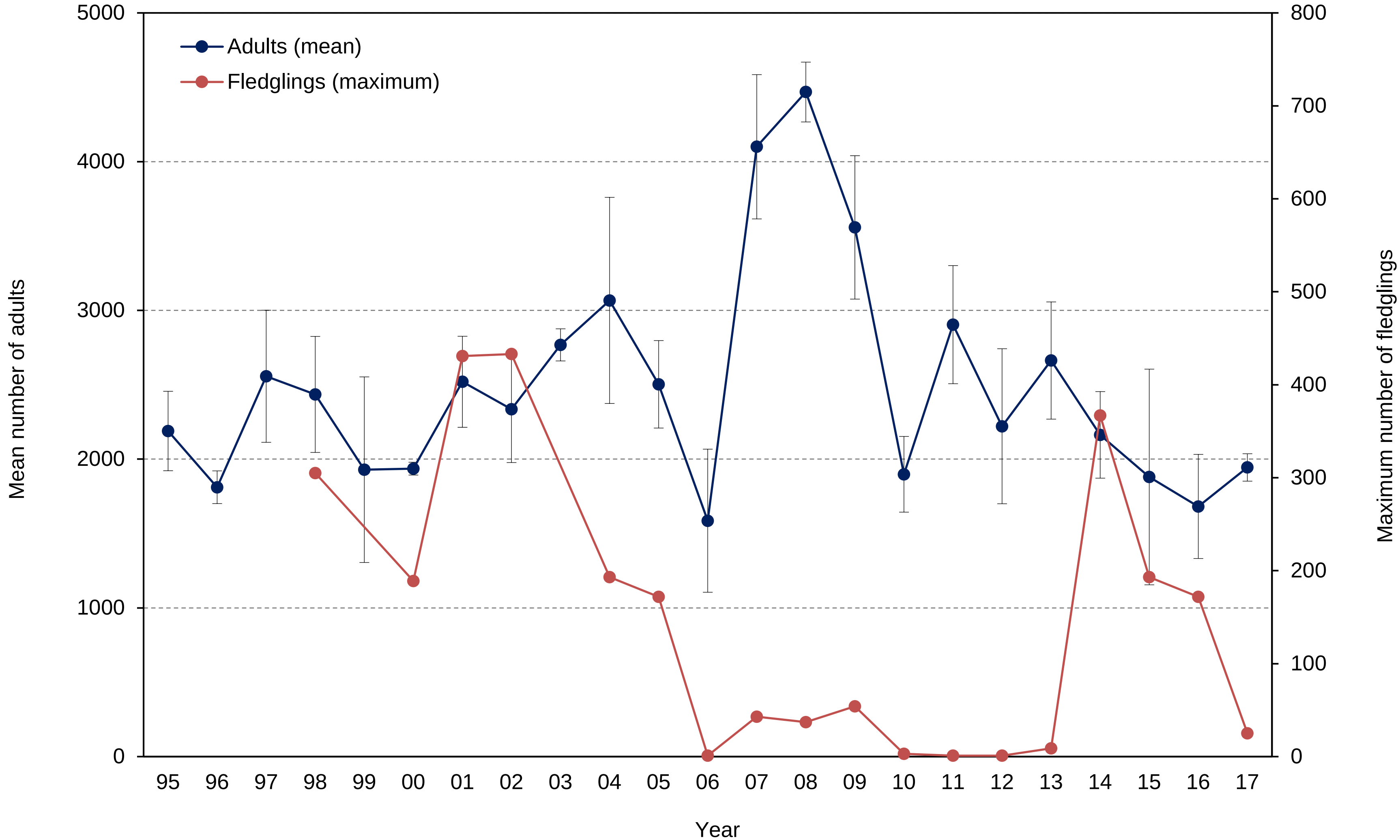

Figure 34. Mean numbers of glaucous-winged gull adults and maximum numbers of glaucous-winged fledglings counted on index plots (adults) or along beach transects (fledglings) at Aiktak Island, Alaska. No fledgling counts were conducted in 1999 or 2003.

Table 49. Numbers of glaucous-winged gulls counted on index plots at Aiktak Island, Alaska.

Replicate	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	1994	1701	2689	2481	2004	1975	2564	2233	2804	2280	2130	2333
2	2240	1875	3211	3039	1275	1872	2996	2684	2725	2639	2887	1450
3	2527	1671	2329	2553	1631	1926	-	2719	2936	4007	2423	999
4	-	-	-	2592	2734	1909	-	2152	2718	3519	2695	1530
5	-	-	-	1944	-	-	-	1887	2657	2889	2379	1617
Mean	2189	1811	2557	2435	1929	1936	2520	2335	2768	3067	2503	1586
Max.	2527	1875	3211	3039	2734	1975	2996	2719	2936	4007	2887	2333
n	3	3	3	5	4	4	2	5	5	5	5	5
SD	267	110	444	390	624	43	306	358	108	693	294	481
First count	9 Jun	19 Jun	30 May	2 Jun	30 May	16 Jun	6 Jun	29 May	22 May	24 May	3 Jun	1 Jun
Last count	16 Jul	18 Jul	16 Jun	15 Jun	11 Jun	25 Jun	8 Jun	15 Jun	6 Jun	14 Jun	19 Jun	17 Jun

Table 49 (continued). Numbers of glaucous-winged gulls counted on index plots at Aiktak Island, Alaska.

Replicate	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	3412	4494	3252	1775	2993	1615	2242	2457	1171	1458	2026
2	4546	4749	3749	2191	2676	1730	3173	2368	2255	1920	2012
3	4176	4187	4227	1728	3046	2370	2507	1902	2710	2037	1908
4	4265	4490	2966	-	3427	2655	2731	1923	1385	1314	1831
5	-	4420	3600	-	2377	2737	-	1697	-	-	-
Mean	4100	4468	3558	1898	2904	2211	2663	2163	1880	1682	1944
Max.	4546	4749	4227	2191	3427	2737	3173	2457	2255	2037	2026
n	4	5	5	3	5	5	4	5	4	4	4
SD	485	201	482	255	397	521	394	291	725	350	92
First count	4 Jun	3 Jun	4 Jun	31 May	3 Jun	6 Jun	5 Jun	6 Jun	25 May	24 May	24 May
Last count	14 Jun	11 Jun	12 Jun	5 Jun	8 Jun	11 Jun	20 Jun	13 Jun	12 Jun	11 Jun	11 Jun

Table 50. Numbers of glaucous-winged gull fledglings counted on New Camp and Old Camp beaches at Aiktak Island, Alaska. No counts were conducted in 1999 or 2003.

Replicate	1998	2000	2001	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	28	37	112	81	20	14	0	3	1	11	3	0	1	0	28	1	0	0
2	31	87	431	376	22	17	0	9	23	9	1	0	0	7	77	46	11	4
3	38	189	62	404	50	18	1	15	37	22	-	1	0	9	356	85	81	25
4	106	120	-	433	133	50	-	31	-	28	-	1	0	-	367	186	172	24
5	305	113	-	361	193	123	-	43	-	40	-	-	1	-	-	193	-	-
6	-	171	-	-	-	172	-	-	-	54	-	-	-	-	-	-	-	-
Max.	305	189	431	433	193	172	1	43	37	54	3	1	1	9	367	193	172	25
n	5	6	3	5	5	6	3	5	3	6	2	4	5	3	4	5	4	4
SD	118	56	200	142	77	67	1	17	18	17	1	1	1	9	180	85	79	13
First count	14 Aug	13 Aug	17 Aug	10 Aug	10 Aug	4 Aug	23 Aug	13 Aug	20 Aug	24 Aug	28 Aug	20 Aug	19 Aug	18 Aug	14 Aug	11 Aug	9 Aug	7 Aug
Last count	1 Sep	7 Sep	8 Sep	25 Aug	28 Aug	31 Aug	2 Sep	30 Aug	28 Aug	4 Sep	2 Sep	3 Sep	2 Sep	29 Aug	30 Aug	28 Aug	27 Aug	27 Aug

Table 51. Numbers of glaucous-winged gulls counted on index plots at Aiktak Island, Alaska in 2017.

Plot	Date				Mean	SD
	24 May	27 May	5 Jun	11 Jun		
A	35	29	17	9	-	-
B	280	426	420	300	-	-
C-west	608	572	479	473	-	-
C-north	784	718	702	778	-	-
D	0	0	0	0	-	-
E	34	38	42	49	-	-
F	21	12	20	12	-	-
G	14	15	18	10	-	-
H	25	24	30	29	-	-
I	21	10	4	11	-	-
Club A	109	77	84	58	-	-
Club B	72	66	68	78	-	-
Club C	23	25	24	24	-	-
Total	2026	2012	1908	1831	1944	92

Table 52. Numbers of glaucous-winged gull fledglings counted on New Camp and Old Camp beaches at Aiktak Island, Alaska in 2017.

Plot	Date				Max.
	7 Aug	14 Aug	21 Aug	27 Aug	
Old Camp Beach	0	0	16	9	-
New Camp Beach	0	4	9	15	-
Total	0	4	25	24	25

Table 53. Density of glaucous-winged gull nests on index plots at Aiktak Island, Alaska.

Year	Total nest starts (A)	Nest sites w/ x eggs: 0	1	2	3	4	Nest sites w/ eggs (B)	Total eggs (C)	Area (m^2)	Mean clutch size (C/B)	Density of nests w/ eggs (B/area)	Density of total nests (A/area)	Survey date
1997	93	48	3	13	29	0	45	114	1885.2[a]	2.5	0.02	0.05	xx[b]
1998	76	48	2	7	19	0	28	73	1885.2	2.6	0.01	0.04	xx
1999	84	53	3	18	10	0	31	63	1885.2	2.0	0.02	0.04	xx
2000	47	8	7	16	15	0	38	84	1885.2	2.2	0.02	0.02	xx
2001	70	17	2	15	36	0	53	154	1885.2	2.7	0.03	0.04	xx
2002	90	30	1	12	47	0	49	136	1885.2	2.8	0.03	0.07	xx
2003	90	41	1	9	39	0	49	136	1885.2	2.8	0.03	0.05	xx
2004	81	24	7	18	32	0	57	140	1885.2	2.5	0.03	0.04	xx
2005	81	39	14	8	20	0	42	90	1885.2	2.1	0.02	0.04	xx
2006	86	85	1	0	0	0	1	1	1885.2	1.0	<0.01[c]	0.05[c]	xx
2007	232	204	10	13	5	0	28	54	1885.2	1.9	0.02	0.12	xx
2008	312	275	7	18	11	1	37	80	1885.2	2.1	0.02	0.17	20 Jun
2009	220	182	17	14	7	0	38	66	1885.2	1.7	0.02	0.12	20 Jun
2010	153	151	1	1	0	0	2	3	1885.2	1.5	<0.01[c]	0.08[c]	27 Jun
2011	170	161	5	3	1	0	9	14	1885.2	1.6	<0.01[c]	0.09[c]	23 Jun
2012	227	204	8	8	7	0	23	45	1885.2	2.0	0.01	0.12	29 Jun
2013	188	181	3	2	2	0	7	13	1885.2	1.9	<0.01	0.10	27 Jun
2014	172	117	10	11	34	0	55	134	1885.2	2.4	0.03	0.09	23 Jun
2015	87	42	3	12	30	0	45	117	1885.2	2.6	0.02	0.05	27 Jun
2016[d]	98	58	2	16	22	0	40	100	1885.2	2.5	0.02	0.05	22+23 Jun
2017	176	146	7	11	12	0	30	65	1885.2	2.2	0.02	0.09	19 Jun

[a]Total area consists of sum of six plots of 314.2 m^2 each.

[b]xx indicates data potentially exist but have not yet been summarized.

[c]In 2006, 2010 and 2011, density values may underestimate actual effort because gulls suffered exceptionally high rates of egg loss during the early egg-laying period before density surveys were conducted.

[d]In 2016 index plots were counted during two consecutive days.

Table 54. Density of glaucous-winged gulls on index plots at Aiktak Island, Alaska in 2017.

Parameter		Plot 40	41	42	43	55	78	Total	SD
Total nest starts (A)		36	8	55	25	29	23	176	-
Nest sites w/ x eggs:	0	26	7	47	25	24	17	146	-
	1	1	1	0	0	2	3	7	-
	2	5	0	2	0	2	2	11	-
	3	4	0	6	0	1	1	12	-
	4	0	0	0	0	0	0	0	-
Nest sites w/ eggs (B)		10	1	8	0	5	6	30	-
Total eggs (C)		23	1	22	0	9	10	65	-
Area (m^2)		314.2	314.2	314.2	314.2	314.2	314.2	1885.2	-
Mean clutch size (C/B)		2.3	1.0	2.8	0.0	1.8	1.7	2.2	0.92
Density of nests w/ eggs (B/area)		0.03	0.00	0.03	0.00	0.02	0.02	0.02	0.01
Density of total nests (A/area)		0.11	0.03	0.18	0.08	0.09	0.07	0.09	0.05
Survey date		19 Jun	19 Jun	19 Jun	19 Jun	19 Jun	19 Jun	-	-

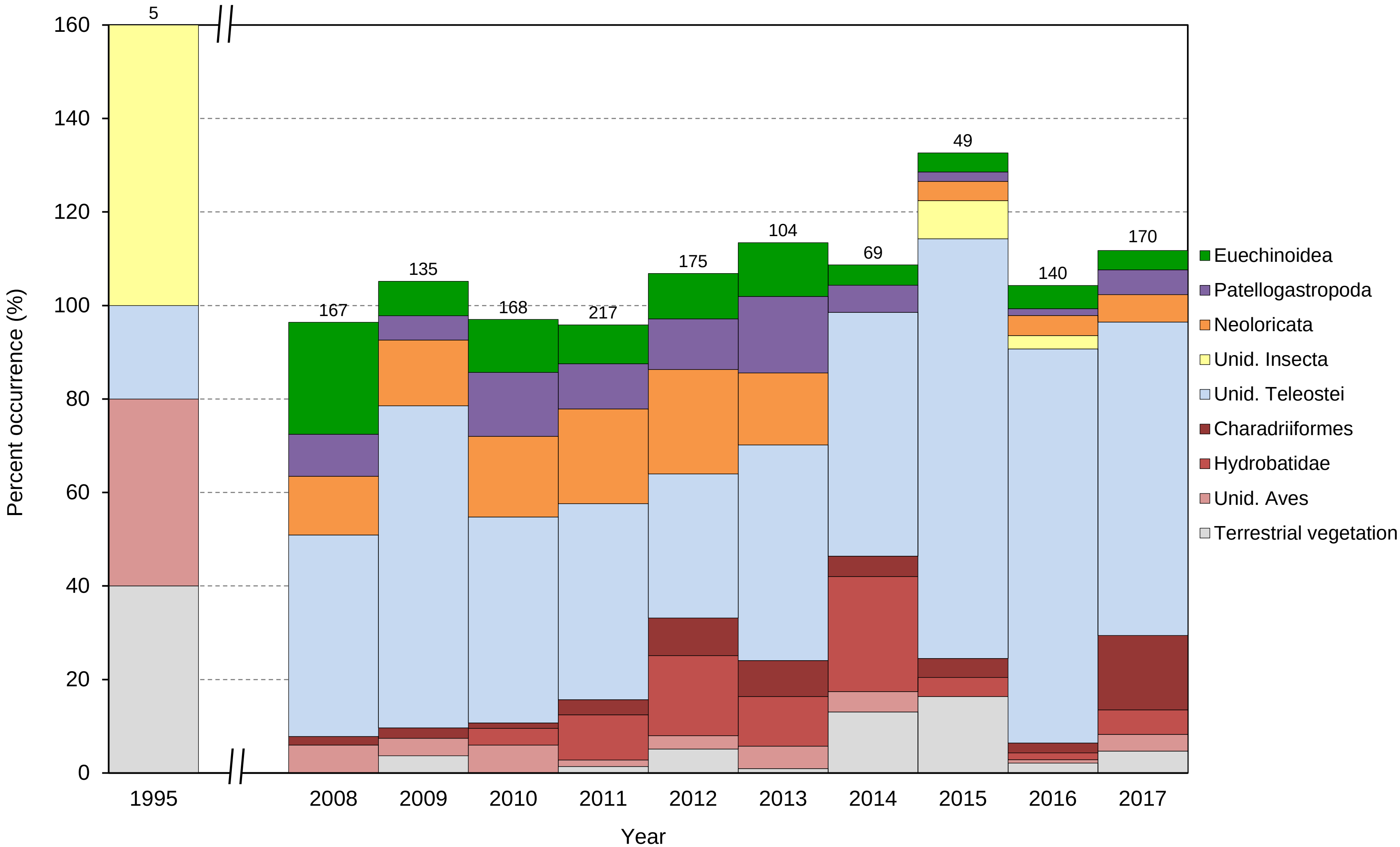

Figure 35. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2008-2017). Numbers above columns indicate sample sizes. No diet samples were collected in 1996-2007.

Table 55. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the laboratory (1995) or field (2008-2017) 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 stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2008-2017). No diet samples were collected in 1996-2007. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	5	167	135	168	217	175	104	69	49	140	170
Invertebrates	**60.0**	**50.3**	**27.4**	**45.8**	**44.7**	**45.1**	**37.5**	**10.1**	**22.4**	**17.9**	**19.4**
Echinoidea	**-**	**24.0**	**7.4**	**11.3**	**8.3**	**9.7**	**11.5**	**4.3**	**4.1**	**5.0**	**4.1**
Euechinoidea	-	24.0	7.4	11.3	8.3	9.7	11.5	4.3	4.1	5.0	4.1
Gastropoda	**-**	**15.0**	**6.7**	**13.7**	**12.4**	**20.6**	**16.3**	**5.8**	**2.0**	**1.4**	**5.9**
Patellogastropoda	-	9.0	5.2	13.7	9.7	10.9	16.3	5.8	2.0	1.4	5.3
Other Gastropoda	-	7.2	2.2	-	2.8	13.7	-	-	-	-	0.6
Insecta	**60.0**	**-**	**-**	**-**	**0.5**	**-**	**1.0**	**-**	**10.2**	**8.6**	**1.2**
Unid. Insecta	60.0	-	-	-	-	-	-	-	8.2	2.9	-
Other Insecta	-	-	-	-	0.5	-	1.0	-	2.0	5.7	1.2
Polyplacophora	**-**	**12.6**	**14.1**	**17.3**	**20.3**	**22.3**	**15.4**	**-**	**4.1**	**4.3**	**5.9**
Neoloricata	-	12.6	14.1	17.3	20.3	22.3	15.4	-	4.1	4.3	5.9
Other Invertebrates	-	1.8	3.7	6.5	10.6	4.0	1.9	-	6.1	3.6	8.2
Fish	**20.0**	**43.1**	**68.9**	**44.0**	**41.9**	**31.4**	**46.2**	**52.2**	**89.8**	**84.3**	**67.1**
Teleostei	**20.0**	**43.1**	**68.9**	**44.0**	**41.9**	**31.4**	**46.2**	**52.2**	**89.8**	**84.3**	**67.1**
Unid. Teleostei	20.0	43.1	68.9	44.0	41.9	30.9	46.2	52.2	89.8	84.3	67.1
Other Teleostei	-	-	-	-	-	0.6	-	-	-	-	-
Birds	**40.0**	**10.8**	**7.4**	**12.5**	**15.2**	**27.4**	**26.0**	**36.2**	**14.3**	**5.0**	**23.5**
Charadriiformes	-	1.8	2.2	1.2	3.2	8.0	7.7	4.3	4.1	2.1	15.9
Procellariiformes	**-**	**-**	**-**	**3.6**	**9.7**	**17.1**	**10.6**	**24.6**	**4.1**	**1.4**	**5.3**
Hydrobatidae	-	-	-	3.6	9.7	17.1	10.6	24.6	4.1	1.4	5.3
Unid. Aves	40.0	6.0	3.7	6.0	1.4	2.9	4.8	4.3	-	0.7	3.5
Other Birds	-	4.8	1.5	1.8	2.3	-	2.9	7.2	-	0.7	-
Mammals	-	-	-	0.6	-	-	-	2.9	-	0.7	-
Other	**40.0**	**2.4**	**9.6**	**1.8**	**12.0**	**10.9**	**3.8**	**15.9**	**18.4**	**7.9**	**10.0**
Terrestrial vegetation	40.0	-	3.7	-	1.4	5.1	1.0	13.0	16.3	2.1	4.7
Other	-	2.4	6.7	1.8	11.1	6.3	2.9	2.9	2.0	6.4	6.5

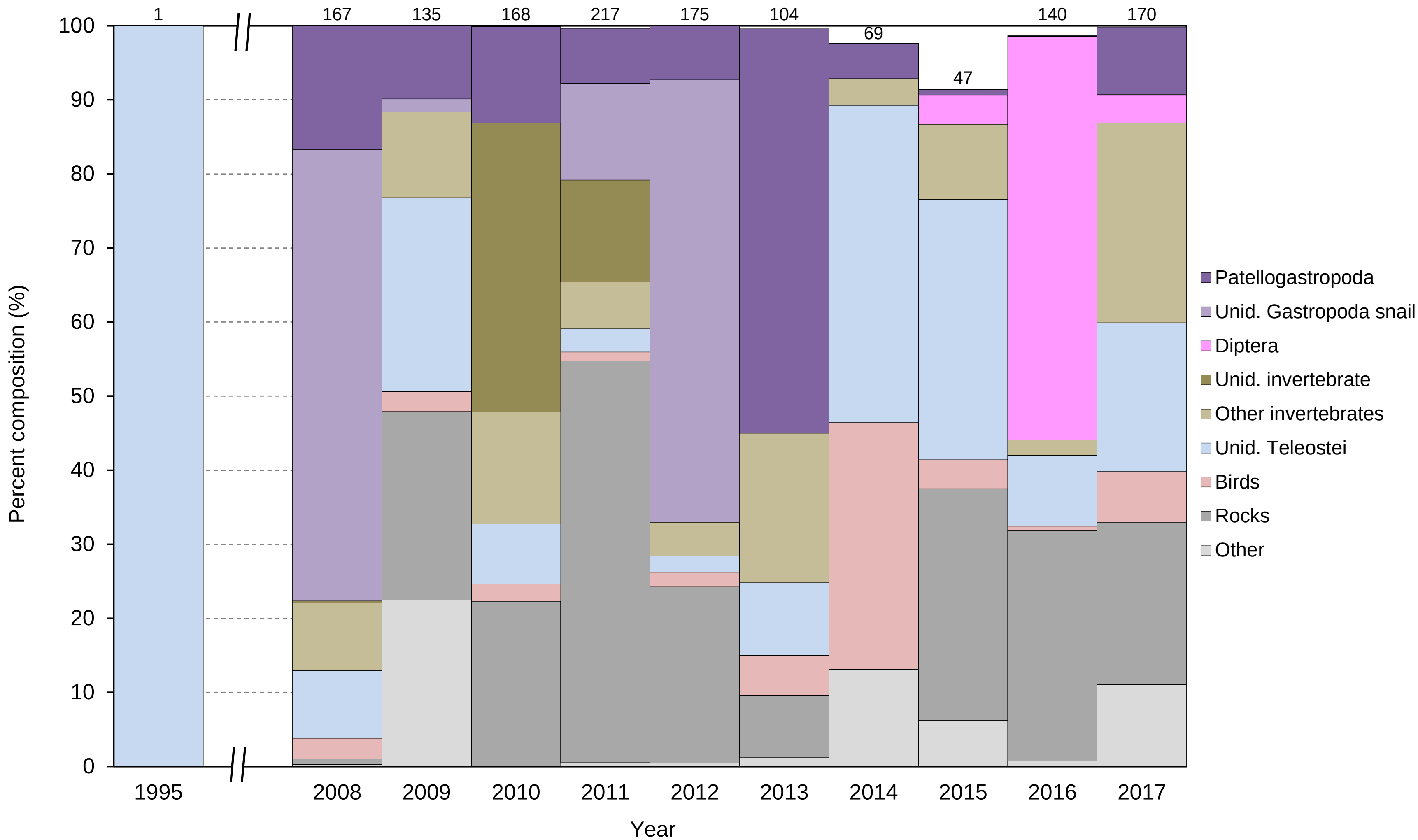

Figure 36. Percent composition of major prey items in diets of glaucous-winged gull adults at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2008-2017). Numbers above columns indicate sample sizes. No diet samples were collected in 1996-2007.

Table 56. Percent composition of major prey items in diets of glaucous-winged gull adults at Aiktak 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 (1995) or field (2008-2017) 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 stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2008-2017). No diet samples were collected in 1996-2007. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	1	167	135	168	217	175	104	69	47	140	170
No. individuals	1	788	405	897	2943	2445	500	84	128	1300	661
Invertebrates	**-**	**87.1**	**23.2**	**67.1**	**40.9**	**71.5**	**75.2**	**8.3**	**23.4**	**57.9**	**40.1**
Gastropoda	**-**	**77.7**	**11.6**	**13.0**	**20.5**	**67.0**	**54.6**	**4.8**	**0.8**	**0.2**	**9.2**
Patellogastropoda	-	16.8	9.9	13.0	7.4	7.3	54.6	4.8	0.8	0.2	9.1
Other Gastropoda	-	60.9	1.7	-	13.0	59.7	-	-	-	-	0.2
Insecta	**-**	**-**	**-**	**-**	**0.3**	**-**	**0.4**	**-**	**12.5**	**55.7**	**3.9**
Diptera	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.9**	**54.5**	**3.8**
Unid. Diptera	-	-	-	-	-	-	-	-	3.9	54.5	3.8
Other Insecta	-	-	-	-	0.3	-	0.4	-	8.6	1.2	0.2
Unid. Invertebrate	-	0.3	-	39.0	13.8	-	-	-	-	-	-
Other Invertebrates	-	9.1	11.6	15.1	6.3	4.5	20.2	3.6	10.2	2.1	26.9
Fish	**100.0**	**9.1**	**26.2**	**8.1**	**3.1**	**2.2**	**9.8**	**42.9**	**35.2**	**9.5**	**20.1**
Teleostei	**100.0**	**9.1**	**26.2**	**8.1**	**3.1**	**2.2**	**9.8**	**42.9**	**35.2**	**9.5**	**20.1**
Unid. Teleostei	100.0	9.1	26.2	8.1	3.1	2.2	9.8	42.9	35.2	9.5	20.1
Other Teleostei	-	-	-	-	-	<0.1	-	-	-	-	-
Birds	-	2.8	2.7	2.3	1.2	2.0	5.4	33.3	3.9	0.5	6.8
Mammals	-	-	-	0.1	-	-	-	2.4	-	0.1	-
Other	**-**	**1.0**	**47.9**	**22.3**	**54.7**	**24.2**	**9.6**	**13.1**	**37.5**	**31.9**	**33.0**
Rocks	-	0.8	25.4	22.3	54.2	23.7	8.4	-	31.3	31.2	21.9
Other	-	0.3	22.5	-	0.5	0.5	1.2	13.1	6.3	0.8	11.0

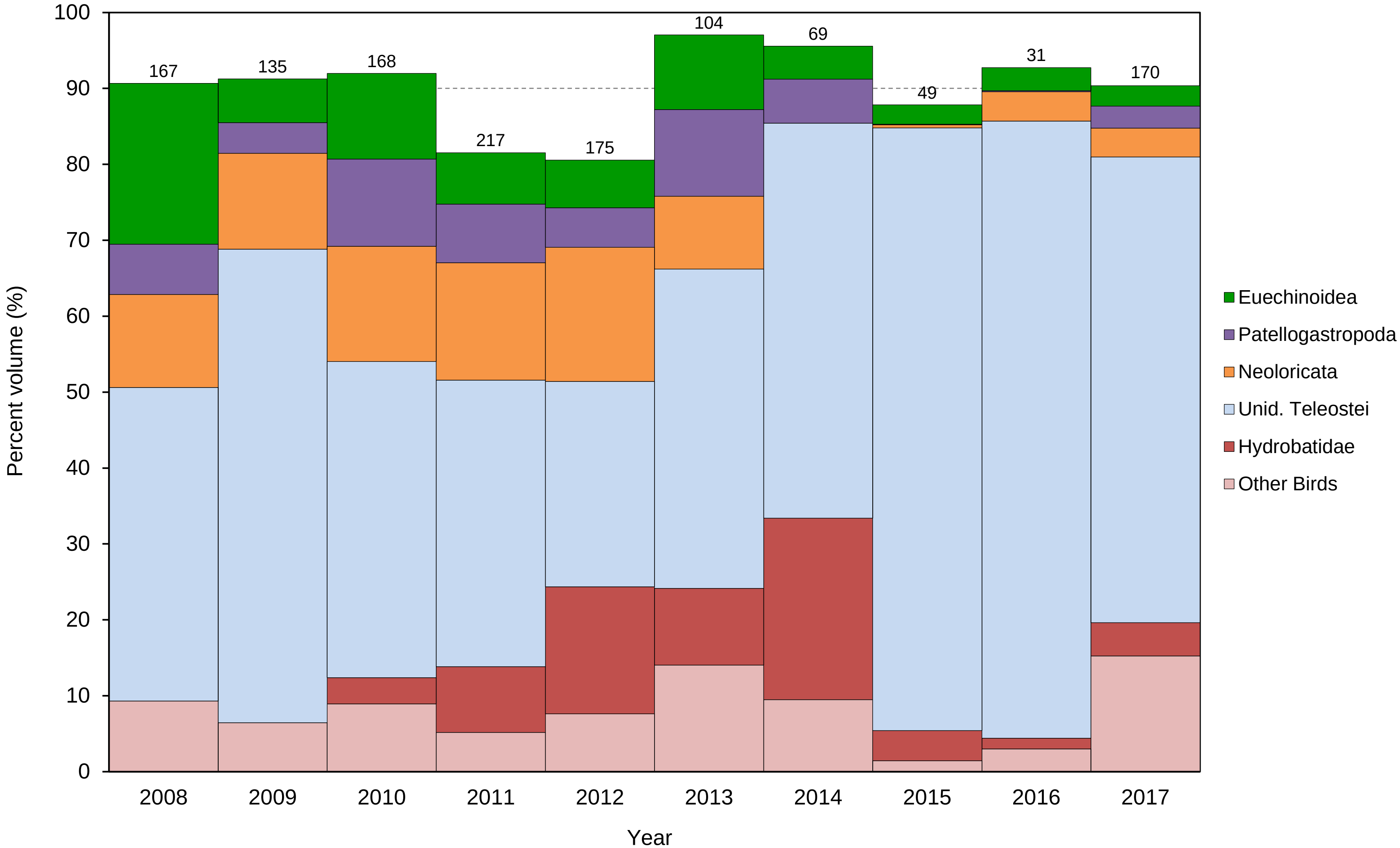

Figure 37. Percent volume of major prey items diets of glaucous-winged gull adults at Aiktak Island, Alaska. Values represent the average percent volume of a prey item in all pellets. Prey is grouped to family level or higher; only taxa with an among-year average volume of at least 5% are shown. Samples consist of pellets regurgitated by adults at the colony. Numbers above columns indicate sample sizes. No diet samples were collected in 1996-2007; no volume data exist for 1995.

Table 57. Percent volume of major prey items diets of glaucous-winged gull adults at Aiktak 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 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 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 1996-2007; no volume data exist for 1995. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	167	135	168	217	175	104	69	49	31	170
Invertebrates	**48.4**	**25.4**	**44.2**	**39.9**	**42.8**	**33.4**	**10.1**	**7.8**	**10.3**	**16.1**
Echinoidea	**21.2**	**5.8**	**11.3**	**6.8**	**6.3**	**9.8**	**4.3**	**2.6**	**3.1**	**2.7**
Euechinoidea	21.2	5.8	11.3	6.8	6.3	9.8	4.3	2.6	3.1	2.7
Gastropoda	**12.5**	**5.0**	**11.5**	**9.6**	**17.1**	**11.4**	**5.8**	**0.1**	**0.1**	**2.9**
Patellogastropoda	6.6	4.0	11.5	7.7	5.2	11.4	5.8	0.1	0.1	2.9
Other Gastropoda	5.9	0.9	-	1.8	11.9	-	-	-	-	0.1
Polyplacophora	**12.3**	**12.6**	**15.2**	**15.4**	**17.7**	**9.6**	**<0.1**	**0.4**	**3.9**	**3.8**
Neoloricata	12.3	12.6	15.2	15.4	17.7	9.6	<0.1	0.4	3.9	3.8
Other Invertebrates	2.4	2.0	6.2	8.1	1.8	2.5	-	4.8	3.2	6.6
Fish	**41.3**	**62.4**	**41.6**	**37.8**	**27.6**	**42.1**	**52.0**	**79.4**	**81.3**	**61.3**
Teleostei	**41.3**	**62.4**	**41.6**	**37.8**	**27.6**	**42.1**	**52.0**	**79.4**	**81.3**	**61.3**
Unid. Teleostei	41.3	62.4	41.6	37.8	27.1	42.1	52.0	79.4	81.3	61.3
Other Teleostei	-	-	-	-	0.6	-	-	-	-	-
Birds	**9.3**	**6.4**	**12.4**	**13.8**	**24.3**	**24.1**	**33.4**	**5.4**	**4.4**	**19.6**
Procellariiformes	**-**	**-**	**3.5**	**8.6**	**16.7**	**10.1**	**23.9**	**4.0**	**1.4**	**4.4**
Hydrobatidae	-	-	3.5	8.6	16.7	10.1	23.9	4.0	1.4	4.4
Other Birds	9.3	6.4	8.9	5.2	7.6	14.0	9.5	1.4	3.0	15.3
Mammals	-	-	0.6	-	-	-	2.8	-	0.4	-
Other	1.0	5.8	1.2	8.5	5.2	0.4	1.6	7.4	3.7	3.0

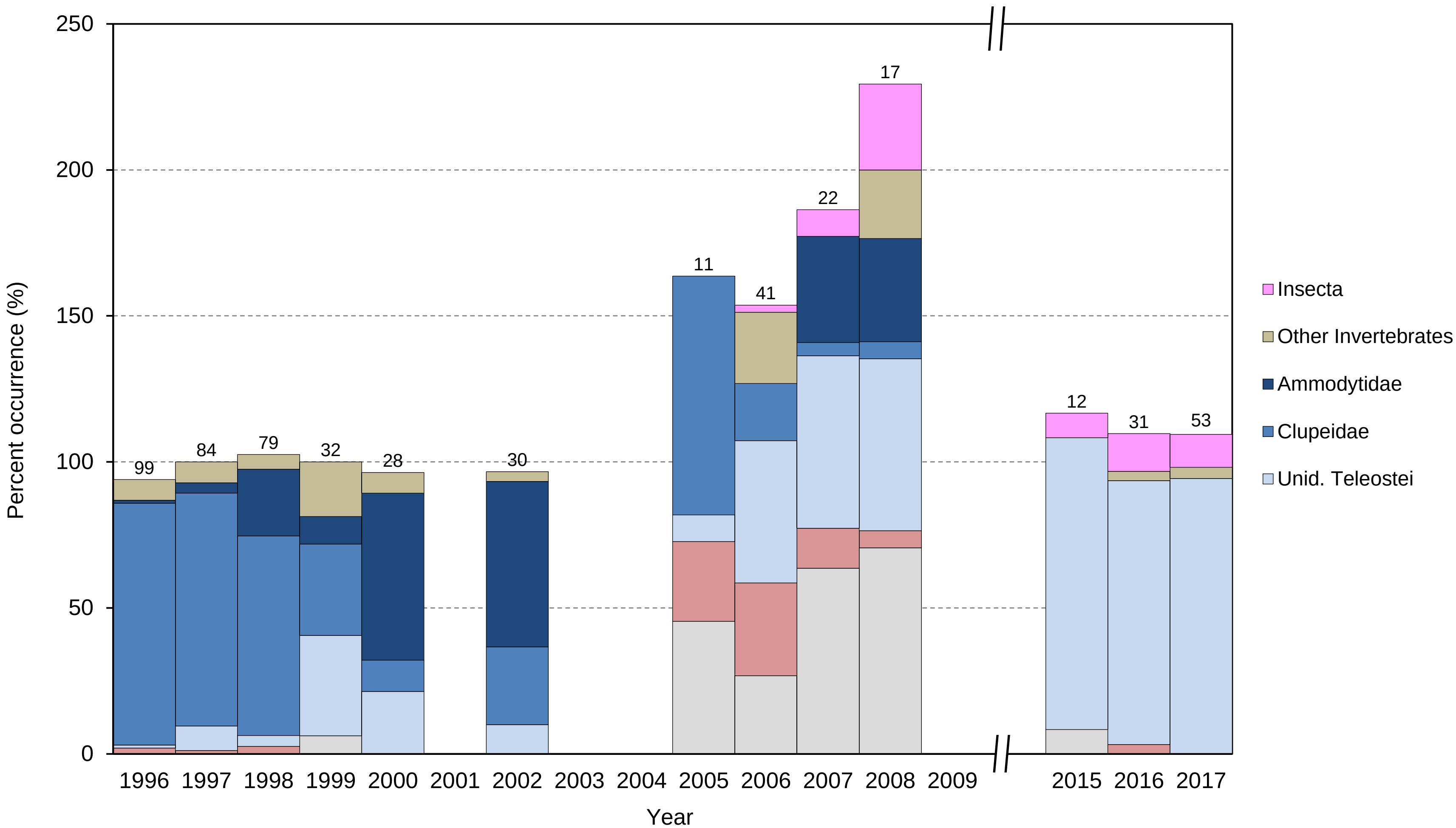

Figure 38. Frequency of occurrence of major prey items in diets of glaucous-winged gull chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of boluses or regurgitations picked up on the ground at the colony (1996-2006, 2015-2017) and regurgitation samples collected directly from chicks (2001, 2007-2009). Numbers above columns indicate sample sizes. No diet samples were collected in 2003-2004 or 2010-2014; samples were collected in 2001 but were too degraded for analysis. Samples were collected in 2009 but have not yet been analyzed.

