AMNWR 08/13

BIOLOGICAL MONITORING AT AIKTAK ISLAND, ALASKA IN 2008: SUMMARY APPENDICES

Brie A. Drummond

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 leucorhoa, Oceanodroma furcata,* 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
Aleutian Islands Unit
95 Sterling Hwy, Suite 1
Homer, Alaska 99603

September 2008

Cite as: Drummond, B. A. Biological monitoring at Aiktak Island, Alaska in 2008: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 08/13. Homer, Alaska. 139 pp.

Southern coast of Aiktak Island, Alaska, in early June.

TABLE OF CONTENTS **PAGE**

INTRODUCTION..... 1
STUDY AREA..... 1
METHODS..... 2
INTERESTING OBSERVATIONS..... 7
ACKNOWLEDGMENTS..... 7
REFERENCES..... 8
FIGURES AND TABLES..... 11
Fork-tailed storm-petrel..... 12
Breeding chronology..... 12
Reproductive performance..... 15
Chick growth..... 18
Food habits..... 19
Leach's storm-petrel..... 22
Breeding chronology..... 22
Reproductive performance..... 25
Chick growth..... 28
Food habits..... 29
All storm-petrel species..... 32
Reproductive performance..... 32
Populations..... 35
Morphology..... 38
Band resightings..... 39
Double-crested cormorant..... 40
Reproductive performance..... 40
Red-faced cormorant..... 41
Reproductive performance..... 41
Pelagic cormorant..... 42
Reproductive performance..... 42
All cormorant species..... 43
Reproductive performance..... 43
Populations..... 44
Black oystercatcher..... 45
Breeding chronology..... 45
Reproductive performance..... 48
Populations..... 50
Glaucous-winged gull..... 52
Breeding chronology..... 52
Reproductive performance..... 55
Populations..... 58
Food habits..... 64
Common murre..... 69
Breeding chronology..... 69
Reproductive performance..... 72
Thick-billed murre..... 74
Breeding chronology..... 74
Reproductive performance..... 77
All murre species..... 79
Populations..... 79
Pigeon guillemot..... 83
Populations..... 83
Ancient murrelet..... 87
Breeding chronology..... 87

Reproductive performance....90
Horned puffin....92
Breeding chronology....92
Reproductive performance....95
Chick growth....97
Populations....98
Tufted puffin....101
Breeding chronology....101
Reproductive performance....104
Chick growth....106
Populations....107
Food habits....110
Miscellaneous....116
Boat-based circumnavigations....116
Off-road point count route....118
Beach transects....121
Annotated list....123
Breeding status....133
Breeding chronology....135
Flowering chronology....136
Sea surface temperature....138

INTRODUCTION

Aiktak Island in the eastern Aleutian Islands is one of nine annual ecological monitoring sites in the Alaska Maritime National Wildlife Refuge (AMNWR). The objective at these monitoring sites is to collect baseline status and trends 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 species feeding in both nearshore and offshore waters, surface feeders and divers. By relating data to environmental conditions and information from other sites, ecosystem processes may be better understood.

Brief visits were first made to Aiktak Island to monitor populations of tufted puffins (*Fratercula cirrhata)* and storm-petrels (*Oceanodroma furcata* and *O. leucorhoa*) 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 (Woodward 1997; Howard and Woodward 1999; Thomson and Smith 2000; Stukowski and Oleszczuk 2001; Dykstra and Wynn 2002; Helm and Zeman 2005, 2006; Helm et al. 2007).

The specific monitoring goals in 2008 were to estimate population and/or productivity parameters for 11 indicator species representing 3 major feeding guilds: diving fish-feeders (pelagic, red-faced and double-crested cormorants [Phalacrocorax *pelagicus, P. urile,* and *P. auritus* respectively], common and thick-billed murres [*Uria aalge* and *U. lomvia* respectively] pigeon guillemots [*Cepphus columba*], horned [*Fratercula corniculata*] and tufted puffins), diving plankton feeders (ancient murrelets [*Synthliboramphus antiquus*]), and surface plankton feeders (Leach's and fork-tailed storm-petrels). Other species monitored at Aiktak Island include glaucous-winged gulls (*Larus glaucescens*) and black oystercatchers (*Haematopus bachmani*). In addition, breeding chronology, food habits, chick growth, and adult survival were described for one or more of the above species.

Detailed results of the 2008 monitoring program are contained in these appendices and archived at the AMNWR office in Homer, Alaska. Due to reanalysis of some data and correction of typographical errors, this report supersedes previous reports.

STUDY AREA

Aiktak Island (54º11.19'N, 164º 49.84'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 three miles 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. Tigalda Island sits three miles to the west of Aiktak and Ugamak Island is directly to the north across a 0.8 km channel.

Aiktak is a small island approximately 2 km long and 1 km wide, encompassing 155 ha and with a circumference of 7.3 km. 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.--Brie Drummond and Maureen (Mo) McClintock worked as USFWS personnel on Aiktak from 21 May until 31 August 2008.

Data collection and analysis.--Researchers followed data collection and analysis methods outlined in the Aiktak Island Protocols, archived at Alaska Maritime National Wildlife Refuge, in Homer, Alaska with the following exceptions:

- Storm-petrels.
  - Comparisons between plots checked every 7 and 14 days indicate that more frequent checks may decrease reproductive success (see Helm and Zeman 2006 for data separate by check frequency). Therefore, since 2007, reproductive performance data include only nests in productivity plots (*n*=13), which were visited on a 14 day interval. Chronology plots (*n*=5) were visited on a 7 day interval and used only for chronology and chick growth data.

  - Plot maps of burrow locations and numbers in 2007 were not available in 2008, so some burrows were given new numbers when old flags were unreadable. Therefore, it may not be possible to compare data from individual nests across years, if such an analysis was ever desired.

  - All plots (productivity and chronology plots) were included in analysis of occupancy rate except plot 26, which contains artificial burrows.

  - All artificial burrows that were located (*n*=18) remained empty throughout the season; many were filled with soil and overgrown with vegetation at the beginning of the season and had to be cleaned out. Plots A-4 and A-5 could not be found in 2008.

  - Chicks were measured only on chronology plots. Chick wings were measured using only relaxed wing chord, rather than both relaxed and flattened wing as in previous years. Chick growth data from previous years were resummarized to include relaxed rather than flattened wing.

  - To minimize disturbance, adults were not measured on chronology plots as in prior years; instead, data on adult morphology were collected on birds captured in mist nets during food collection, consistent with protocols for Buldir and Kasatochi islands (Williams et al. 2002).

- Food samples were collected by capturing adults with mist nets on three nights in August in Petrel Valley. Two nets were set up in the flat terrain between storm-petrel plots 8 and 27, perpendicular to or diagonal across the narrow part of the valley. To help attract birds, recordings of fork-tailed and Leach's vocalizations (from the Birds of Alaska cd) were broadcast using an ipod and portable speakers placed at the base of mist-nets. Sampling appeared moderately successful compared to previous years and may be due to a combination of good net locations and vocalization play-back. Samples were not analyzed in time to be included in this report.

- Historic food samples from 1997-2001 were summarized and presented in this report for the first time.

- Black oystercatchers.
  - All nesting attempts (first clutches and relays) were included in analyses of reproductive success and chronology.

- Cormorants.
  - Due to extremely high numbers of cormorant nests (*n*=348) this year, it was not possible to follow fates of individual nests throughout the season. Instead, cormorant productivity was determined by counting numbers of nests during June and then numbers of large chicks during August, similar to that described in Williams et al. (2002) for cormorant productivity surveys at Ulak Island.

- Glaucous-winged gulls.
  - Three relays following initial nest failures were included in productivity analysis as independent nesting attempts.

  - A substantial number (*n*=167) of gull pellets were found on Gull Mountain and New Camp Beach between camp and Guillemot Rock throughout the season. Most pellets consisted of small piles of fish bones and invertebrate shells, rather than actual solid pellets of partially-digested bird feathers. Contents of pellets were identified on site and both percent volume and number of individuals were recorded according to Williams et al. (2002). Percent volume and percent occurrence of prey in samples were calculated for summary tables and figures. Gull pellet data from 2008 is presented separate from gull food samples from 1995-2002 (Table 41), which are composed of a mix of adult and chick regurgitations and pick-ups rather than exclusively pellets. It is possible that difficulty in locating gull pellets in recent years may have been due to confusion over what to look for and where to look, rather than a lack of pellets.

  - Chick food regurgitations were collected following methods described in Williams et al. (2002) and the 2007 report (Helm et al. 2007). However, few samples were collected this year due to low hatching success. Samples were collected mainly from chicks on productivity plots on Gull Mountain after productivity monitoring was complete, as well as from a few chicks in the vegetation backing Old Camp Beach.

- Murres.

- Due to small sample sizes, all nests of each species were lumped together across all plots for productivity analysis, rather than using a ratio-estimator to estimate reproductive success (Williams et al. 2002).

- Onset of breeding was late this year and most chicks were still present but too young to call "fledged" at our last check in late August (still present and ≥13 days; Williams et al. 2002). We considered chicks that were still present but <13 days at last check to be "potentially" successful and calculated reproductive success as a maximum potential success, but distinguished between those young chicks and chicks that had actually fledged (disappeared ≥15 days or still present and ≥13 days) in productivity tables (Tables 47 and 50).

- No boat-based population counts were conducted this year.