Table 58. Frequency of occurrence of major prey items in diets of glaucous-winged gull chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the laboratory (1996-2009) or field (2015-2017) 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 boluses or regurgitations picked up on the ground at the colony (1996-2006, 2015-2017) and regurgitation samples collected directly from chicks (2007-2009). No diet samples were collected in 2003-2004 or 2010-2014; samples were collected in 2001 but were too degraded for analysis. Samples were collected in 2009 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1996	1997	1998	1999	2000	2002	2005	2006	2007	2008	2009	2015	2016	2017
No. samples	99	84	79	32	28	30	11	41	22[a]	17[b]	12	12	31	53
Invertebrates	**7.1**	**7.1**	**5.1**	**18.8**	**7.1**	**3.3**	**-**	**26.8**	**9.1**	**41.2**	*pending*	**8.3**	**16.1**	**15.1**
Insecta	-	-	-	-	-	-	-	2.4	9.1	29.4	-	8.3	12.9	11.3
Other Invertebrates	7.1	7.1	5.1	18.8	7.1	3.3	-	24.4	-	23.5	-	-	3.2	3.8
Fish	**88.9**	**89.3**	**97.5**	**71.9**	**89.3**	**96.7**	**90.9**	**68.3**	**100.0**	**100.0**	**-**	**100.0**	**90.3**	**94.3**
Teleostei	**88.9**	**89.3**	**97.5**	**71.9**	**89.3**	**96.7**	**90.9**	**68.3**	**100.0**	**100.0**	**-**	**100.0**	**90.3**	**94.3**
Ammodytidae	**1.0**	**3.6**	**22.8**	**9.4**	**57.1**	**56.7**	**-**	**-**	**36.4**	**35.3**	**-**	-	**-**	**-**
Ammodytes spp.	1.0	3.6	22.8	9.4	57.1	56.7	-	-	36.4	35.3	-	-	-	-
Clupeidae	**82.8**	**79.8**	**68.4**	**31.3**	**10.7**	**26.7**	**81.8**	**19.5**	**4.5**	**5.9**	**-**	-	**-**	**-**
Clupea pallasii	82.8	79.8	68.4	31.3	10.7	26.7	81.8	19.5	4.5	5.9	-	-	-	-
Unid. Teleostei	1.0	8.3	3.8	34.4	21.4	10.0	9.1	48.8	59.1	58.8	-	100.0	90.3	94.3
Other Teleostei	5.1	-	13.9	-	3.6	3.3	-	-	-	-	-	-	-	-
Birds	**15.2**	**8.3**	**5.1**	**9.4**	**3.6**	**-**	**27.3**	**31.7**	**13.6**	**5.9**	**-**	-	**6.5**	**1.9**
Unid. Aves	2.0	1.2	2.5	-	-	-	27.3	31.7	13.6	5.9	-	-	3.2	-
Other Birds	13.1	7.1	2.5	9.4	3.6	-	-	-	-	-	-	-	3.2	1.9
Mammals	-	-	1.3	3.1	-	-	-	-	-	-	-	-	-	-
Other	**-**	**-**	**-**	**6.3**	**3.6**	**-**	**45.5**	**29.3**	**72.7**	**76.5**	**-**	**8.3**	**6.5**	**-**
Terrestrial vegetation	-	-	-	6.3	-	-	45.5	26.8	63.6	70.6	-	8.3	-	-
Other	-	-	-	3.1	3.6	-	-	4.9	18.2	5.9	-	-	6.5	-

[a]Eight additional samples are still pending analysis.
[b]One additional sample is still pending analysis.

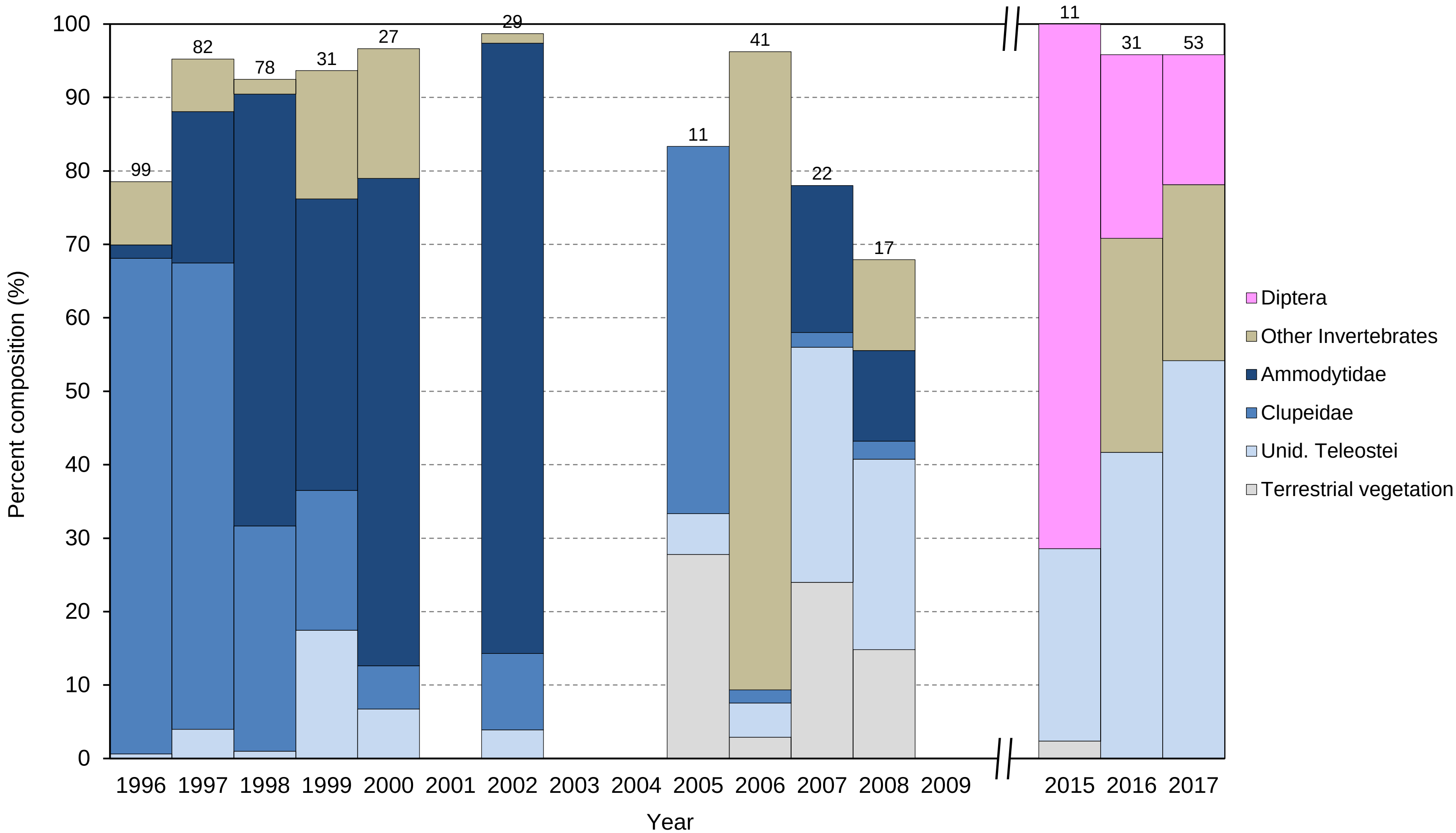

Figure 39. Percent composition of major prey items in diets of glaucous-winged gull chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of boluses or regurgitations picked up on the ground at the colony (1996-2006, 2015-2017) and regurgitation samples collected directly from chicks (2001, 2007-2009). Numbers above columns indicate sample sizes. No diet samples were collected in 2003-2004 or 2010-2014; samples were collected in 2001 but were too degraded for analysis. Samples were collected in 2009 but have not yet been analyzed.

Table 59. Percent composition of major prey items in diets of glaucous-winged gull chicks at Aiktak 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 (1996-2009) or field (2015-2017) 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 boluses or regurgitations picked up on the ground at the colony (1996-2006, 2015-2017) and regurgitation samples collected directly from chicks (2007-2009). No diet samples were collected in 2003-2004 or 2010-2014; samples were collected in 2001 but were too degraded for analysis. Samples were collected in 2009 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1996	1997	1998	1999	2000	2002	2005	2006	2007	2008	2009	2015	2016	2017
No. samples	99	82	78	31	27	29	11	41	22[a]	17[b]	12	11	31	53
No. individuals	163	126	199	63	119	77	18	450	50	81	*pending*	42	72	96
Invertebrates	**8.6**	**7.1**	**2.0**	**17.5**	**17.6**	**1.3**	**-**	**87.1**	**8.0**	**32.1**	**-**	**71.4**	**54.2**	**44.8**
Insecta	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.2**	**8.0**	**19.8**	**-**	**71.4**	**25.0**	**20.8**
Diptera	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	**71.4**	**25.0**	**17.7**
Unid. Diptera	-	-	-	-	-	-	-	-	-	-	-	71.4	25.0	17.7
Other Insecta	-	-	-	-	-	-	-	0.2	8.0	19.8	-	-	-	3.1
Other Invertebrates	8.6	7.1	2.0	17.5	17.6	1.3	-	86.9	-	12.3	-	-	29.2	24.0
Fish	**81.6**	**88.1**	**95.5**	**76.2**	**81.5**	**98.7**	**55.6**	**6.4**	**54.0**	**40.7**	**-**	**26.2**	**41.7**	**54.2**
Teleostei	**81.6**	**88.1**	**95.5**	**76.2**	**81.5**	**98.7**	**55.6**	**6.4**	**54.0**	**40.7**	**-**	**26.2**	**41.7**	**54.2**
Ammodytidae	**1.8**	**20.6**	**58.8**	**39.7**	**66.4**	**83.1**	**-**	**-**	**20.0**	**12.3**	**-**	**-**	**-**	**-**
Ammodytes spp.	1.8	20.6	58.8	39.7	66.4	83.1	-	-	20.0	12.3	-	-	-	-
Clupeidae	**67.5**	**63.5**	**30.7**	**19.0**	**5.9**	**10.4**	**50.0**	**1.8**	**2.0**	**2.5**	**-**	**-**	**-**	**-**
Clupea pallasii	67.5	63.5	30.7	19.0	5.9	10.4	50.0	1.8	2.0	2.5	-	-	-	-
Unid. Teleostei	0.6	4.0	1.0	17.5	6.7	3.9	5.6	4.7	32.0	25.9	-	26.2	41.7	54.2
Other Teleostei	11.7	-	5.0	-	2.5	1.3	-	-	-	-	-	-	-	-
Birds	9.8	4.8	2.0	4.8	0.8	-	16.7	3.1	6.0	1.2	-	-	2.8	1.0
Mammals	-	-	0.5	1.6	-	-	-	-	-	-	-	-	-	-
Other	**-**	**-**	**-**	**-**	**-**	**-**	**27.8**	**3.3**	**32.0**	**25.9**	**-**	**2.4**	**1.4**	**-**
Terrestrial vegetation	-	-	-	-	-	-	27.8	2.9	24.0	14.8	-	2.4	-	-
Other	-	-	-	-	-	-	-	0.4	8.0	11.1	-	-	1.4	-

[a]Eight additional samples are still pending analysis.
[b]One additional sample is still pending analysis.

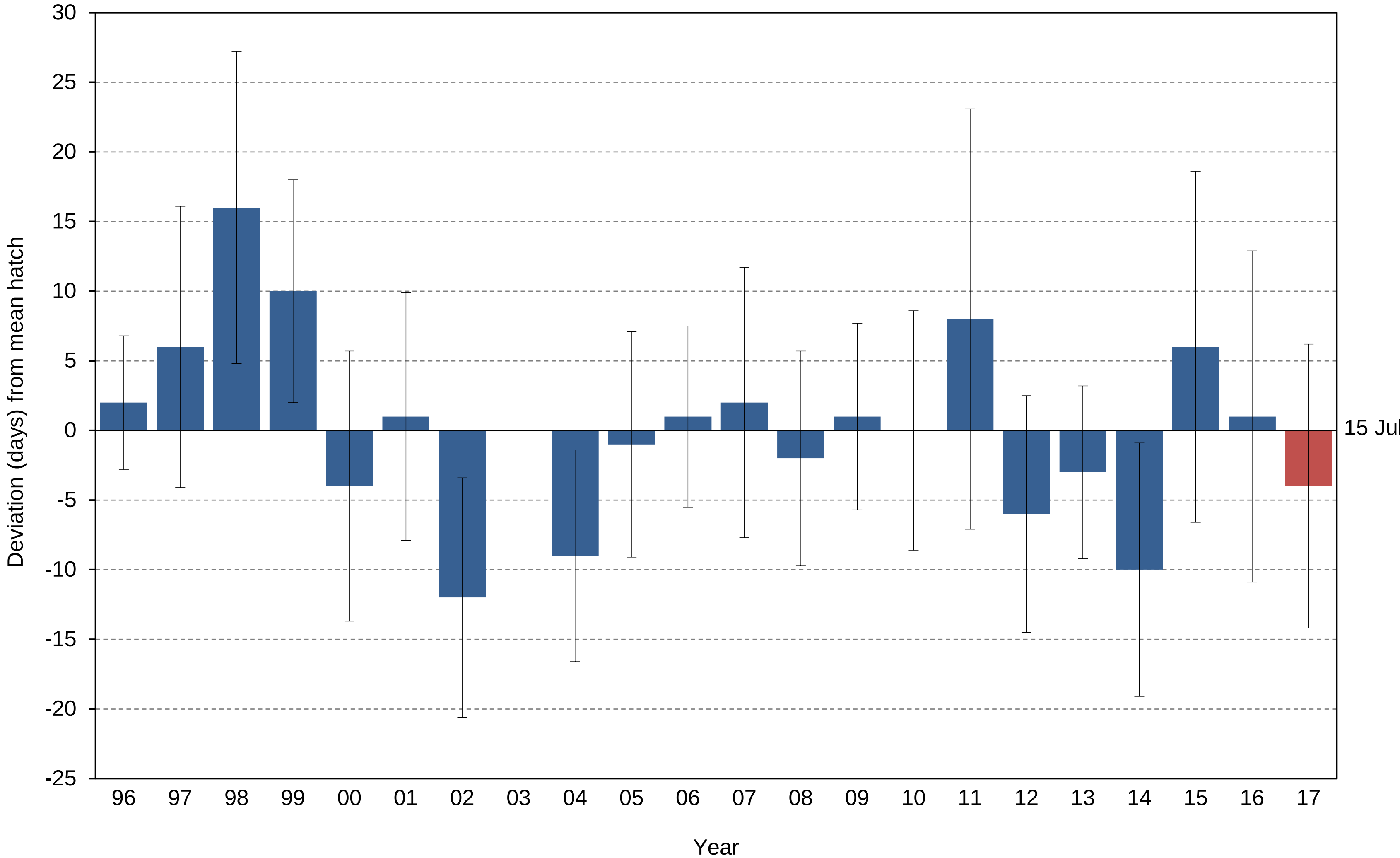

Figure 40. Yearly hatch date deviation (from the 1996-2016 average of 15 July) for fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only chronology plots monitored on an interval of about 7 days. Negative values indicate earlier than mean hatch date, positive values indicate later than 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 2003.

Table 60. Breeding chronology of fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only chronology plots monitored on an interval of about 7 days. No data were collected in 2003.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1996	16 Jul	4.8	6	3 Jul	25 Jul	21 Aug
1997	21 Jul	10.1	16	7 Jul	13 Aug	>1 Sep
1998	31 Jul	11.2	16	14 Jul	20 Aug	>3 Sep
1999	25 Jul	8.0	28	9 Jul	21 Aug	>31 Aug
2000	10 Jul	9.7	35	26 Jun	13 Aug	25 Aug
2001	16 Jul	8.4	38	16 Jun	4 Aug	3 Sep
2002	3 Jul	8.6	21	20 Jun	2 Aug	22 Aug
2004	6 Jul	7.6	32	22 Jun	19 Jul	17 Aug
2005	14 Jul	8.1	45	23 Jun	10 Aug	30 Aug
2006	16 Jul	6.5	20	8 Jul	30 Jul	>1 Sep
2007	17 Jul	9.7	23	5 Jul	13 Aug	>30 Aug
2008	12 Jul	7.7	28	2 Jul	31 Jul	25 Aug
2009	16 Jul	6.7	29	29 Jun	12 Aug	>2 Sep
2010	15 Jul	8.6	26	3 Jul	4 Aug	>30 Aug
2011	23 Jul	15.1	21	3 Jul	28 Aug	>5 Sep
2012	8 Jul	8.5	24	26 Jun	24 Jul	29 Aug
2013	12 Jul	6.2	18	25 Jun	17 Jul	>26 Aug
2014	5 Jul	9.1	26	21 Jun	27 Jul	15 Aug
2015	21 Jul	12.6	26	5 Jul	14 Aug	>28 Aug
2016	15 Jul	11.9	34	22 Jun	13 Aug	25 Aug
2017	11 Jul	10.2	44	25 Jun	8 Aug	27 Aug

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

[b]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 61. Frequency distribution of hatch dates for fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. No data were collected in 2003.

Julian date[a]	No. nests hatching on Julian date																				
	96	97	98	99	00	01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17
171	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
173	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
176	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	1	-	-	-	2
177	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	6	-	3	2
179	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	-	-	-	-	-
180	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-
181	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
182	-	-	-	-	2	-	8	5	-	-	-	-	-	-	-	-	-	-	-	1	5
183	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	-	-	-	-	-	-	-	3	3	-	-	5	2	2	1	-	1	-	-	2	4
185	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186	-	-	-	-	9	3	5	4	-	-	-	-	-	-	-	13	-	10	3	-	-
187	-	-	-	-	-	-	-	-	-	2	4	-	-	-	-	-	-	-	-	-	-
188	-	1	-	-	-	1	-	-	9	-	-	-	-	-	-	-	-	-	-	2	10
189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3	-	-
190	-	-	-	-	10	2	1	-	-	-	-	11	-	5	5	-	7	-	-	-	-
191	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	1	1	5	16	-	-	-	8	-	-	1	-	-	3	3	7
193	-	1	-	1	-	-	-	-	-	7	7	-	-	-	-	-	-	-	-	-	-
194	-	-	-	2	4	5	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
195	4	-	1	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	8	8	-	-	-	-	10	-	-	-	1	1	6	3
197	1	5	-	3	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-
198	-	-	-	1	-	7	-	-	-	-	-	-	14	-	6	-	9	-	1	4	3
199	-	1	2	1	3	2	-	-	-	8	6	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	3	-	1	1	-	-
201	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
202	-	-	1	2	-	3	-	2	-	-	-	-	-	-	-	-	-	-	4	3	1
203	-	1	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	-	3	-	-	2	-	4	2	-	-	-	-	-	-
205	-	-	-	4	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
206	-	-	1	1	-	1	-	-	-	-	-	-	3	-	-	3	-	1	2	3	2
207	1	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
208	-	-	4	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-
209	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	1	1	1	5	-	-	-	-	-	2	-	2	-	-	-	-	2	3	4
211	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-
212	-	-	-	1	-	-	-	-	1	-	-	-	2	-	3	-	-	-	1	1	-
213	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	-	-	-	-	-	1	-	-	1	-	-	-	-	2	-	-	-	-	-	1	-
217	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
218	-	-	1	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-
219	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
221	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
222	-	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
223	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
225	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	2	1	-
227	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
228	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
232	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-

Table 61 (continued). Frequency distribution of hatch dates for fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only chronology plots in which observations of egg to chick ≤ 7 days. No data were collected in 2003.

Julian date[a]	No. nests hatching on Julian date																				
	96	97	98	99	00	01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17
233	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
234	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
235	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
236	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
237	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
238	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
n	6	16	16	28	35	38	21	32	45	20	23	28	29	26	21	24	18	26	26	34	44

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

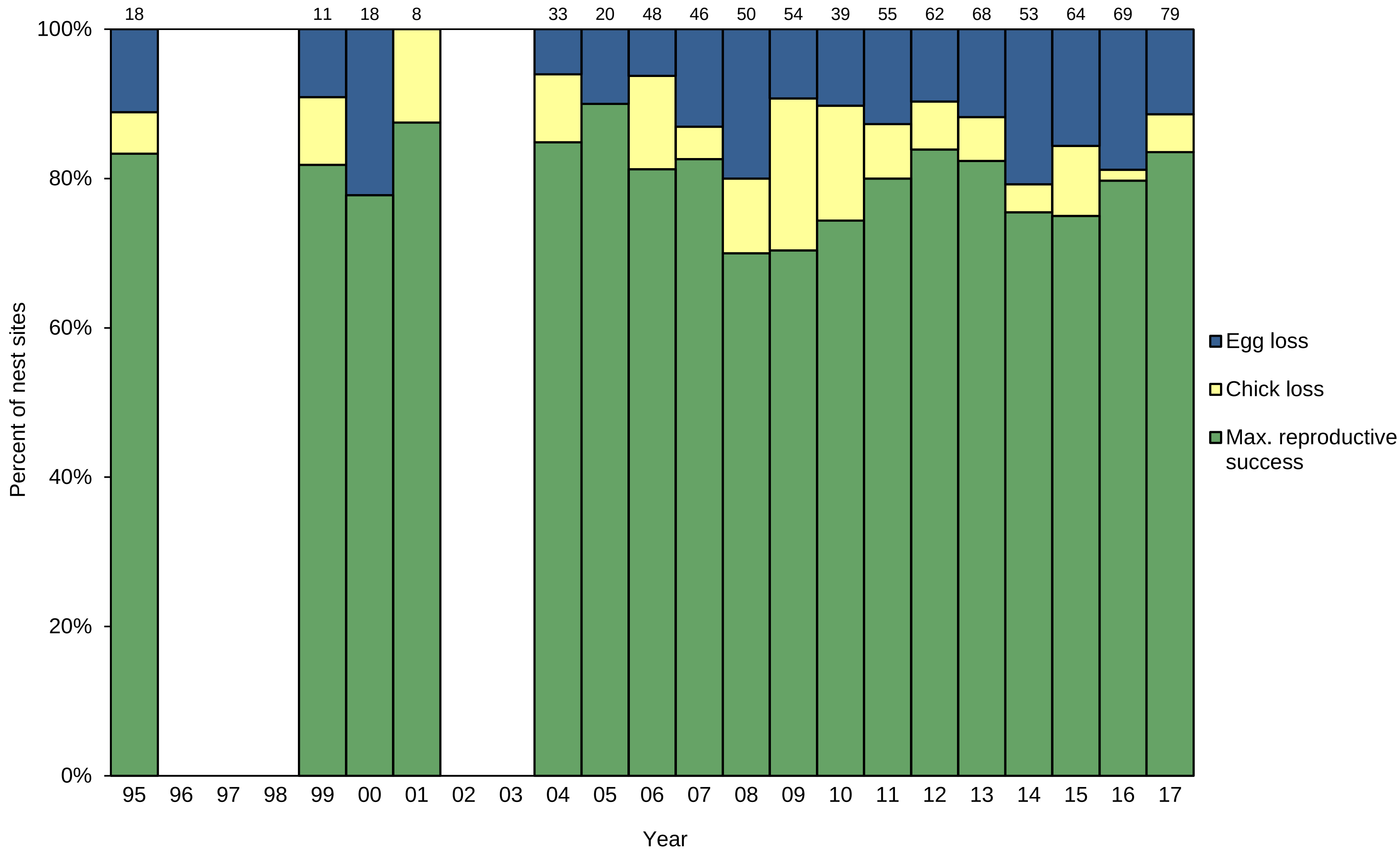

Figure 41. Reproductive performance of fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Egg loss=[(B+H)-(D+H)]/(B+H); Chick loss=[(D+H)-(F+H)]/(B+H); Maximum potential reproductive success=(F+H)/(B+H), where B+H=maximum 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 1996-1998 or 2002-2003.

Table 62. Reproductive performance of fork-tailed storm-petrels at Aiktak 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 1996-1998 or 2002-2003.

Year	Max. nest sites w/ eggs (B+H)	Max nest sites w/ chicks (D+H)	Max. nest sites w/ chicks fledged (F+H)[a]	Nest sites w/ viable eggs at last visit[b]	Max. potential nesting success [(D+H)/(B+H)][c]	Max. potential fledging success [(F+H)/(D+H)][d]	Max. potential reproductive success [(F+H)/(B+H)]
1995	18	16	15	0	0.89	0.94	0.83
1999	11	10	9	0	0.91	0.90	0.82
2000	18	14	14	0	0.77	1.00	0.77
2001	8	8	7	0	1.00	0.88	0.88
2004	33	31	28	0	0.94	0.90	0.85
2005	20	18	18	0	0.90	1.00	0.90
2006	48	45	39	1	0.94	0.87	0.81
2007	46	40	38	0	0.87	0.95	0.83
2008	50	40	35	0	0.80	0.88	0.70
2009	54	49	38	0	0.91	0.78	0.70
2010	39	35	29	1	0.90	0.83	0.74
2011	55	48	44	2	0.87	0.92	0.80
2012	62	56	52	0	0.90	0.93	0.84
2013	68	60	56	1	0.88	0.93	0.82
2014	53	42	40	0	0.79	0.95	0.76
2015	64	54	48	2	0.84	0.89	0.75
2016	69	56	55	0	0.81	0.98	0.80
2017	79	70	66	1	0.89	0.94	0.84

[a]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).

[b]Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

[c]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).

[d]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).

Table 63. Standard deviation in reproductive performance parameters of fork-tailed storm-petrels at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Sampling for storm-petrels is clustered by plot except when sample sizes per plot are too small or plot data are not available. No data were collected in 1996-1998 or 2002-2003.

Year	No. plots	Nest sites w/ eggs	Sampling design[a]	Max. potential nesting success	Max. potential fledging success	Max. potential reproductive success
1995	7	18	Cluster by plot	0.07	0.07	0.09
1999	7	11	Cluster by plot	0.09	0.15	0.16
2000	11	18	Cluster by plot	0.10	0.00	0.10
2001	6	8	Cluster by plot	0.00	0.13	0.13
2004	11	33	Cluster by plot	0.06	0.06	0.07
2005	7	20	Cluster by plot	0.06	0.00	0.06
2006	14	48	Cluster by plot	0.03	0.05	0.06
2007	13	46	Cluster by plot	0.07	0.03	0.07
2008	13	50	Cluster by plot	0.03	0.05	0.06
2009	13	54	Cluster by plot	0.04	0.05	0.07
2010	12	39	Cluster by plot	0.04	0.05	0.06
2011	12	55	Cluster by plot	0.04	0.04	0.03
2012	13	62	Cluster by plot	0.03	0.04	0.06
2013	14	68	Cluster by plot	0.04	0.04	0.03
2014	13	53	Cluster by plot	0.05	0.03	0.06
2015	13	64	Cluster by plot	0.04	0.04	0.05
2016	13	69	Cluster by plot	0.04	0.02	0.04
2017	13	79	Cluster by plot	0.02	0.03	0.03

[a]For sampling clustered by plot, values are calculated using ratio estimator spreadsheets based on plot as a sample unit.

Table 64. Reproductive performance of fork-tailed storm-petrels at Aiktak Island, Alaska in 2017. Data include only non-chronology plots monitored on an interval of about 14 days.

Parameter	Plot													Total	SD[a]
	9	10	11	13	16	17	18	19	20	21	22	24	26		
Max. nest sites w/ eggs (B+H)	9	5	13	3	2	7	8	8	5	2	1	2	14	79	-
Max. nest sites w/ chicks (D+H)	7	4	12	3	2	6	7	7	5	2	1	1	13	70	-
Max. nest sites w/ chicks fledged (F+H)[b]	7	4	12	2	2	5	7	6	4	2	1	1	13	66	-
Nest sites w/ viable eggs at last visit[c]	0	0	1	0	0	0	0	0	0	0	0	0	0	1	-
Max. potential nesting success[(D+H)/(B+H)][d]	0.78	0.80	0.92	1.00	1.00	0.86	0.88	0.88	1.00	1.00	1.00	0.50	0.93	0.89	0.02
Max. potential fledging success [(F+H)/(D+H)][e]	1.00	1.00	1.00	0.67	1.00	0.83	1.00	0.86	0.80	1.00	1.00	1.00	1.00	0.94	0.03
Max. potential reproductive success [(F+H)/(B+H)]	0.78	0.80	0.92	0.67	1.00	0.71	0.88	0.75	0.80	1.00	1.00	0.50	0.93	0.84	0.03

[a]Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit.

[b]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).

[c]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.

[d]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).

[e]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).

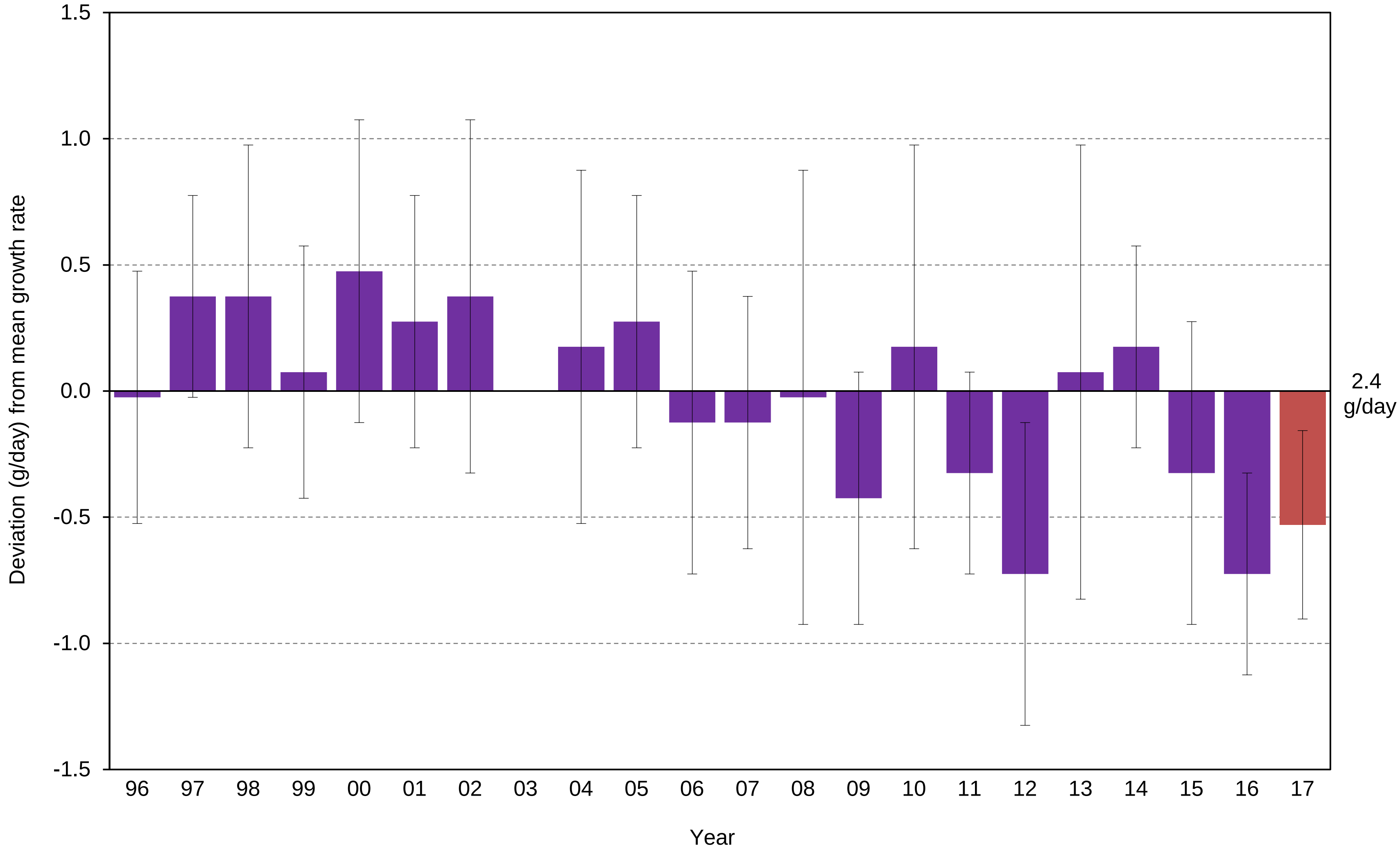

Figure 42. Yearly chick growth rate deviation (from the 1996-2016 average of 2.4 g/day) for fork-tailed storm-petrels at Aiktak Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate; red highlights the current year. No data were collected in 2003.

Table 65. Mean growth rates of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (approximately mass 0-80g; wing chord 20-140mm); chicks that died were excluded. No data were collected in 2003.

Year	Mass (g/day)				Wing chord (mm/day)[a]			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1996	2.4	0.5	1.7 - 3.6	16	3.4	0.2	3.0 - 3.6	16
1997	2.8	0.4	1.7 - 3.7	16	3.4	0.3	2.7 - 4.0	16
1998	2.8	0.6	1.9 - 4.4	25	3.2	0.8	1.1 - 4.1	24
1999	2.5	0.5	1.4 - 3.9	32	3.6	0.3	2.8 - 4.1	30
2000	2.9	0.6	2.0 - 4.7	33	3.5	0.2	3.0 - 3.8	33
2001	2.7	0.5	1.3 - 4.1	44	3.5	0.2	3.2 - 4.0	16
2002	2.8	0.7	1.6 - 4.0	17	3.5	0.5	2.4 - 4.6	18
2004	2.6	0.7	1.1 - 4.0	26	3.2	0.6	0.7 - 4.2	37
2005	2.7	0.5	1.7 - 3.8	41	2.9	0.3	2.1 - 3.6	40
2006	2.3	0.6	1.3 - 4.1	19	3.0	0.2	2.7 - 3.4	20
2007	2.3	0.5	1.5 - 3.1	18	3.1	0.4	2.0 - 3.5	20
2008	2.4	0.9	0.8 - 4.0	22	3.2	0.3	2.2 - 3.6	21
2009	2.0	0.5	1.5 - 3.2	22	3.0	0.3	2.2 - 3.6	22
2010	2.6	0.8	1.2 - 4.5	20	3.0	0.5	1.7 - 3.6	20
2011	2.1	0.4	1.3 - 2.6	18	2.7	0.6	1.4 - 3.3	18
2012	1.7	0.6	1.0 - 3.6	19	2.9	0.5	1.1 - 3.4	23
2013	2.5	0.9	1.2 - 5.3	22	3.2	0.4	2.1 - 3.9	22
2014	2.6	0.4	1.8 - 3.7	26	3.4	0.3	2.4 - 3.9	26
2015	2.1	0.6	1.1 - 4.2	23	3.5	0.2	3.1 - 4.0	18
2016	1.7	0.4	1.0 - 2.5	29	3.2	0.5	1.8 - 3.8	32
2017	1.9	0.4	1.1 - 2.8	34	3.3	0.4	1.5 - 3.8	35

[a]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.

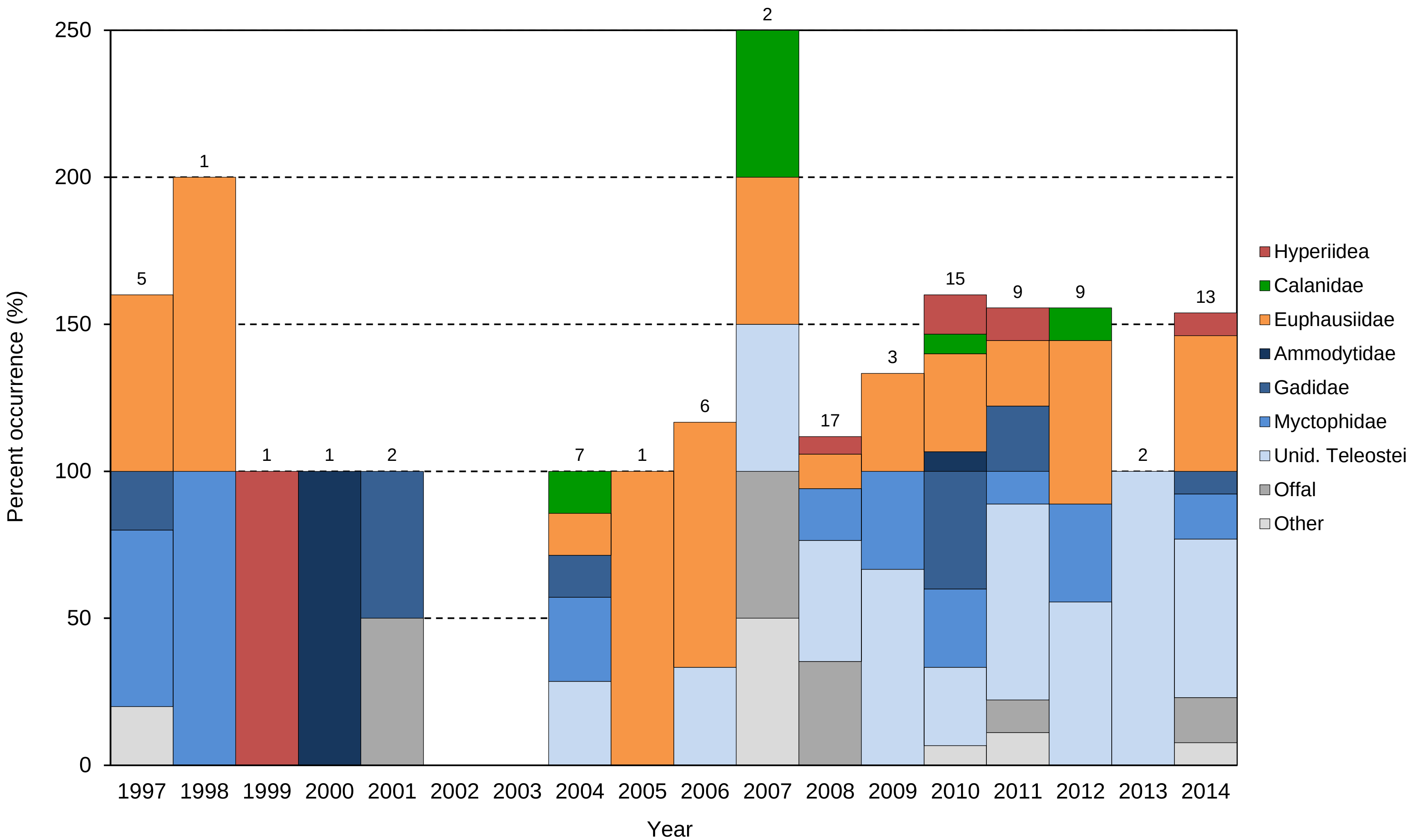

Figure 43. Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2003 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed.

Table 66. Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. 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 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. No diet samples were collected in 2003 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1997	1998	1999	2000	2001	2004	2005	2006	2007	2008
No. samples	5	1	1	1	2	7	1	6	2	17
Invertebrates	**60.0**	**100.0**	**100.0**	**-**	**-**	**28.6**	**100.0**	**100.0**	**50.0**	**23.5**
Amphipoda	**-**	**-**	**100.0**	**-**	**-**	**-**	**-**	**33.3**	**-**	**11.8**
Hyperiidea	**-**	**-**	**100.0**	**-**	**-**	**-**	**-**	**-**	**-**	**5.9**
Themisto spp.	-	-	100.0	-	-	-	-	-	-	-
Other Hyperiidea	-	-	-	-	-	-	-	-	-	-
Other Amphipoda	-	-	-	-	-	-	-	33.3	-	11.8
Copepoda	**-**	**-**	**-**	**-**	**-**	**14.3**	**-**	**-**	**50.0**	**-**
Calanidae	-	-	-	-	-	14.3	-	-	50.0	-
Other Copepoda	-	-	-	-	-	-	-	-	-	-
Euphausiacea	**60.0**	**100.0**	**-**	**-**	**-**	**14.3**	**100.0**	**83.3**	**50.0**	**11.8**
Euphausiidae	**60.0**	**100.0**	**-**	**-**	**-**	**14.3**	**100.0**	**83.3**	**50.0**	**11.8**
Thysanoessa spp.	-	-	-	-	-	-	-	66.7	-	11.8
Unid. Euphausiidae	60.0	100.0	-	-	-	14.3	100.0	50.0	50.0	-
Other Euphausiidae	-	-	-	-	-	-	-	-	-	5.9
Other Invertebrates	-	-	-	-	-	14.3	-	-	50.0	-
Fish	**80.0**	**100.0**	**-**	**100.0**	**50.0**	**71.4**	**-**	**33.3**	**50.0**	**64.7**
Teleostei	**80.0**	**100.0**	**-**	**100.0**	**50.0**	**71.4**	**-**	**33.3**	**50.0**	**64.7**
Ammodytidae	**-**	**-**	**-**	**100.0**	**-**	**-**	**-**	**-**	**-**	**-**
Ammodytes spp.	-	-	-	100.0	-	-	-	-	-	-
Gadidae	**20.0**	**-**	**-**	**-**	**50.0**	**14.3**	**-**	**-**	**-**	**-**
Gadus chalcogrammus	20.0	-	-	-	50.0	14.3	-	-	-	-
Other Gadidae	-	-	-	-	-	-	-	-	-	-
Myctophidae	**60.0**	**100.0**	**-**	**-**	**-**	**28.6**	**-**	**-**	**-**	**17.6**
Stenobrachius leucopsarus	60.0	100.0	-	-	-	-	-	-	-	-
Other Myctophidae	-	-	-	-	-	28.6	-	-	-	17.6
Unid. Teleostei	-	-	-	-	-	28.6	-	33.3	50.0	41.2
Other Teleostei	-	-	-	-	-	-	-	-	-	5.9
Other	**20.0**	**-**	**-**	**-**	**50.0**	**-**	**-**	**-**	**100.0**	**35.3**
Offal	-	-	-	-	50.0	-	-	-	50.0	35.3
Other	20.0	-	-	-	-	-	-	-	50.0	-

[a]One additional sample is still pending analysis.

Table 66 (continued). Frequency of occurrence of major prey items in diets of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. 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 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. No diet samples were collected in 2003 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	3[a]	15	9	9	2	13	1	15	9
Invertebrates	**33.3**	**53.3**	**33.3**	**77.8**	**-**	**53.8**	*pending*	*pending*	*pending*
Amphipoda	**-**	**26.7**	**11.1**	**22.2**	**-**	**15.4**	**-**	**-**	**-**
Hyperiidea	**-**	**13.3**	**11.1**	**-**	**-**	**7.7**	**-**	**-**	**-**
Themisto spp.	-	-	-	-	-	-	-	-	-
Other Hyperiidea	-	-	11.1	-	-	-	-	-	-
Other Amphipoda	-	13.3	-	22.2	-	7.7	-	-	-
Copepoda	**-**	**13.3**	**-**	**11.1**	**-**	**-**	**-**	**-**	**-**
Calanidae	-	6.7	-	11.1	-	-	-	-	-
Other Copepoda	-	6.7	-	-	-	-	-	-	-
Euphausiacea	**33.3**	**33.3**	**22.2**	**55.6**	**-**	**46.2**	**-**	**-**	**-**
Euphausiidae	**33.3**	**33.3**	**22.2**	**55.6**	**-**	**46.2**	**-**	**-**	**-**
Thysanoessa spp.	33.3	20.0	11.1	33.3	-	15.4	-	-	-
Unid. Euphausiidae	-	13.3	11.1	22.2	-	7.7	-	-	-
Other Euphausiidae	-	-	22.2	-	-	30.8	-	-	-
Other Invertebrates	-	6.7	11.1	-	-	7.7	-	-	-
Fish	**100.0**	**100.0**	**88.9**	**88.9**	**100.0**	**76.9**	**-**	**-**	**-**
Teleostei	**100.0**	**100.0**	**88.9**	**88.9**	**100.0**	**76.9**	**-**	**-**	**-**
Ammodytidae	**-**	**6.7**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ammodytes spp.	-	6.7	-	-	-	-	-	-	-
Gadidae	**-**	**40.0**	**22.2**	**-**	**-**	**7.7**	**-**	**-**	**-**
Gadus chalcogrammus	-	6.7	11.1	-	-	-	-	-	-
Other Gadidae	-	33.3	11.1	-	-	7.7	-	-	-
Myctophidae	**33.3**	**26.7**	**11.1**	**33.3**	**-**	**15.4**	**-**	**-**	**-**
Stenobrachius leucopsarus	-	-	-	-	-	-	-	-	-
Other Myctophidae	33.3	26.7	11.1	33.3	-	15.4	-	-	-
Unid. Teleostei	66.7	26.7	66.7	55.6	100.0	53.8	-	-	-
Other Teleostei	-	-	-	-	-	-	-	-	-
Other	**-**	**6.7**	**22.2**	**-**	**-**	**23.1**	**-**	**-**	**-**
Offal	-	-	11.1	-	-	15.4	-	-	-
Other	-	6.7	11.1	-	-	7.7	-	-	-

[a]One additional sample is still pending analysis.

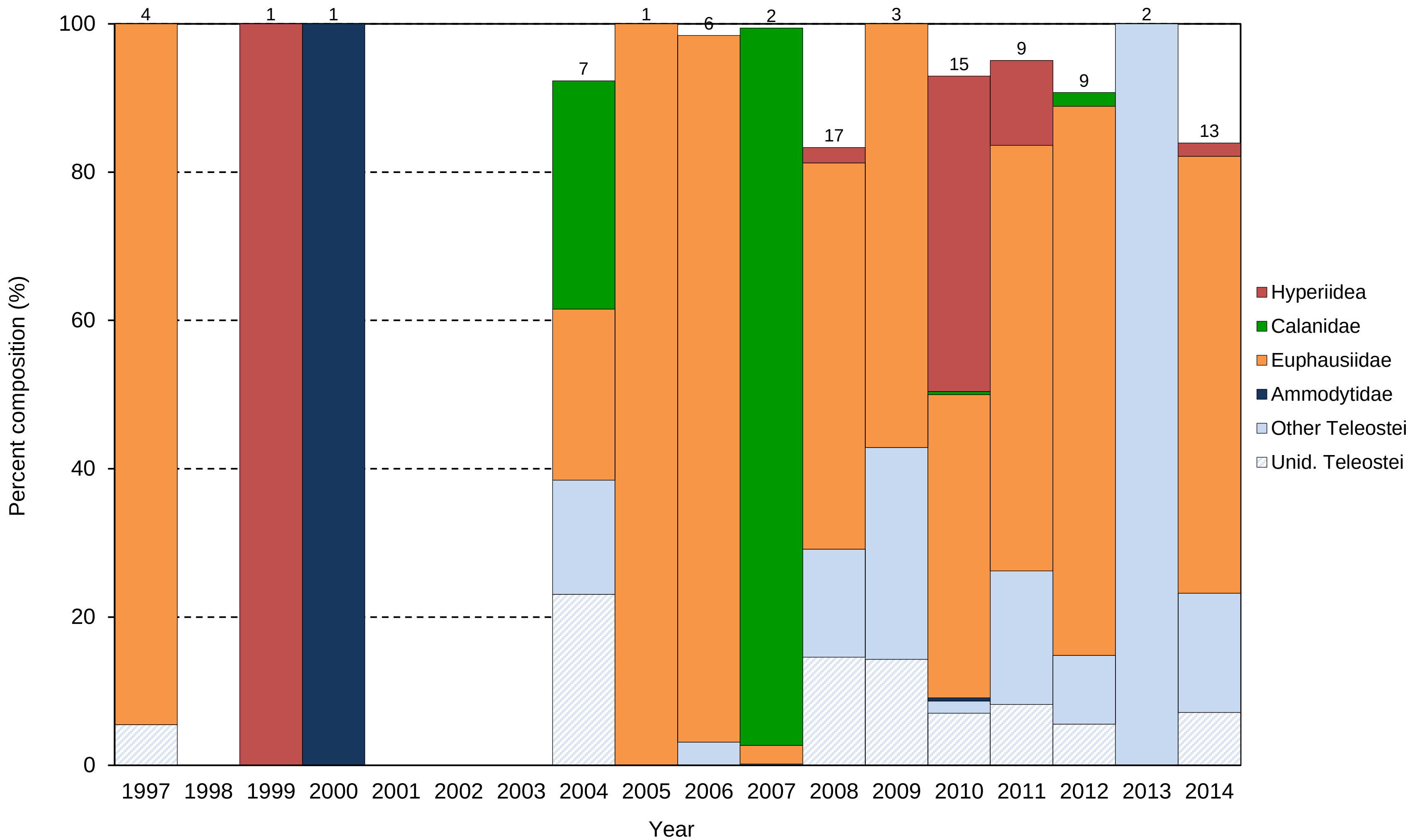

Figure 44. Percent composition of major prey items in diets of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2003, no data exist for 2002 (samples lost), and no count data exist for 1998 or 2001-2002; samples were collected in 2015-2017 but have not yet been analyzed.

Table 67. Percent composition of major prey items in diets of fork-tailed chicks at Aiktak 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. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. No diet samples were collected in 2003, no data exist for 2002 (samples lost), and no count data exist for 1998 or 2001-2002; samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1997	1999	2000	2004	2005	2006	2007	2008	2009
No. samples	4	1	1	7	1	6	2	17	3[a]
No. individuals	91	2	5	13	12	128	521	48	7
Invertebrates	**94.5**	**100.0**	**-**	**61.5**	**100.0**	**96.9**	**99.8**	**70.8**	**57.1**
Amphipoda	**-**	**100.0**	**-**	**-**	**-**	**1.6**	**-**	**6.3**	**-**
Hyperiidea	**-**	**100.0**	**-**	**-**	**-**	**-**	**-**	**2.1**	**-**
Themisto spp.	-	100.0	-	-	-	-	-	-	-
Other Hyperiidea	-	-	-	-	-	-	-	2.1	-
Other Amphipoda	-	-	-	-	-	1.6	-	4.2	-
Copepoda	**-**	**-**	**-**	**30.8**	**-**	**-**	**96.7**	**-**	**-**
Calanidae	**-**	**-**	**-**	**30.8**	**-**	**-**	**96.7**	**-**	**-**
Neocalanus plumchrus/flemengeri	-	-	-	-	-	-	96.7	-	-
Other Calanidae	-	-	-	30.8	-	-	-	-	-
Other Copepoda	-	-	-	-	-	-	-	-	-
Euphausiacea	**94.5**	**-**	**-**	**23.1**	**100.0**	**95.3**	**2.5**	**52.1**	**57.1**
Euphausiidae	**94.5**	**-**	**-**	**23.1**	**100.0**	**95.3**	**2.5**	**52.1**	**57.1**
Thysanoessa inermis	-	-	-	-	-	-	-	10.4	-
Thysanoessa spp.	-	-	-	-	-	28.1	-	41.7	57.1
Unid. Euphausiidae	94.5	-	-	23.1	100.0	67.2	2.5	-	-
Other Euphausiidae	-	-	-	-	-	-	-	-	-
Other Invertebrates	-	-	-	7.7	-	-	0.6	12.5	-
Fish	**5.5**	**-**	**100.0**	**38.5**	**-**	**3.1**	**0.2**	**29.2**	**42.9**
Teleostei	**5.5**	**-**	**100.0**	**38.5**	**-**	**3.1**	**0.2**	**29.2**	**42.9**
Ammodytidae	**-**	**-**	**100.0**	**-**	**-**	**-**	**-**	**-**	**-**
Ammodytes spp.	-	-	100.0	-	-	-	-	-	-
Unid. Teleostei	-	-	-	15.4	-	3.1	0.2	14.6	28.6
Other Teleostei	5.5	-	-	23.1	-	-	-	14.6	14.3
Other	1.1	-	-	-	-	-	0.4	12.5	-

[a]One additional sample is still pending analysis.

Table 67 (continued). Percent composition of major prey items in diets of fork-tailed chicks at Aiktak 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. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. No diet samples were collected in 2003, no data exist for 2002 (samples lost), and no count data exist for 1998 or 2001-2002; samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	15	9	9	2	13	1	15	9
No. individuals	242	61	54	2	56	*pending*	*pending*	*pending*
Invertebrates	**90.9**	**73.8**	**85.2**	**-**	**76.8**	**-**	**-**	**-**
Amphipoda	**46.7**	**11.5**	**7.4**	**-**	**10.7**	**-**	**-**	**-**
Hyperiidea	**42.6**	**11.5**	**-**	**-**	**1.8**	**-**	**-**	**-**
Themisto spp.	-	-	-	-	-	-	-	-
Other Hyperiidea	42.6	11.5	-	-	1.8	-	-	-
Other Amphipoda	4.1	-	7.4	-	8.9	-	-	-
Copepoda	**1.7**	**-**	**1.9**	**-**	**-**	**-**	**-**	**-**
Calanidae	**0.4**	**-**	**1.9**	**-**	**-**	**-**	**-**	**-**
Neocalanus plumchrus/flemengeri	-	-	1.9	-	-	-	-	-
Other Calanidae	0.4	-	-	-	-	-	-	-
Other Copepoda	1.2	-	-	-	-	-	-	-
Euphausiacea	**40.9**	**57.4**	**74.1**	**-**	**58.9**	**-**	**-**	**-**
Euphausiidae	**40.9**	**57.4**	**74.1**	**-**	**58.9**	**-**	**-**	**-**
Thysanoessa inermis	-	32.8	-	-	21.4	-	-	-
Thysanoessa spp.	39.7	18.0	70.4	-	35.7	-	-	-
Unid. Euphausiidae	1.2	4.9	3.7	-	1.8	-	-	-
Other Euphausiidae	-	1.6	-	-	-	-	-	-
Other Invertebrates	1.7	4.9	1.9	-	7.1	-	-	-
Fish	**9.1**	**26.2**	**14.8**	**100.0**	**23.2**	**-**	**-**	**-**
Teleostei	**9.1**	**26.2**	**14.8**	**100.0**	**23.2**	**-**	**-**	**-**
Ammodytidae	**0.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ammodytes spp.	0.4	-	-	-	-	-	-	-
Unid. Teleostei	1.7	18.0	9.3	100.0	16.1	-	-	-
Other Teleostei	7.0	8.2	5.6	-	7.1	-	-	-
Other	0.4	3.3	-	-	5.4	-	-	-

[a]One additional sample is still pending analysis.

Table 68. Morphological measurements of adult fork-tailed storm-petrels at Aiktak Island, Alaska. No data were collected in 1998-2000.

Year	Mass (g)				Wing chord (mm)				Diagonal tarsus (mm)			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1995	72.7	4.0	65.0-79.0	18	-	-	-	-	27.5	1.0	25.4-29.3	22
1996	73.1	5.4	57.0-86.0	54	-	-	-	-	27.5	0.9	24.9-29.3	38
1997	65.0	4.3	52.0-76.0	56	-	-	-	-	27.5	0.7	26.0-29.1	47
2001	68.6	5.6	59.5-77.0	9	162	5.7	158- 166	2	-	-	-	-
2002	69.5	7.1	57.0-82.0	20	159	5.6	152-176	20	29.8	35	19.5-38.6	20
2003	65.5	5.8	56.0-75.0	12	157	3.1	153-163	12	-	-	-	-
2004	67.9	6.9	42.0-82.0	50	159	4.3	150-167	50	30.4	3.7	24.3-39.6	50
2005	67.5	5.9	58.5-80.0	22	157	4.4	146-163	22	27.9	0.9	26.0-29.0	22
2006	65.5	5.8	55.0-81.5	33	158	3.8	150-165	33	27.5	1.0	26.0-29.5	33
2007	65.0	4.5	55.0-74.0	30	157	4.9	147-166	30	27.1	0.9	25.1-28.5	30
2008	58.9	4.9	47.5-71.0	32	156	4.2	148-165	32	26.9	0.7	25.1-28.2	32
2009	60.6	2.8	57.0-65.0	10	160	3.6	155-165	10	27.3	0.7	25.5-28.1	10
2010	62.9	5.9	50.0-76.0	41	156	5.9	140-165	41	26.6	0.9	24.3-28.4	41
2011	61.8	4.3	55.0-71.0	12	158	2.9	153-163	12	26.4	0.9	24.8-28.2	12
2012	60.4	4.8	55.0-73.5	22	159	3.9	153-166	22	26.9	1.1	24.4-29.6	22
2013	63.7	6.3	56.0-76.0	11	157	3.0	151-161	11	26.6	0.8	25.2-28.2	11
2014	64.0	3.3	59.0-71.0	22	159	3.1	154-165	22	26.2	0.8	24.8-27.6	22
2015	62.0	4.5	57.0-70.0	9	157	3.2	150-160	9	26.7	0.9	25.4-28.3	9
2016	62.4	7.3	52.0-80.0	21	161	5.1	152-172	21	27.1	1.1	25.4-29.1	21
2017	62.6	5.2	55.0-71.0	12	162	3.4	156-167	12	26.7	0.9	25.5-28.3	12

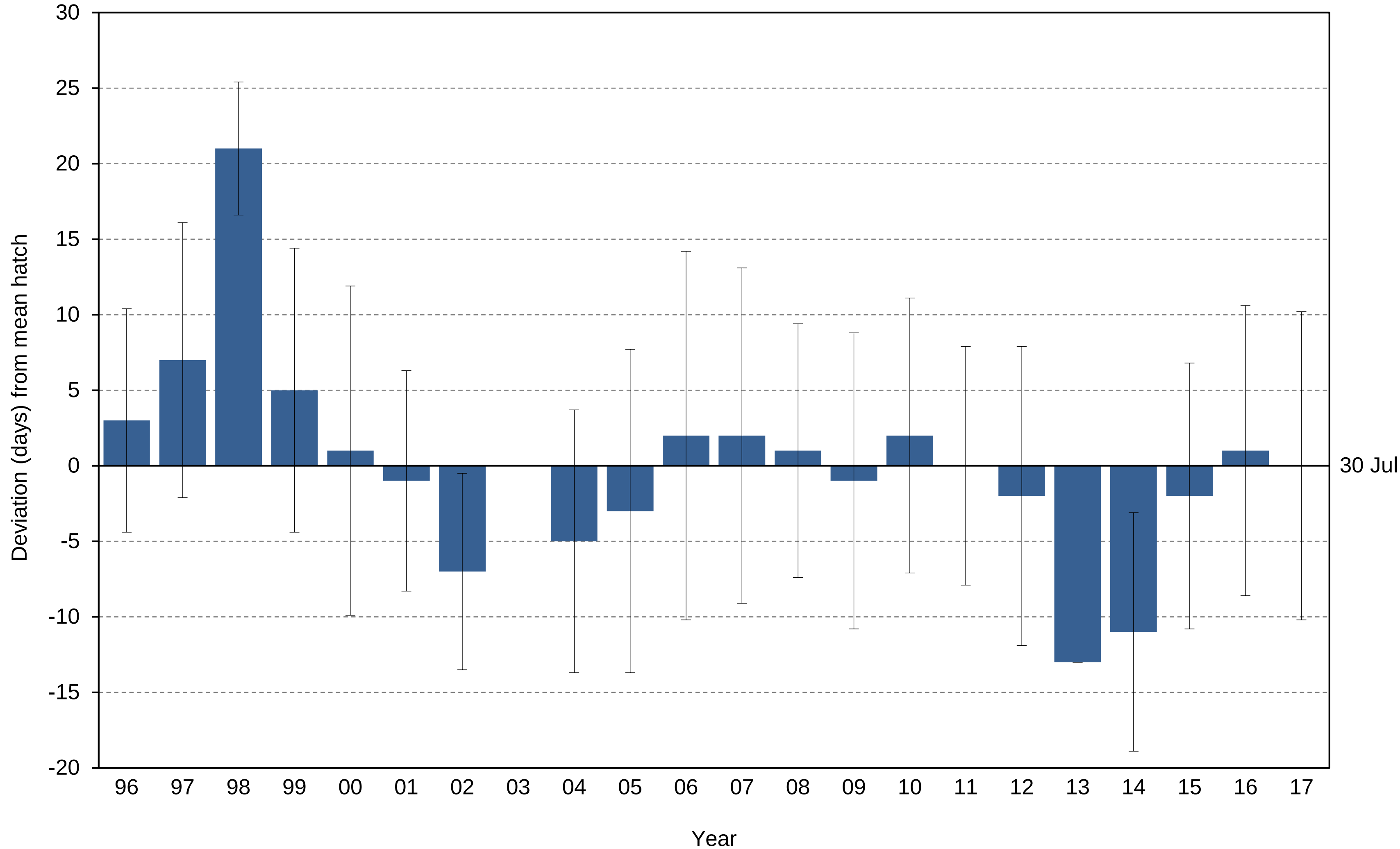

Figure 45. Yearly hatch date deviation (from the 1996-2016 average of 30 July) for Leach's storm-petrels at Aiktak Island, Alaska. Data include only chronology plots monitored on an interval of about 7 days. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 2003.

Table 69. Breeding chronology of Leach's storm-petrels at Aiktak Island, Alaska. Data include only chronology plots monitored on an interval of about 7 days. No data were collected in 2003.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1996	1 Aug	7.4	33	6 Jul	18 Aug	>20 Aug
1997	6 Aug	9.1	62	20 Jul	30 Aug	>1 Sep
1998	20 Aug	4.4	23	14 Jul	1 Sep	>3 Sep
1999	4 Aug	9.4	35	11 Jul	29 Aug	>31 Aug
2000	30 Jul	10.9	42	9 Jul	4 Sep	>11 Sep
2001	29 Jul	7.3	27	10 Jul	26 Aug	>8 Sep
2002	23 Jul	6.5	10	9 Jul	31 Jul	>9 Sep
2004	24 Jul	8.7	37	5 Jul	16 Aug	>31 Aug
2005	27 Jul	10.7	44	11 Jul	30 Aug	>31 Aug
2006	1 Aug	12.2	34	12 Jul	29 Aug	>1 Sep
2007	1 Aug	11.1	38	17 Jul	23 Aug	>30 Aug
2008	30 Jul	8.4	45	15 Jul	25 Aug	>28 Aug
2009	29 Jul	9.8	57	11 Jul	28 Aug	>2 Sep
2010	1 Aug	9.1	23	15 Jul	18 Aug	>30 Aug
2011	30 Jul	7.9	29	17 Jul	20 Aug	>5 Sep
2012	27 Jul	9.9	42	18 Jul	21 Aug	>2 Sep
2013	17 Jul	0.0	5	17 Jul	17 Jul	>26 Aug
2014	19 Jul	7.9	36	5 Jul	10 Aug	>27 Aug
2015	28 Jul	8.8	36	15 Jul	22 Aug	>28 Aug
2016	30 Jul	9.6	48	14 Jul	25 Aug	> 1 Sep
2017	30 Jul	10.2	49	11 Jul	22 Aug	> 31 Aug

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]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 70. Frequency distribution of hatch dates for Leach's storm-petrels at Aiktak Island, Alaska. Data includes only chronology plots in which observations of egg to chick ≤ 7 days. No data were collected in 2003.

Julian date[a]	No. nests hatching on Julian date																				
	96	97	98	99	00	01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17
186	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	-	1	4	-	-	-	2	-	-	-	-	7	-	-	1
193	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	6	-	-	-	-	-	1	-	-	-	-	1	1	3
197	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
198	-	-	-	-	-	-	-	-	-	-	-	-	11	-	3	-	5	-	3	2	5
199	-	-	-	-	3	1	1	-	-	4	5	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	13	-	17	-	-	-
201	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
202	-	-	-	-	-	3	-	8	2	-	-	-	-	-	-	-	-	-	5	7	5
203	2	2	-	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
204	4	1	-	-	-	-	5	1	13	-	-	14	-	6	6	-	-	-	-	-	-
205	-	-	-	3	-	-	-	-	-	11	11	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	8	7	-	8	-	-	-	-	15	-	-	15	-	1	9	8	7
207	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	3	-	-	-
209	-	10	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	2	-	-	-	4	7	1	-	-	-	-	12	-	6	-	-	-	-	7	7	5
211	7	1	-	-	-	-	-	-	-	3	6	-	-	-	-	-	-	-	-	-	-
212	1	-	-	1	-	-	2	4	4	-	-	-	13	-	13	-	-	-	4	8	6
213	-	13	-	5	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214	-	-	-	-	4	1	-	-	1	-	-	-	-	-	-	6	-	2	1	-	-
215	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	-	-	-	-	-	2	-	5	2	-	-	-	-	6	-	-	-	-	1	5	4
217	-	8	-	3	-	-	-	-	-	8	7	-	-	-	-	-	-	-	-	-	-
218	-	-	-	-	2	-	-	-	-	-	-	10	-	-	5	-	-	-	-	-	-
219	2	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	3	-	1	-	4	4
221	-	8	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
222	-	-	-	-	9	2	-	3	3	-	-	-	-	1	-	-	-	1	1	-	3
223	3	1	-	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-
224	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2
225	-	4	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
226	-	-	2	-	-	2	-	1	-	-	-	7	3	-	1	-	-	-	2	1	-
227	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
228	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	1	-	-
229	-	6	-	1	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
230	-	-	3	-	2	-	-	-	-	-	-	-	-	3	-	-	-	-	-	1	2
231	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
232	-	-	7	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
233	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
234	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	2	1
235	-	-	1	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
236	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
237	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
238	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-
239	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
241	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
242	-	2	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
243	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
244	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n	33	62	23	35	42	27	10	37	44	34	38	45	57	23	29	42	5	36	36	48	49

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.

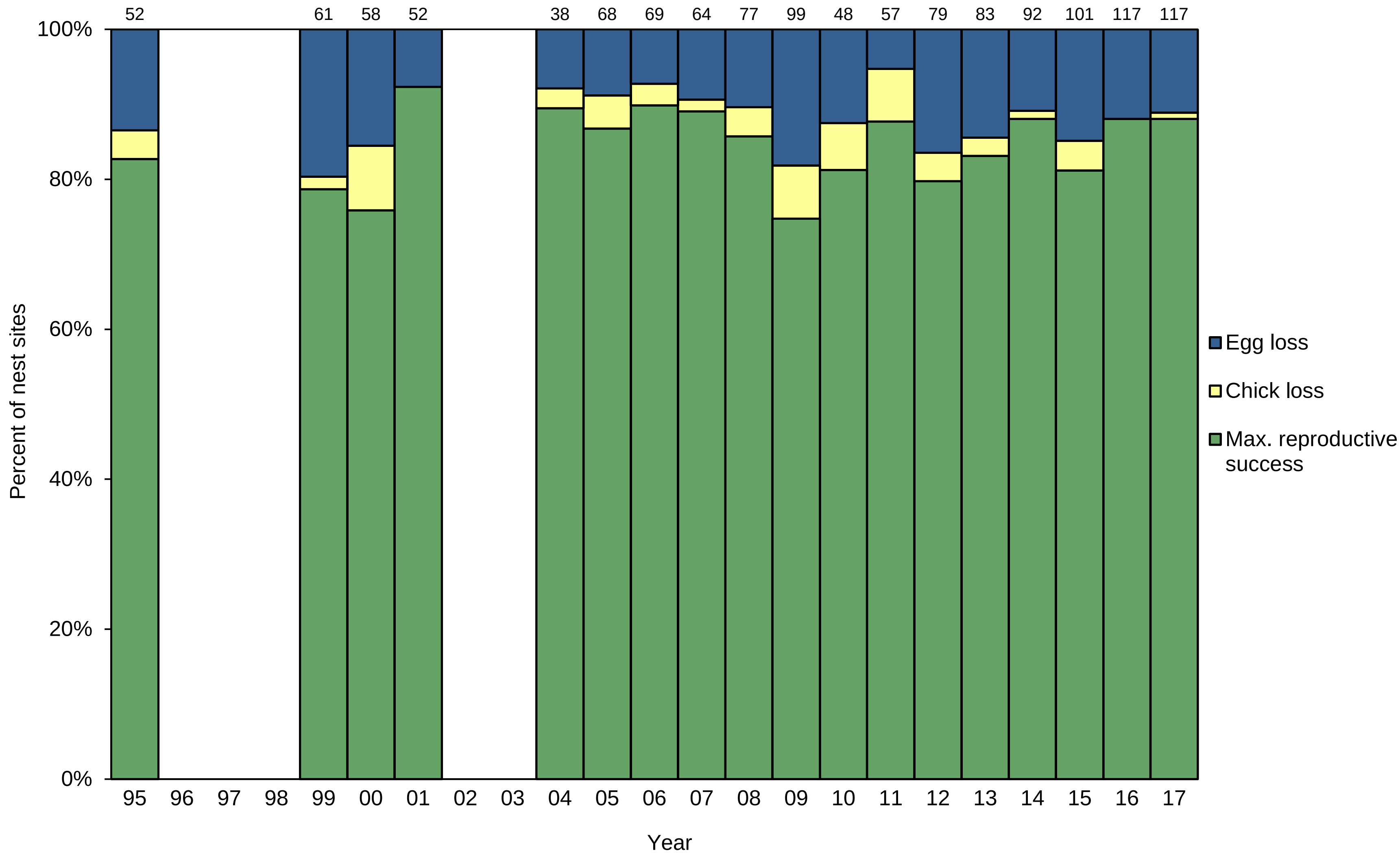

Figure 46. Reproductive performance of Leach's storm-petrels at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Egg loss=[(B+H)-(D+H)]/(B+H); Chick loss=[(D+H)-(F+H)]/(B+H); Maximum potential reproductive success=(F+H)/(B+H), where B+H=maximum 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 1996-1998 or 2002-2003.