- Pigeon guillemots.
  - For consistency with pigeon guillemot counts conducted elsewhere in the Alaska Maritime NWR, protocols for land-based pigeon guillemot counts were refined with respect to time of day and period in season. Counts were conducted only during morning hours and only during incubation (June to early July). In addition, all observation points were counted on the same day. These changes have been updated in the Aiktak protocols and should be followed in future years. Data from previous years that did not meet those criteria were removed from summary tables in this report; only three counts from 2003 fit the requirements for comparable data to be included in this and future reports.

  - For consistency with prior years, land-based counts did not include observation point Pole 87, which was added as an observation point in 2006 and counted only in 2006 and 2007.

  - To resolve years of confusion over the exact location of observation points for land-based counts, all observation points (n=8) were permanently marked with rebar poles with uniquely-numbered caps. Locations were also mapped, photographed, and entered into the GPS. In future years, counts should be conducted only from these specified observation points. (Note these observation points are also used to count horned puffins, but at different times of the day and season).

  - No boat-based population counts were conducted this year.

- Horned puffins.
  - Nests monitored for productivity followed methods described in Williams et al. (2002) rather than those outlined in the Aiktak protocol binder. Specifically, nests were monitored at 7 day intervals, except around expected hatch when intervals were shortened to 4-5 days. This was part of an attempt to make the work conducted at Aiktak more consistent with the protocols followed at Kasatochi and Buldir islands, the two other Aleutian Island long-term monitoring sites.

  - Protocols for land-based horned puffin counts were altered to adhere to the recommendations of a recent paper on horned puffin attendance patterns (Harding et al. 2005). Specifically, modifications were made with respect to time of day and period in season. Analysis suggested that counts on the water should occur during the last 30 days of

incubation, at the time of day when puffin abundance peaked. Based on breeding chronology data from previous years (see Helm et al. 2007), we determined counts should occur from approximately late June through late July, ending when birds are observed carrying food or chicks hatch in nests monitored for productivity (thus indicating the end of the incubation period). Horned puffin attendance can vary dramatically from island to island, so to determine appropriate time of day for counts, we conducted all-day counts to determine when peak attendance occurred at Aiktak. During four days spread across late June to late July, we counted numbers of horned puffins observed on the water in Petrel Valley Cove (the largest concentration of horned puffins on Aiktak) at 30 minute intervals from 0800h to 2000h Aleutian Standard Time (ALST). Counts were made from the observation point for the Petrel Valley Cove land-based horned puffin plot, just below pole 502 on the west side of the cove. Across all days, patterns of attendance were relatively consistent, with a clear peak in puffin numbers during the late afternoon (see Figure 40). Therefore, we conducted land-based horned puffin counts around the whole island between peak hours of 1530h and 1830h ALST. Based on this work, we suggest the following for conducting horned puffin counts on Aiktak:

(a) Counts should be conducted during late June to late July, ending when birds begin carrying fish or chicks are observed

(b) Counts should be conducted during peak horned puffin attendance, between 1530-1830h ALST (it may be worthwhile to confirm this with an all-day count in late June in future years, in case of interannual variation)

(c) All observation points need to be counted during each survey

These changes have been updated in the Aiktak protocols and should be followed in future years. Data from previous years that did not meet those criteria were removed from summary tables in this report; none fit the requirements for comparable data to be included in this and future reports.

- To resolve years of confusion over the exact location of observation points for land-based counts, all observation points (n=8) were permanently marked with rebar poles with uniquely-numbered caps. Locations were also mapped, photographed, and entered into the GPS. In future years, counts should be conducted only from these specified observation points. (Note these observation points are also used to count pigeon guillemots, but at different times of the day and season).

- For consistency with prior years, land-based counts did not include observation point Pole 87, which was added as an observation point in 2006 and counted only in 2006 and 2007.

- Tufted puffins.
  - Nests monitored for productivity followed a combination of methods described in the Aiktak protocol binder and in Williams et al. 2002. Specifically, nests were monitored at 7 day intervals (as in the Aiktak protocol binder), except around expected hatch when intervals were shortened to 4-5 days (as in Williams et al. 2002). The increased check frequency close to hatch was part of an attempt to make the work conducted at Aiktak more consistent with the protocols followed at Kasatochi and Buldir islands, the two other Aleutian Island long-term monitoring sites.

- Data analysis for productivity includes both artificial burrows and natural burrows found during mid-incubation (early-late July). Only 25 of 82 artificial burrows were occupied this year, so most burrows used for productivity (111 of 136) were natural burrows located in the vicinity of the artificial burrow plots.

- For chick growth, all artificial burrows with chicks (*n*=15) and four easily-accessible natural burrows were used. Chick growth nests were included in the productivity sample, as analysis indicates that chick growth measurements do not bias productivity (J. McDonough 2004).

- Food samples were collected by screening burrows on four sampling bouts in August. Afternoon and evening sampling periods were more efficient than the early morning. Samples were not analyzed in time to be included in this report.

- Percent biomass was calculated for historic tufted puffin food samples from 1996-2001 using laboratory mass values for prey in samples from 2000-2001 and field mass values for prey in samples from 1996-1999 (because most identification and measurement was conducted in the field and few samples sent to the lab in those years). Laboratory identification and measurement is considered more accurate than that performed in the field; in future years, only laboratory data should be used to summarize of puffin food.

- An effort to band tufted puffins to begin a mark-recapture survival study was attempted in 2008. To minimize disturbance to breeding birds, we planned to capture puffins as they were socializing on land during June, before most eggs were laid, and then resight banded birds throughout the remainder of the season. Lines of monofilament nooses staked to the ground were used to try to capture birds (M. Hipfner, pers. comm.), similar to the noose-carpet technique used for capturing auklets (Williams et al. 2002). However, puffin attendance patterns during the early half of the breeding season made capture of birds on the ground difficult. Throughout June and the first half of July, puffins spent most time flying around the clifftops in large flocks and little time actually standing around on the surface. On many days, no birds were observed on land at all. When birds did land, they usually stayed for less than an hour and appeared extremely skittish, flushing easily and often not returning again that day. Given that whether any birds would land on a day day, and if so, when that would occur, was entirely unpredictable, it was impossible to guess when to try to catch puffins. Whole days were spent waiting in vain for birds to land, and trying to catch birds only after they were spotted on land was similarly futile because they would be gone again by the time we arrived at the site. Following difficulties in capturing puffins on the surface, we attempted to catch birds as they left their burrows in the early morning using windsock-like contraptions sewn from old mist nets and staked around the burrow entrance; however, this too was unsuccessful. Ultimately, the poor and erratic surface attendance during the first half of the summer made it difficult not only to catch puffins at all, but also to schedule banding attempts in with the other monitoring work that needed to be done at Aiktak. By the beginning of July, we gave up attempts; in the end, no puffins were banded. (Ironically, surface attendance changed dramatically during the second half of the season after chicks hatched, with puffins consistently spending lots of time on land; refer to the Annotated List (Table 80) for a full description).

- Circumnavigations

- No circumnavigation surveys were conducted this year.

INTERESTING OBSERVATIONS

- Nearly 350 pairs of cormorants nested on the cliffs of Southwest Bight (part of murre plot 3), the largest record of cormorants breeding on Aiktak since the beginning of the monitoring program.

- For the third year in a row, glaucous-winged gulls experienced low reproductive success, with high rates of egg loss during incubation.

- Despite high numbers of murres attending cliffs, nesting effort was extremely low. Less than 5% of murres on index plots were observed with eggs or in incubating posture; most spent the season loafing around on the cliffs and facing seawards. Those few that did lay eggs were generally late; most chicks were still young and a few birds were still on eggs at our departure from the island in late August. Murres have not bred in great numbers on Aiktak since 2001.

- On our arrival in May, some areas of ground were still frozen and several patches of snow and ice still remained in deep gullies along the north shore, likely due to particularly cold spring temperatures. Lids of most artificial puffin burrows were frozen in place under thick slabs of ice and entrances of at least a dozen storm-petrel nests were blocked by ice until early to mid June.

- Thousands of small pumice stones washed up on the beaches around the island on 21 July, presumably from Okmok volcano on Umnak Island, which erupted almost continuously throughout July and August.

ACKNOWLEDGMENTS

Utmost appreciation goes to Maureen McClintock for her enthusiasm, hard work, and companionship during three and a half months together on a small, wet island. The crew of the *M/V* Tiglax provided safe transport, wholehearted support, and generous hospitality throughout the summer and were instrumental in the success of the monitoring program at Aiktak. Additional thanks to Garret Savory, Ruben Guestchow, and Martin Reedy for helping to offload camp supplies in May. A number of Refuge staff and others supplied excellent support and cheerful radio communications from Adak throughout the summer, including Lisa Scharf, Jeff Williams, Marvin Baur, Jen Curl, Garret Savory, and Martin Reedy. Finally, as always, Jeff Williams and Vernon Byrd provided guidance and unwavering enthusiasm and without them the monitoring program would not exist.

REFERENCES

Blomstrom, D. and A. Nault. 1989. Seabird monitoring at Aiktak Island, Aleutian Islands, June--July 1992. U.S. Fish and Wildl. Serv. Unpubl. Rep., AMNWR 89/11. Homer, Alas. 16pp.

Bureau of Biological Survey, U.S. Department of Agriculture. 1940. Status of Fox Islands in the Aleutian Islands National Wildlife Refuge in fiscal year 1940. Unpublished report, Juneau, Alas. 180pp.

DeGange, A. R. and D. J. Forsell. 1981. Summary of work completed on Aiktak Island and recommendations for future work. U.S. Fish and Wildl. Serv. Rep., AMNWR 81/16. Anchorage, Alas. 10 pp.

Dragoo, D. E. and S. Woodward. 1996. Seabird monitoring at Aiktak Island, Alaska in 1995. U.S. Fish and Wildl. Serv. Rep., AMNWR 96/02. Homer, Alas. 57pp.

Dykstra, D. and D. Wynn. 2002. Biological monitoring at Aiktak Island, Alaska in 2002: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 02/09. Homer, Alas. 64 pp.

Forsell, D. J. 1983a. Observations of seabirds at Aiktak Island- August 1982. U.S. Fish and Wildl. Serv. Rep., AMNWR 83/09. Anchorage, Alas. 2pp.

Forsell, D. J. 1983b. Progress report on field studies in the Aleutian Islands, Semidi Islands, and Bering Sea, 1983. U.S. Fish and Wildl. Serv. Rep., AMNWR 83/01. Anchorage, Alas. 6 pp.

Harding, A. M. A., J. F. Piatt, G. V. Byrd, S. A. Hatch, N. B. Konyukhov, E. U. Golubova, and J. C. Williams. 2005. Variability in colony attendance of crevice-nesting horned puffins: implications for population monitoring. Journal of Wildlife Management 69: 1279-1296.

Helm, J. A. and T. A. Zeman. 2005. Biological monitoring at Aiktak Island, Alaska in 2005: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 06/07. Homer, Alas. 94 pp.

Helm, J. A. and T. A. Zeman. 2006. Biological monitoring at Aiktak Island, Alaska in 2006: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 06/10. Homer, Alas. 106 pp.

Howard, R. J. and S. Woodward. 1999. Results of seabird monitoring at Aiktak Island, Alaska in 1999. U.S. Fish and Wildl. Serv. Rep., AMNWR 99/06. Homer, Alas. 39 pp.

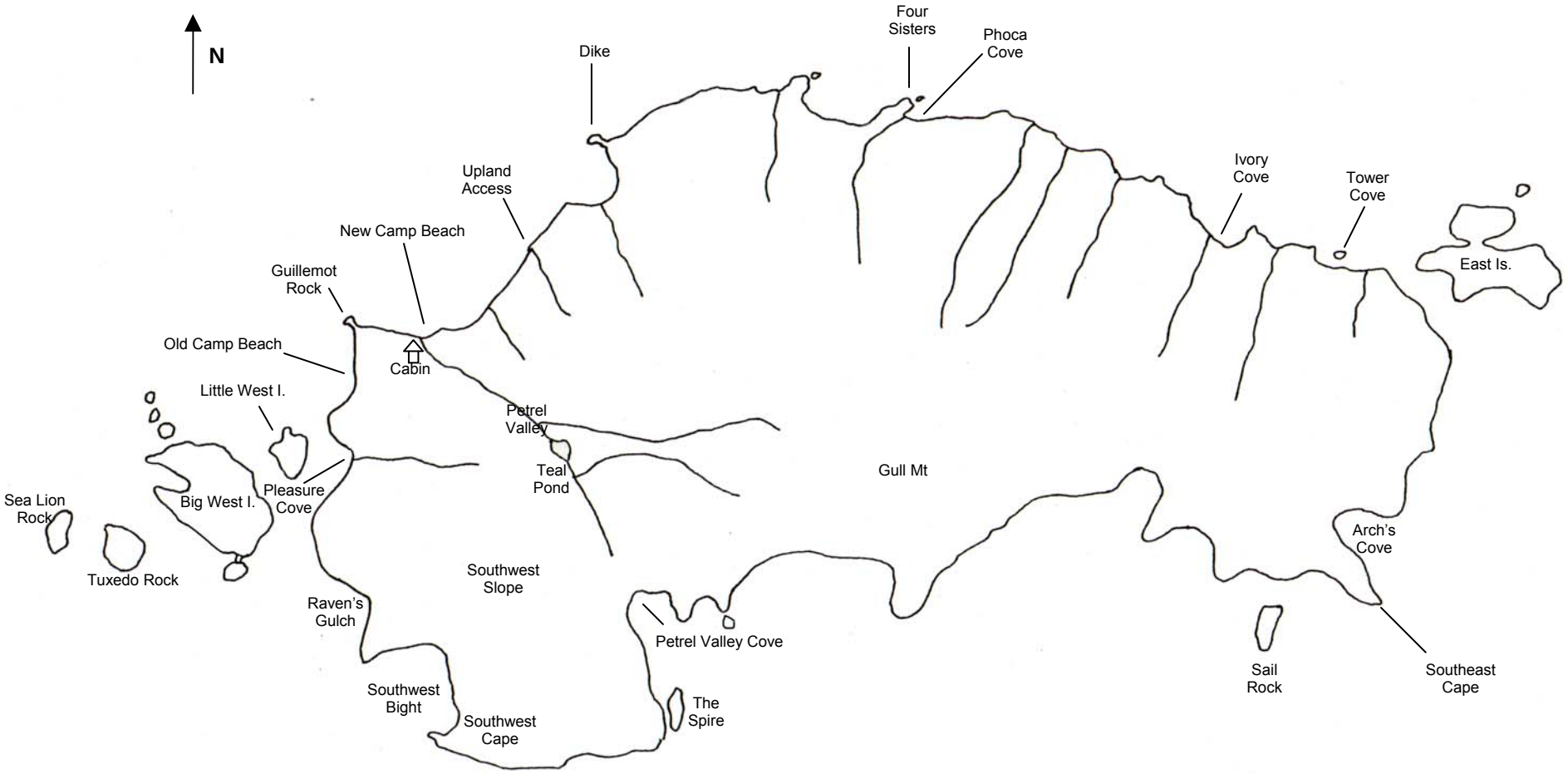
O'Daniel, D. L., H. Knechtel, and J. C. Schneeweis. 1990. Seabird monitoring at Aiktak Island, Aleutian Islands, Alaska in 1990. U.S. Fish and Wildl. Serv. Rep., AMNWR 90/06. Adak, Alas. 17 pp.

Sztukowski, L. and D. Oleszczuk. 2001. Biological monitoring at Aiktak Island, Alaska in 2001: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 01/14. Homer, Alas. 70 pp.

Thomson, G. L. and J. Smith. 2000. Biological monitoring at Aiktak Island, Alaska in 2000: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 00/06. Homer, Alas. 61 pp.

Woodward, S. 1997. Results of seabird monitoring at Aiktak Island, Alaska in 1995 and 1996: summary appendices. U.S. Fish and Wildl. Serv. Rep., AMNWR 97/12. Homer, Alas. 127 pp.

Williams, J.C., L. Scharf, and G.V. Byrd. 2002. Ecological monitoring methods of the Aleutian Islands Unit, Alaska Maritime National Wildlife Refuge – revised edition 2. U.S. Fish and Wildl. Serv. Rep., AMNWR 00/01. Adak, Alas. 351pp.



Map of Aiktak Island, Alaska

Aiktak Island from the west

Aiktak Island from the east

FIGURES AND TABLES

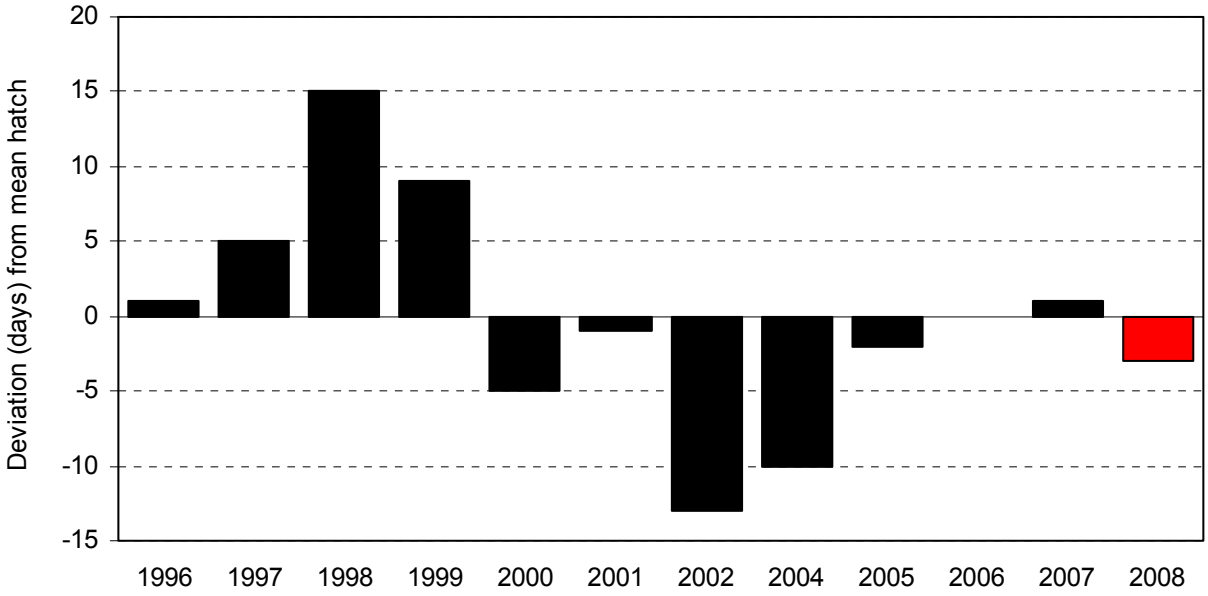


Figure 1. Yearly hatch date deviation (from the 1996-2007 average of 16 July) of fork-tailed storm-petrels at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. No bar present in 2006 indicates the yearly hatch date was equal to the long-term mean.