Table 71. Reproductive performance of Leach's storm-petrels at Aiktak 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 1996-1998 or 2002-2003.

Year	Max. nest sites w/ eggs (B+H)	Max nest sites w/ chicks (D+H)	Max. nest sites w/ chicks fledged (F+H)[a]	Nest sites w/ viable eggs at last visit[b]	Max. potential nesting success [(D+H)/(B+H)][c]	Max. potential fledging success [(F+H)/(D+H)][d]	Max. potential reproductive success [(F+H)/(B+H)]
1995	52	45	43	0	0.87	0.96	0.83
1999	61	49	48	2	0.80	0.98	0.79
2000	58	49	44	1	0.84	0.90	0.76
2001	52	48	48	0	0.92	1.00	0.92
2004	38	35	34	0	0.92	0.97	0.89
2005	68	62	59	1	0.91	0.95	0.87
2006	69	64	62	1	0.93	0.97	0.90
2007	64	58	57	1	0.91	0.98	0.89
2008	77	69	66	4	0.90	0.96	0.86
2009	99	81	74	0	0.82	0.91	0.75
2010	48	42	39	0	0.88	0.93	0.81
2011	57	54	50	10	0.95	0.93	0.88
2012	79	66	63	2	0.84	0.95	0.80
2013	83	71	69	6	0.86	0.96	0.82
2014	92	82	81	2	0.89	0.99	0.88
2015	101	86	82	1	0.85	0.95	0.81
2016	117	103	103	0	0.88	1.00	0.88
2017	117	104	103	3	0.89	0.99	0.88

[a]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).

[b]Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

[c]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).

[d]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).

Table 72. Standard deviation in reproductive performance parameters of Leach's storm-petrels at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Sampling for storm-petrels is clustered by plot except when sample sizes per plot are too small or plot data are not available. No data were collected in 1996-1998 or 2002-2003.

Year	No. plots	Nest sites w/ eggs	Sampling design[a]	Max. potential nesting success	Max. potential fledging success	Max. potential reproductive success
1995	11	52	Cluster by plot	0.07	0.02	0.07
1999	12	61	Cluster by plot	0.05	0.02	0.06
2000	13	58	Cluster by plot	0.04	0.04	0.04
2001	13	52	Cluster by plot	0.04	0.00	0.04
2004	11	38	Cluster by plot	0.10	0.03	0.10
2005	13	68	Cluster by plot	0.03	0.03	0.04
2006	14	69	Cluster by plot	0.02	0.02	0.03
2007	14	64	Cluster by plot	0.04	0.02	0.04
2008	13	77	Cluster by plot	0.04	0.02	0.04
2009	13	99	Cluster by plot	0.03	0.03	0.04
2010	12	48	Cluster by plot	0.06	0.03	0.05
2011	12	57	Cluster by plot	0.03	0.03	0.04
2012	12	79	Cluster by plot	0.04	0.03	0.04
2013	14	83	Cluster by plot	0.04	0.02	0.04
2014	14	92	Cluster by plot	0.02	0.01	0.02
2015	13	101	Cluster by plot	0.04	0.02	0.03
2016	14	117	Cluster by plot	0.02	0.00	0.02
2017	12	117	Cluster by plot	0.03	0.01	0.03

[a]For sampling clustered by plot, values are calculated using ratio estimator spreadsheets based on plot as a sample unit.

Table 73. Reproductive performance of Leach's storm-petrels at Aiktak Island, Alaska in 2017. Data include only non-chronology plots monitored on an interval of about 14 days.

Parameter	Plot 9	10	11	13	17	18	19	20	21	22	24	26	Total	SD[a]
Max. nest sites w/ eggs (B+H)	15	11	11	3	10	9	7	12	12	10	5	12	117	-
Max. nest sites w/ chicks (D+H)	15	10	11	3	7	8	5	11	11	9	3	11	104	-
Max. nest sites w/ chicks fledged (F+H)[b]	15	10	11	3	7	7	5	11	11	9	3	11	103	-
Nest sites w/ viable eggs at last visit[c]	0	0	1	0	0	0	0	0	0	2	0	0	3	-
Max. potential nesting success[(D+H)/(B+H)][d]	1.00	0.91	1.00	1.00	0.70	0.89	0.71	0.92	0.92	0.90	0.60	0.92	0.89	0.03
Max. potential fledging success [(F+H)/(D+H)][e]	1.00	1.00	1.00	1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.01
Max. potential reproductive success [(F+H)/(B+H)]	1.00	0.91	1.00	1.00	0.70	0.78	0.71	0.92	0.92	0.90	0.60	0.92	0.88	0.03

[a]Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit.
[b]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).
[c]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.
[d]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).
[e]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).

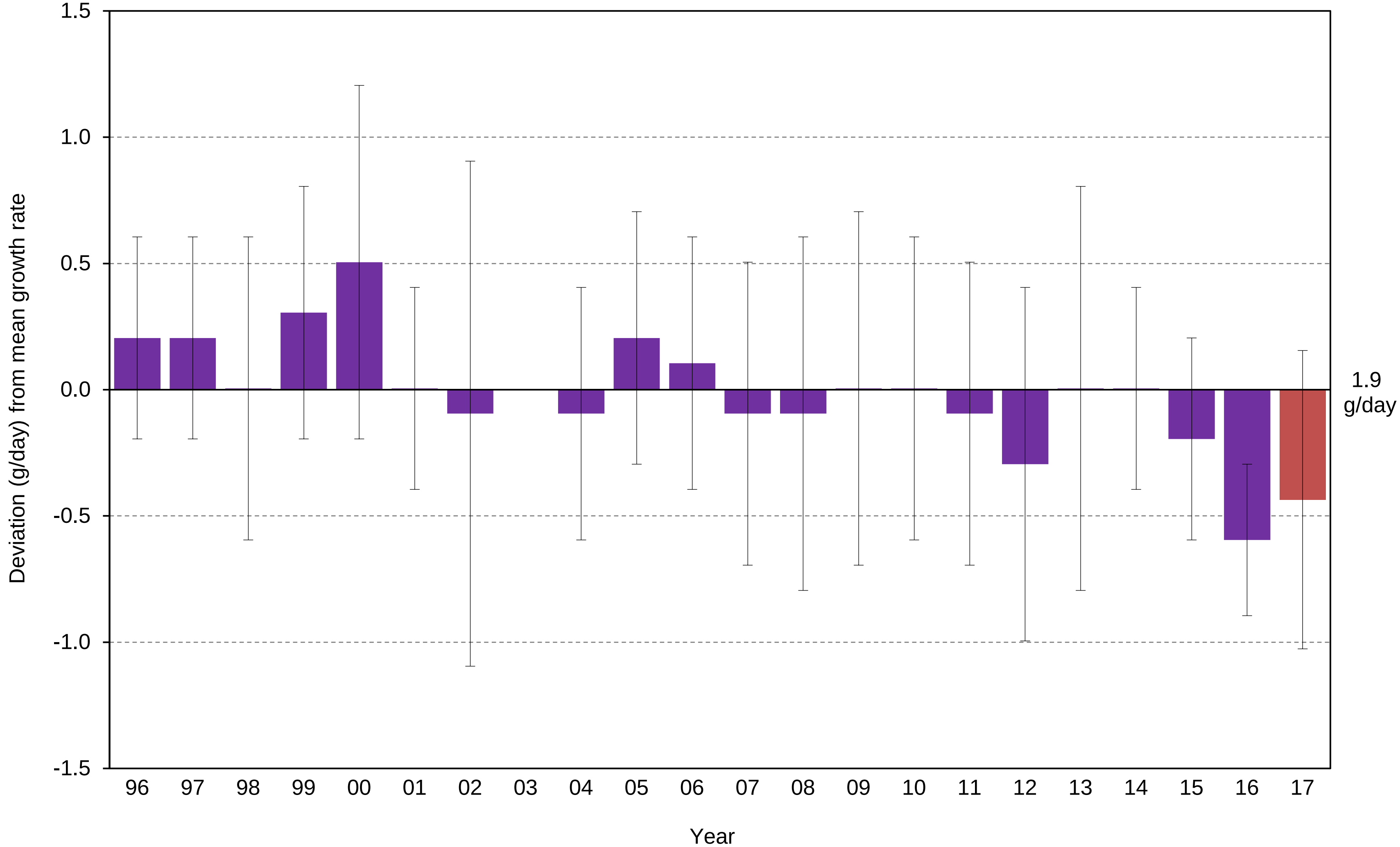

Figure 47. Yearly chick growth rate deviation (from the 1996-2016 average of 1.9 g/day) for Leach's storm-petrels at Aiktak Island, Alaska. Negative values indicate less than the mean growth rate, positive values exceed the mean growth rate. Error bars represent standard deviation around each year's mean growth rate; red highlights the current year. No data were collected in 2003.

Table 74. Mean growth rates of Leach's storm-petrel chicks at Aiktak Island, Alaska. Data include chicks measured at least two times during the linear phase of growth (approximately mass 0-60g; wing chord 20-140mm); chicks that died were excluded. No data were collected in 2003.

Year	Mass (g/day)				Wing chord (mm/day)[a]			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1996	2.1	0.4	1.3 - 3.4	36	2.8	0.4	1.8 - 3.4	35
1997	2.1	0.4	1.1 - 3.0	40	2.4	0.5	1.4 - 3.5	32
1998	1.9	0.6	0.6 - 3.2	40	2.3	0.6	1.2 - 3.4	24
1999	2.2	0.5	0.7 - 3.4	29	3.1	0.1	3.0 - 3.3	3
2000	2.4	0.7	1.4 - 4.5	36	3.3	0.8	1.3 - 5.0	20
2001	1.9	0.4	1.4 - 2.7	28	-	-	-	-
2002	1.8	1.0	1.0 - 2.5	8	3.1	0.5	2.5 - 4.1	7
2004	1.8	0.5	0.9 - 3.1	41	2.7	0.9	0.9 - 4.2	24
2005	2.1	0.5	1.4 - 4.1	37	2.4	0.4	1.1 - 3.3	37
2006	2.0	0.5	1.1 - 3.4	26	2.5	0.3	1.8 - 3.0	25
2007	1.8	0.6	1.1 - 3.0	30	2.5	0.5	1.7 - 3.6	19
2008	1.8	0.7	0.3 - 3.7	30	2.5	0.4	1.8 - 3.0	21
2009	1.9	0.7	0.5 - 3.6	42	2.0	0.5	1.0 - 3.8	41
2010	1.9	0.6	0.8 - 3.1	21	2.2	0.6	1.1 - 3.2	20
2011	1.8	0.6	0.9 - 3.3	27	2.1	0.6	0.9 - 3.4	27
2012	1.6	0.7	0.4 - 3.5	33	2.2	0.6	0.8 - 2.9	26
2013	1.9	0.8	0.6 - 4.3	30	2.2	0.7	0.6 - 3.3	30
2014	1.9	0.4	1.3 - 2.7	33	2.9	0.3	2.0 - 3.3	32
2015	1.7	0.4	0.9 - 2.7	32	2.9	0.4	2.0 - 3.6	20
2016	1.3	0.3	0.8 - 2.1	31	2.7	0.3	1.6 - 3.3	30
2017	1.5	0.6	0.5 - 3.4	32	2.9	0.4	1.6 - 3.7	27

[a]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.

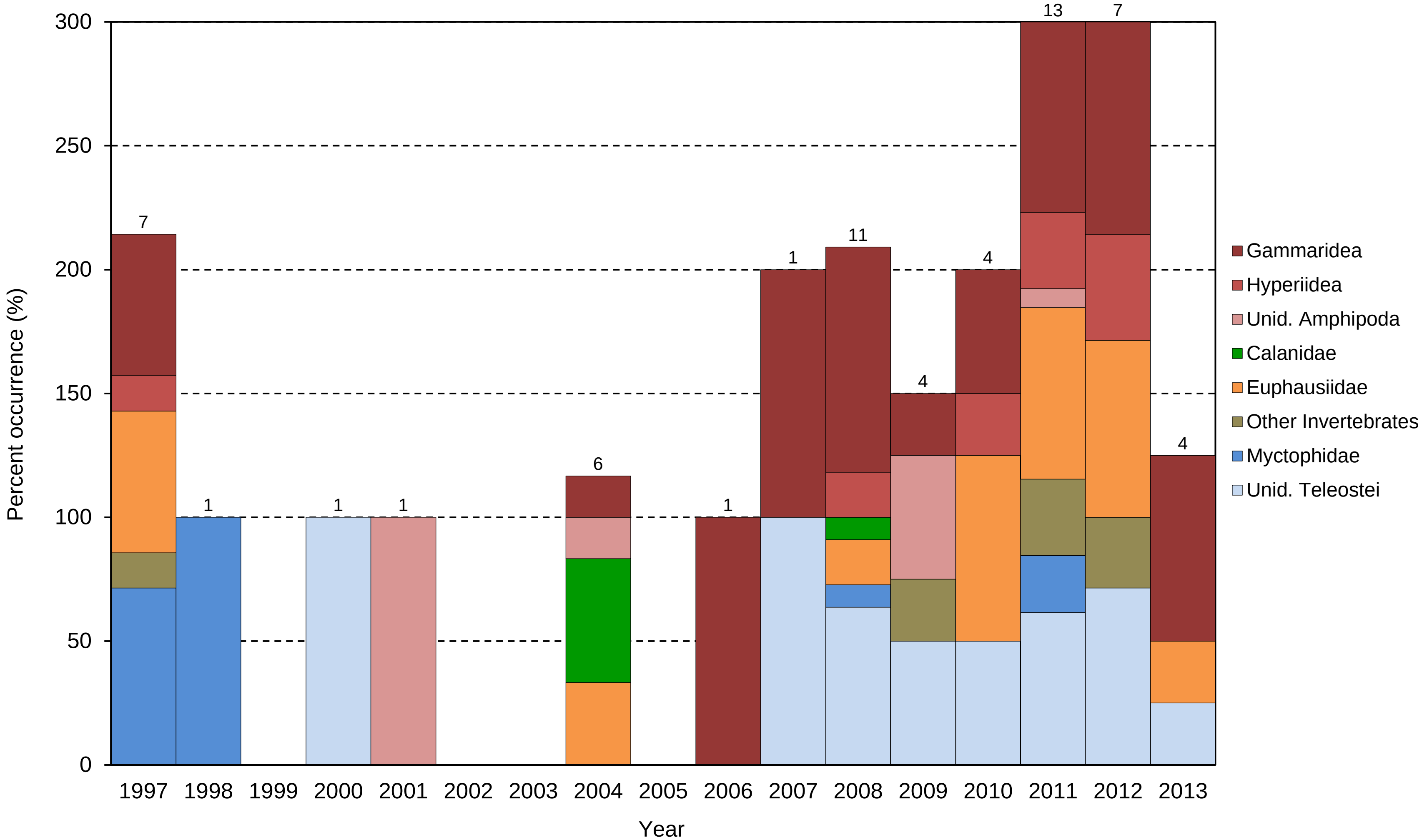

Figure 48. Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999, 2003, 2005, or 2014 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed.

Table 75. Frequency of occurrence of major prey items in diets of Leach's storm-petrel chicks at Aiktak Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. 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 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. No diet samples were collected in 1999, 2003, 2005, or 2014 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1997	1998	2000	2001	2004	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016	2017
No. samples	7	1	1	1	6	1	1	11[a]	4	4	13	7	4	6	5	7
Invertebrates	**57.1**	**-**	**-**	**100.0**	**100.0**	**100.0**	**100.0**	**90.9**	**75.0**	**75.0**	**100.0**	**100.0**	**75.0**	*pending*	*pending*	*pending*
Amphipoda	**57.1**	**-**	**-**	**100.0**	**33.3**	**100.0**	**100.0**	**90.9**	**75.0**	**50.0**	**84.6**	**100.0**	**75.0**	**-**	**-**	**-**
Gammaridea	**57.1**	**-**	**-**	**-**	**16.7**	**100.0**	**100.0**	**90.9**	**25.0**	**50.0**	**76.9**	**85.7**	**75.0**	**-**	**-**	**-**
Lysianassidae	57.1	-	-	-	16.7	100.0	-	-	-	50.0	-	71.4	-	-	-	-
Paracallisoma coecum	-	-	-	-	-	-	100.0	54.5	25.0	-	69.2	-	25.0	-	-	-
Unid. Gammaridea	-	-	-	-	-	-	-	63.6	25.0	25.0	7.7	42.9	50.0	-	-	-
Other Gammaridea	-	-	-	-	-	-	-	9.1	-	-	46.2	-	-	-	-	-
Hyperiidea	14.3	-	-	-	-	-	-	18.2	-	25.0	30.8	42.9	-	-	-	-
Unid. Amphipoda	-	-	-	100.0	16.7	-	-	-	50.0	-	7.7	-	-	-	-	-
Copepoda	**-**	**-**	**-**	**-**	**50.0**	**-**	**-**	**9.1**	**-**	**-**	**-**	**14.3**	**-**	**-**	**-**	**-**
Calanidae	-	-	-	-	50.0	-	-	9.1	-	-	-	-	-	-	-	-
Other Copepoda	-	-	-	-	-	-	-	-	-	-	-	14.3	-	-	-	-
Euphausiacea	**57.1**	**-**	**-**	**-**	**33.3**	**-**	**-**	**18.2**	**-**	**75.0**	**69.2**	**71.4**	**25.0**	**-**	**-**	**-**
Euphausiidae	**57.1**	**-**	**-**	**-**	**33.3**	**-**	**-**	**18.2**	**-**	**75.0**	**69.2**	**71.4**	**25.0**	**-**	**-**	**-**
Thysanoessa spp.	-	-	-	-	-	-	-	9.1	-	50.0	38.5	28.6	-	-	-	-
Unid. Euphausiidae	57.1	-	-	-	33.3	-	-	-	-	25.0	30.8	28.6	25.0	-	-	-
Other Euphausiidae	-	-	-	-	-	-	-	9.1	-	-	7.7	14.3	-	-	-	-
Other Invertebrates	14.3	-	-	-	-	-	-	-	25.0	-	30.8	28.6	-	-	-	-
Fish	**85.7**	**100.0**	**100.0**	**-**	**-**	**-**	**100.0**	**72.7**	**50.0**	**75.0**	**84.6**	**71.4**	**25.0**	**-**	**-**	**-**
Teleostei	**85.7**	**100.0**	**100.0**	**-**	**-**	**-**	**100.0**	**72.7**	**50.0**	**75.0**	**84.6**	**71.4**	**25.0**	**-**	**-**	**-**
Myctophidae	**71.4**	**100.0**	**-**	**-**	**-**	**-**	**-**	**9.1**	**-**	**-**	**23.1**	**-**	**-**	**-**	**-**	**-**
Stenobrachius leucopsarus	71.4	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Myctophidae	-	-	-	-	-	-	-	9.1	-	-	23.1	-	-	-	-	-
Unid. Teleostei	-	-	100.0	-	-	-	100.0	63.6	50.0	50.0	61.5	71.4	25.0	-	-	-
Other Teleostei	57.1	-	-	-	-	-	-	-	-	25.0	-	-	-	-	-	-
Other	28.6	-	-	-	-	-	-	-	-	-	15.4	-	-	-	-	-

[a]One additional sample is still pending analysis.

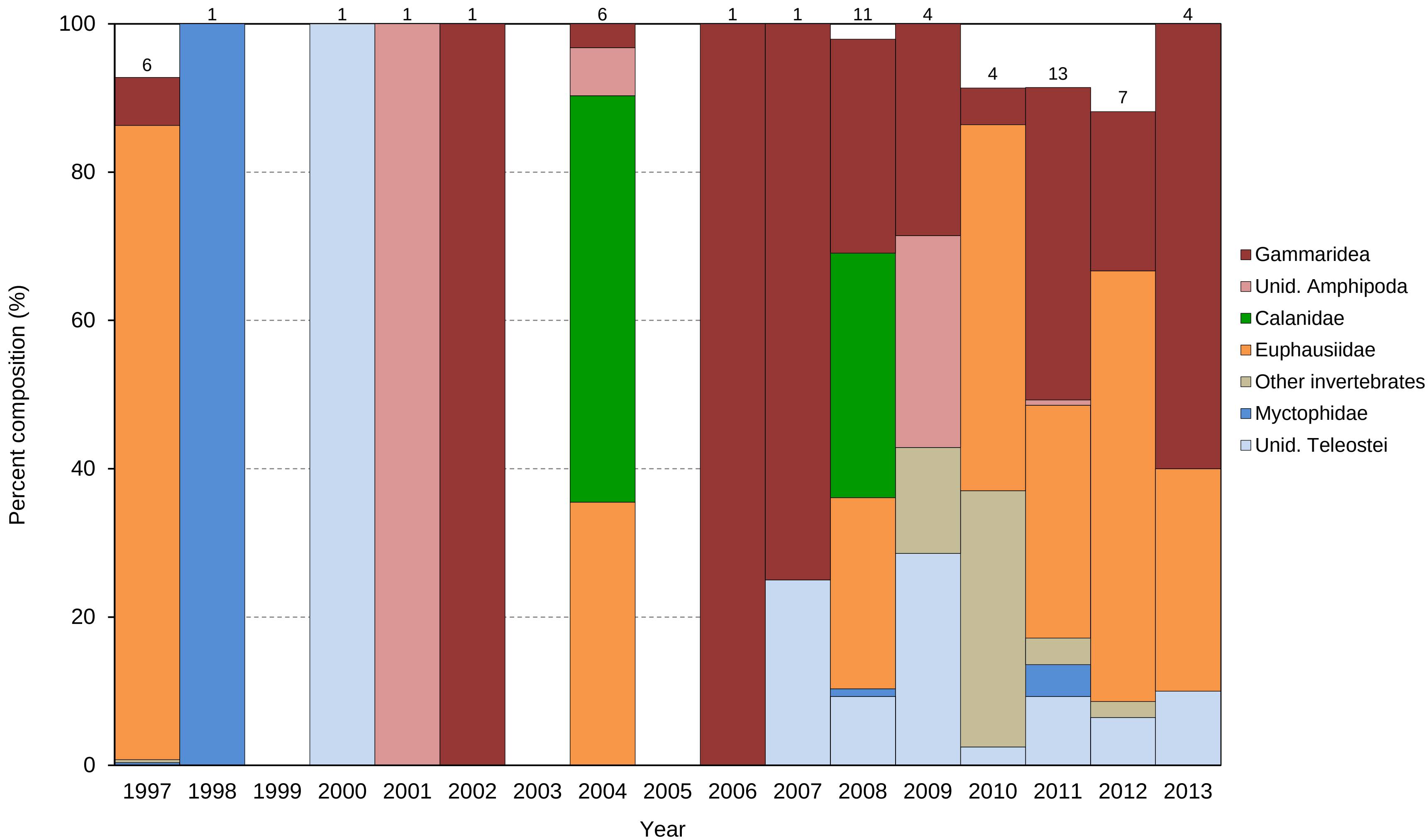

Figure 49. Percent composition of major prey items in diets of Leach's storm-petrel chicks at Aiktak Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999, 2003, 2005, or 2014 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed.

Table 76. Percent composition of major prey items in diets of Leach's chicks at Aiktak 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. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. No diet samples were collected in 1999, 2003, 2005 or 2014 and no data exist for 2002 (samples lost); samples were collected in 2015-2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1997	1998	2000	2001	2004	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016	2017
No. samples	6	1	1	1	6	1	1	11[a]	4	4	13	7	4	6	5	7
No individuals	263	1	1	1	31	2	4	97	7	81	140	93	10	*pending*	*pending*	*pending*
Invertebrates	**92.8**	**-**	**-**	**100.0**	**100.0**	**100.0**	**75.0**	**89.7**	**71.4**	**96.3**	**85.0**	**93.5**	**90.0**	**-**	**-**	**-**
Amphipoda	**6.8**	**-**	**-**	**100.0**	**9.7**	**100.0**	**75.0**	**30.9**	**57.1**	**12.3**	**50.0**	**28.0**	**60.0**	**-**	**-**	**-**
Gammaridea	**6.5**	**-**	**-**	**-**	**3.2**	**100.0**	**75.0**	**28.9**	**28.6**	**4.9**	**42.1**	**21.5**	**60.0**	**-**	**-**	**-**
Lysianassidae	6.5	-	-	-	3.2	100.0	-	-	-	3.7	-	12.9	-	-	-	-
Paracallisoma coecum	-	-	-	-	-	-	75.0	13.4	14.3	-	28.6	-	40.0	-	-	-
Other Gammaridea	-	-	-	-	-	-	-	15.5	14.3	1.2	13.6	8.6	20.0	-	-	-
Unid. Amphipoda	-	-	-	100.0	6.5	-	-	-	28.6	-	0.7	-	-	-	-	-
Other Amphipoda	0.4	-	-	-	-	-	-	2.1	-	7.4	7.1	6.5	-	-	-	-
Copepoda	**-**	**-**	**-**	**-**	**54.8**	**-**	**-**	**33.0**	**-**	**-**	**-**	**5.4**	**-**	**-**	**-**	**-**
Calanidae	-	-	-	-	54.8	-	-	33.0	-	-	-	-	-	-	-	-
Other Copepoda	-	-	-	-	-	-	-	-	-	-	-	5.4	-	-	-	-
Euphausiacea	**85.6**	**-**	**-**	**-**	**35.5**	**-**	**-**	**25.8**	**-**	**49.4**	**31.4**	**58.1**	**30.0**	**-**	**-**	**-**
Euphausiidae	**85.6**	**-**	**-**	**-**	**35.5**	**-**	**-**	**25.8**	**-**	**49.4**	**31.4**	**58.1**	**30.0**	**-**	**-**	**-**
Thysanoessa spp.	-	-	-	-	-	-	-	1.0	-	18.5	24.3	38.7	-	-	-	-
Unid. Euphausiidae	85.6	-	-	-	35.5	-	-	-	-	30.9	5.7	12.9	30.0	-	-	-
Other Euphausiidae	-	-	-	-	-	-	-	24.7	-	-	1.4	6.5	-	-	-	-
Other Invertebrates	0.4	-	-	-	-	-	-	-	14.3	34.6	3.6	2.2	-	-	-	-
Fish	**6.1**	**100.0**	**100.0**	**-**	**-**	**-**	**25.0**	**10.3**	**28.6**	**3.7**	**13.6**	**6.5**	**10.0**	**-**	**-**	**-**
Teleostei	**6.1**	**100.0**	**100.0**	**-**	**-**	**-**	**25.0**	**10.3**	**28.6**	**3.7**	**13.6**	**6.5**	**10.0**	**-**	**-**	**-**
Myctophidae	**0.4**	**100.0**	**100.0**	**-**	**-**	**-**	**-**	**1.0**	**-**	**-**	**4.3**	**-**	**-**	**-**	**-**	**-**
Stenobrachius leucopsarus	0.4	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Myctophidae	-	-	-	-	-	-	-	1.0	-	-	4.3	-	-	-	-	-
Unid. Teleostei	-	-	100.0	-	-	-	25.0	9.3	28.6	2.5	9.3	6.5	10.0	-	-	-
Other Teleostei	5.7	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-
Other	1.1	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-

[a]One additional sample is still pending analysis.

Table 77. Morphological measurements of adult Leach's storm-petrels at Aiktak Island, Alaska. No data were collected in 1998-2000.

Year	Mass (g)				Wing chord (mm)				Diagonal tarsus (mm)			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1995	51.5	4.4	43.0-60.0	63	-	-	-	-	24.6	0.8	22.5-26.1	72
1996	53.8	5.1	40.0-67.0	130	-	-	-	-	24.6	0.6	22.9-26.0	91
1997	46.5	4.1	38.0-58.0	157	-	-	-	-	24.5	0.6	23.0-25.7	83
2001	49.4	3.9	42.5-55.3	18	154	2.2	152-156	2	-	-	-	-
2002	50.0	3.4	42.0-55.0	15	157	3.8	150-163	15	26.2	1.6	24.1-29.8	15
2003	44.8	4.2	41.0-55.5	10	156	3.2	153-163	10	-	-	-	-
2004	48.2	6.3	35.0-59.0	42	156	4.8	140-165	42	25.1	2.3	20.5-29.9	42
2005	47.1	4.2	39.0-58.0	72	154	3.1	148-160	71	24.5	0.8	23.0-26.0	71
2006	46.2	4.4	38.5-55.5	48	154	3.8	146-162	48	24.4	0.6	22.5-25.5	48
2007	45.9	4.4	38.0-54.0	57	156	4.1	147-166	56	24.3	0.9	22.9-27.3	57
2008	42.9	3.2	37.5-53.0	45	155	3.3	148-163	45	24.1	0.7	22.9-25.6	45
2009	42.7	2.6	36.5-42.7	34	155	3.9	148-165	34	24.5	0.9	22.2-26.7	34
2010	42.0	3.2	36.0-50.0	51	154	4.6	143-163	51	24.0	0.7	22.7-25.4	51
2011	41.1	3.0	35.0-49.0	36	155	3.4	144-161	36	24.1	0.9	22.3-26.1	36
2012	41.6	3.0	36.0-50.0	37	154	3.1	150-162	37	24.5	0.7	23.2-26.2	37
2013	42.1	3.2	34.0-56.0	91	154	3.7	144-165	91	24.2	0.7	22.4-26.2	91
2014	44.3	3.0	40.0-48.0	9	157	2.6	155-164	9	23.7	0.4	23.1-24.1	9
2015	41.8	3.2	37.0-53.0	33	156	5.0	145-167	34	24.4	0.9	22.6-26.1	34
2016	43.1	2.6	38.0-48.0	25	157	3.8	150-165	25	24.4	0.6	23.1-25.3	25
2017	42.4	2.9	36.0-47.0	23	155	3.1	150-161	23	24.1	0.7	22.7-25.6	23

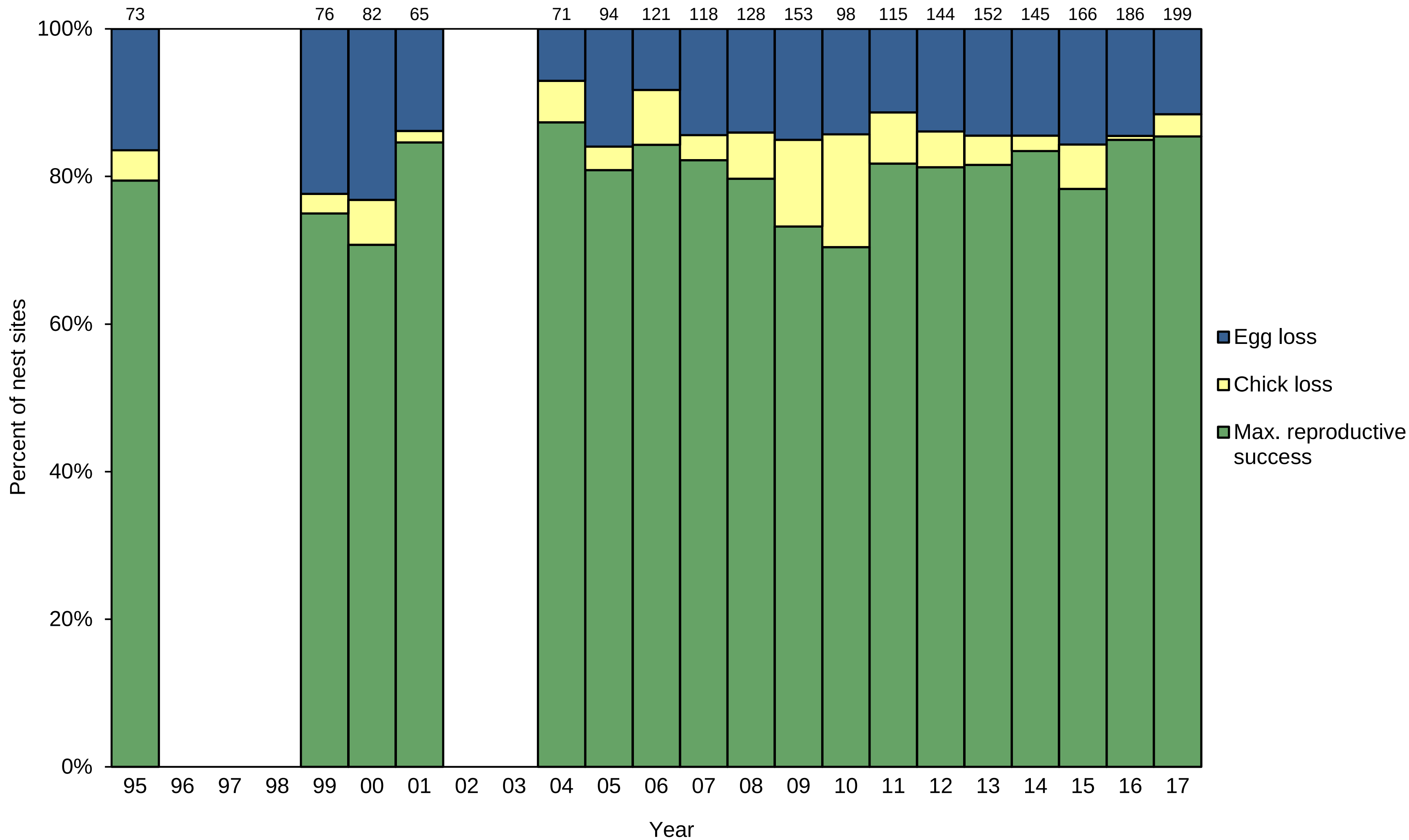

Figure 50. Reproductive performance of all storm-petrels (fork-tailed, Leach's, and unknown storm-petrel species) at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Egg loss=[(B+H)-(D+H)]/(B+H); Chick loss=[(D+H)-(F+H)]/(B+H); Maximum potential 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 1996-1998 or 2002-2003.

Table 78. Reproductive performance of all storm-petrels (fork-tailed, Leach's, and unknown storm-petrel species) at Aiktak 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 1996-1998 or 2002-2003.