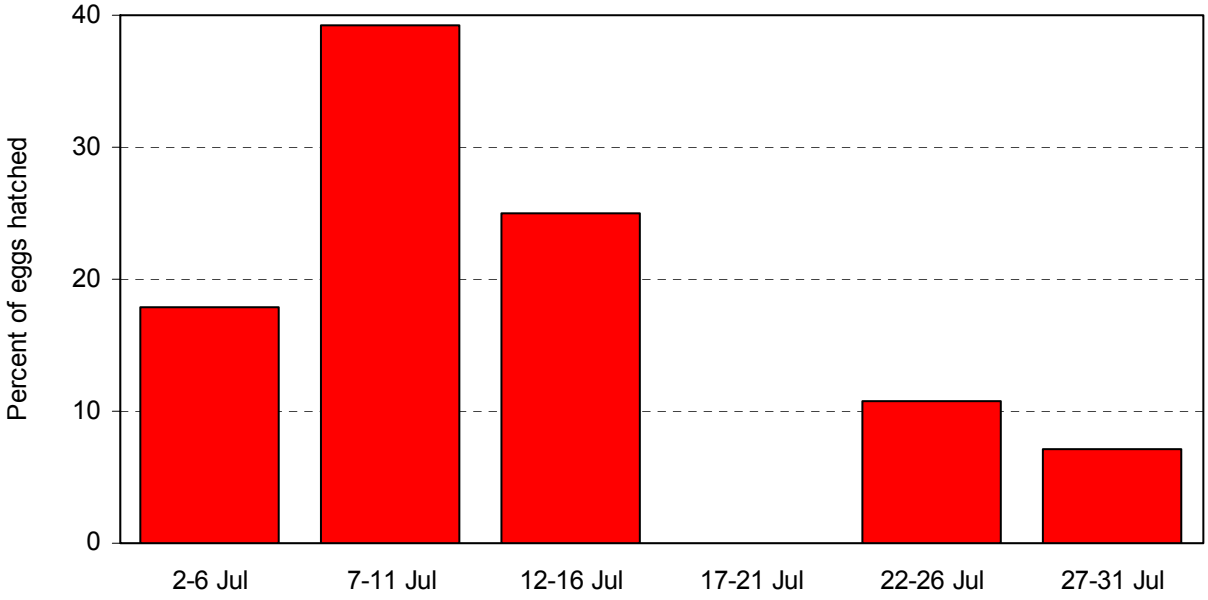


Figure 2. Hatching chronology of fork-tailed storm-petrels at Aiktak Island, Alaska in 2008.

Table 1. Breeding chronology of fork-tailed storm-petrels at Aiktak Island, Alaska. Chronology burrows were monitored on an interval of 7 days.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First hatch	Last hatch	First fledge
1996	16 Jul	4.8	6	13 Jul	28	3 Jul	25 Jul	21 Aug
1997	21 Jul	10.1	16	19 Jul	35	7 Jul	13 Aug	>1 Sep
1998	31 Jul	11.2	16	27 Jul	36	14 Jul	20 Aug	>3 Sep
1999	25 Jul	8.0	28	24 Jul	51	9 Jul	21 Aug	>31 Aug
2000	10 Jul	9.7	35	8 Jul	61	26 Jun	13 Aug	25 Aug
2001	15 Jul	8.9	38	17 Jul	53	16 Jun	4 Aug	3 Sep
2002	3 Jul	8.6	21	1 Jul	25	20 Jun	2 Aug	22 Aug
2004	6 Jul	7.6	32	4 Jul	68	22 Jun	19 Jul	17 Aug
2005	14 Jul	8.1	45	11 Jul	71	23 Jun	10 Aug	30 Aug
2006	16 Jul	6.5	20	18 Jul	75	8 Jul	30 Jul	>1 Sep
2007	17 Jul	9.7	23	18 Jul	75	5 Jul	13 Aug	>30 Aug
2008	12 Jul	7.7	28	8 Jul	84	2 Jul	31 Jul	25 Aug

[a]Data were not collected in 1995 and 2003.

[b]Sample sizes used to calculate mean and median hatch and fledge dates are a sub-sample of total nests for which egg to chick or chick to empty interval is $\leq$ 7 days.

[c]All nests monitored for chronology are used to estimate first and last hatch and fledge dates and may include observations with egg to chick or chick to empty intervals > 7 days.

Table 2. Frequency distribution of hatch dates for fork-tailed storm-petrels at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date											
date	1996	1997	1998	1999	2000	2001	2002	2004	2005	2006	2007	2008
171	--	--	--	--	--	--	1	--	--	--	--	--
172	--	--	--	--	--	--	--	--	--	--	--	--
173	--	--	--	--	--	--	--	--	--	--	--	--
174	--	--	--	--	--	--	1	--	--	--	--	--
175	--	--	--	--	--	--	--	--	--	--	--	--
176	--	--	--	--	--	--	2	2	--	--	--	--
177	--	--	--	--	--	--	--	1	--	--	--	--
178	--	--	--	--	--	--	--	--	--	--	--	--
179	--	--	--	--	--	--	--	2	--	--	--	--
180	--	--	--	--	--	--	1	--	--	--	--	--
181	--	--	--	--	--	--	--	--	--	--	--	--
182	--	--	--	--	2	--	8	5	--	--	--	--
183	--	--	--	--	--	2	--	--	--	--	--	--
184	--	--	--	--	--	--	--	3	3	--	--	5
185	--	--	--	--	--	1	--	--	--	--	--	--
186	--	--	--	--	9	3	5	4	--	--	--	--
187	--	--	--	--	--	--	--	--	--	2	4	--
188	--	1	--	--	--	1	--	--	9	--	--	--
189	--	--	--	--	--	--	--	--	--	--	--	--
190	--	--	--	--	10	2	1	--	--	--	--	11
191	--	--	--	--	1	1	--	--	--	--	--	--
192	--	--	--	--	--	2	1	5	16	--	--	--
193	--	1	--	1	--	--	--	--	--	7	7	--
194	--	--	--	2	4	5	--	--	--	--	--	--
195	4	--	1	--	2	2	--	--	--	--	--	--
196	--	--	--	--	--	--	--	8	8	--	--	--
197	1	5	--	3	--	--	--	--	--	--	--	7
198	--	--	--	1	--	7	--	--	--	--	--	--
199	--	1	2	1	3	2	--	--	--	8	6	--
200	--	--	--	--	--	--	--	--	2	--	--	--
201	--	2	--	--	--	--	--	--	--	--	--	--
202	--	--	1	2	--	3	--	2	--	--	--	--
203	--	1	--	1	1	1	--	--	--	--	--	--
204	--	--	--	--	--	--	--	--	3	--	--	2
205	--	--	--	4	--	--	--	--	--	1	2	--
206	--	--	1	1	--	1	--	--	--	--	--	--
207	1	1	--	--	--	--	--	--	--	--	--	1
208	--	--	4	1	--	--	--	--	1	--	--	--
209	--	1	--	2	--	--	--	--	--	--	--	--
210	--	--	1	1	1	5	--	--	--	--	--	2
211	--	--	--	--	--	--	--	--	--	2	2	--
212	--	--	--	1	--	--	--	--	1	--	--	--
213	--	--	1	3	--	--	--	--	--	--	--	--
214	--	--	--	--	--	--	1	--	--	--	--	--
215	--	--	--	--	--	--	--	--	--	--	--	--
216	--	--	--	--	--	1	--	--	1	--	--	--
217	--	1	--	--	--	--	--	--	--	--	1	--
218	--	--	1	3	--	--	--	--	--	--	--	--
219	--	1	--	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--	--
221	--	--	--	1	--	--	--	--	--	--	--	--
222	--	--	1	--	1	--	--	--	1	--	--	--
223	--	--	--	--	--	--	--	--	--	--	1	--
224	--	--	--	--	--	--	--	--	--	--	--	--
225	--	1	--	--	--	--	--	--	--	--	--	--
226	--	--	--	--	1	--	--	--	--	--	--	--
227	--	--	--	--	--	--	--	--	--	--	--	--
228	--	--	2	--	--	--	--	--	--	--	--	--
229	--	--	--	--	--	--	--	--	--	--	--	--
230	--	--	--	--	--	--	--	--	--	--	--	--
231	--	--	--	--	--	--	--	--	--	--	--	--
232	--	--	1	--	--	--	--	--	--	--	--	--
n	6	16	16	28	35	38	21	32	45	20	23	28

[a]Data were not collected in 1995 and 2003.

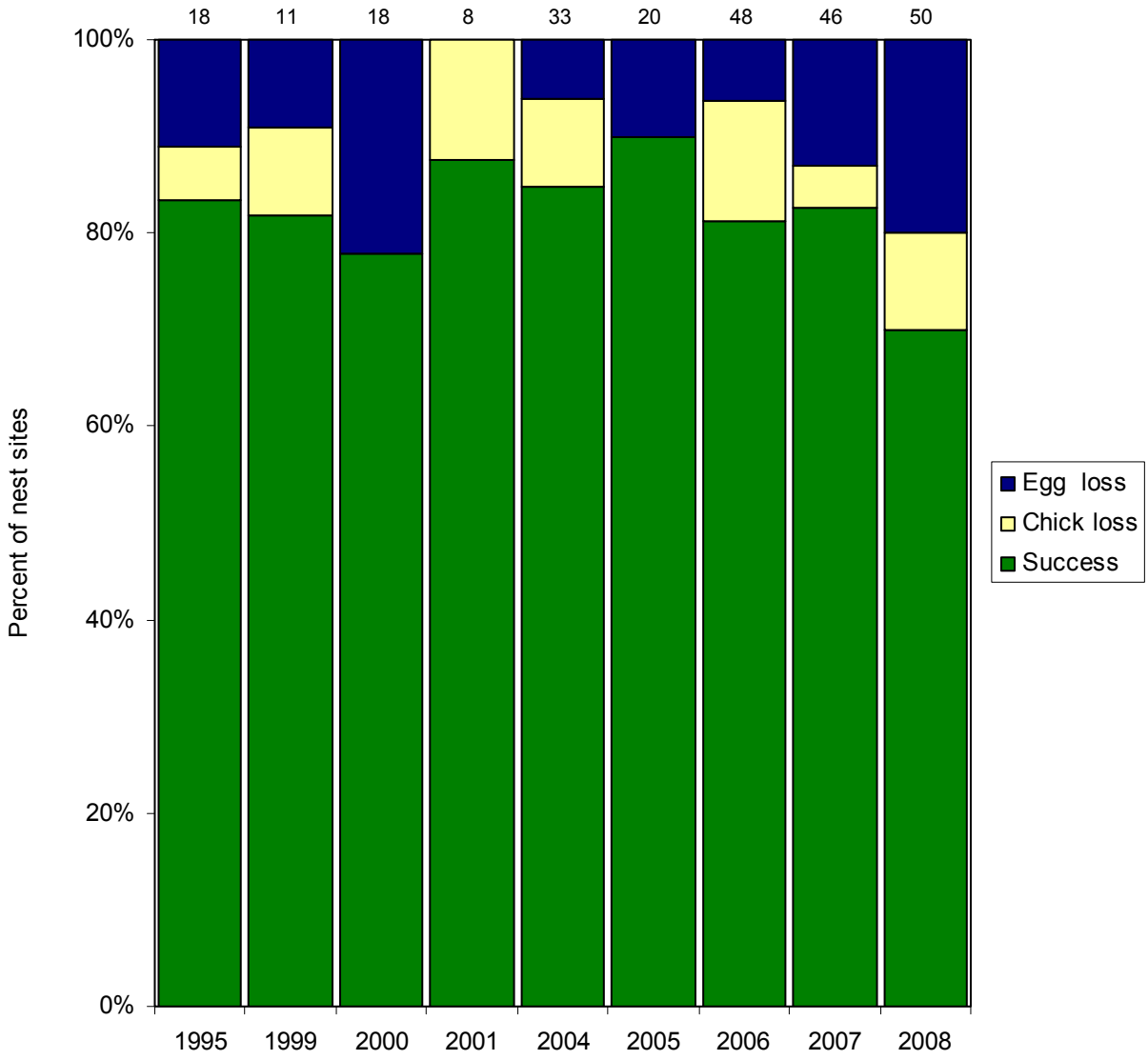


Figure 3. Reproductive performance of fork-tailed storm-petrels in non-chronology burrows at Aiktak Island, Alaska. Egg loss=(C-D)/C; Chick loss=(D-E)/C; Success=E/C, where C=number of eggs, D=number of eggs hatched, and E=number of chicks fledged or still alive at last check (codes come from following productivity tables). Success represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower. Numbers above columns indicate sample sizes.

Table 3. Productivity values of fork-tailed storm-petrels in non-chronology burrows[a] at Aiktak Island, Alaska[b].

Parameter	1995	1999	2000	2001	2004	2005	2006	2007	2008
No. burrows w/ known contents (A)	110	154	199	94	296	272	273	278	300
No. occupied burrows (B)	21	12	18	8	33	41	48	52	52
No. eggs w/ known fate (C)	18	11	18	8	33	20	48	46	50
eggs lost to: disappearance	1	0	1	0	0	0	0	2	1
abandonment	1	1	3	0	1	0	0	3	8
breakage	0	0	0	0	1	2	3	1	1
No. eggs still viable at last visit (unk. fate)	0	0	0	0	0	0	0	1	0
No. chicks (D)	16	10	14	8	31	18	45	40	40
chicks lost to: disappearance[c]	0	0	0	0	3	0	1	0	1
death	1	1	0	1	0	0	5	2	4
No. chicks potentially successful (E)	15	9	14	7	28	18	39	38	35
chicks fledged[d]	0	0	4	2	4	2	0	0	1
chicks still present at last visit	15	9	10	5	24	16	39	38	34
Hatching success (D/C)	0.89	0.91	0.77	1.00	0.94	0.90	0.94	0.87	0.80
Fledging success (E/D)[e]	0.94	0.90	1.00	0.88	0.90	1.00	0.87	0.95	0.88
Reproductive success (E/C)[e]	0.83	0.82	0.77	0.88	0.85	0.90	0.81	0.83	0.70

[a]Non-chronology burrows were monitored on an interval of 14 days.
[b]More detailed data exists in Helm and Zeman 2006 for 1996-1998 and 2002. Data were not collected in 2003.
[c]Chicks < 50 days old at disappearance were considered failed.
[d]Chicks $\geq$ 50 days old at disappearance were considered fledged.
[e]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

Table 4. Productivity values of fork-tailed storm-petrels in non-chronology burrows[a] at Aiktak Island, Alaska in 2008.

Parameter	Plot													All plots	Mean	SD
	9	10	11	13	16	17	18	19	20	21	22	24	26			
No. burrows w/ known contents (A)	42	26	23	11	8	17	27	29	17	23	18	10	49	300		
No. occupied burrows (B)	9	4	5	2	2	4	4	4	1	2	1	2	12	52		
No. eggs w/ known fate (C)	9	4	5	2	2	4	4	4	1	2	1	1	11	50		
eggs lost to: disappearance	0	0	0	0	0	0	0	0	0	0	0	0	1	1		
abandonment	1	1	1	0	0	1	1	0	0	1	0	0	2	8		
breakage	0	0	0	0	0	0	0	1	0	0	0	0	0	1		
No. eggs still viable at last visit (unk. fate)	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
No. chicks (D)	8	3	4	2	2	3	3	3	1	1	1	1	8	40		
chicks lost to: disappearance[b]	0	0	0	0	0	0	0	0	0	0	0	0	1	1		
death	0	1	0	0	1	1	0	0	0	0	0	0	1	4		
No. chicks potentially successful (E)	8	2	4	2	1	2	3	3	1	1	1	1	6	35		
chicks fledged[c]	0	0	1	0	0	0	0	0	0	0	0	0	0	1		
chicks still present at last visit	8	2	3	2	1	2	3	3	1	1	1	1	6	34		
Hatching success (D/C)	0.89	0.75	0.80	1.00	1.00	0.75	0.75	0.75	1.00	0.50	1.00	1.00	0.73	0.80	0.84	0.2
Fledging success (E/D)[d]	1.00	0.67	1.00	1.00	0.50	0.33	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.88	0.87	0.2
Reproductive success (E/C)[d]	0.89	0.50	0.80	1.00	0.50	0.50	0.75	0.75	1.00	0.50	1.00	1.00	0.55	0.70	0.75	0.2

[a]Non-chronology burrows were monitored on an interval of 14 days.
[b]Chicks < 50 days old at disappearance were considered failed.
[c]Chicks $\geq$ 50 days old at disappearance were considered fledged.
[d]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

Table 5. Mean growth rates of fork-tailed storm-petrel chicks at Aiktak Island, Alaska. Data include chicks measured at least 2 times during the linear phase of growth (approximately mass 0-80g; wing chord 20-140mm); chicks that died or did not exhibit linear growth were excluded.

	Mass (g/day)				Wing chord (mm/day)[b]			
Year[a]	*n*	mean	SD	range	*n*	mean	SD	range
1996	16	2.4	0.5	1.7 - 3.6	16	3.4	0.2	3.0 - 3.6
1997	16	2.8	0.4	1.7 - 3.7	16	3.4	0.3	2.7 - 4.0
1998	25	2.8	0.6	1.9 - 4.4	24	3.2	0.8	1.1 - 4.1
1999	32	2.5	0.5	1.4 - 3.9	30	3.6	0.3	2.8 - 4.1
2000	33	2.9	0.6	2.0 - 4.7	33	3.5	0.2	3.0 - 3.8
2001	44	2.7	0.5	1.3 - 4.1	16	3.5	0.2	3.2 - 4.0
2002	17	2.8	0.7	1.6 - 4.0	18	3.5	0.5	2.4 - 4.6
2004	26	2.6	0.7	1.1 - 4.0	37	3.2	0.6	0.7 - 4.2
2005	41	2.7	0.5	1.7 - 3.8	40	2.9	0.3	2.1 - 3.6
2006	19	2.3	0.6	1.3 - 4.1	20	3.0	0.2	2.7 - 3.4
2007	18	2.3	0.5	1.5 - 3.1	20	3.1	0.4	2.0 - 3.5
2008	22	2.4	0.9	0.8 - 4.0	21	3.2	0.3	2.2 - 3.6

[a]Data were not collected in 1995 and 2003.
[b]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.