Year	Max. nest sites w/ eggs (B+H)	Max nest sites w/ chicks (D+H)	Max. nest sites w/ chicks fledged (F+H)[a]	Nest sites w/ viable eggs at last visit[b]	Max. potential nesting success [(D+H)/(B+H)][c]	Max. potential fledging success [(F+H)/(D+H)][d]	Max. potential reproductive success [(F+H)/(B+H)]
1995	73	61	58	0	0.84	0.95	0.79
1999	76	59	57	4	0.78	0.97	0.75
2000	82	63	58	1	0.77	0.92	0.71
2001	65	56	55	4	0.86	0.98	0.85
2004	71	66	62	0	0.93	0.94	0.87
2005	94	79	76	1	0.84	0.96	0.81
2006	121	111	102	1	0.92	0.92	0.84
2007	118	101	97	2	0.86	0.96	0.82
2008	128	110	102	4	0.86	0.93	0.80
2009	153	130	112	0	0.85	0.86	0.73
2010	98	84	69	3	0.86	0.82	0.70
2011	115	102	94	14	0.89	0.92	0.82
2012	144	124	117	2	0.86	0.94	0.81
2013	152	130	124	7	0.86	0.95	0.82
2014	145	124	121	2	0.86	0.98	0.84
2015	166	140	130	3	0.84	0.93	0.78
2016	186	159	158	0	0.85	0.99	0.85
2017	199	176	170	4	0.88	0.97	0.85

[a]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).

[b]Eggs still present and apparently viable at last check are considered unknown fate and are not included in sample sizes or success estimates.

[c]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).

[d]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).

Table 79. Standard deviation in reproductive performance parameters of all storm-petrels (fork-tailed, Leach's, and unknown storm-petrel species) at Aiktak Island, Alaska. Data include only non-chronology plots monitored on an interval of about 14 days. Sampling for storm-petrels is clustered by plot except when sample sizes per plot are too small or plot data are not available. No data were collected in 1996-1998 or 2002-2003.

Year	No. plots	Nest sites w/ eggs	Sampling design[a]	Max. potential nesting success	Max. potential fledging success	Max. potential reproductive success
1995	11	73	Cluster by plot	0.05	0.02	0.05
1999	12	76	Cluster by plot	0.05	0.03	0.05
2000	13	82	Cluster by plot	0.04	0.03	0.04
2001	14	65	Cluster by plot	0.04	0.00	0.04
2004	12	71	Cluster by plot	0.03	0.03	0.05
2005	13	94	Cluster by plot	0.02	0.02	0.03
2006	14	121	Cluster by plot	0.02	0.03	0.05
2007	14	118	Cluster by plot	0.04	0.02	0.04
2008	13	128	Cluster by plot	0.03	0.02	0.03
2009	13	153	Cluster by plot	0.04	0.02	0.03
2010	13	98	Cluster by plot	0.03	0.03	0.03
2011	13	115	Cluster by plot	0.03	0.03	0.03
2012	13	144	Cluster by plot	0.02	0.02	0.03
2013	16	152	Cluster by plot	0.03	0.01	0.03
2014	14	145	Cluster by plot	0.02	0.01	0.02
2015	13	166	Cluster by plot	0.04	0.04	0.03
2016	14	186	Cluster by plot	0.02	0.01	0.03
2017	13	199	Cluster by plot	0.02	0.01	0.03

[a]For sampling clustered by plot, values are calculated using ratio estimator spreadsheets based on plot as a sample unit

Table 80. Reproductive performance of all storm-petrels (fork-tailed, Leach's, and unknown storm-petrel species) at Aiktak Island, Alaska in 2017. Data include only non-chronology plots monitored on an interval of about 14 days.

Parameter	Plot													Total	SD[a]
	9	10	11	13	16	17	18	19	20	21	22	24	26		
Max. nest sites w/ eggs (B+H)	25	16	24	6	2	17	17	15	18	14	11	7	27	199	-
Max. nest sites w/ chicks (D+H)	22	14	23	6	2	13	15	12	17	13	10	4	25	176	-
Max. nest sites w/ chicks fledged (F+H)[b]	22	14	23	5	2	12	14	11	15	13	10	4	25	170	-
Nest sites w/ viable eggs at last visit[c]	0	0	2	0	0	0	0	0	0	0	2	0	0	4	-
Max. potential nesting success[(D+H)/(B+H)][d]	0.88	0.88	0.96	1.00	1.00	0.76	0.88	0.80	0.94	0.93	0.91	0.57	0.93	0.88	0.02
Max. potential fledging success [(F+H)/(D+H)][e]	1.00	1.00	1.00	0.83	1.00	0.92	0.93	0.92	0.88	1.00	1.00	1.00	1.00	0.97	0.01
Max. potential reproductive success [(F+H)/(B+H)]	0.88	0.88	0.96	0.83	1.00	0.71	0.82	0.73	0.83	0.93	0.91	0.57	0.93	0.85	0.03

[a]Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit.
[b]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).
[c]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.
[d]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).
[e]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).

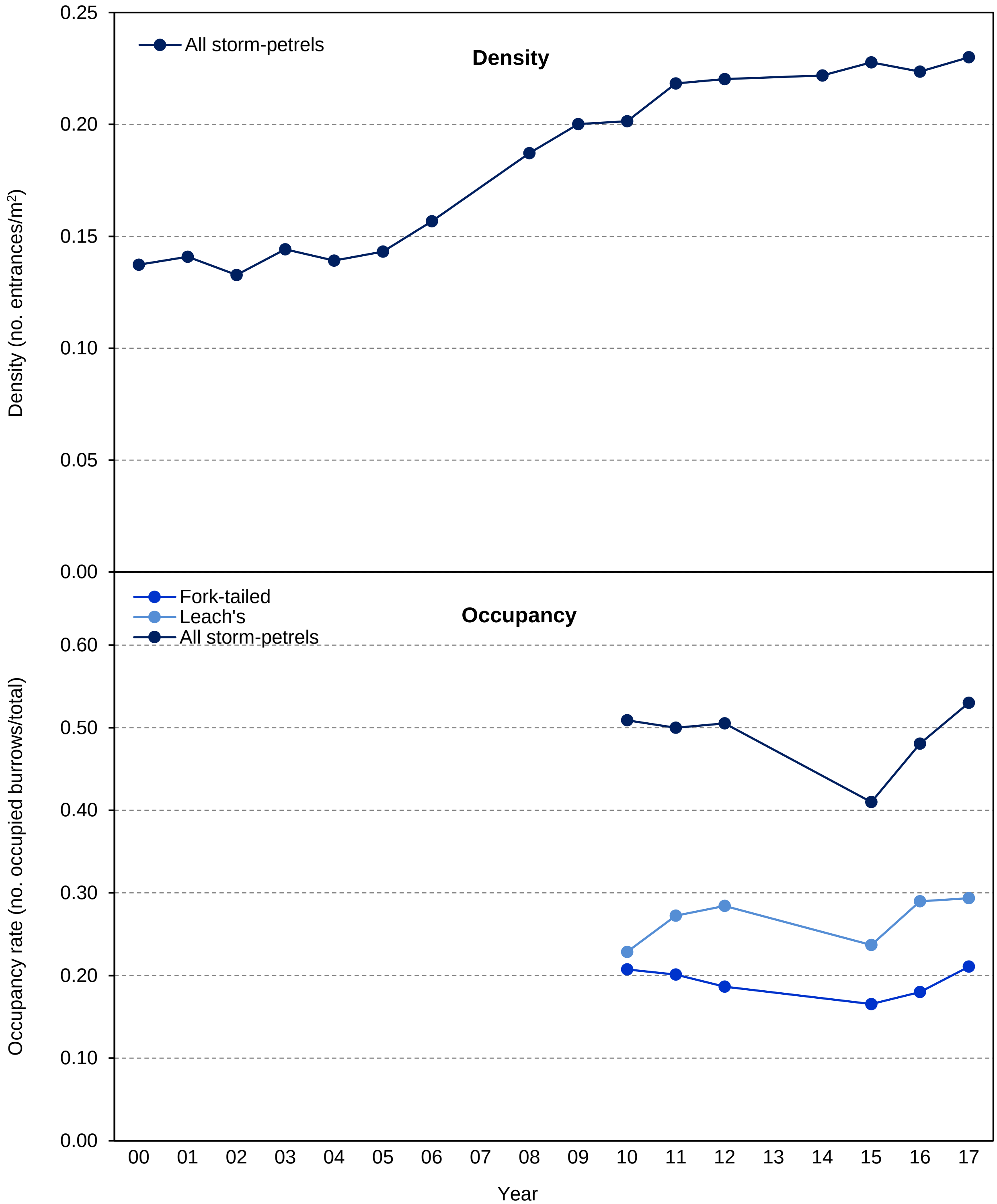

Figure 51. Burrow entrance densities and chamber occupancy rates of storm-petrels on index plots at Aiktak Island, Alaska. Data from 1990 and 1995-1999 are excluded because not all plots were counted; density data from 2007 and 2013 are excluded due to data inconsistencies; no occupancy data were collected in 2003; occupancy data from 2013 and 2014 are excluded due to data inconsistencies; occupancy data from 2002-2004 and 2004-2009 are currently under review.

Table 81. Burrow entrance densities of storm-petrels on index plots at Aiktak Island, Alaska. Density is expressed as the number of small/medium burrow entrances per m^2. Data include all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot. Data from 1990 and 1995-1999 are excluded because not all plots were counted; data from 2007 and 2013 are excluded due to data inconsistencies. Density data have been revised from values presented in previous reports.

Year	Plot																	Total	Mean	SD
	8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27			
2000	0.52	0.22	0.20	0.52	0.48	0.12	0.09	0.36	0.07	0.29	0.40	0.25	0.06	0.14	0.25	0.04	0.16	0.14	0.25	0.16
2001	0.45	0.24	0.21	0.58	0.48	0.16	0.1	0.42	0.08	0.29	0.40	0.24	0.07	0.14	0.25	0.04	0.16	0.14	0.25	0.16
2002	0.38	0.21	0.20	0.6	0.44	0.16	0.08	0.42	0.08	0.27	0.39	0.23	0.07	0.13	0.25	0.04	0.16	0.13	0.24	0.16
2003	0.51	0.21	0.21	0.58	0.5	0.2	0.1	0.42	0.08	0.28	0.40	0.24	0.07	0.15	0.27	0.04	0.19	0.14	0.26	0.17
2004	0.41	0.22	0.20	0.64	0.46	0.18	0.08	0.4	0.08	0.26	0.39	0.24	0.07	0.15	0.29	0.04	0.17	0.14	0.25	0.16
2005	0.51	0.24	0.19	0.56	0.5	0.24	0.09	0.38	0.07	0.30	0.41	0.26	0.06	0.14	0.31	0.04	0.19	0.14	0.26	0.16
2006	0.55	0.23	0.24	0.62	0.46	0.26	0.14	0.44	0.09	0.33	0.41	0.29	0.07	0.16	0.42	0.04	0.19	0.16	0.29	0.17
2008	0.51	0.34	0.29	0.74	0.46	0.3	0.15	0.6	0.14	0.43	0.45	0.30	0.09	0.15	0.37	0.04	0.26	0.19	0.33	0.19
2009	0.53	0.35	0.31	0.76	0.54	0.38	0.15	0.6	0.14	0.47	0.47	0.32	0.09	0.18	0.35	0.05	0.29	0.20	0.35	0.19
2010	0.52	0.35	0.31	0.78	0.5	0.36	0.15	0.66	0.15	0.47	0.47	0.31	0.10	0.18	0.37	0.04	0.31	0.20	0.35	0.20
2011	0.54	0.40	0.32	0.82	0.54	0.38	0.15	0.86	0.16	0.52	0.51	0.34	0.10	0.20	0.38	0.05	0.31	0.22	0.39	0.23
2012	0.54	0.38	0.33	0.88	0.58	0.38	0.15	0.8	0.16	0.50	0.56	0.33	0.11	0.22	0.38	0.05	0.32	0.22	0.39	0.23
2014	0.55	0.38	0.31	0.88	0.56	0.4	0.15	0.92	0.16	0.50	0.60	0.32	0.11	0.21	0.40	0.05	0.32	0.22	0.40	0.25
2015	0.56	0.39	0.35	0.9	0.54	0.42	0.16	0.88	0.17	0.50	0.59	0.34	0.11	0.23	0.40	0.05	0.31	0.23	0.41	0.24
2016	0.57	0.38	0.37	0.92	0.48	0.42	0.15	0.84	0.16	0.47	0.59	0.32	0.10	0.24	0.38	0.05	0.31	0.22	0.40	0.24
2017	0.56	0.39	0.34	0.98	0.50	0.42	0.17	0.80	0.16	0.48	0.57	0.34	0.10	0.23	0.38	0.06	0.31	0.23	0.40	0.24
Plot area (m^2)	100	200	150	50	50	50	100	50	494	125	75	119	288	455	52	1219	340	3917	-	-

Table 82. Occupancy rates of fork-tailed storm-petrels on index plots at Aiktak Island, Alaska. Occupancy is expressed as the number of occupied burrows over the number of burrows with known contents. Data include all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot. Data from 1990 and 1995-1999 are excluded because not all plots were counted; no data were collected in 2003; data from 2013 and 2014 are excluded due to data inconsistencies; data from 2000-2002 and 2004-2009 are currently under review and will be updated in a future report. Occupancy data presented have been revised from values presented in previous reports.

Year	Plot																	Total	Mean	SD
	8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27			
2010	0.24	0.29	0.17	0.28	0.08	0.50	0.29	0.13	0.23	0.21	0.07	0.11	0.10	0.27	0.00	0.26	0.16	0.21	0.20	0.12
2011	0.13	0.24	0.11	0.45	0.00	0.22	0.22	0.17	0.29	0.25	0.14	0.17	0.00	0.21	0.00	0.32	0.16	0.20	0.18	0.12
2012	0.13	0.13	0.22	0.30	0.19	0.29	0.44	0.19	0.22	0.26	0.17	0.13	0.12	0.21	0.10	0.16	0.14	0.19	0.20	0.09
2015	0.21	0.13	0.03	0.27	0.24	0.20	0.21	0.21	0.13	0.21	0.16	0.08	0.08	0.17	0.08	0.20	0.17	0.17	0.16	0.07
2016	0.17	0.14	0.14	0.32	0.29	0.17	0.17	0.23	0.18	0.18	0.16	0.09	0.04	0.19	0.15	0.21	0.20	0.18	0.18	0.06
2017	0.25	0.17	0.14	0.34	0.28	0.25	0.15	0.26	0.18	0.28	0.15	0.09	0.04	0.22	0.14	0.21	0.27	0.21	0.20	0.08

Table 83. Occupancy rates of Leach's storm-petrels on index plots at Aiktak Island, Alaska. Occupancy is expressed as the number of occupied burrows over the number of burrows with known contents. Data include all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot. Data from 1990 and 1995-1999 are excluded because not all plots were counted; no data were collected in 2003; data from 2013 and 2014 are excluded due to data inconsistencies; data from 2000-2002 and 2004-2009 are currently under review and will be updated in a future report. Occupancy data presented have been revised from values presented in previous reports.

Year	Plot																	Total	Mean	SD
	8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27			
2010	0.10	0.38	0.17	0.39	0.31	0.00	0.29	0.27	0.19	0.11	0.33	0.33	0.30	0.27	0.25	0.11	0.23	0.23	0.24	0.11
2011	0.17	0.24	0.22	0.27	0.29	0.11	0.22	0.24	0.25	0.21	0.41	0.42	0.44	0.36	0.33	0.14	0.29	0.27	0.27	0.10
2012	0.20	0.26	0.26	0.37	0.25	0.29	0.00	0.26	0.41	0.19	0.33	0.38	0.41	0.25	0.30	0.27	0.35	0.28	0.28	0.10
2015	0.18	0.25	0.28	0.27	0.12	0.20	0.07	0.21	0.17	0.15	0.23	0.54	0.35	0.22	0.42	0.24	0.20	0.24	0.24	0.11
2016	0.28	0.26	0.48	0.29	0.24	0.33	0.08	0.38	0.21	0.21	0.39	0.45	0.39	0.25	0.23	0.40	0.13	0.29	0.30	0.11
2017	0.31	0.28	0.31	0.29	0.22	0.25	0.00	0.37	0.20	0.24	0.36	0.52	0.52	0.27	0.36	0.35	0.20	0.29	0.30	0.12

Table 84. Occupancy rates of all storm-petrels (including fork-tailed, Leach's, and unknown species) on index plots at Aiktak Island, Alaska. Occupancy is expressed as the number of occupied burrows over the number of burrows with known contents. Data include all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot. Data from 1990 and 1995-1999 are excluded because not all plots were counted; no data were collected in 2003; data from 2013 and 2014 are excluded due to data inconsistencies; data from 2000-2002 and 2004-2009 are currently under review and will be updated in a future report. Occupancy data presented have been revised from values presented in previous reports.

Year	Plot																	Total	Mean	SD
	8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27			
2010	0.41	0.76	0.46	0.83	0.46	0.50	0.71	0.40	0.54	0.32	0.53	0.56	0.40	0.61	0.25	0.41	0.43	0.51	0.51	0.15
2011	0.39	0.53	0.39	0.77	0.29	0.33	0.56	0.41	0.54	0.46	0.55	0.67	0.44	0.57	0.33	0.50	0.47	0.50	0.48	0.12
2012	0.40	0.39	0.48	0.67	0.44	0.57	0.56	0.52	0.63	0.52	0.63	0.56	0.53	0.46	0.50	0.46	0.53	0.51	0.52	0.08
2015	0.42	0.38	0.31	0.54	0.35	0.40	0.29	0.43	0.30	0.35	0.39	0.65	0.42	0.41	0.50	0.44	0.41	0.41	0.41	0.09
2016	0.44	0.40	0.62	0.61	0.53	0.50	0.25	0.62	0.39	0.39	0.55	0.55	0.43	0.46	0.38	0.64	0.36	0.48	0.48	0.11
2017	0.58	0.48	0.48	0.63	0.5	0.58	0.23	0.63	0.41	0.59	0.55	0.61	0.57	0.57	0.5	0.56	0.47	0.53	0.53	0.10

Table 85. Burrow entrance densities and chamber occupancy rates of storm-petrels on index plots at Aiktak Island, Alaska in 2017. Data include all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot.

Parameter	Plot																	Total	Mean	SD
	8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27			
Density[a]																				
No. burrow entrances[b]	56	79	51	49	25	21	17	40	80	60	43	40	30	103	20	68	104	886	52	27
Total area (m^2)	100	200	150	50	50	50	100	50	494	125	75	119	288	455	52	1219	340	3917	-	-
Density of burrow entrances	0.56	0.39	0.34	0.98	0.50	0.42	0.17	0.80	0.16	0.48	0.57	0.34	0.10	0.23	0.38	0.06	0.31	0.23	0.40	0.24
Occupancy																				
No. burrows occupied (O)[c] by:																				
Fork-tailed storm-petrels	9	9	4	14	5	3	2	7	8	8	5	2	1	15	2	11	17	122	-	-
Leach's storm-petrels	11	15	9	12	4	3	0	10	9	7	12	12	12	18	5	18	13	170	-	-
All storm-petrels[d]	21	26	14	26	9	7	3	17	18	17	18	14	13	38	7	29	30	307	-	-
Total no. burrows w/ known contents (N)[e]	36	54	29	41	18	12	13	27	44	29	33	23	23	67	14	52	64	579	-	-
Occupancy rate (O/N) of:																				
Fork-tailed storm-petrels	0.25	0.17	0.14	0.34	0.28	0.25	0.15	0.26	0.18	0.28	0.15	0.09	0.04	0.22	0.14	0.21	0.27	0.21	0.20	0.08
Leach's storm-petrels	0.31	0.28	0.31	0.29	0.22	0.25	0.00	0.37	0.20	0.24	0.36	0.52	0.52	0.27	0.36	0.35	0.20	0.29	0.30	0.12
All storm-petrels[d]	0.58	0.48	0.48	0.63	0.50	0.58	0.23	0.63	0.41	0.59	0.55	0.61	0.57	0.57	0.50	0.56	0.47	0.53	0.53	0.10

[a]Density is expressed as the number of burrow entrances per m^2.

[b]Number of burrow entrances comprise all entrances viewable from the outside, regardless of the presence of a chamber or numerous branching tunnels further in.

[c]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".

[d]Includes fork-tailed, Leach's, and unknown species.

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

Table 86. Band resights of fork-tailed storm-petrels at Aiktak Island, Alaska in 2017. Resight data are collected primarily as incidental observations of banded birds captured during the course of other work and should not be considered a comprehensive dataset of banded individuals for survival analysis.

	Birds initially banded in:			Total
	1995	1996	1997	
No. birds banded	22	38	17	77
No. birds ever resighted[a]	16	31	8	55
No. birds resighted in 2017	0	1	0	1

[a]Includes any bird resighted in at least one year following the year it was banded.

Table 87. Band resights of Leach's storm-petrels at Aiktak Island, Alaska in 2017. Resight data are collected primarily as incidental observations of banded birds captured during the course of other work and should not be considered a comprehensive dataset of banded individuals for survival analysis.

	Birds initially banded in:			Total
	1995	1996	1997	
No. birds banded	72	90	59	221
No. birds ever resighted[a]	51	66	28	145
No. birds resighted in 2017	1	0	1	2

[a]Includes any bird resighted in at least one year following the year it was banded.

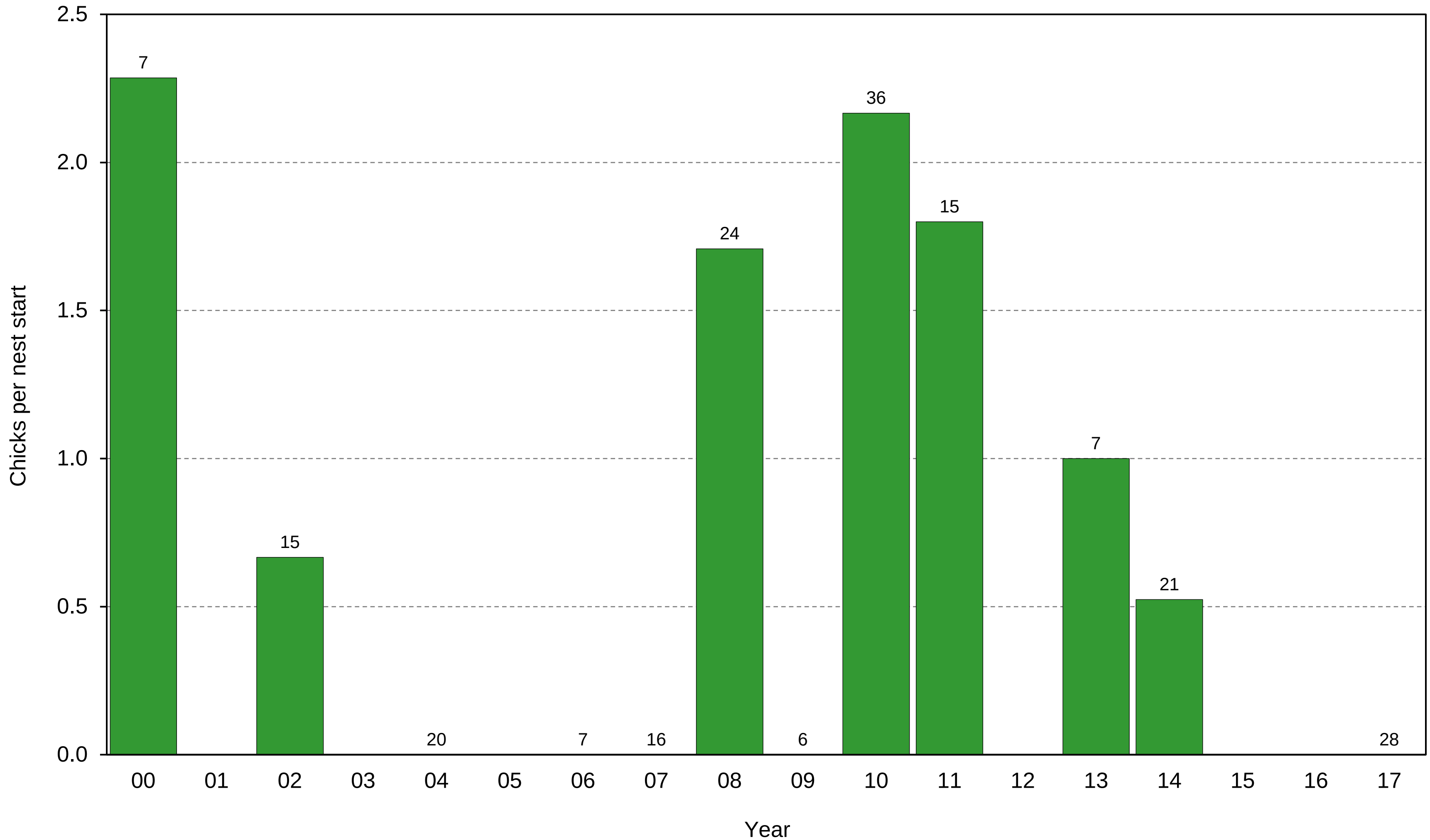

Figure 52. Reproductive performance of double-crested cormorants at Aiktak Island, Alaska. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). Data come from Boom-or-Bust methodology (2000-2009, 2011, and 2014) and frequent monitoring of individual nests (2010 and 2013). Double-crested cormorants bred at Aiktak but no data were collected in 1995-1998 or 2003; no nests were found in 1999, 2001, 2005, 2012, or 2015-2016.

Table 88. Reproductive performance of double-crested cormorants at Aiktak 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. Double-crested cormorants bred at Aiktak but no data were collected in 1995-1998 or 2003; no nests were found in 1999, 2001, 2005, 2012, or 2015-2016.

Year	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
2000	7	2	2	2	1	7	16	2.3	1.00	2.29	20 Aug	20 Aug
2002	15	2	4	0	0	6	10	1.7	0.40	0.67	N/A[c]	N/A
2004	20	0	0	0	0	0	0	0.0	0.00	0.00	22 Jun	-
2006	7	0	0	0	0	0	0	0.0	0.00	0.00	11 Jul	-
2007	16	0	0	0	0	0	0	0.0	0.00	0.00	10 Jun	-
2008	24	4	5	9	0	18	41	2.3	0.75	1.71	17 Jun	20 Aug
2009	6	0	0	0	0	0	0	0.0	0.00	0.00	16 Jun	-
2010[d]	40	*individual nests monitored during 2010; see Table 89*				-	-	-	-	-	18 Jun	-
2011	15	2	6	3	1	12	27	2.3	0.80	1.80	21 Jun	5 Aug
2013[d]	7	*individual nests monitored during 2013; see Table 89*				-	-	-	-	-	1-27 Jul	-
2014	21	0	4	0	1	5	11	2.2	0.24	0.52	5 Jul	29 Aug
2017	28	0	0	0	0	0	0	0.0	0.00	0.00	1 Jul	-

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

[b]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.

[c]N/A indicates data not available.

[d]Excluding counts of nest starts (A), remainder of reproductive performance data in 2010 and 2013 come from a subset of individual nests that were monitored frequently and may not be comparable with estimates of reproductive performance from Boom-or-Bust methodology; thus, these data are presented separately (see Table 89).

Table 89. Reproductive performance of double-crested cormorants at Aiktak Island, Alaska in 2017, as determined by a Boom or Bust methodology.

Date	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks
	(A)	1	2	3	4	(D)	(E)
13 Jun	9	0	0	0	0	0	0
21 Jun	20	0	0	0	0	0	0
1 Jul	28	0	0	0	0	0	0
10 Aug	0	0	0	0	0	0	0
15 Aug	0	0	0	0	0	0	0

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

Table 90. Reproductive performance of double-crested cormorants at Aiktak, Alaska. Measures of success are based on frequent monitoring of individual nests (as opposed to Boom-or-Bust methodology presented in Table 88). Most chicks were too young to fledge by the time of the last visit so fledgling numbers and productivity represent maximum estimates, based on the assumption that any chick still present at last check could fledge. No data were collected in years not listed.

Year	Total nest starts	Nest sites w/ x chicks[a]:					Nest sites w/ chicks	Total chicks	Max. nest sites w/ chicks fledged	Max. total chicks fledged	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Max. fledglings/ nest start	Max. prod.
	(A)	0	1	2	3	4	(D)	(E)	(Fmax)[b]	(Gmax)[b]	(E/D)	(D/A)	(E/A)	(Gmax/A)	(Fmax/A)
2010	36	6	2	10	16	2	30	78	26	65	2.6	0.83	2.17	1.81	0.72
2013	7	4	1	0	2	0	3	7	3	7	2.3	0.43	1.00	1.00	0.43

[a]Numbers of chicks may represent a minimum count as not all may have been visible.
[b]All chicks that were present at last check and chicks that were huge when they disappeared were considered to be potentially fledged.

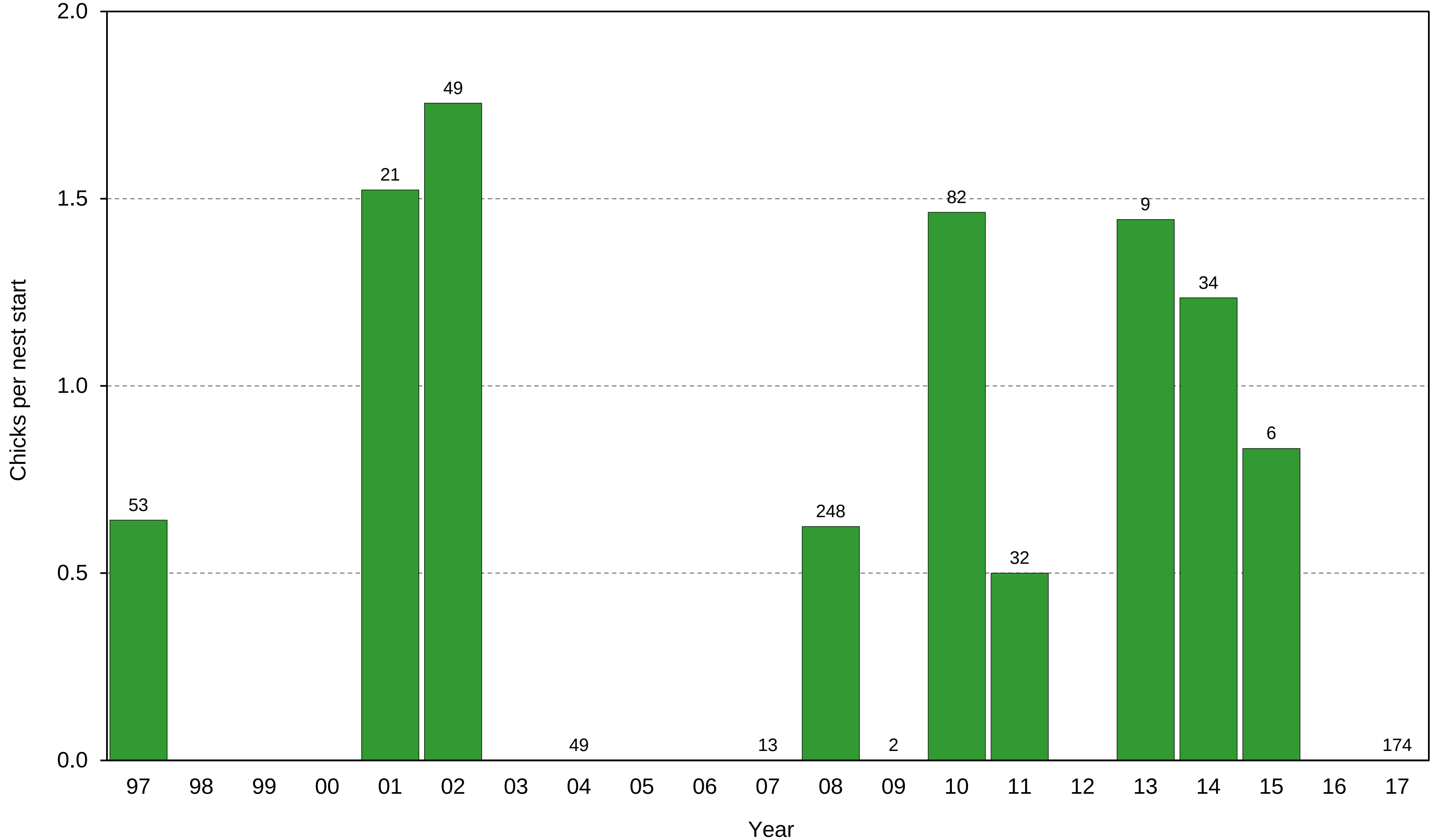

Figure 53. Reproductive performance of red-faced cormorants at Aiktak Island, Alaska. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). Data come from Boom-or-Bust methodology (1997-2009, 2011, and 2014-2015) and frequent monitoring of individual nests (2010 and 2013). Red-faced cormorants bred at Aiktak but no data were collected in 1998 or 2003; no nests were found in 1995-1996, 1999-2000, 2005-2006, 2012, or 2016.

Table 91. Reproductive performance of red-faced cormorants at Aiktak 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. Red-faced cormorants bred at Aiktak but no data were collected in 1998 or 2003; no nests were found in 1995-1996, 1999-2000, 2005-2006, 2012, or 2016.

Year	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
1997	53	4	6	6	0	16	34	2.1	0.30	0.64	N/A[c]	N/A
2001	21	3	3	6	1	13	32	2.5	0.62	1.52	N/A	N/A
2002	49	3	19	15	0	37	86	2.3	0.76	1.76	N/A	N/A
2004	49	0	0	0	0	0	0	0.0	0.00	0.00	22 Jun	-
2007	13	0	0	0	0	0	0	0.0	0.00	0.00	10 Jun	-
2008	248	41	71	20	3	135	155	1.9	0.54	0.63	17 Jun	20 Aug
2009	2	0	0	0	0	0	0	0.0	0.00	0.00	16 Jun	-
2010[d]	134	*individual nests monitored during 2010; see Table 91*					-	-	-	-	7 Jul	-
2011	32	1	3	3	0	7	16	2.3	0.22	0.50	21 Jun+1 Jul	26 Jul
2013[d]	13	*individual nests monitored during 2013; see Table 91*					-	-	-	-	1 Jul-5 Aug	-
2014	34	4	10	6	0	20	42	2.1	0.59	1.24	5 Jul	29 Aug
2015	6	0	1	1	0	2	5	2.5	0.33	0.83	26 Jun	26 Aug
2017	174	0	0	0	0	0	0	0.0	0.00	0.00	1 Jul	-

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

[b]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.

[c]N/A indicates data not available.

[d]Excluding counts of nest starts (A), remainder of reproductive performance data in 2010 and 2013 come from a subset of individual nests that were monitored frequently and may not be comparable with estimates of reproductive performance from Boom-or-Bust methodology; thus, these data are presented separately (see Table 91).

Table 92. Reproductive performance of red-faced cormorants at Aiktak Island, Alaska in 2017, as determined by a Boom or Bust methodology.

Date	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks
	(A)	1	2	3	4	(D)	(E)
13 Jun	136	0	0	0	0	0	0
21 Jun	158	0	0	0	0	0	0
1 Jul	174	0	0	0	0	0	0
10 Aug	0	0	0	0	0	0	0
15 Aug	0	0	0	0	0	0	0

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

Table 93. Reproductive performance of red-faced cormorants at Aiktak, Alaska. Measures of success are based on frequent monitoring of individual nests (as opposed to Boom-or-Bust methodology presented in Table 90). Most chicks were too young to fledge by the time of the last visit so fledgling numbers and productivity represent maximum estimates, based on the assumption that any chick still present at last check could fledge. No data were collected in years not listed.