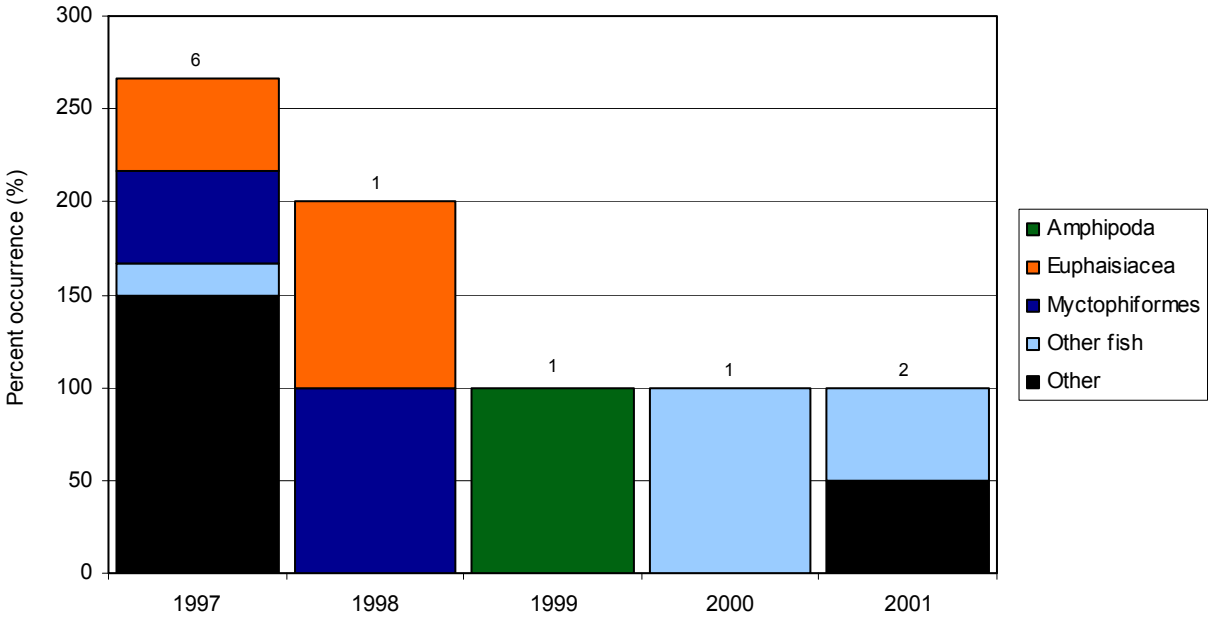


Figure 4. Percent occurrence of prey in diets of fork-tailed storm-petrels at Aiktak Island, Alaska. Numbers represent the percentage of food samples in which each species was present. Prey samples were collected in 2002 and 2004-2008 but had not been analyzed at the time of this report. Numbers above columns indicate sample sizes.

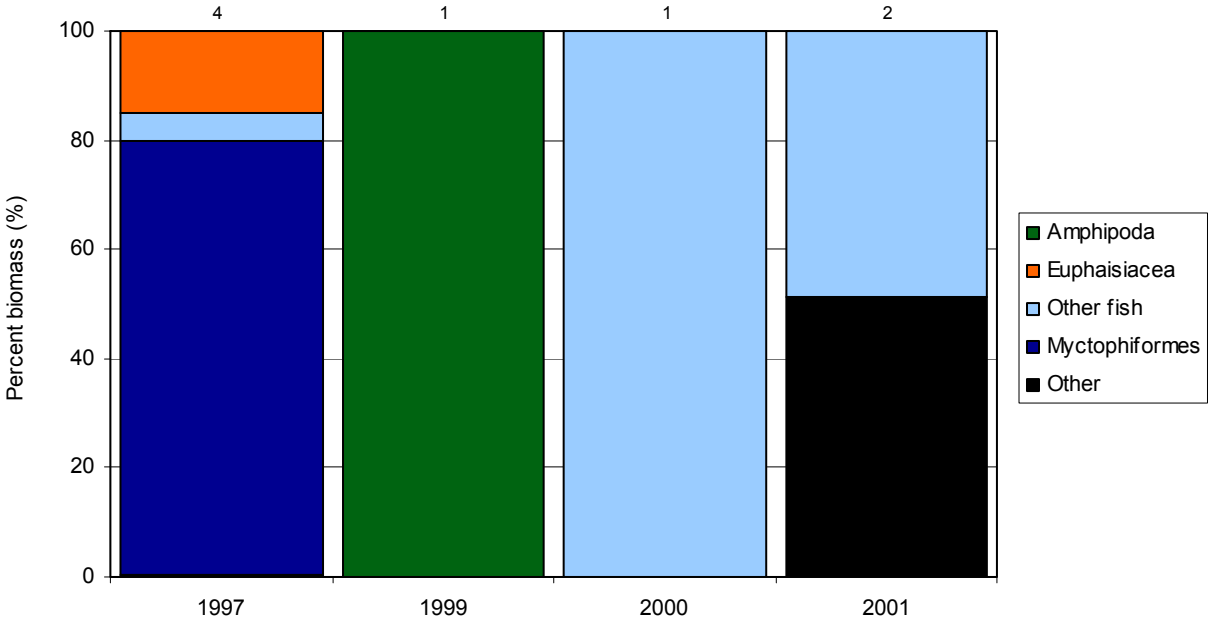


Figure 5. Relative biomass of prey in diets of fork-tailed storm-petrels at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each species. Prey samples were collected in 2002 and 2004-2008 but had not been analyzed at the time of this report; one sample was collected in 1998 but biomass could be not calculated. Numbers above columns indicate sample sizes.

Table 6. Percent occurrence of prey in diets of fork-tailed storm-petrels at Aiktak Island, Alaska[a]. Numbers represent the percentage of food samples in which each species was present.

	1997	1998	1999	2000	2001
No. samples	6	1	1	1	2
Amphipoda					
Hyperiidea					
Parathemisto spp.	--	--	100.0	--	--
Euphausiacea					
Euphausiid spp.	50.0	100.0	--	--	--
Unid. invertebrate	16.7	--	--	--	--
Myctophiformes					
Myctophidae					
Stenobrachius spp.	50.0	100.0	--	--	--
Gadiformes					
Gadidae					
Theragra chalcogramma	16.7	--	--	--	50.0
Perciformes					
Ammodytidae					
Ammodytes hexapterus	--	--	--	100.0	--
Other					
Oil	16.7	--	--	--	--
Plant seed	33.3	--	--	--	--
White lava rock	16.7	--	--	--	--
Offal (fish liver)	--	--	--	--	50.0

[a]Prey samples were collected in 2002, 2004-2008 but had not been analyzed at the time of this report; samples were not collected in 2003.

Table 7. Relative biomass of prey in diets of fork-tailed storm-petrels at Aiktak Island, Alaska[a]. Numbers represent the percentage of the mass of combined food samples comprised by each species.

	1997[b]	1999	2000	2001
No. samples	4	1	1	2
Total mass (g)	24.9	<0.1	3.9	8.0
Amphipoda				
Hyperiidea				
Parathemisto spp.	--	--	100.0	--
Euphausiacea				
Euphausiid spp.	15.1	--	--	--
Unid. invertebrate	0.4	--	--	--
Myctophiformes				
Myctophidae				
Stenobrachius spp.	79.6	--	--	--
Gadiformes				
Gadidae				
Theragra chalcogramma	4.8	--	100.0	50.0
Perciformes				
Ammodytidae				
Ammodytes hexapterus	--	--	100.0	--
Other				
Offal (fish liver)	--	--	--	50.0

[a]Prey samples were collected in 2002, 2004-2008 but had not been analyzed at the time of this report; samples were not collected in 2003. One sample was collected in 1998 but biomass could be not calculated because mass of prey items were not recorded.

[b]Biomass could be calculated for only four of six prey samples in 1997 because mass of prey items in two samples were not recorded.

Table 8. Mass of food loads collected from fork-tailed storm-petrels at Aiktak Island, Alaska[a]. Data include only samples with solid food material, not those containing only oil.

Chick-rearing period[c]	*n*	Mass of load (g)[b] mean	SD	range
2008				
Early	8[d]	4.7	3.6	1.5 - 9.5
Mid	7	5.5	1.6	2.8 - 7.4
Late	2	6.3	6.7	1.6 - 11.1
Total----------				
1997	6	N/A[e]	N/A	N/A
1998	1	N/A	--	--
1999	1	1.6	--	--
2000	1	7.0	--	--
2001	2	N/A	--	--
2002	5	1.4	0.9	0.5 - 2.5
2004	7	2.0	1.5	0.5 - 5.0
2005	1	10.4	--	--
2006	8	5.1	3.1	1.5 - 10.3
2007	2	9.1	9.1	2.7 - 15.6
2008	17	5.2	3.1	1.5 - 11.1

[a]Food samples were not collected in 2003; samples were collected in 1996 but data is missing.
[b]Mass values are corrected for estimated percent recovery of each sample.
[c]In 2008, food samples were collected nights of 5 August (early), 20 August (mid), and 26 August (late).
[d]Nine samples were collected but mass for one could not be calculated due to unknown percent recovery.
[e]Mass data not recorded.

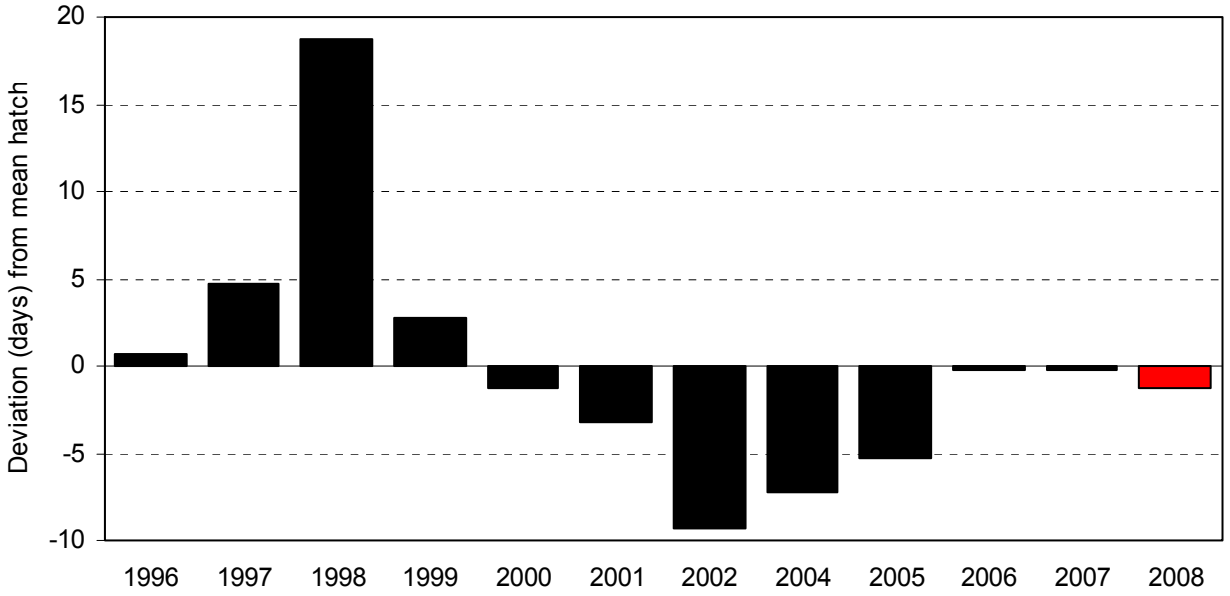


Figure 6. Yearly hatch date deviation (from the 1996-2007 average of 1 Aug) of Leach's storm-petrels at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

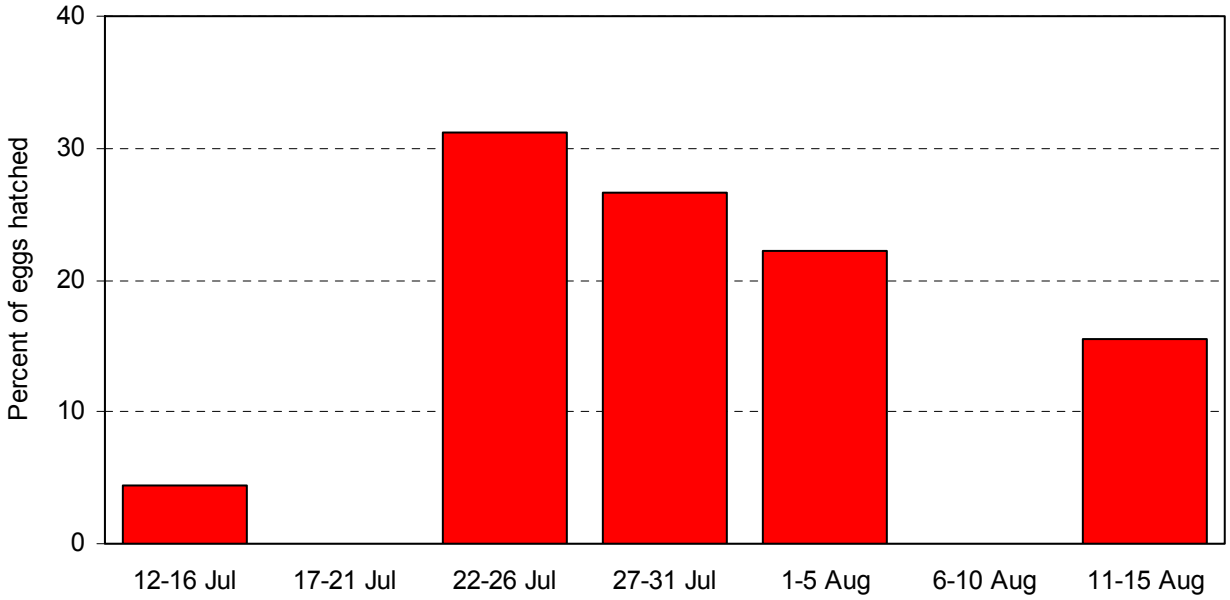


Figure 7. Hatching chronology of Leach's storm-petrels at Aiktak Island, Alaska in 2008.

Table 9. Breeding chronology of Leach's storm-petrels at Aiktak Island, Alaska. Chronology burrows were monitored on an interval of 7 days.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First hatch	Last hatch	First fledge
1996	1 Aug	7.4	33	29 Jul	64	6 Jul	18 Aug	>20 Aug
1997	6 Aug	9.1	62	5 Aug	98	20 Jul	30 Aug	>1 Sep
1998	20 Aug	4.4	23	20 Aug	83	14 Jul	1 Sep	>3 Sep
1999	4 Aug	9.4	35	1 Aug	109	11 Jul	29 Aug	>31 Aug
2000	30 Jul	10.9	42	28 Jul	114	9 Jul	4 Sep	>11 Sep
2001	29 Jul	7.3	27	29 Jul	83	10 Jul	26 Aug	>8 Sep
2002	23 Jul	6.5	10	23 Jul	15	9 Jul	31 Jul	>9 Sep
2004	24 Jul	8.7	37	24 Jul	78	5 Jul	16 Aug	>31 Aug
2005	27 Jul	10.7	44	23 Jul	123	11 Jul	30 Aug	>31 Aug
2006	1 Aug	12.2	34	30 Jul	111	12 Jul	29 Aug	>1 Sep
2007	1 Aug	11.1	38	30 Jul	109	17 Jul	23 Aug	>30 Aug
2008	30 Jul	8.4	45	28 Jul	136	15 Jul	25 Aug	>28 Aug

[a]Data were not collected in 1995 and 2003.

[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.

[c]All nests monitored for chronology are used to estimate first and last hatch and fledge dates and may include observations with egg to chick or chick to empty intervals > 7 days.

Table 10. Frequency distribution of hatch dates for Leach's storm-petrels at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date											
date	1996	1997	1998	1999	2000	2001	2002	2004	2005	2006	2007	2008
190	--	--	--	--	--	--	1	--	--	--	--	--
191	--	--	--	--	--	--	--	--	--	--	--	--
192	--	--	--	--	--	--	--	1	4	--	--	--
193	--	--	--	--	--	--	--	--	--	1	--	--
194	--	--	--	--	--	--	--	--	--	--	--	--
195	--	--	--	--	--	--	--	--	--	--	--	--
196	--	--	--	--	--	--	--	6	--	--	--	--
197	--	--	--	--	--	--	--	--	--	--	--	2
198	--	--	--	--	--	--	--	--	--	--	--	--
199	--	--	--	--	3	1	1	--	--	4	5	--
200	--	--	--	--	--	--	--	--	6	--	--	--
201	--	1	--	2	--	--	--	--	--	--	--	--
202	--	--	--	--	--	3	--	8	2	--	--	--
203	2	2	--	1	8	--	--	--	--	--	--	--
204	4	1	--	--	--	--	5	1	13	--	--	14
205	--	--	--	3	--	--	--	--	--	11	11	--
206	--	--	--	--	8	7	--	8	--	--	--	--
207	2	--	--	--	--	--	--	--	--	--	--	--
208	--	--	--	--	--	--	--	--	6	--	--	--
209	--	10	--	7	--	--	--	--	--	--	--	--
210	2	--	--	--	4	7	1	--	--	--	--	12
211	7	1	--	--	--	--	--	--	--	3	6	--
212	1	--	--	1	--	--	2	4	4	--	--	--
213	--	13	--	5	--	1	--	--	--	--	--	--
214	--	--	--	--	4	1	--	--	1	--	--	--
215	7	1	--	--	--	--	--	--	--	--	--	--
216	--	--	--	--	--	2	--	5	2	--	--	--
217	--	8	--	3	--	--	--	--	--	8	7	--
218	--	--	--	--	2	--	--	--	--	--	--	10
219	2	1	--	--	--	1	--	--	--	--	--	--
220	--	--	--	--	--	--	--	--	--	--	--	--
221	--	8	--	5	--	--	--	--	--	--	--	--
222	--	--	--	--	9	2	--	3	3	--	--	--
223	3	1	--	--	--	--	--	--	--	3	3	--
224	--	--	1	--	--	--	--	--	--	--	--	--
225	--	4	--	5	--	--	--	--	--	--	--	--
226	--	--	2	--	--	2	--	1	--	--	--	7
227	2	--	--	--	--	--	--	--	1	--	--	--
228	--	--	4	--	--	--	--	--	--	--	--	--
229	--	6	--	1	--	--	--	--	--	1	2	--
230	--	--	3	--	2	--	--	--	--	--	--	--
231	1	--	--	--	--	--	--	--	--	--	--	--
232	--	--	7	--	--	--	--	--	--	--	--	--
233	--	1	--	1	--	--	--	--	--	--	--	--
234	--	--	2	--	--	--	--	--	--	--	--	--
235	--	--	1	--	--	--	--	--	--	--	4	--
236	--	--	--	--	--	--	--	--	--	--	--	--
237	--	2	2	--	--	--	--	--	--	--	--	--
238	--	--	--	--	--	--	--	--	1	--	--	--
239	--	--	--	--	--	--	--	--	--	--	--	--
240	--	--	--	--	--	--	--	--	--	--	--	--
241	--	--	--	1	--	--	--	--	--	3	--	--
242	--	2	--	--	2	--	--	--	1	--	--	--
243	--	--	--	--	--	--	--	--	--	--	--	--
244	--	--	1	--	--	--	--	--	--	--	--	--
n	33	62	23	35	42	27	10	37	44	34	38	45