Year	Total nest starts	Nest sites w/ x chicks[a]:					Nest sites w/ chicks	Total chicks	Max. nest sites w/ chicks fledged	Max. total chicks fledged	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Max. fledglings/ nest start	Max. prod.
	(A)	0	1	2	3	4	(D)	(E)	(Fmax)[b]	(Gmax)[b]	(E/D)	(D/A)	(E/A)	(Gmax/A)	(Fmax/A)
2010	82	29	8	24	20	1	53	120	41	75	2.3	0.65	1.46	0.91	0.50
2013	9	3	2	1	3	0	6	13	5	12	2.2	0.67	1.44	1.33	0.56

[a]Numbers of chicks may represent a minimum count as not all may have been visible.
[b]All chicks that were present at last check and chicks that were huge when they disappeared were considered to be potentially fledged.

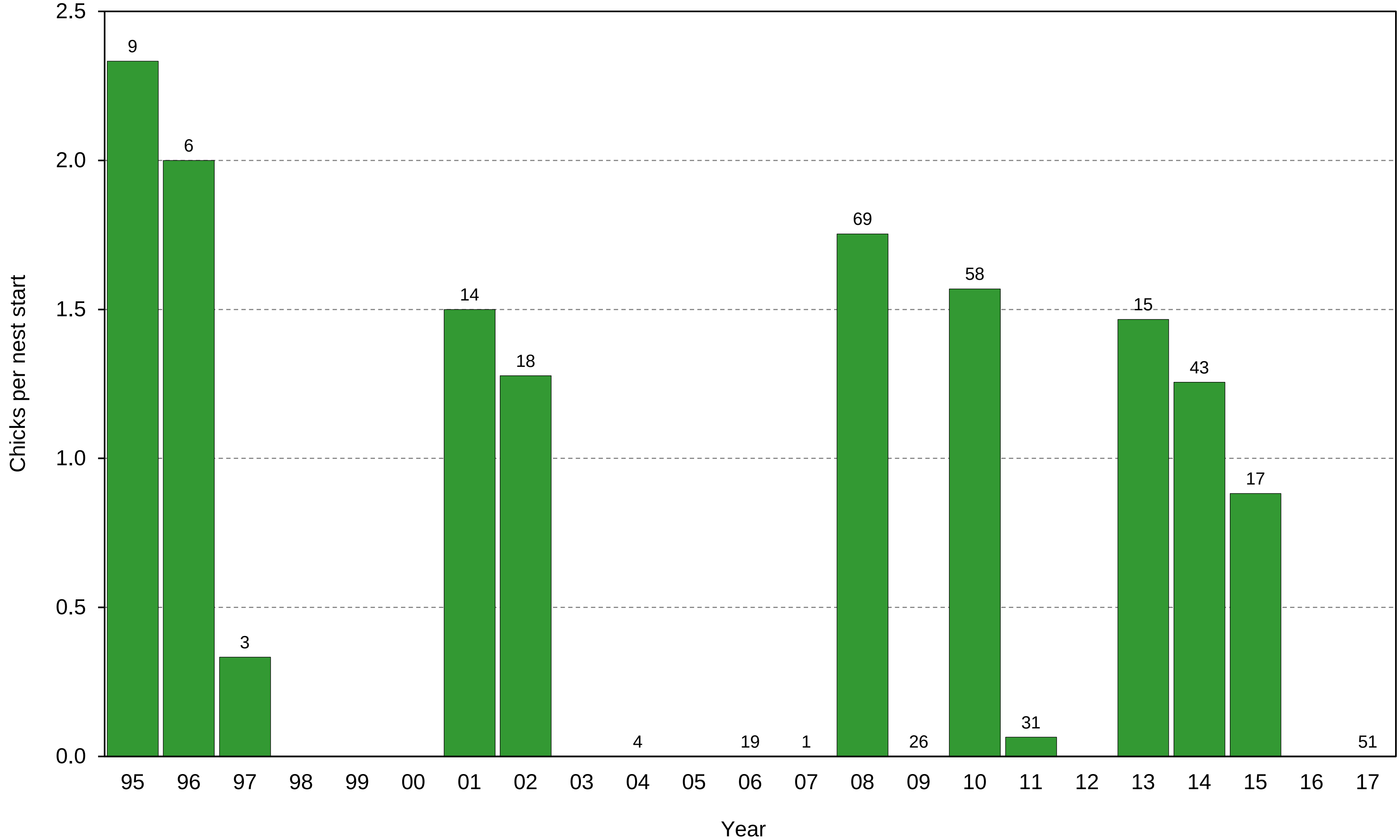

Figure 54. Reproductive performance of pelagic cormorants at Aiktak Island, Alaska. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). Data come from Boom-or-Bust methodology (1995-2009, 2011, and 2014-2015) and frequent monitoring of individual nests (2010 and 2013). Pelagic cormorants bred at Aiktak but no data were collected in 1998, 2000, or 2003; no nests were found in 1999, 2005, 2012, or 2016.

Table 94. Reproductive performance of pelagic cormorants at Aiktak 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. Pelagic cormorants bred at Aiktak but no data were collected in 1998, 2000, or 2003; no nests were found in 1999, 2005, 2012, or 2016.

Year	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
1995	9	N/A[c]	N/A	N/A	N/A	9	21	2.3	1.00	2.33	N/A	N/A
1996	6	N/A	N/A	N/A	N/A	5	12	2.4	0.83	2.00	N/A	N/A
1997	3	1	0	0	0	1	1	1.0	0.33	0.33	N/A	N/A
2001	14	4	4	3	0	11	21	1.9	0.79	1.50	N/A	N/A
2002	18	2	6	3	0	11	23	2.1	0.61	1.28	N/A	N/A
2004	4	0	0	0	0	0	0	0.0	0.00	0.00	22 Jun	
2006	19	0	0	0	0	0	0	0.0	0.00	0.00	17 Jul	-
2007	1	0	0	0	0	0	0	0.0	0.00	0.00	10 Jun	-
2008	69	10	31	15	1	57	121	2.1	0.83	1.75	22 Jul	20 Aug
2009	26	0	0	0	0	0	0	0.0	0.00	0.00	16 Jun	-
2010[d]	64	*individual nests monitored during 2010; see Table 93*					-	-	-	-	27 Jun	-
2011	31	0	1	0	0	1	2	2.0	0.03	0.06	21 Jun+1 Jul	28 Jul
2013[d]	25	*individual nests monitored during 2013; see Table 93*					-	-	-	-	1 Jul-6 Aug	-
2014	43	5	9	0	1	24	54	2.3	0.56	1.26	5 Jul	29 Aug
2015	17	2	5	1	0	8	15	1.9	0.47	0.88	26 Jun	26 Aug
2017	51	0	0	0	0	0	0	0.0	0.00	0.00	1 Jul	-

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

[b]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.

[c]N/A indicates data not available.

[d]Excluding counts of nest starts (A), remainder of reproductive performance data in 2010 and 2013 come from a subset of individual nests that were monitored frequently and may not be comparable with estimates of reproductive performance from Boom-or-Bust methodology; thus, these data are presented separately (see Table 93).

Table 95. Reproductive performance of pelagic cormorants at Aiktak Island, Alaska in 2017, as determined by a Boom or Bust methodology.

Date	Total nest starts	Nest sites w/ x chicks[a]:				Nest sites w/ chicks	Total chicks
	(A)	1	2	3	4	(D)	(E)
13 Jun	28	0	0	0	0	0	0
21 Jun	34	0	0	0	0	0	0
1 Jul	51	0	0	0	0	0	0
10 Aug	0	0	0	0	0	0	0
15 Aug	0	0	0	0	0	0	0

[a]Numbers of chicks may represent a minimum count as not all may have been visible.

Table 96. Reproductive performance of pelagic cormorants at Aiktak, Alaska. Measures of success are based on frequent monitoring of individual nests (as opposed to Boom-or-Bust methodology presented in Table 92). Most chicks were too young to fledge by the time of the last visit so fledgling numbers and productivity represent maximum estimates, based on the assumption that any chick still present at last check could fledge. No data were collected in years not listed.

Year	Total nest starts	Nest sites w/ x chicks[a]:					Nest sites w/ chicks	Total chicks	Max. nest sites w/ chicks fledged	Max. total chicks fledged	Mean brood size	Prop. nest sites w/ chicks	Chicks/ nest start	Max. fledglings/ nest start	Max. prod.
	(A)	0	1	2	3	4	(D)	(E)	(Fmax)[b]	(Gmax)[b]	(E/D)	(D/A)	(E/A)	(Gmax/A)	(Fmax/A)
2010	58	16	8	20	13	1	42	91	39	85	2.17	0.72	1.57	1.47	0.67
2013	15	4	1	9	1	0	11	22	9	18	2.0	0.73	1.47	1.20	0.60

[a]Numbers of chicks may represent a minimum count as not all may have been visible.
[b]All chicks that were present at last check and chicks that were huge when they disappeared were considered to be potentially fledged.

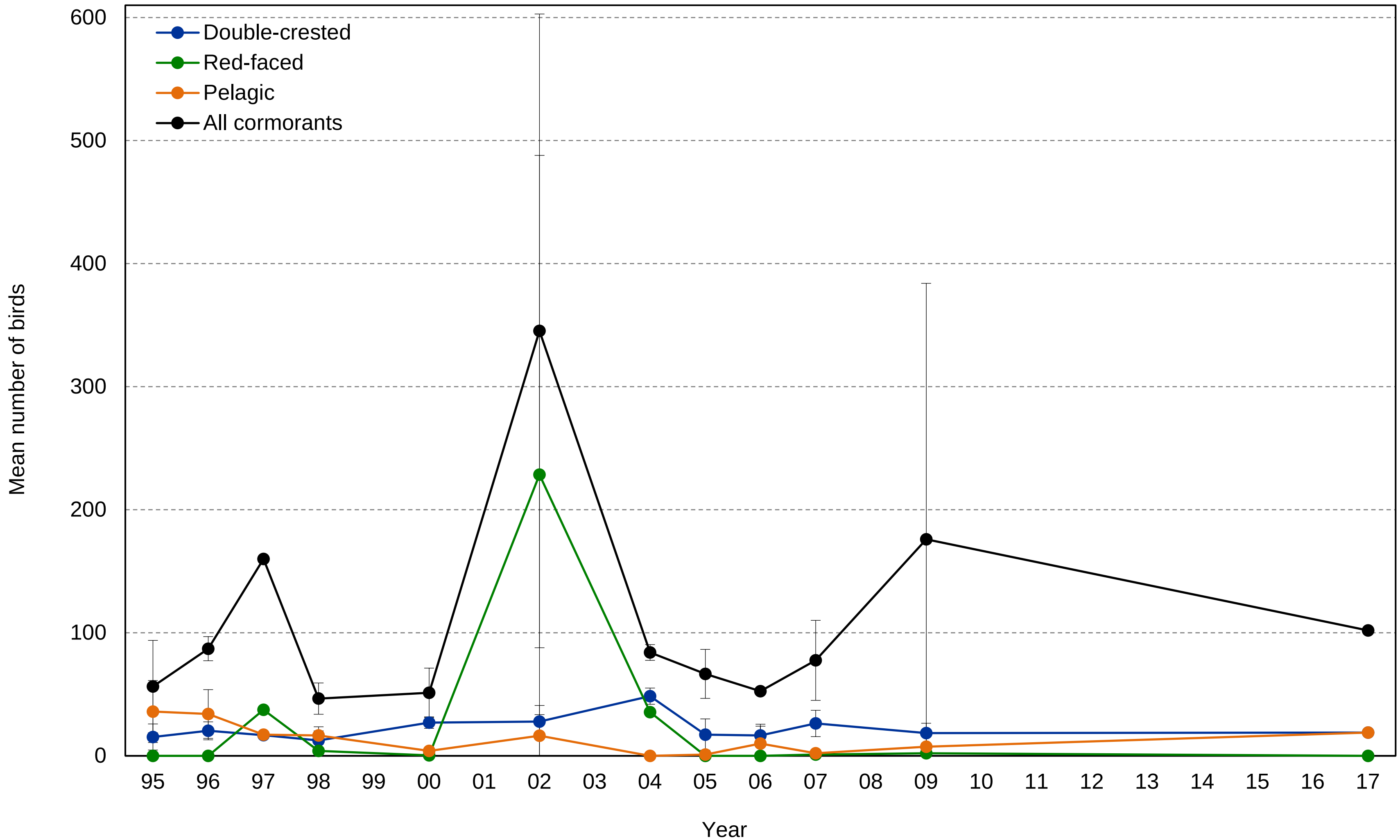

Figure 55. Mean numbers of cormorants counted during circumnavigation surveys at Aiktak Island, Alaska. Values come from general circumnavigation data (Table 94). Error bars represent standard deviation. No circumnavigation surveys were conducted in 1999, 2001, 2003, 2008, or 2010-2016.

Table 97. Mean numbers of birds and marine mammals counted during circumnavigation surveys at Aiktak Island, Alaska. No circumnavigation surveys were conducted in 1999, 2001, 2003, 2008, or 2010-2016.

Species	1995	1996	1997	1998	2000	2002	2004	2005	2006	2007	2009	2017
Green-winged teal	1	3	0	1	3	11	25	2	4	1	9	0
Harlequin duck	12	25	8	48	3	4	3	15	21	13	9	24
Black oystercatcher	31	28	20	23	29	24	28	25	91	41	44	5
Rock sandpiper	0	0	0	0	0	0	0	<1	0	0	0	0
Murre (both species)	4989	5898	6398	4414	2913	602	1766	2698	2856	3097	2235[a]	312
Pigeon guillemot	39	35	34	33	28	9	4	16	12	13	4	34
Ancient murrelet	0	0	0	0	0	0	0	0	0	0	1	0
Parakeet auklet	0	0	0	0	<1	0	0	0	0	0	1	0
Whiskered auklet	<1	0	0	0	0	0	0	0	0	0	0	0
Horned puffin	92	91	73	52	114	91	40	141	192	195	93	81
Tufted puffin	NC[b]	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	12,520
Black-legged kittiwake	0	0	0	0	0	0	0	0	0	0	0	19
Glaucous-winged gull	1670	1168	1175	NC	823	409	877	NC[b]	NC	NC	NC	375
Northern fulmar	0	0	0	0	<1	0	0	0	0	0	0	3
Short-tailed shearwater	0	0	0	0	0	0	0	0	0	<1	0	0
Unid. shearwater	0	0	6	0	0	0	0	<1	1	0	0	0
Cormorant (all species)	56	87	160	47	51	345	84	67	53	78	176	102
Double-crested cormorant	15	20	17	13	27	28	49	17	17	26	19	19
Red-faced cormorant	0	0	38	4	<1	229	36	0	0	1	2	0
Pelagic cormorant	36	34	17	17	4	16	0	1	10	2	8	19
Unid. cormorant	5	33	89	14	20	73	0	48	26	48	149	64
Bald eagle	7	5	6	10	5	12	16	5	4	8	6	8
Peregrine falcon	0	0	1	2	1	1	4	0	0	1	2	1
Common raven	4	2	3	10	4	14	13	7	2	9	4	7
Sea otter	<1	0	0	0	0	0	<1	1	0	0	1	0
Steller sea lion	35	3	4	1	5	47	66	62	109	106	95	7
Harbor seal	31	29	29	28	27	23	10	21	23	42	39	17
n	3	4	3	2	5	4	4	3	2	3	2	1
Survey dates	25 Jun-5 Aug	21 Jul-15 Aug	23 Jul-9 Aug	27 Jul-3 Aug	9 Jul-11 Aug	26 May-18 Jul	22 Jul-10 Aug	22 Jul-14 Aug	21 Jul-27 Aug	22 Jul-20 Aug	25 Jul-15 Aug	6 Aug

[a]In 2009, murre counts are birds observed on cliffs and not those rafting below in water.
[b]Glaucous-winged gulls (between 2005 and 2009) and tufted puffins were not counted during circumnavigation surveys due to their abundance.

Table 98. Numbers of birds detected during off-road point count survey[a] at Ugamak 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. No point count surveys were conducted in 1999 or after 2009.

Species	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Green-winged teal	3	0	0	3	9	0	0	0*	2	1	0*	0
Harlequin duck	0	0	0	0	0	0	0	0	0	0	0	1
Common goldeneye	0	0	0	0	1	0	0	0	0	0	0	0
Rock ptarmigan	0*	1	1	2	3	5	5	6	10	4	2	6
Black oystercatcher	1	0	0	0	0	1	0	0	0	0*	0	0
Rock sandpiper	0*	2	1	8	2	1	6	4	5	1	9	13
Least sandpiper	0	0	0	0	0	0	0	0	0	0	0	1
Tufted puffin	0	0	0	0	0	0	0	0	0	4	0	0
Glaucous-winged gull	10	0	23	0	4	1	0	1	0	6	4	2
Double-crested cormorant	0	0	0	0	2	0	0	1	0	0	0	0
Bald eagle	1	0	0*	0	12	0	0	2	2	4	3	0
Rough-legged hawk	0	0	0	0	0	0	0	0	0	0*	1	1
Short-eared owl	2	0*	0	0	0	0	1	1	2	0*	0*	0
Peregrine falcon	0	0	0	0	0	0	0	0*	0*	1	0	0
Common raven	1	1	1	0	1	0	0	1	0	1	4	1
Bank swallow	0	0	0	0	0	3	3	0	1	0	0	0
Pacific wren	3	3	0	5	8	12	1	2	7	1	11	8
American pipit	0	0	0	0	0	0	0	2	0*	9	4	3
Gray-crowned rosy-finch	1	4	0	4	5	2	3	12	4	0*	4	5
Lapland longspur	7	5	5	15	6	22	9	3	2	9	18	9
Snow bunting	5	2	0*	1	1	0	0	1	2	0*	0*	1
Savannah sparrow	19	33	8	24	10	14	14	25	33	32	26	22
Fox sparrow	0	0	0	0	0	0	0	0	0	0	1	0
Song sparrow	5	8	17	8	24	23	19	9	1	12	11	3
Date	4 Jun	14 Jun	16 Jun	18 Jun	4 Jun	4 Jun	9 Jun	22 Jun	11 Jun	12 Jun	10 Jun	13 Jun
Survey design[b]	xx[c]	xx	xx	xx	xx	xx	xx	xx	xx	xx	B	B

[a]Route established 8 September 1996.
[b]A=5-minute counts, < and > 50m; B=5-minute counts, distance estimation out to 400m.
[c]xx indicates data potentially exist but have not yet been summarized.

Table 99. Mean numbers of birds detected on beach transect surveys along Old Camp Beach, Aiktak Island, Alaska. Data represent species' presence but not necessarily absence in all years. No counts were conducted in 2000.

Species	96	97	98	99	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
Black oystercatcher	7	7	9	9	0	5	4	8	6	6	6	6	4	5	6	6	4	8	5	5	6
Rock sandpiper	0	0	0	0	0	1	0	<1	0	0	0	0	<1	<1	0	0	0	0	0	0	0
Wandering tattler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Pacific wren	3	4	0	1	2	2	3	4	2	1	1	3	2	<1	<1	7	1	6	3	2	0
Gray-crowned rosy finch	0	2	0	0	0	<1	0	3	1	<1	0	0	<1	0	0	0	0	1	1	0	<1
Savannah sparrow	4	3	N/A[a]	2	1	1	4	5	N/A	2	6	8	3	<1	0	5	1	3	0	0	1
Song sparrow	6	7	5	5	9	4	9	7	12	12	8	10	7	7	10	12	5	10	11	12	12
n	5	5	5	4	1	5	6	5	3	4	5	5	6	5	5	5	6	5	5	5	5
First survey	21 Jun	1 Jun	11 Jun	8 Jun	7 Jun	2 Jun	26 May	30 May	6 Jun	1 Jun	1 Jun	1 Jun	4 Jun	3 Jun	3 Jun	6 Jun	7 Jun	8 Jun	6 Jun	4 Jun	2 Jun
Last survey	10 Jul	10 Jun	20 Jun	18 Jun	-	13 Jun	13 Jun	12 Jun	12 Jun	14 Jun	14 Jun	14 Jun	14 Jun	11 Jun	9 Jun	13 Jun	15 Jun	13 Jun	13 Jun	8 Jun	9 Jun

[a]N/A indicates species was not counted during surveys, so presence is unknown.

Table 100. Numbers of birds detected on beach transect surveys along Old Camp Beach, Aiktak Island, Alaska in 2017.

Species	Date					Mean	SD
	2 Jun	5 Jun	7 Jun	8 Jun	9 Jun		
Black oystercatcher	8	5	6	7	6	6	1
Rock sandpiper	0	0	0	0	0	0	0
Wandering tattler	0	0	1	0	0	<1	<1
Pacific wren	0	0	0	0	0	0	0
Gray-crowned rosy finch	0	0	0	1	1	<1	<1
Savannah sparrow	1	2	2	0	1	1	1
Song sparrow	6	10	11	19	14	12	5
Start time (AKST)	0905	0850	0855	0853	0854	-	-
End time (AKST)	0928	0910	0922	0920	0921	-	-

Table 101. Mean numbers of individuals found and encounter rates during COASST surveys along Old Camp-New Camp Beach, Aiktak Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does 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 (1.3 km for Old Camp-New Camp Beach) divided by the number of surveys.

Species	2006		2007		2008		2009		2010		2011	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Black oystercatcher	-	-	-	-	-	-	0.1	0.3	-	-	-	-
Common murre	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Unidentified murre	-	-	-	-	-	-	-	-	-	-	0.3	0.4
Ancient murrelet	-	-	-	-	-	-	-	-	0.1	0.1	-	-
Horned puffin	-	-	-	-	-	-	-	-	-	-	-	-
Tufted puffin	0.1	0.1	0.6	0.4	0.1	0.1	0.1	0.1	0.3	0.4	0.1	0.1
Unidentified puffin	-	-	0.3	0.3	0.1	0.1	-	-	-	-	-	-
Glaucous-winged gull	-	-	-	-	-	-	0.1	0.1	-	-	-	-
Northern fulmar	-	-	-	-	-	-	0.1	0.2	-	-	-	-
Short-tailed shearwater	0.1	0.2	-	-	-	-	0.1	0.1	-	-	-	-
Pelagic cormorant	-	-	0.1	0.5	-	-	-	-	-	-	-	-
Bald eagle	-	-	0.1	0.1	-	-	-	-	-	-	-	-
Unidentified bird	-	-	-	-	0.1	0.4	-	-	-	-	-	-
All species	0.2	0.3	1.1	1.4	0.4	0.7	0.7	0.9	0.4	0.5	0.5	0.6
n	17		7		7		7		9		8	
First survey	17 May		2 Jun		28 May		29 May		22 May		27 May	
Last survey	30 Aug		24 Aug		20 Aug		26 Aug		28 Aug		3 Sep	

Table 101 (continued). Mean numbers of individuals found and encounter rates during COASST surveys along Old Camp-New Camp Beach, Aiktak Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does 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 (1.3 km for Old Camp-New Camp Beach) divided by the number of surveys.

Species	2012		2013		2014		2015		2016		2017	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Black oystercatcher	-	-	-	-	-	-	-	-	-	-	-	-
Common murre	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified murre	-	-	-	-	-	-	0.2	0.6	0.3	1.3	-	-
Ancient murrelet	-	-	-	-	-	-	-	-	0.4	0.8	-	-
Horned puffin	-	-	-	-			0.2	0.1	0.1	0.2	-	-
Tufted puffin	-	-	-	-	0.1	0.1	0.5	0.9	0.6	0.4	-	-
Unidentified puffin	-	-	-	-	-	-	0.3	0.8	0.4	1.1	-	-
Glaucous-winged gull	0.3	0.3	-	-	-	-	0.3	0.9	0.1	0.7	0.3	0.2
Northern fulmar	-	-	-	-	-	-	-	-	-	-	-	-
Short-tailed shearwater	-	-	-	-	-	-	-	-	-	-	-	-
Pelagic cormorant	-	-	-	-	-	-	-	-	-	-	-	-
Bald eagle	-	-	0.4	1.1	-	-	-	-	-	-	-	-
Unidentified bird	-	-	-	-	0.3	0.2	-	-	-	-	-	-
All species	0.3	0.3	0.4	1.1	0.5	0.4	1.5	3.3	2.0	4.5	0.3	0.2
n	8		7		8		6		7		7	
First survey	25 May		1 Jun		27 May		18 Jun		28 May		28 May	
Last survey	2 Sep		29 Aug		26 Aug		28 Aug		21 Aug		19 Aug	

Table 102. Mean numbers of individuals found and encounter rates during COASST surveys along Petrel Cove, Aiktak Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does 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 (0.1 km for Petrel Cove) divided by the number of surveys. No surveys were conducted in 2008-2009 or after 2010.

Species	2006		2007		2010	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Ancient murrelet	-	-	0.1	1.0	0.1	1.4
Tufted puffin	-	-	-	-	0.1	1.4
Unidentified puffin	-	-	0.1	2.0	0.1	1.4
Unidentified gull	-	-	-	-	0.1	1.4
Northern fulmar	-	-	0.1	2.0	-	-
Unidentified bird	0.1	4.0	-	-	-	-
All species	0.1	4.0	0.3	5.0	0.6	5.7
n	10		10		7	
First survey	18 May		2 Jun		22 May	
Last survey	2 Sep		2 Sep		27 Aug	

Table 103. Numbers of birds encountered on COASST surveys along Old Camp-New Camp Beach, Aiktak Island, Alaska in 2017. Data represent numbers of new individual birds found each survey; numbers of birds still present and re-encountered on each survey are shown parentheses.

Species	Date							Individuals[a]			Encounters[b]	
	28 May	11 Jun	26 Jun	10 Jul	24 Jul	7 Aug	19 Aug	Total	Mean	SD	Total	Enc. rate[c]
Glaucous-winged gull	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0)	2	0.3	0.8	2	0.2
Total new individuals	0	0	0	0	0	0	2	2	0.3	0.8	-	-
Total encounters	0	0	0	0	0	0	2	-	-	-	2	0.2

[a]Individuals represent new birds seen on surveys only and do not include birds still present and re-encountered on surveys.
[b]Encounters represent all birds seen on surveys, including both new individuals and all instances of re-encountered birds.
[c]Encounter rate = number of birds encountered / km beach surveyed (1.3 km for Old Camp-New Camp Beach) / number of surveys.

Annotated list of wildlife species observed at Aiktak Island, Alaska in 2017 (18 May to 1 September).

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 of 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)

BIRDS

Emperor goose (*Anser canagicus*). Uncommon migrant. Date range of observations: 26 August to 31 August. Range of individuals observed: six – 21. Location of observations: intertidal zone of New Camp Beach, Upland Access, and Pleasure Cove. Activity observed: foraging and migration. A family group of two adults and four juveniles arrived to the island 26 August and was present until departure. Birds most often observed foraging on kelp in the intertidal zone. No banded birds observed. On 1 September, prior to our departure, a group of 21 adults and juveniles were observed on the beach of Upland Access. Photos are available.

Aleutian cackling goose (*Branta hutchinsii leucopareia*). Uncommon migrant. Date range of observations: 18 May to 29 August. Range of individuals observed: one to 20 and 40; almost always observed in small groups. Location of observations: Gull Mountain, Southwest Slope, and Ugamak Island. Activity observed: foraging, roosting, and migration. Poor photos available. Species never confirmed, but assume species Aleutian cackling goose. Birds intermittently observed in beginning of season (18 May to 4 June). Birds often observed with gulls on Gull Mountain (productivity plot 43). One bird was observed on 23 June. On 29 August a group of 40 birds was observed landing on Ugamak Island; species not confirmed but assume Aleutian cackling goose. On one occasion a bald eagle was observed chasing a goose. Photos are available.

Northern pintail (*Anas acuta*). Irregular migrant. Two females were observed together on 18 August in nearshore waters of New Camp Beach. Photos are available.

Green-winged teal (*Anas crecca*). Common breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 14; generally observed in groups of three to ten. Location of observations: most often observed foraging along northern beaches in kelp beds and/or intertidal zone; also commonly observed flying in/out of Petrel Valley. First chick: 7 June. Activity observed: foraging and nesting. American (*A.c. carolensis*) and Eurasian (*A.c. crecca*) subspecies were commonly observed throughout the summer alone and in groups. The largest group observed was comprised of 14 individuals in the intertidal zone off New Camp Beach on 5 June. A hen and brood of seven small ducklings was observed on 7 June in Teal Pond on the southern end of Petrel Valley. On 8 June a hen with at least three small ducklings was observed in Upland Access creek outlet. On 17 June a hen with roughly five small ducklings was observed in Rural Juror and never observed subsequently. On 3 August seven small ducklings where observed in intertidal zone off the west end of New Camp Beach following and foraging with parent; four other hens where observed near this group. A total of four broods were observed this season, but their survival is unknown.

Harlequin duck (*Histrionicus histrionicus*). Common resident non-breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 30; generally observed in groups of three to six. Location of observations: wading and/or foraging in near waters on the north side of the island; most commonly observed in the waters between Aiktak and western islets. On 22 May a mixed sex group of 14 ducks was observed in the intertidal zone of Sea Lion Cove and a mixed sex group of 16 ducks was observed in nearshore waters off New Camp Beach. Ducks were observed for the first eight days upon arrival to the island and then ducks were not observed again until 18 June.

Red-breasted merganser (*Mergus serrator*). Rare migrant. Dates and locations of observations: 21 May (New Camp Beach), 27 May (Sea Lion Cove), 16 June (New Camp Beach), 18 June (New Camp Beach). Range of individuals observed: one to three (in water off New Camp Beach). Activity observed: foraging and migration. A daily maximum of three birds was observed together on 16 June in nearshore waters off New Camp Beach; birds appeared to be either males or birds in non-breeding plumage (photos available). A male female pair was observed in the nearshore waters off New Camp Beach in front of the cabin on 21 May (no photo) (identification based on comb). Photos are available.

Hummingbird (Trochilidae; unknown species). Accidental vagrant. An unidentified hummingbird was observed in Petrel Valley by storm petrel plot 25 on 27 August; it appeared to be foraging.

Sandhill crane (*Antigone canadensis*). Accidental vagrant. Dates and locations of observations: 27 May (Gull Mountain and Southwest Slope), 10 June (Gull Mountain), 11 June (Old Camp Beach). Range of individuals observed: one to three. Activity observed: migration. Birds always observed flying high in transit. On 10 June three birds flew around Gull Mountain and then headed east. Photos are available.

Black oystercatcher (*Haematopus bachmani*). Common breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 18; generally observed as breeding pairs on territories. Location of observations: most often observed on breeding territories along northern shore of the island. First nests: 18 May. First eggs: 18 May. First fledgling: 21 July a chick was observed flying. Activity observed: foraging and nesting. Eggs present upon arrival to the island on 18 May. Nests were monitored at Little West Island, Pleasure Cove, Old Camp Beach (one at the west end and one at Guillemot Rock), New Camp Beach (one in the boulder section and one in the sandy section), Upland Access, Rocky Platform One (re-laid), Sea Lion Cove, Rural Juror, Tower Cove, and Petrel Valley Cove (one on east end of Horned Puffin plot and one on west end). On 27 May a breeding pair was observed on East Island with one bird on the nest and its mate standing nearby. Additionally, we frequently observed and/or heard oystercatchers at Two Crik Cove, Arch's Cove, below pole 51, and Puff Inlet region. On 6 August, during a circumnavigation survey, a group of 30 birds was observed on the southern side of Ugamak Island in the intertidal zone. Birds began to disperse and/or group starting early August.

Pacific golden-plover (*Pluvialis fulva*). Accidental vagrant. Dates and locations of observations: 19 May (Little West intertidal zone). Range of individuals observed: one. Activity observed: foraging and migration. On 19 May a female bird in breeding plumage was observed in Little West intertidal zone; bird observed only once. Photos are available.

Semipalmated plover (*Charadrius semipalmatus*). Irregular migrant. Dates and locations of observations: 18 May (New Camp Beach), 24 July (New and Old Camp Beach), 27 July (New Camp Beach), 29 July (unknown), and 30 July (New Camp Beach). Range of individuals observed: one to two.

Activity observed: foraging and migration. A daily maximum of two birds was observed together on 27 and 29 July. Photos are available.

Ruddy turnstone (*Arenaria interpres*). Rare migrant. Dates and locations of observations: 29 July (Pleasure Point intertidal zone), 16 August (New Camp Beach), and 18 August (Little West intertidal zone). Range of individuals observed: one to two (max on New Camp Beach). Activity observed: foraging and migration. Photos are available.

Rock sandpiper (*Calidris ptilocnemis*). Uncommon migrant. Date range of observations: 24 July to 31 August. Range of individuals observed: one to five (in Petrel Valley Cove); usually observed in pairs or small groups. Location of observations: intertidal zone and/or beach of New Camp Beach, Old Camp Beach, and Petrel Valley Cove. Activity observed: foraging and migration. A daily maximum of five birds was observed on 31 July in the intertidal zone of Petrel Valley Cove. Bird observed on 4 August appeared to be in winter plumage. Photos are available.

Least sandpiper (*Calidris minutilla*). Uncommon possible breeder. Date range of observations: 18 May to 24 August. Range of individuals observed: one to six (max observed on New Camp Beach and Little West Channel); generally observed as pairs. Location of observations: New Camp Beach, Old Camp Beach, Little West Channel, and Ivory Cove. Activity observed: foraging and migration. A pair of birds was frequently observed on New Camp Beach in front of the cabin. Photos are available.

Wandering tattler (*Tringa incana*). Uncommon migrant. Date range of observations: 19 May to 10 June. Range of individuals observed: one to two (max in Pleasure Cove); almost always observed alone. Location of observations: New Camp Beach, Little West, Rural Juror, and Tower Cove. Activity observed: foraging and migration. Daily maximum observed on 7 June in Pleasure Cove following passerine transect. Identification was confirmed based on call. Photos are available.

Common and thick-billed murre (*Uria aalge* and *U. lomvia*). Abundant breeders. Date range of observations: 20 May to 26 August. Range of individuals observed: one to roughly 200; generally found in groups of 30 to 100 on cliffs and/or rafting in near waters off colonies. Location of observations: most often observed on cliff faces and/or rafting on southeast and southwest portions of the island. No eggs were observed this season. On 25 May murres were seen in good numbers in usual nesting locations on east and west south facing cliff faces, including productivity plot 10, which in previous years was devoid of murres due to a nearby bald eagle nest. Thick-billed murres appeared more present on cliff faces compared to common murres. During the circumnavigation survey on 6 August very few murres were observed on cliff faces. On 15 August 70 murres were observed in population plot 6 and 42 thick-billed murres were observed on Sail Rock in population plot 5, all in usual nest locations; only two common murres were observed on Sail Rock on this day. Relative to the previous year, cliff attendance was especially intermittent, with murres never observed in most cliff regions of the island and infrequently in those areas where previously mentioned. No breeding attempts were documented for either murre species.

Pigeon guillemot (*Cepphus columba*). Common probable breeder. Date range of observations: 13 June to 27 August. Range of individuals observed: one to eight; observed individually and in groups. Location of observations: intertidal and nearshore waters of New Camp Beach, Petrel Valley Cove, Harbor Barbor, Tower Cove, and Arch's Cove. Activity observed: foraging and likely nesting. Birds likely present before 13 June but we didn't actively look for them. Daily maximum counts occurred on 26 June and 1 July during population counts; birds present in Tower and Arch's Cove on these days. No fledglings were observed, and no nests were located. Many birds were observed, several with fish, around Aiktak and Ugamak islands during a circumnavigation survey on 6 August.

Ancient murrelet (*Synthliboramphas antiquus*). Abundant breeder. Date range of observations: 19 May to 20 July. Range of individuals observed: one to four (two adults with two fledging chicks); generally only observed in burrows. Location of observations: principle nesting habitat occurs along the northern coast of the island (Pleasure Cove, Cabin Creek, New Camp Beach, Upland Access, and Tower Cove). Activity observed: nesting. Birds were found occupying soil burrows along beach bluffs and creek drainages, shallow holes under grass tussocks, cavities under piles of large and medium sized driftwood logs, and under medium and large boulders. Adults were heard calling to newly fledged chicks at night from late-June to mid-July on New Camp Beach and around the cabin.

Roughly five predated birds were found around the cabin upon arrival to the island. On 28 May a common raven was observed eating an ancient murrelet near New Camp Beach and cabin productivity plots; this bird may have been pulled from a burrow by the raven. On 29 May a previously followed burrow (nest 217) in the New Camp Beach productivity plot appeared excavated with ancient murrelet feathers at the entrance and two lone cold ancient murrelet eggs of the year; it is assumed that a common raven dug open this burrow and predated the attending adult ancient murrelet. Similarly, on 20 June a followed burrow (nest 33) in the Upland Access productivity plot appeared excavated with a greatly enlarged entrance and ancient murrelet feathers at entrance and the two eggs missing. Ravens were frequently observed in ancient murrelet productivity plots and it is assumed they were looking for ancient murrelet burrows they could dig open. Some burrows in Pleasure Cove ancient murrelet productivity plot showed signs of raven predation. It is theorized that the ravens potentially were cueing in on the orange productivity flags.

Cassin's auklet (*Ptychoramphus aleuticus*). Rare breeder. Date range of observations: 11 July to 29 August. Observed individually. Location of observations: Tufted puffin colony of New Camp Beach, Little West, and tufted puffin occupancy plot 1. First chick: 11 July. First fledgling: 20 July. Activity observed: breeding. On 1 July and on several other occasions birds were heard calling from pole 700 area. In the three locations species observed there were many additional appropriately sized burrows, some with unique poop patches that likely were Cassin's auklet burrows. On multiple occasions red colored regurgitations (likely copepods) were found in these areas.

On 11 July a downy chick was discovered in a burrow on Little West above the nest chamber of tufted puffin artificial burrow 75; on 11 August the nest was empty (assume fledged). Nest 2: Another chick was found in a burrow on 13 July by pole 700 on New Camp Beach; this nest was empty on 20 July (assume fledged). Adult birds were observed in puffin sized burrows on 13 July in the New Camp Beach colony and 18 July in the Little West colony. On 9 August, in tufted puffin occupancy plot 1, an appropriately sized dead egg was found that more than likely came from a Cassin's auklet. Lastly, a fledgling (some down left) was found during the night in a trail behind the cabin on 29 August. Observations from this season provide the first breeding record for this species on Aiktak. It is likely this species bred here in previous years but went undetected. Active burrows were marked with flags for future monitoring. Photos are available.

Rhinoceros auklet (*Cerorhinca monocerata*). Irregular breeder. A nest was found in Tower Cove under a log pile in the ancient murrelet productivity plot. The nest was initially monitored because it was thought to be an ancient murrelet nest but was later discovered to be a rhinoceros auklet nest. An ancient murrelet may have been present and was evicted by the rhinoceros auklet. Last egg observation with an adult was on 13 July and first chick observation was on 20 July. The chick was mostly feathered and still present on 29 August. Observations from this season provide the first breeding record for this species on Aiktak. It is likely this species bred here in previous years but went undetected. Active burrow was marked with flag for future monitoring (nest 214). Photos are available.

Horned puffin (*Fratercula corniculata*). Abundant breeder. Date range of observations: 20 May to 31 August. Range of individuals observed: 25 to 100; generally observed in rafts of 25 to 100 off west end colonies. Location of observations: observed in near waters around entirety of the island but principally found rafting off productivity plots at Pleasure Cove and Petrel Valley Cove; found in crevices in these locations as well. Activity observed: nesting and/or rafting. Horned puffins nested among beach boulders, in rock crevices, and in cracks in the cliffs around the island (primarily Big West Island). The highest concentrations of birds accessible to researchers were in Petrel Valley Cove and Pleasure Cove where productivity and chronology monitoring was conducted. A few new crevices were added to the Petrel Valley Cove productivity plot (two produced chicks). It is likely that there were many more breeding pairs in inaccessible areas on Aiktak and Big West Island. Birds were observed on several occasions circling above the cove to the east of Petrel Valley Cove (below pole four, near Phallic Rock). An attempt was made to access this cove but water and cliff blocked our path.

Tufted puffin (*Fratercula cirrhata*). Abundant breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 1000’s (on colony attendance days); generally observed in rafts or in flight as concentrated spin of birds at colony areas. Location of observations: thousands of birds were observed spinning above cliffs, rafting in near waters, and attending burrows throughout the season; colonies exist across the island but are principally restricted to areas on the edge of the island. First chick: 20 July (from New Camp Beach productivity burrow 174 by membrane). Activity observed: nesting.

On 28 May a large flock of birds was observed on the southern edge of the island and Gull Mountain. Attendance was very low for the month of July. The last substantial spins were observed on 26, 27, and 30 August. Interestingly, the birds that spun in front of New Camp Beach principally only did so late evening and/or at night. On the 6 August circumnavigation survey of Ugamak Island over 1000 birds were observed flying past the southwestern most tip of the island (likely commuting to foraging grounds). In general, attendance (i.e., spins) at the island was more infrequent than last season.

Nests were followed for reproductive success, chronology, and chick growth. Tufted puffins had the worst year on record for productivity with 13% maximum potential reproductive success. No chicks had fledged prior to our departure. Occupancy was also lower in index plots at 18% which is the lowest on record (start of record 1995).

Also of note, 28 breeding birds were rescued from various creeks and island trails having become mired. Rescued birds were brought to either the edge of the island or the ocean; some birds were retained in a box with towels for a couple hours before being released in hopes they would become drier. At a minimum 17 dead birds were also found in creeks having starved (seems to be a regular occurrence based on records in past reports). It is unclear how birds became downed in the middle of the island as it was never witnessed.

Black-legged kittiwake (*Rissa tridactyla*). Common resident non-breeder. Date range of observations: 29 June to 31 August. Range of individuals observed: one to seven; observed individually or in small groups. Location of observations: intertidal and nearshore waters of New Camp Beach, Old Camp Beach, Sea Lion Cove, and Four Sisters. Activity observed: foraging. On 6 August 19 individuals were observed foraging in nearshore waters of New Camp Beach. Foraging birds appeared to be having success in catching small fish. On 7 August seven birds was observed resting in the intertidal zone with glaucous-winged gulls. A juvenile bird was observed on 10 August and a couple occasions afterwards. On 27 August a predated bird was found above the wrack on New Camp Beach.

Glaucous-winged gull (*Larus glaucescens*). Abundant breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 1000's; generally observed in groups in colonies, clubs, intertidal zone, and/or near shore waters. Location of observations: nested primarily in the interior of the island, concentrated on Gull Mountain and the Southwest Slope. Small numbers of birds also nested along and at the base of the low bluffs backing Old Camp Beach near Guillemot Rock. Gulls also frequently observed resting and/or foraging in the intertidal zone and nearshore waters of the island. First nests: 19 May (first productivity nest marked). Activity observed: nesting and foraging.

Gulls nests on Gull Mountain were monitored for chronology and productivity until hatch. On 31 May many single egg nests were observed and by 4 June clutches were trending toward completeness (i.e., three eggs). Egg predation by other glaucous-winged gulls was noted throughout the nesting season. An egg nest was observed on Old Camp Beach on 8 June but in general fewer chicks were observed along this beach compared to 2016; the same can be said for New Camp Beach (boulder section). By 14 July egg laying ceased and hatching was well underway, with feathered chicks present on 26 July. The first fledglings were observed on New Camp Beach on 10 August with fewer birds (adults and fledglings) noted on Gull Mountain starting 18 August. Fledglings trickled onto New Camp Beach up until our departure. The usual behavior of vegetation and moss collection was observed in Petrel Valley with some birds bringing collected material to New Camp Beach (30 June); it is not known why they would bring vegetation to the beach as they are not nesting there. In productivity plots hatching success was roughly 20% lower than the previous three years as was the maximum number of fledglings (25) counted on survey beaches.

It appeared as though more birds were present in the gull colonies at the very beginning of the season than any other time; it also appeared that there were more birds present towards evening hours (perhaps roosting for the night). Juvenile gulls of various ages were observed around the island on and around 20 May. Upon arrival and up until our departure bald eagles were observed flushing and hunting gulls throughout the day at gull colonies.

An interesting behavior was noted on 20 July when various aged birds were observed dancing or pattering on floating kelp; it was assumed they were foraging. A funny anecdote was observed on 27 July when a fishing boat motored past the cabin with a large contingent of the island's gulls following it. On 29 August a bird pile comprised mostly of glaucous-winged gulls was observed just offshore of New Camp Beach in front of the cabin; fish were had by many but it was unclear what species of fish they were eating. Also of note, one adult and one fledgling gull were rescued from around the cabin and released at the beach.

Glaucous gull (*Larus hyperboreus*). Accidental vagrant. Dates and locations of observations: 19 May (on Gull Mountain). Range of individuals observed: one. Activity observed: roosting and migration. An individual was observed once on Gull Mountain loafing with glaucous-winged gulls. Identification confirmed by Lisa Spitler from Adak Island by photo. Photos are available.

Northern fulmar (*Fulmarus glacialis*). Casual resident non-breeder. Dates and locations of observations: 6 August (off Old Camp beach foraging), 17 August (dead on New Camp Beach), and 27 August (dead in wrack of Sea Lion Cove). Range of individuals observed: one to two (dead birds). Activity observed: foraging and dead. On 6 August a bird was observed foraging off Old Camp Beach during the circumnavigation survey. Three dead birds were found this season including one on New Camp Beach and two in the wrack of Sea Lion Cove. Cause of death unknown.

Fork-tailed storm-petrel (*Oceanodroma furcata*). Abundant breeder. Date range of observations: 20 May to 31 August. Range of individuals observed: one to 100's (on colony attendance nights and/or plot checks); generally observed in burrows but also observed or heard at night and in early morning throughout Petrel Valley. Location of observations: primarily observed in-flight and at or in burrows within monitoring plots of Petrel Valley and those on east end of the island. First nests: 24 May (eggs present first check). Activity observed: nesting and prospecting. First fledge: 27 August.

This species nests primarily in soil burrows on slopes of creek drainages across the island. The highest concentration of nesting birds was found among index plots in Petrel Valley. Nests were followed for productivity and chronology in index plots. A handful of occupied burrows were incidentally found across the island outside monitoring plots including burrows found in tufted puffin (including artificial burrows), horned puffin, and ancient murrelet monitoring plots. Several unknown species of storm-petrel were found in gull monitoring plots (usually under tussocks); it is assumed that some of these belonged to this species. It is unclear how birds nesting in gull colonies avoid being predated by gulls (they likely don't spend much time exposed).

Birds were present in burrows on first plot checks on 24 May, including first egg. Peak lay likely occurred on or around 31 May; by 16 July 56% of eggs in chronology plots hatched. Chicks started showing pin feathers in chronology plots starting 25 July. Several chicks in monitoring plots died soon after hatching. On 29 July a newly hatched chick in chronology plot 25 showed many malformations including what appeared to be several dislocations in legs; malformations likely congenital. Another chick found in chronology plot 23 had what appeared to be a protruding eye that scabbed over; the eye stayed this way but the chick was otherwise healthy. It is unclear how the eye became damaged.

Leach's storm-petrel (*Oceanodroma leucorhoa*). Abundant breeder. Date range of observations: 20 May to 31 August. Range of individuals observed: one to 100's (on colony attendance nights and/or plot checks); generally observed in burrows but also observed or heard at night and in early morning throughout Petrel Valley. Location of observations: primarily observed in-flight and at or in burrows within monitoring plots of Petrel Valley and those on east end of the island. Activity observed: nesting and prospecting.

This species nests primarily in soil burrows along creek drainages and slopes across the island. The highest concentration of nesting birds was found among index plots of Petrel Valley. Nests were followed for productivity and chronology in index plots. A couple occupied burrows were incidentally found in the cabin ancient murrelet monitoring plot. Several unknown species of storm-petrel were found in gull monitoring plots (usually under tussocks); it is assumed that some of these belonged to this species. It is unclear how birds nesting in gull colonies avoid being predated by gulls (they likely don't spend much time exposed).

Birds were present in burrows on first plot check on 24 May. On 31 May it felt like most birds were on their pre-laying exodus. Peak lay likely occurred on or around 20 June, by 30 June birds were still laying and digging. By 18 July many eggs hatched. No chicks considered fledged prior to leaving the island.

Many growth chicks showed an interesting pattern of growth this season where they had a period where their growth rates for mass stalled (rates of growth for wing chord remained consistent).

Double-crested, red-faced, and pelagic cormorant (*Phalacrocorax auritus, P. urile, and P. pelagicus*). Common breeders. Date range of observations: 19 May to 31 August. Range of individuals observed: one to 300 (on days colonies observed); observed in groups and individually. Location of observations: all three species observed individually and in groups. All three species nested on south facing cliff faces. Additionally, all three species could be observed throughout the season foraging individually in the intertidal zone and/or loafing or drying wings in groups of one to 50. Common loafing and/or wing drying locations included rock outcroppings off East Island and Big West (includes Sea Lion Rock). First nests: 22 May. First eggs: 5 June. First chick: 24 June (red-faced in plot 3). Activity observed: nesting and foraging.

On 20 May birds were observed (likely mostly red-faced) landing momentarily and taking off from the cliff face below the southeast point of the Southwest Slope; this cliff can't be properly viewed for monitoring. Around this time many birds could be seen gathering kelp on the water.

On 22 May all three species (mostly red-faced) were observed on the cliff face below pole 89 (plot 3 and murre population plots 6 and 10). Birds continued to fill in on this cliff and on 5 June the first eggs were observed within two red-faced nests; there were many red-faced cormorants in incubation postures on this date. Pelagic cormorant nests were likely present on this date too but this was not confirmed. Double-crested cormorants were present on the abovementioned cliff face on 5 June but none were observed in incubation postures. Nest building was still observed through 14 July.

The maximum nest count occurred on 1 July; chick counts started 10 August. Nest counts predominately included red-faced cormorants, although pelagic and double-crested were also present. A red-faced nest was observed with at least one chick on 29 July; not soon after that date all cormorants within count areas catastrophically failed. Though observations were mostly obscured by fog, it appeared that all nesting cormorants within those areas monitored had failed on 31 July. This failure status was confirmed on 1 August. Further, it was on this date that more birds appeared in the intertidal zone and/or on rock outcroppings previously described; it is assumed birds from failed breeding attempts moved onto foraging grounds around the island. No chicks were present in count areas during first chick count on 10 August; nests were still present on this date but there were no signs of eggs, chicks, or adults.

On 6 August during the circumnavigation survey of Aiktak Island no active nests were observed anywhere on the island. Similarly, Ugamak Island didn't appear to have any active nests. On the same day a circumnavigation of Kaligagan Island by Refuge staff (USFWS, unpublished data) found 20 cormorant nests (unknown species) on a south facing cliff, most of which were empty but some chicks were present.

Bald eagle (*Haliaeetus leucocaphalus*). Common breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 15; generally observed individually, in pairs, or in groups of three. Location of observations: generally observed in-flight over Gull Mountain, Southwest Slope, and northern shore. First nests: 19 May. First chick: 5 June (Big West nest). First fledgling: 4 August (Four Sisters; chick could fly). Activity observed: nesting and hunting.

Adult and juvenile eagles were observed around the island throughout the season; most birds were juveniles. Eagles were frequently observed in gull colonies on Gull Mountain and Southwest Slope either quietly perched or flying through causing large disturbance. Eagles were also observed hunting puffins and the occasional fish. Juvenile birds on several occasions perched on the cabin, radio antenna, or large rock (aka Pride Rock) on New Camp Beach. Additionally, juvenile birds were often observed playing aerial games (tumbling over each other).

On 24 May a group of 10 juvenile eagles and three adult eagles were observed perched in the intertidal zone near Upland Access of New Camp Beach. This gathering was investigated further thinking perhaps a carcass was near, but nothing was found. On 19 May a dead adult was found in the wrack line of Petrel Valley Cove. The bird was un-banded and no obvious cause of death was ascertained.

On 7 June a large gathering of juvenile and adult eagles was found feeding on or perched nearby the orca that washed into Sea Lion Cove. This whale would later wash into the kelp beds off Rock Platform One where eagles would continue to feed on it. Eventually the whale would wash back into Sea Lion Cove (23 July) but eagles didn’t seem as interested in the whale at this point (too decayed perhaps).

On 26 August a potential nest site was discovered just inland of Phallic Rock (54°10’55.38” N, 164°50’00.52” W). An adult was present next to an area of matted grass with guano white wash. It is unclear if any nest attempts were made at this location this season. This site can’t be viewed from any pole or trail.

Three eagle nests or territories were located during the season:

1) On the first spire of Four Sisters (54°11’20.72” N, 164°49’53.42” W): two adults with unknown nest contents were observed on 19 May. One chick appeared on 15 June; a tending adult was observed collecting dried nest material on this date as well. A second chick was observed on 18 June. Feathers were observed on chicks on 11 July. The adults seemed less territorial this season when we hiked past their nest, but there were still territorial when birds approached close. Chicks appeared mostly feathered on 20 July and fully feathered on 24 July. One chick was not observed at the nest site on 4 August but reappeared on 6 August and then both chicks fledged on 17 August. One chick was still hanging around nest site as of 29 August.

2) On southern cliff edge of Big West (54°10’56.00” N, 164°50’58.05” W): on 24 May an adult bird was observed on a nest in an incubation posture. On 5 June at least one chick was viewed at this nest site. A fully feathered chick was observed on 17 July; 95% confident that this nest only hatched one chick. The chick was no longer observed at the nest site starting on 24 July (gone at seven weeks) which is lower than average fledging age conventions of eight to 14 weeks and as a result this nest was considered a failed nesting attempt.

3) In middle of Rocky Platform Two (54°11’16.98” N, 164°49’27.49” W): on 27 May to 1 July an adult bird was observed making typical territory defense calls and flight patterns. This is the same area an adult bird made these displays in previous field seasons. It is unknown if a nest existed at this location this season, but a territory was definitely being held throughout the season.

Short-eared owl (*Asio flammeus*). Uncommon resident non-breeder. Date range of observations: 27 May to 6 July. Range of individuals observed: one; always observed as lone individuals. Location of observations: Petrel Valley and east end of the island. Activity observed: foraging and potentially nesting. Owl pellets were found in Petrel Valley as well as several storm-petrel carcasses or parts that were likely from predation events. On 23 June a lone bird was observed vocalizing in the vicinity of storm-petrel productivity plot 11. Further, on 6 July a bird was flushed from the ground in the vicinity of Upland Junction Trail a quarter ways down the trail from leaving storm-petrel productivity plot 11. When flushed the bird promptly started vocalizing as it flew from the area. A nest was potentially in this area but it was never located.

Peregrine falcon (*Falco peregrinus*). Uncommon breeder. Date range of observations: 19 May to 31 August. Range of individuals observed: one to four; generally observed individually or in pairs. Location of observations: found across the island (including Big West) but more commonly observed at Arch's Cove and the southeast end of the island (pole 51). First chick: 13 June. First fledgling: 10 August (pole 89 nest). Activity observed: nesting and hunting.

On 13 June an active nest was located on the cliff face below pole 89 (54°10'57.95" N, 164°49'24.35" W). One adult was observed guarding three downy chicks that were huddled together; chicks were roughly baseball sized. On 30 June all three chicks were showing lots of feathers including primaries and retrice's. Three birds were observed calling and chasing (looked very molty) each other on 3 July; two birds were observed doing the same on 3 August. On 10 August no chicks or adults were observed at the pole 89 nest site. Two juvenile birds were observed on 11 August chasing black oystercatchers at Big West, New Camp Beach, and Upland Access. On this day oystercatcher chicks and adults at New Camp Beach and Upland Access were repeatedly chased with some birds downing in the water; no oystercatchers were killed. Three falcons (likely from pole 89 nest) were observed on 17 August by pole 51.

Common raven (*Corvus corax*). Common probable breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to seven; generally observed individually or small groups. Location of observations: found across the island (including Little West, Big West, and East Island); predominately found in coastal areas of the island. First chick: 24 May. First fledgling: 5 June. Activity observed: nesting and foraging.

On 24 May a nest site was discovered in Raven's Gulch (54°10'53.16" N, 164°50'44.32" W) with four near fledglings on the cliff ledge making what sounded like begging calls with an adult flying nearby calling. By 5 June this nest site was empty of fledglings but one bird was perched nearby begging. On 20 June six birds were observed on New Camp Beach picking through washed up kelp; we assumed these were recently fledged chicks and adults from the Raven's Gulch nest. The complete family unit was last seen in Pleasure Cove and at Pleasure Point on 3 July. Following the last observation of the complete family unit only three gawky birds (assume same family unit) were seen together on the west end of the island in Raven's Gulch area.

On 28 May and on several other occasions individuals were observed feeding on ancient murrelet carcasses in and around ancient murrelet productivity plots at the cabin, New Camp Beach, Upland Access, and Pleasure Cove. It appeared these individuals were looking for ancient murrelet burrows where they could pull an incubating bird out. Evidence was found of birds having dug open burrow entrances (see ancient murrelet account for more details).

Additionally, birds were often observed foraging in rotting kelp on New Camp Beach. Birds were also observed consuming tufted puffin eggs. On 31 August one dead, moderately fresh, unknown-age individual was found above the wrack line on Little West.

Bank swallow (*Riparia riparia*). Uncommon migrant. Date range of observations: 2 June to 20 August. Range of individuals observed: one to seven; usually observed in groups. Location of observations: around the cabin, Petrel Valley, Old Camp Beach, along Upland Access Trail, and Ivory Cove. Activity observed: foraging and migration. A group of seven birds was observed on 2 June in Petrel Valley. On 16 June four adult swallows were observed foraging over the creek in front of the cabin for roughly an hour. Photos are available.

Pacific wren (*Troglodytes pacificus*). Common breeder. Date range of observations: 19 May to 31 August. Range of individuals observed: one to seven; generally observed individually. Location of observations: found across the island; predominately found in coastal areas of the island. Activity observed: nesting and foraging. Wrens were commonly seen throughout the season on beaches and cliffs and foraging in vegetation in the interior of the island. On 30 May two family groups were observed: one in Sea Lion Cove and one along Rocky Platform One.

American pipit (*Anthus rubescens*). Irregular migrant. Date range of observations: 11 August to 29 August. Range of individuals observed: one to at least 11 (maximum on New Camp Beach and Little West); usually observed in groups. Location of observations: New Camp Beach, Upland Access, Old Camp Beach, and Little West. Activity observed: foraging and migration. Daily maximum occurred on 18 August where groups were observed on New Camp Beach and Little West; maximum represents a minimum as more birds likely present. Birds almost always observed foraging amongst kelp of the wrack line. Photos are available.

Gray-crowned rosy finch (*Leucosticte tephrocotis*). Common breeder. Date range of observations: 18 May to 29 August. Range of individuals observed: one to seven; generally observed in pairs. Location of observations: found across the island; predominately found in coastal areas of the island near cliffs, beaches, and coves. Activity observed: nesting and foraging. On 18 May and several other occasions birds were seen foraging in rotting beached kelp.

Savannah sparrow (*Passerculus sandwichensis*). Abundant breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to eight; generally observed as individuals. Location of observations: found across the island but predominately found in coastal areas of the island. First fledgling: 4 July. Activity observed: nesting and foraging. Sparrows were seen regularly throughout the summer on the interior vegetation and beaches (more common on north side of the island). Birds also commonly observed on New Camp Beach foraging in dead kelp of the wrack line; kelp fly larvae seemed a favorable diet item. First fledgling was observed 4 July in Petrel Valley. It seemed like there were more birds this season than the previous two seasons.

Fox sparrow (*Passerella iliaca*). Rare resident non-breeder. One adult bird was observed 17 July behind the cabin as captured on time-lapse photography. Photos are available.

Song sparrow (*Melospiza melodia*). Abundant breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 19 (max observed on passerine transect); generally observed as individuals. Location of observations: found across the island but predominately found in coastal areas of the island. First fledgling: 7 June. Activity observed: nesting and foraging. The daily maximum number of birds observed was on 8 June on a passerine beach transect. Birds often perched and sang from the cabin and various structures around the cabin (lots of pooping). Singing seemed to be significantly less around 15 July. A couple of presumed nests were observed near the cabin by watching individual birds repeatedly disappear into grass in the same places. On 30 June a nest site was found, based on the begging calls of chicks, on a grassy terrace in Petrel Valley Cove; an adult was attending this nest site. On 7 June a fledgling was found on the trail from the cabin down to New Camp Beach. Fledglings commonly observed begging from parents on New Camp Beach. Birds were almost always observed on New Camp Beach foraging in dead kelp of the wrack; kelp fly larvae seemed to be a dominate food item. An interesting diet observation occurred on 13 June where an individual was observed eating intertidal snails.

Golden-crowned sparrow (*Zonotrichia atricapilla*). Casual migrant. An immature sparrow was observed on New Camp Beach on 27 August.

Yellow warbler (*Setophaga petechia*). Casual migrant. On 27 and 28 August a warbler was observed around the cabin. On 27 August a warbler (likely same bird observed at the cabin) was observed at storm-petrel plot 27. Photos are available.

Wilson's warbler (*Cardellina pusilla*). Casual migrant. Dates and locations of observations: 15 August (male in front of the cabin) and 22 August (probable female at the cabin). Range of individuals observed: one. Activity observed: foraging and migration. Photos are available.

MARINE MAMMALS

Sea otter (*Enhydra lutris*). Common breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to four (max observed in Petrel Valley Cove); generally observed as individuals. Location of observations: predominately observed in kelp beds and intertidal zone along north shore though otters were often observed in Arch's Cove and Petrel Valley Cove. Activity observed: foraging and resting (hauled out in intertidal zone or wrapped in kelp). Otters were seen as individuals or in groups of two to three on at least 29 occasions. The first otter was observed on 18 May off New Camp Beach and the last otter on 31 August in kelp beds off Petrel Valley Cove. A daily maximum of four individuals was observed on 14 August in kelp beds off Petrel Valley Cove. No pups were ever observed. Pairs of otters were sometimes observed playing and/or rolling around each other in nearshore waters. On 29 August two individuals were observed swimming with each other off New Camp Beach consuming octopus parts laid across their bellies. On a circumnavigation survey of Aiktak Island on 6 August no otters were observed. On the same day a survey of Kaligagan Island by Refuge staff (USFWS, unpublished data) found a congregation of otters (total of 12 adults and 7 pups) at northwest point kelp beds.

Steller sea lion (*Eumetopias jubatus*). Common resident non-breeder. Date range of observations: 18 May to 31 August. Range of individuals observed: one to 80 (max observed on Sea Lion Rock); generally observed in groups. Location of observations: most commonly observed hauled out on Sea Lion Rock, Round Island, and in Pleasure Cove. First pup: 8 June. Activity observed: commuting and resting (hauled out on beaches and intertidal zone). Individuals and small groups of females, sub-adult males, and bulls were frequently hauled out at Pleasure Cove and Old Camp Beach. The number of individuals hauled out on island coasts (excluding outer islets) was similar to the previous season. The maximum number of individuals observed on or around the island (excluding outer islets) was five as observed on 18 May and 18 June; maximum count including outer islets was on 20 May.

On 8 June a lone pup was found on Rocky Platform One wandering in the intertidal zone all the while calling out; the pup appeared lost and alone. This pup would appear on New Camp Beach later on the same day. On 26 June a dead pup was found at Pleasure Point on Old Camp Beach, it is assumed this was the lost pup earlier observed. As of 29 August sea lions could still be heard at Ugamak rookeries. One branded sea lion (A497) was observed this season in Pleasure Cove on 4 August.

Harbor seal (*Phoca vitulina*). Common breeder. Date range of observations: 19 May to 27 August. Range of individuals observed: one to 19 (max observed in Harbor Barbor); generally observed in groups hauled out in intertidal zones. Location of observations: most commonly observed hauled out or swimming in Harbor Barbor, Petrel Valley Cove, and East Island. First pup: 8 June. Activity observed: foraging, resting (in intertidal zone), and breeding. Individuals and groups of two to 19 were seen in the water or hauled out in the intertidal zone throughout the season at various locations around the island.

The first pup (presumed) was observed on 8 June in Harbor Barbor in the intertidal zone with several other adult seals. Pups identified based on color (uniform fresh color usually starting off blackish and transitioning to tan), size (shorter and very rotund), and proximity to a large adult seal (assumed mother). Pups also often easily identified based on unique behaviors including various modes of play. On 15 June three pups were identified hauled out in Harbor Barbor and 18 June a pup was identified in Petrel Valley Cove in the nearshore waters piggy-backing on a parent (this pup was uniquely colored). The pup identified in Petrel Valley Cove was sometimes seen in Harbor Barbor. A total of four pups were identified this season.

An interesting behavior was observed on 23 July off New Camp Beach wherein an adult seal was slapping the water's surface and grabbing kelp and thrashing it; it is unclear what the purpose of this display was.

Orca (*Orcinus orca*). Rare migrant. Dates and locations of observations: 27 August (Petrel Valley Cove and Ugamak Island) and 29 August (channel). Range of individuals observed: two to four. Activity observed: foraging and migration. On 27 August a pod consisting of two males, one female, and one smaller individual was observed commuting past Petrel Valley Cove, around Southwest Slope, past Big West, and headed to the western end of Ugamak Island. There were potentially two additional small individuals as part of this pod but this is uncertain. A second observation occurred on 29 August where one male and one female whale were observed in channel between Aiktak and Ugamak islands on east end of Aiktak.

INVERTEBRATES

Jelly fish (unknown species). Common migrant. Silver dollar shaped jelly fish were observed as well another species that was more bell shaped and appeared to be partly bioluminescent. On 8 June and on several other dates jellies (primarily silver dollar shaped ones) were found washed into the intertidal zone and/or on the beach of New Camp Beach through Sea Lion Cove. Photos are available.

Bumblebee (unknown species). Abundant breeder. Date range of observations: 8 June to 21 August. Range of individuals observed: one to roughly 50; observed as individuals. Location of observations: Petrel Valley and anywhere else flowers present. Activity observed: foraging and breeding. On 8 June many bees where observed in Petrel Valley feeding on the many flowers, especially purple ones. By 23 June even more flowers were open. By 2 July bees still present but fewer observed. Best observations of bees occurred earlier in season on warm, sunny, low wind days. Species unknown but assume more than one species present. An unknown fly species was found mimicking (coloration and body shape/design) bumblebees on 15 August. Photos and specimen are available.

Kelp flies (*Coelopa frigida*). Abundant breeder. Date range of observations: 18 May to 21 August. Range of individuals observed: one to 1000's; always observed in groups. Location of observations: coastal areas of the island where dead kelp present in the wrack line. Activity observed: feeding and breeding. Large swarms of flies present upon arrival to the island and on subsequent warm, sunny, low wind days. On 18 and 19 May glaucous-winged gulls and ravens were observed foraging on kelp fly larvae found in kelp or sand of New Camp Beach. Flies seemed to decrease in number after mid-June but still present in good numbers as larvae within rotting or buried kelp of the New Camp Beach wrack line.

Seabird tick (*Ixodes uriae*). Abundant breeder. Date range of observations: 9 June to 27 August. Range of individuals observed: one to 1000's; observed as groups of individuals. Location of observations: anywhere tufted and horned puffins breeding; some found in storm-petrel colonies as well. Activity observed: foraging and breeding. On 9 July the first large patch of ticks (as seed ticks) was observed in tufted puffin productivity plot C; large congregations of ticks were observed through 15 August. On 15 July large (full size) and small (seed) ticks were observed. By 27 August fewer ticks observed. At least two tufted puffin growth chicks had ticks removed from feet on multiple occasions.

Table 104. Observations and breeding status of birds and selected mammals at Aiktak 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).

Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder
X/B?=bred in other years but not specified in current year

Species	2000	2001	2002	2003[a]	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Greater white-fronted goose	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Emperor goose	X	X	X	-	X	X	X	X	-	X	X	X	X	-	X	X	X	X
Snow goose	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Brant	-	-	-	-	X	X	-	X	-	-	-	-	-	-	-	-	-	-
Aleutian cackling goose	-	X	X	-	X	X	X	X	X	X	X	-	X	X	-	X	X	X
Gadwall	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Eurasian wigeon	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
American wigeon	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Mallard	-	-	-	-	-	X	X	-	-	X	-	X	-	X	-	X	X	-
Northern shoveler	-	X	X	X	X	-	-	-	-	X	-	-	-	-	-	-	-	-
Northern pintail	X	X	X	-	-	X	-	X	X	-	X	-	X	-	-	-	-	X
Green-winged teal	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
King eider	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Common eider	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
Harlequin duck	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surf scoter	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
White-winged scoter	-	-	X	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-
Black scoter	-	-	-	-	-	-	X	-	X	X	-	-	-	-	X	-	-	-
Long-tailed duck	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Common merganser	-	-	-	-	-	X	-	X	-	-	-	-	X	-	-	-	-	-
Red-breasted merganser	X	X	X	-	X	X	X	X	-	X	X	X	-	-	X	X	X	X
Rock ptarmigan	-	-	-	X	X	-	X	-	X	X	X	-	-	-	-	-	-	-
Red-necked grebe	-	-	-	-	-	X	-	X	X	-	-	-	-	-	-	-	-	-
Oriental cuckoo	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Sandhill crane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X
Black oystercatcher	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Pacific golden-plover	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Semipalmated plover	X	-	-	X	X	X	X	X	X	X	X	X	X	-	X	X	-	X
Bristle-thighed curlew	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	-	-	-
Bar-tailed godwit		X	-	-	-	-	-	-	-	-	-	-	-	X	X	-	X	-
Ruddy turnstone	X	X	X	-	-	X	X	X	X	X	X	-	X	X	X	-	X	X
Dunlin	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Rock sandpiper	X	X	X	-	X	P	X	X	X	X	X	X	X	X	X	-	X	X
Least sandpiper	X	X	X	X	X	P	P	P	P	P	P	X	P	P	P	X	X	X
Semipalmated sandpiper	-	-	-	-	-	-	-	X	-	-	-	-	X	-	X	X	-	-
Western sandpiper	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-

Table 104 (continued). Observations and breeding status of birds and selected mammals at Aiktak 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).

Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder
X/B?=bred in other years but not specified in current year

Species	2000	2001	2002	2003[a]	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Short-billed dowitcher	X	X	X	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-
Terek sandpiper	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gray-tailed tattler	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Wandering tattler	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X
Lesser yellowlegs	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-	-	-	-
Wood sandpiper	-	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Red-necked phalarope	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Red phalarope	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Common murre	B	B	X	B	X	X	B	B	B	B	B	B	B	B	B	B	B	X
Thick-billed murre	B	B	X	B	X	X	B	B	B	B	B	B	B	B	B	B	B	X
Pigeon guillemot	B	X/B?	B	P	P	B	B	B	P	B	B	B	B	P	P	P	P	P
Marbled murrelet	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Ancient murrelet	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Cassin's auklet	-	-	-	-	-	-	-	-	-	B	P	-	-	-	-	-	P	B
Parakeet auklet	X	-	X	-	-	-	-	X	-	X	-	-	-	-	-	-	-	-
Least auklet	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whiskered auklet	-	-	-	-	-	-	-	X	-	P	-	X	P	-	X	-	-	-
Rhinoceros auklet	X	-	-	-	-	X	-	-	-	P	X/B?	-	X	-	-	-	P	B
Horned puffin	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Tufted puffin	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Black-legged kittiwake	-	X	-	-	-	X	X	-	-	X	-	X	-	-	-	X	-	X
Slaty-backed gull	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-	-	-
Glaucous-winged gull	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Glaucous gull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X
Common loon	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-
Northern fulmar	X	-	X	-	X	-	-	X	-	-	-	-	-	-	-	-	-	X
Short-tailed shearwater	-	-	-	-	-	X	X	X	-	-	-	-	-	X	-	-	-	-
Sooty shearwater	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-
Fork-tailed storm-petrel	B	B	B	B	B	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	B	B	B	B	B
Double-crested cormorant	B	X	B	B	B	X	B	B	B	B	B	B	P	B	B	P	P	B
Red-faced cormorant	X	B	B	B	B	X	P	B	B	B	B	B	P	B	B	B	P	B
Pelagic cormorant	B	B	B	B	B	X	B	B	B	B	B	B	P	B	B	B	P	B
Bald eagle	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Northern harrier	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Rough-legged hawk	-	-	-	-	-	-	-	-	-	X	-	-	X	X	-	-	-	-
Golden eagle	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 104 (continued). Observations and breeding status of birds and selected mammals at Aiktak 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).

Codes: B=confirmed breeder, P=probable/possible breeder, X=observed non-breeder
X/B?=bred in other years but not specified in current year

Species	2000	2001	2002	2003[a]	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Short-eared owl	X	P	X	X	X	X	X	X	X	P	X	P	X	P	P	X	X	P
Belted kingfisher	-	-	-	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-
Peregrine falcon	B	B	B	B	B	B	P	B	B	B	B	B	B	X	B	P	P	B
Common raven	P	B	B	B	B	P	P	B	B	B	P	B	B	P	B	P	P	B
Purple martin	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Tree swallow	-	-	-	-	X	X	X	-	X	-	X	-	-	-	-	-	-	-
Violet-green swallow	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank swallow	X	X	X	X	X	-	X	X	X	X	X	-	X	B	X	X	X	X
Cliff swallow	-	X	-	-	-	-	-	X	-	-	X	-	-	-	X	-	-	-
Barn swallow	-	-	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Pacific (formerly winter) wren	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Ruby-crowned kinglet	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American pipit	X	X	X	-	-	X	X	X	X	X	X	X	X	-	X	-	X	X
Gray-crowned rosy-finch	B	B	B	X	X	B	B	B	B	B	P	B	B	B	B	B	B	P
Lapland longspur	-	-	-	-	X	X	-	-	X	X	-	-	-	-	-	-	-	-
Snow bunting	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Savannah sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Fox 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	B	B	B	B	B
White-crowned sparrow	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Golden-crowned sparrow	X	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	X
Yellow warbler	-	-	-	-	-	-	-	-	-	X	-	-	X	-	X	-	-	X
Wilson's warbler	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X	X	X
Sea otter	X	X	X	X	X	X	X	B	X	X	X	X	X	P	X	X	B	X
Steller sea lion	?	?	?	X	X	X	X	X	X	B	X	X	X	X	X	X	X	X
Northern elephant seal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Harbor seal	X/B?	X/B?	X/B?	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Minke whale	-	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-
Humpback whale	X	-	-	-	X	-	-	X	X	X	X	X	X	X	X	-	-	-
Orca	X	-	-	-	X	X	X	X	X	X	X	X	-	-	-	X	-	X
Gray whale	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Harbor porpoise	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
Porpoise spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Observation dates	16 Jun-12 Sep	16 May-11 Sep	12 May-11 Sep	18 May-10 Jul	10 May-28 Aug	10 May-10 Sep	16 May-3 Sep	24 May-1 Sep	21 May-31 Aug	21 May-4 Sep	21 May-3 Sep	23 May-5 Sep	21 May-2 Sep	24 May-30 Aug	21 May-31 Aug	22 May-1Sep	23 May-2 Sep	18 May -1 Sep

[a]Data may be incomplete in 2003 due to the early departure of field crew (10 July).

Table 105. First flowering dates of plants identified on Aiktak 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 2015.

Family	Species	2003	2004	2005	2006	2007	2008	2009
Lycopodiaceae	*Lycopodium selago selago*	-	-	16 May	late May	-	-	-
	Lycopodium annotinum annotinum	-	-	16 May	late May	-	-	-
Equisetaceae	*Equisetum arvense*	3 Jun	-	18 Jun	27 May	late May	early Jun	8 Jun
Ophioglossaceae	*Botrychium lunaria*	-	-	-	-	-	-	28 May
Athyriaceae	*Cystopteris fragilis fragilis*	-	-	early Jun	1 Jun	-	-	8 Jun
	Athyrium filix-femma cyclosorum	-	-	early Jun	early Jun	-	-	8 Jun
Graminae	*Poa* spp.	22 May	15 Jul	-	-	-	-	-
	Elymus arenarius mollis	20 Jun	10 Jul	-	-	early Jul	12 Jul	early Jul
	Calamagrostis canadensis	25 Jun	15 Jul	-	-	-	-	Jul
	Festuca rubra aucta	14 Jun	15 Jul	-	-	-	-	Jul
	Phleum commutatum americanum	early Jun	10 Jul	-	-	-	-	2 Jul
	Hordeum brachyantherum	-	17 Jul	-	-	-	-	Jun
Cyperacea	*Eriophorum russeolum* spp.	15 Jun	26 Jun	5 Jul	18 Jun	-	late Jun	-
	Eriophorum angustifolium subarcticum	-	27 Jun	-	-	-	-	-
	Carex macrochaeta	-	1 Jun	-	-	-	-	2 Jun
	Carex saxatilis laxa	-	1 Jun	-	-	-	-	-
	Carex spp.	4 Jun	-	-	-	-	7 Jun	-
Juncaceae	*Luzula multiflora multiflora*	-	1 Jul	-	-	-	-	-
	Luzula multiflora Kobayasii	-	1 Jul	-	-	-	-	-
	Juncus arcticus sitchensis	-	1 Jul	-	-	-	-	-
Liliaceae	*Fritillaria camschatcensis*	8 Jun	12 Jun	4 Jun	6 Jun	27 Jun	26 Jun	12 Jun
	Streptopus amplexifolius	-	-	-	-	-	-	-
Orchidaceae	*Platanthera convallariaefolia*	2 Jul	1 Jul	early Jul	25 Jun	27 Jun	2 Jul	23 Jun
	Platanthera dilatata	19 Jun	16 Jun	-	-	-	-	-
	Listera chordata	5 Jun	1 Jun	-	-	-	-	-
	Dactylorhiza aristata	3 Jun	29 May	4 Jun	27 May	26 Jun	13 Jun	28 May
Salicaceae	*Salix arctica crassijulis*	19 Jun	26 Jun	-	14 Jun	26 May	22 Jun	-
	Salix reticulata	-	-	-	29 Jul	29 Jul	-	-
Polygonaceae	*Oxyria digyna*	-	-	-	-	27 Jun	-	-
	Rumex fenestratus	-	3 Jul	early Jul	20 Jun	late Jun	2 Jul	29 Jun
	Polygonum viviparum	-	-	-	23 Jul	1 Aug	25 Jul	7 Jul
Portulaceae	*Claytonia sibirica*	<18 May	13 May	16 May	24 May	29 May	3 Jun	24 May
	Montia fontana Fontana	-	-	-	-	-	-	Jun
Caryophyllaceae	*Honkenya peploides major*	-	13 May	30 May	19 Jun	-	9 Jun	13 Jul
	Cerastium beeringianum grandiflorum	-	12 Jun	-	27 May	late May	13 Jun	10 Jun
	Cerastium fischerianum	-	-	-	-	-	-	<30 Jun
	Moehringia lateriflora	-	-	-	-	-	-	1 Jul
	Stellaria media	-	-	-	-	late Jun	-	24 May
	Stellaria ruscifolia	-	-	-	31 May	-	-	-
	Stellaria sitchana bongardiana	-	-	-	13 Aug	-	-	7 Jul
Ranunculaceae	*Caltha palustris asarifolia*	-	17 May	24 May	28 May	late Jun	11 Jun	8 Jun
	Aconitum maximum	-	16 Jul	-	14 Jul	-	25 Jul	22 Jul
	Aconitum delphinifolium delphinifolium	-	16 Jul	mid Jul	mid Jul	2 Aug	late Jul	25 Jul
	Ranunculus occidentalis	-	-	-	-	-	-	5 Jun
	Ranunculus eschscholtzii	-	-	-	-	-	-	8 Jun
	Ranunculus spp.	-	15 Jun	mid Jun	1 Jun	mid Jun	3 Jun	-
	Anemone narcissiflora villosissiflora	-	13 May	19 May	24 May	24 May	31 May	26 May
Cruciferae	*Draba hyperborea*	26 May	13 Jun	-	26 May	-	1 Jun	22 May
	Draba borealis	26 May	25 May	late May	27 May	-	early Jun	17 Jun
	Draba nivalis	-	-	-	14 Jun	-	-	-
	Cardemine umbellata	15 Jun	15 Jun	5 Jul	31 May	mid Jun	mid Jul	23 May
	Arabis lyrata	-	15 Jun	-	-	-	-	-
	Cochlearia officialis oblongifolia	-	-	-	28 Jul	-	-	-

Table 105 (continued). First flowering dates of plants identified on Aiktak 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 2015.

Family	Species	2010	2011	2012	2013	2014	2016	2017
Lycopodiaceae	*Lycopodium selago selago*	-	-	late May	-	late May	-	-
	Lycopodium annotinum annotinum	-	-	late May	-	late May	-	-
Equisetaceae	*Equisetum arvense*	early Jun	28 May	9 Jun	4 Jun	late May	24 May	19 May
Ophioglossaceae	*Botrychium lunaria*	-	-		-	-	-	-
Athyriaceae	*Cystopteris fragilis fragilis*	-	-		2 Jun	-	-	-
	Athyrium filix-femma cyclosorum	-	-		2 Jun	-	-	-
Graminae	*Poa* spp.	-	-	7 Jun	-	-	-	-
	Elymus arenarius mollis	-	-	22 Jul	-	-	-	-
	Calamagrostis canadensis	-	-	late Jul	-	-	-	-
	Festuca rubra aucta	-	-	-	-	-	-	-
	Phleum commutatum americanum	-	-	25 Jun	-	-	-	-
	Hordeum brachyantherum	-	-	-	-	-	-	-
Cyperacea	*Eriophorum russeolum* spp.	6 Jul	2 Jul	-	-	-	19 Jun	>5 Jun
	Eriophorum angustifolium subarcticum	-	-	4 Jul	-	23 Jun	17 Jun	16 Jun
	Carex macrochaeta	-	-	22 Jun	-	1 Jun	-	-
	Carex saxatilis laxa	-	-	-	1 Jun	-	-	-
	Carex spp.	-	-	-	-	-	-	-
Juncaceae	*Luzula multiflora multiflora*	-	-	-	-	-	-	-
	Luzula multiflora Kobayasii	-	-	-	-	-	-	-
	Juncus arcticus sitchensis	-	-	-	-	-	-	-
Liliaceae	*Fritillaria camschatcensis*	23 Jun	15 Jun	24 Jun	10 Jun	29 May	1 Jun	8 Jun
	Streptopus amplexifolius	6 Jul	-	24 Jul	22 Jul	26 Jun	<1 Sep	>16 Jun
Orchidaceae	*Platanthera convallariaefolia*	6 Jul	23 Jun	4 Jul	24 Jun	9 Jun	10 Jun	16 Jun
	Platanthera dilatata	-	-	-	-	-	-	<1 Aug
	Listera chordata	-	-	-	-	-	-	-
	Dactylorhiza aristata	9 Jun	28 May	9 Jun	1 Jun	24 May	24 May	24 May
Salicaceae	*Salix arctica crassijulis*	23 Jun	14 Jun	23 Jun	3 Jul	24 May	12 Jun	5 Jun
	Salix reticulata	-	-	2 Jul	-	23 Jun	-	-
Polygonaceae	*Oxyria digyna*	-	-	-	-	-	-	-
	Rumex fenestratus	6 Jul	15 Jun	30 Jun	29 Jun	1 Jun	19 Jun	23 Jun
	Polygonum viviparum	26 Jul	14 Jul	20 Jul	17 Jun	20 Jul	22 Jun	<10 Jul
Portulaceae	*Claytonia sibirica*	9 Jun	26 May	7 Jun	27 May	23 May	23 May	<18 May
	Montia fontana Fontana	-	-	-	-	-	-	-
Caryophyllaceae	*Honkenya peploides major*	-	-	1 Aug	4 Aug	10 Jun	24 Jun	30 Jun
	Cerastium beeringianum grandiflorum	23 Jun	28 May	29 Jun	6 Jun	1 Jun	24 May	24 May
	Cerastium fischerianum	-	-	-	-	-	-	-
	Moehringia lateriflora	-	-	-	-	-	-	-
	Stellaria media	-	28 May	-	-	-	-	-
	Stellaria ruscifolia	-	-	-	-	-	-	-
	Stellaria sitchana bongardiana	-	-	12 Aug	-	1 Jun	-	-
Ranunculaceae	*Caltha palustris asarifolia*	23 Jun	2 Jun	12 Jun	3 Jun	24 May	23 May	26 May
	Aconitum maximum	6 Aug	20 Jul	31 Jul	23 Jul	5 Jul	29 Jun	7 Jul
	Aconitum delphinifolium delphinifolium	early Aug	20 Jul	2 Aug	-	13 Jul	13 Jul	21 Jul
	Ranunculus occidentalis	-	14 Jun	29 Jun	-	1 Jun	23 May	-
	Ranunculus eschscholtzii	-	-	-	6 Jun	-	-	-
	Ranunculus spp.	9 Jun	-	29 Jun	-	1 Jun	23 May	5 Jun
	Anemone narcissiflora villosissiflora	9 Jun	<22 May	9 Jun	24 May	23 May	23 May	<18 May
Cruciferae	*Draba hyperborea*	1 Jul	24 May	31 May	6 Jun	24 May	23 May	22 May
	Draba borealis	9 Jun	3 Jun	12 Jun	-	24 May	-	31 May
	Draba nivalis	-	-	-	-	-	1 Jun	-
	Cardemine umbellata	-	13 Jul	8 Jun	6 Jun	2 Jun	24 May	5 Jun
	Arabis lyrata	-	-	-	-	-	-	-
	Cochlearia officialis oblongifolia	-	28 Jul	3 Aug	-	1 Jul	-	-

Table 105 (continued). First flowering dates of plants identified on Aiktak 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 2015.

Family	Species	2003	2004	2005	2006	2007	2008	2009
Saxifragaceae	*Saxifraga punctata insularis*	25 Jun	25 Jun	-	19 Jun	1 Jul	15 Jun	2 Jul
	Saxifraga bracteata	5 Jun	5 Jun	-	31 May	-	20 Jun	28 May
	Parnassia palustris	-	-	-	8 Aug	-	-	-
	Parnassia kotzebuei	-	-	-	27 Jun	-	-	30 Jul
	Chrysosplenium wrightii	-	-	-	-	-	-	13 Jul
Rosaceae	*Rubus arcticus stellatus*	14 Jun	30 May	19 Jun	6 Jun	late Jun	3 Jul	16 Jun
	Potentilla villosa	30 May	10 Jun	16 Jun	6 Jun	mid Jun	20 Jun	10 Jun
	Geum macrophyllum	19 Jun	16 Jun	-	27 Jun	26 Jul	11 Jul	26 Jun
	Sanguisorba stipulata	-	20 Jun	29 Jul	-	mid Jul	-	2 Aug
Leguminosae	*Lupinus nootkatensis*	<18 May	13 May	25 May	28 May	28 May	13 Jun	5 Jun
Geraniaceae	*Geranium erianthum*	early Jun	29 May	4 Jun	2 Jun	27 Jun	29 Jun	23 Jun
Violaceae	*Viola langsdorffii*	23 May	17 May	31 May	28 May	29 May	9 Jun	28 May
Onagraceae	*Epilobium glandulosum*	7 Jul	6 Jul	-	4 Jul	8 Aug	20 Jul	19 Jul
	Epilobium treleaseanum	-	-	-	28 Jul	-	-	-
	Epilobium angustifolium	-	14 Aug	6 Aug	29 Jul	-	28 Aug	15 Aug
	Epilobium behringianum	-	-	27 Jul	-	-	-	-
	Epilobium hornemannii	-	-	27 Jul	-	-	-	-
	Epilobium leptocarum	-	29 Jul	-	-	-	-	-
	Epilobium sertulatum	-	-	-	-	-	-	16 Jul
Apiaceae	*Heracleum lanatum*	25 Jun	2 Jul	5 Jul	11 Jul	13 Jul	15 Jul	7 Jul
	Angelica lucida	15 Jun	30 Jun	5 Jul	28 Jun	1 Jul	10 Jul	29 Jun
	Ligusticum scoticum-Hultenii	27 Jun	30 Jun	late Jun	-	26 Jul	7 Aug	late Jul
	Conioselinum chinense	-	20 Jul	4 Aug	28 Jul	10 Aug	19 Aug	18 Jul
Ericaceae	*Rhododendron camtschaticum*	7 Jul	26 Jun	8 Jul	17 Jul	23 Jul	31 Jul	16 Jul
Primulaceae	*Trientalis europaea arctica*	25 Jun	30 Jun	5 Jul	14 Jun	-	11 Jul	30 Jun
	Androsace chameajasme Lehmanniana	8 Jun	7 Jun	-	-	-	-	20 Jun
	Primula tschuktschorum	-	-	-	-	-	-	21 Jun
Gentianaceae	*Gentiana amarelle acuta* var. Plebeya	-	-	28 Jul	-	-	-	16 Jun
Polemoniaceae	*Polemonium acutiforum*	25 Jun	15 Jun	10 Jul	20 Jun	late Jun	14 Jul	3 Jul
Hydrophyllaceae	*Romanzoffia unalaschecensis*	-	10 Jun	-	-	-	-	21 Jun
Boraginacea	*Mertensia maritima*	-	-	-	-	7 Jul	-	-
Scrophulariaceae	*Mimulua guttatus*	7 Jul	5 Jul	6 Jul	29 Jun	16 Jul	25 Jul	14 Jul
	Pedicularis langsdorffii langsdorffii	15 Jun	23 Jun	15 Jun	22 Jun	14 Jul	11 Jul	14 Jul
	Veronica stelleri	11 Jun	11 Jun	-	-	-	29 Jun	23 Jun
	Veronica wormskjoldii	-	-	-	15 Jun	-	-	-
	Veronica serpyllifolia	-	-	-	-	-	-	-
	Castilleja unalaschcenis	8 Jun	15 Jun	5 Jul	9 Jun	30 Jun	11 Jul	23 Jun
	Rhinanthus minor boreales	-	27 Jul	29 Jul	8 Aug	8 Aug	12 Aug	13 Aug
	Lagotis glauca	-	-	-	8 Jun	-	25 Jun	15 Jun
Rubiaceae	*Galium aparine*	-	26 Jun	5 Jul	23 Jul	-	24 Jul	13 Jul
	Galium triflorum	-	-	-	-	-	-	-
Campanulaceae	*Campanula lasiocarpa lasiocarpa*	-	28 Jul	1 Aug	23 Jul	-	5 Aug	14 Jul
	Campanula chamissonis	-	-	-	30 Jul	27 Aug	-	-
Asteraceae	*Petasites frigidus*	25 Jun	17 May	-	31 May	late May	23 May	22 May
	Achillea borealis	15 Jun	2 Jun	-	19 Jun	27 Jun	11 Jul	11 Jul
	Senecio pseudo-arnica	3 Jul	17 Jul	7 Jul	10 Jul	23 Jul	20 Jul	13 Jul
	Taraxacum trigonolobum	15 Jun	23 Jun	30 Jun	13 Jun	22 Jul	3 Jul	19 Jun
	Erigeron peregrinus	7 Jul	2 Jul	6 Jul	29 Jun	-	19 Jul	7 Jul
	Anaphalis margaritacea	-	-	29 Jul	25 Jul	18 Aug	12 Aug	14 Jul
	Solidago multiradiata	-	1 Aug	-	22 Aug	-	-	16 Aug

Table 105 (continued). First flowering dates of plants identified on Aiktak 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 2015.

Family	Species	2010	2011	2012	2013	2014	2016	2017
Saxifragaceae	*Saxifraga punctata insularis*	6 Jul	12 Jul	21 Jun	6 Jul	11 Jun	10 Jun	7 Jun
	Saxifraga bracteata	20 Jun	4 Jun	7 Jun	-	25 May	1 Jun	-
	Parnassia palustris	-	-	11 Aug	-	-	22 Jul	2 Aug
	Parnassia kotzebuei	-	-	-	-	-	-	-
	Chrysosplenium wrightii	10 Jul	-	-	-	-	-	-
Rosaceae	*Rubus arcticus stellatus*	-	3 Jun	23 Jun	23 Jun	27 May	25 May	31 May
	Potentilla villosa	6 Jul	28 May	21 Jun	1 Jun	6 Jun	23 May	25 May
	Geum macrophyllum	-	-	22 Jun	29 May	24 May	< 17 Jun	9 Jun
	Sanguisorba stipulata	-	-	7 Aug	late Jul	25 Jul	22 Jul	14 Jul
Leguminosae	*Lupinus nootkatensis*	9 Jun	26 May	12 Jun	6 Jun	23 May	23 May	28 May
Geraniaceae	*Geranium erianthum*	23 Jun	2 Jun	24 Jun	6 Jun	30 May	25 May	24 May
Violaceae	*Viola langsdorffii*	9 Jun	22 May	9 Jun	1 Jun	23 May	24 May	24 May
Onagraceae	*Epilobium glandulosum*	-	13 Jul	23 Jul	6 Jul	25 Jun	1 Jul	9 Jul
	Epilobium treleaseanum	-	-	-	-	-	17 Jul	1 Jul
	Epilobium angustifolium	-	24 Aug	-	mid Aug	23 Jun	22 Jul	4 Aug
	Epilobium behringianum	-	-	-	-	-	-	-
	Epilobium hornemannii	-	-	-	-	-	-	-
	Epilobium leptocarum	-	-	-	-	-	-	-
	Epilobium sertulatum	>3 Sep	-	-	-	-	-	-
Apiaceae	*Heracleum lanatum*	19 Jul	6 Jul	16 Jul	mid Jul	15 Jun	17 Jun	23 Jun
	Angelica lucida	early Jul	15 Jun	15 Jul	mid Jul	9 Jun	3 Jun	20 Jun
	Ligusticum scoticum-Hultenii	-	26 July	11 Jun	mid Jul	8 Jun	28 Jun	19 Jul
	Conioselinum chinense	4 Aug	6 Aug	16 Jul	mid Jul	15 Jun	19 Jun	29 Jul
Ericaceae	*Rhododendron camtschaticum*	3 Aug	26 Jul	3 Aug	late Jul	3 Jul	24 Jun	6 Jul
Primulaceae	*Trientalis europaea arctica*	-	29 Jun	7 Jul	-	17 Jun	28 Jun	8 Jun
	Androsace chameajasme Lehmanniana	1 Jul	-	-	-	-	19 Jun	4 Jun
	Primula tschuktschorum	-	-	21 Jun	-	-	-	-
Gentianaceae	*Gentiana amarelle acuta* var. Plebeya	-	3 Aug	14 Aug	mid Aug	26 Jul	17 Jul	15 Aug
Polemoniaceae	*Polemonium acutiforum*	5 Jul	28 Jul	7 Jul	12 Jul	8 Jun	17 Jun	6 Jul
Hydrophyllaceae	*Romanzoffia unalaschecensis*	-	-	12 Jun	6 Jul	25 May	23 May	10 Jun
Boraginacea	*Mertensia maritima*	-	-	-	-	-	-	-
Scrophulariaceae	*Mimulua guttatus*	26 Jul	13 Jul	20 Jul	20 Jul	19 Jun	19 Jun	2 Jul
	Pedicularis langsdorffii langsdorffii	7 Jul	15 Jun	14 Jul	3 Jul	6 Jun	7 Jun	4 Jul
	Veronica stelleri	6 Jul	14 Jun	2 Jul	-	-	-	-
	Veronica wormskjoldii	-	-	-	-	-	-	-
	Veronica serpyllifolia	-	-	-	-	-	-	9 Jun
	Castilleja unalaschcenis	23 Jun	15 Jun	25 Jun	3 Jun	27 May	1 Jun	31 May
	Rhinanthus minor boreales	-	3 Aug	12 Aug	28 Jul	25 Jul	24 Jul	22 Jul
	Lagotis glauca	27 Jun	11 Jun	28 Jun	24 Jun	23 May	24 May	8 Jun
Rubiaceae	*Galium aparine*	-	-	11 Jul	-	20 Jul	25 Jun	30 Jun
Campanulaceae	*Campanula lasiocarpa lasiocarpa*	early Aug	28 Jul	24 Jul	late Jul	4 Jul	15 Jul	-
	Campanula chamissonis	-	-	25 Jun	-	-	-	10 Aug
Asteraceae	*Petasites frigidus*	5 Jul	23 May	29 May	28 May	23 May	24 May	19 May
	Achillea borealis	6 Jul	11 Jul	8 Jul	3 Jul	10 Jun	7 Jun	20 Jun
	Senecio pseudo-arnica	-	7 Jul	20 Jul	11 Jul	20 Jun	20 Jun	9 Jul
	Taraxacum trigonolobum	9 Jun	12 Jun	20 Jul	9 Jul	6 Jun	24 May	5 Jun
	Erigeron peregrinus	19 Jul	13 Jul	10 Jul	9 Jul	6 Jun	19 Jun	4 Jun
	Anaphalis margaritacea	9 Aug	4 Aug	9 Aug	early Aug	11 Jul	24 Jul	5 Aug
	Solidago multiradiata	17 Aug	5 Aug	18 Aug	17 Aug	1 Jul	13 Jul	4 Jul

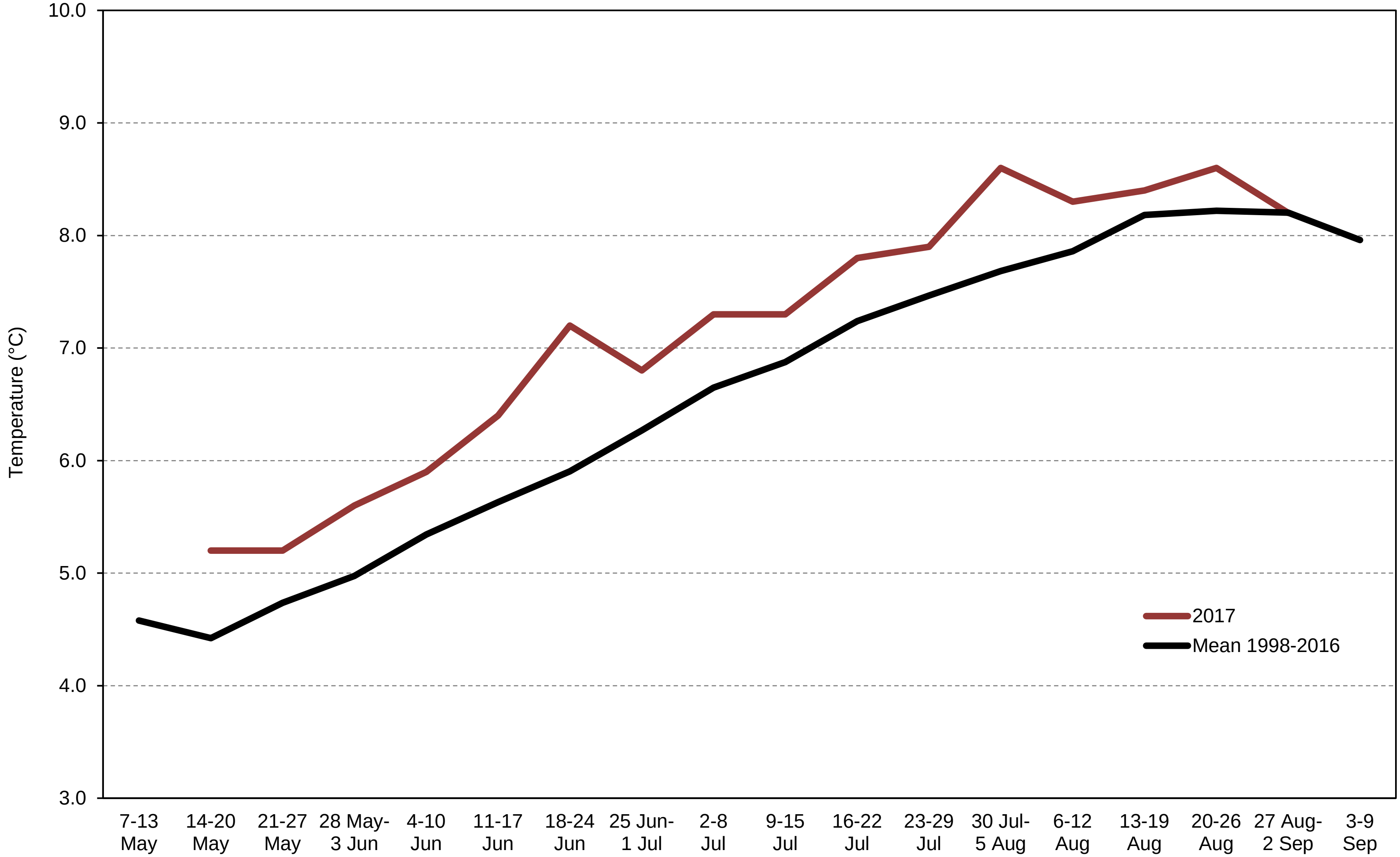

Figure 56. Mean weekly sea surface temperatures (°C) at Aiktak Island, Alaska. No data were collected in 2001.

Table 106. Mean weekly sea surface temperatures (°C) at Aiktak Island, Alaska. No data were collected in 2001.

Week	1998	1999	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
7-13 May	-	-	-	4.4	-	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-
14-20 May	4.8	-	-	4.5	5.3	4.8	-	4.1	-	-	3.6	3.8	-	-	-	-	-	-	5.2
21-27 May	5.1	-	-	4.8	5.5	5.1	-	4.5	3.7	3.8	3.8	4.1	4.9	3.5	4.3	5.7	5.8	6.4	5.2
28 May-3 Jun	5.4	4.1	-	5.2	6.2	5.4	-	5.0	3.9	4.1	4.1	4.5	5.2	3.6	4.5	5.6	6.2	6.7	5.6
4-10 Jun	5.6	4.4	-	5.7	6.5	5.5	-	5.4	4.3	4.3	4.4	5.1	5.3	4.0	5.0	6.5	6.4	7.0	5.9
11-17 Jun	5.8	4.8	5.2	5.9	6.5	6.0	-	5.6	4.6	4.8	5.3	5.3	5.8	4.5	5.3	6.5	6.7	7.2	6.4
18-24 Jun	6.2	4.9	5.3	6.3	6.9	6.0	-	5.7	5.2	5.0	5.4	5.6	6.0	4.9	5.7	6.6	7.3	7.5	7.2
25 Jun-1 Jul	6.6	5.2	5.7	6.7	7.1	6.8	-	6.1	5.2	5.3	5.7	5.8	6.1	5.2	6.1	7.4	7.6	7.9	6.8
2-8 Jul	7.1	5.8	6.0	7.3	7.2	6.9	-	6.8	5.9	5.6	5.9	6.7	6.3	5.5	6.2	7.9	7.9	8.2	7.3
9-15 Jul	7.1	6.2	6.4	7.0	7.7	7.5	-	7.0	6.0	5.8	6.4	6.6	6.6	5.9	6.4	8.0	8.1	8.3	7.3
16-22 Jul	7.6	6.3	6.4	7.6	8.1	7.6	7.5	7.5	7.2	6.0	6.4	6.9	6.8	6.1	6.8	8.4	8.3	8.9	7.8
23-29 Jul	7.7	6.5	7.2	7.5	8.3	7.9	8.2	7.7	6.9	6.6	6.6	7.0	7.0	6.5	7.2	8.5	8.3	8.9	7.9
30 Jul-5 Aug	8.3	6.3	6.9	8.6	8.7	7.4	8.4	7.8	6.9	6.7	6.9	7.5	7.2	6.6	8.0	8.5	8.9	8.8	8.6
6-12 Aug	8.5	6.4	7.2	8.3	8.9	8.1	7.8	7.8	7.6	8.0	7.2	7.2	7.4	6.7	8.1	8.4	9.0	8.9	8.3
13-19 Aug	8.2	7.1	7.7	8.9	8.9	8.1	8.7	8.0	7.8	8.3	6.9	7.6	7.8	7.7	7.9	9.3	9.1	9.4	8.4
20-26 Aug	8.1	7.0	7.7	8.5	8.8	8.8	8.7	8.2	8.0	7.7	7.2	7.8	7.7	7.4	8.5	9.4	9.3	9.2	8.6
27 Aug-2 Sep	-	7.0	7.4	8.8	8.9	-	-	8.6	7.8	7.8	7.0	8.2	7.6	7.7	8.4	8.9	9.2	9.7	8.2
3-9 Sep	-	-	7.9	8.2	9.3	-	-	-	-	-	6.9	-	7.5	-	-	-	-	-	-
10-16 Sep	-	-	7.6	-	9.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

Species	Recipient	Diet type	Years	In 2017 annual report
Black oystercatcher	Chick	Prey pile	2013-2017	Y
Common murre	Adult	Stomach	1983, 1991, 1993-1995	N
Thick-billed murre	Adult	Stomach	1983, 1993, 1994, 1998	N
Pigeon guillemot	Adult	Stomach	1993, 1995	N
Pigeon guillemot	Chick	Bill load	2000, 2005	N
Cassin's auklet	Adult	Stomach	2005	N
Horned puffin	Adult	Stomach	1993-1995	N
Horned puffin	Chick	Bill load	2000, 2005, 2010, 2012, 2014, 2016-2017	Y
Tufted puffin	Adult	Stomach	1990-1995	N
Tufted puffin	Chick	Bill load	1986-1987, 1990-2002, 2004-2017	Y
Glaucous-winged gull	Adult	Stomach	1995	Y
Glaucous-winged gull	Adult	Pellet	2008-2017	Y
Glaucous-winged gull	Chick	Bolus, Regurgitation, Unknown	1996-2002, 2004-2009, 2015-2017	Y
Fork-tailed storm-petrel	Chick	Regurgitation	1997-2001, 2004-2014, (2015-2017)	Y
Leach's storm-petrel	Chick	Regurgitation	1997-1998, 2000-2002, 2004, 2006-2013, (2015-2017)	Y
Double-crested cormorant	Adult	Stomach	1991, 1993, 1994	N
Double-crested cormorant	Chick	Regurgitation	2000	N
Bald eagle	Unknown	Bolus	2004	N
Short-eared owl	Adult	Pellet	2004	N