[a]Data were not collected in 1995 and 2003.

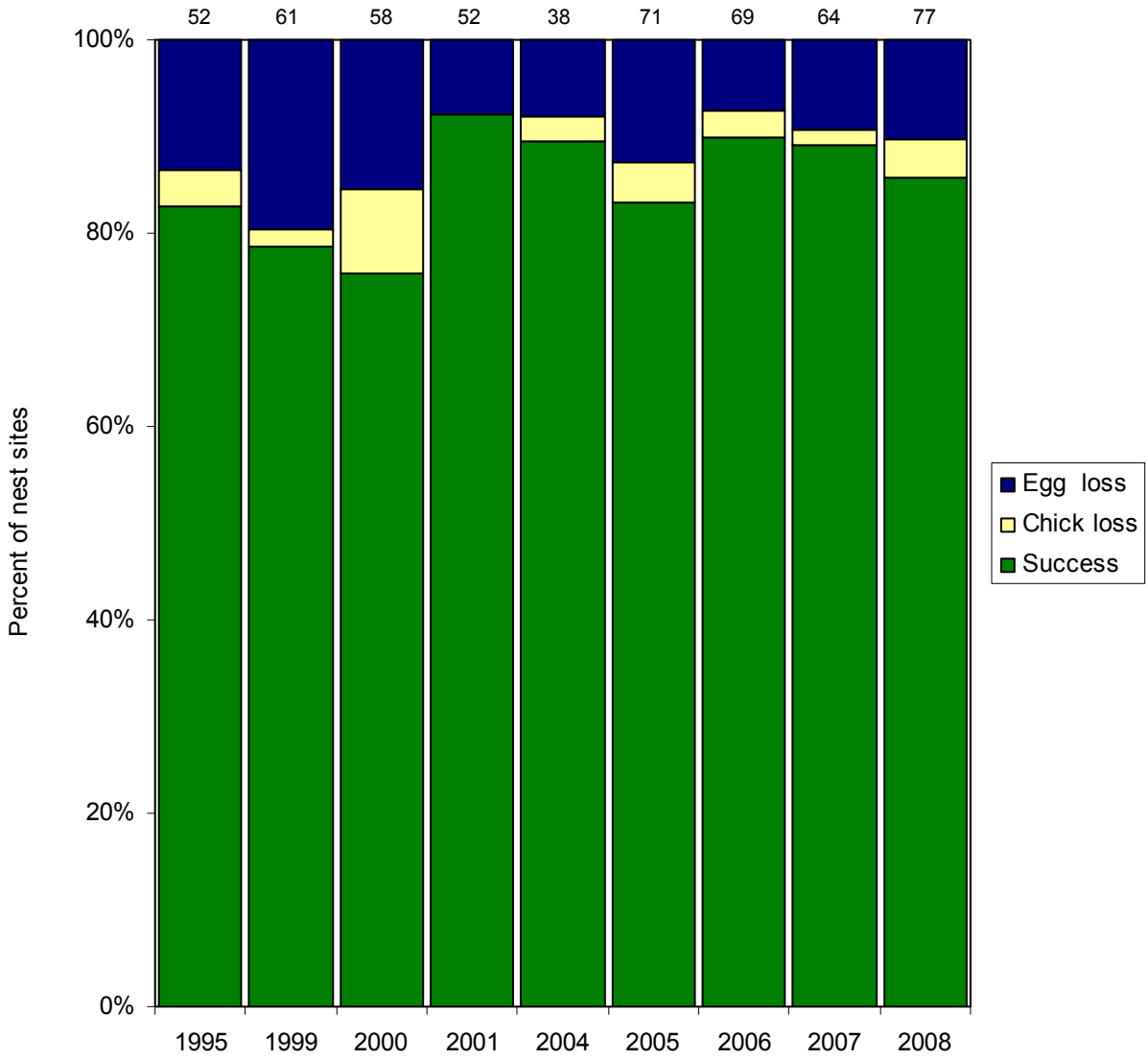


Figure 8. Reproductive performance of Leach's storm-petrels in non-chronology burrows at Aiktak Island, Alaska. Egg loss=(C-D)/C; Chick loss=(D-E)/C; Success=E/C, where C=number of eggs, D=number of eggs hatched, and E=number of chicks fledged or still alive at last check (codes come from following productivity tables). Success represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower. Numbers above columns indicate sample sizes.

Table 11. Productivity values of Leach's storm-petrels in non-chronology burrows[a] at Aiktak Island, Alaska[b].

Parameter	1995	1999	2000	2001	2004	2005	2006	2007	2008
No. burrows w/ known contents (A)	129	205	223	218	321	272	273	276	300
No. occupied burrows (B)	55	65	60	53	38	72	71	68	81
No. eggs w/ known fate (C)	52	61	58	52	38	68	69	64	77
eggs lost to: disappearance	3	1	5	0	1	0	0	1	3
abandonment	2	9	3	4	1	2	4	4	2
breakage	2	2	1	0	1	7	1	1	3
No. eggs still viable at last visit (unk. fate)	0	2	1	0	0	1	1	1	4
No. chicks (D)	45	49	49	48	35	62	64	58	69
chicks lost to: disappearance[c]	2	0	1	0	1	0	0	0	0
death	0	1	4	0	0	3	2	1	3
No. chicks potentially successful (E)	43	48	44	48	34	59	62	57	66
chicks fledged[d]	0	0	0	0	0	0	0	0	0
chicks still present at last visit	43	48	44	48	34	59	62	57	66
Hatching success (D/C)	0.87	0.80	0.84	0.92	0.92	0.91	0.93	0.91	0.90
Fledging success (E/D)[e]	0.96	0.98	0.90	1.00	0.97	0.95	0.97	0.98	0.96
Reproductive success (E/C)[e]	0.83	0.79	0.76	0.92	0.89	0.87	0.90	0.89	0.86

[a]Non-chronology burrows were monitored on an interval of 14 days.
[b]More detailed data exists in Helm and Zeman 2006 for 1996-1998 and 2002. Data were not collected in 2003.
[c]Chicks < 50 days old at disappearance were considered failed.
[d]Chicks $\geq$ 50 days old at disappearance were considered fledged.
[e]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

Table 12. Productivity values of Leach's storm-petrels in non-chronology burrows[a] at Aiktak Island, Alaska in 2008.

Parameter	Plot 9	10	11	13	16	17	18	19	20	21	22	24	26	All plots	Mean	SD
No. burrows w/ known contents (A)	42	26	23	11	8	17	27	29	17	23	18	10	49	300		
No. occupied burrows (B)	12	4	8	2	3	6	10	9	5	3	8	2	9	81		
No. eggs w/ known fate (C)	11	4	7	1	3	6	10	9	5	3	7	2	9	77		
eggs lost to: disappearance	1	0	0	0	0	0	2	0	0	0	0	0	0	3		
abandonment	0	0	1	0	0	0	0	1	0	0	0	0	0	2		
breakage	0	0	1	0	0	0	1	1	0	0	0	0	0	3		
No. eggs still viable at last visit (unk. fate)	1	0	1	1	0	0	0	0	0	0	1	0	0	4		
No. chicks (D)	10	4	5	1	3	6	7	7	5	3	7	2	9	69		
chicks lost to: disappearance[b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
death	0	0	0	0	1	0	0	1	0	0	1	0	0	3		
No. chicks potentially successful (E)	10	4	5	1	2	6	7	6	5	3	6	2	9	66		
chicks fledged[c]	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
chicks still present at last visit	10	4	5	1	2	6	7	6	5	3	6	2	9	66		
Hatching success (D/C)	0.91	1.00	0.71	1.00	1.00	1.00	0.70	0.78	1.00	1.00	1.00	1.00	1.00	0.90	0.93	0.1
Fledging success (E/D)[d]	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.86	1.00	1.00	0.86	1.00	1.00	0.96	0.95	0.1
Reproductive success (E/C)[d]	0.91	1.00	0.71	1.00	0.67	1.00	0.70	0.67	1.00	1.00	0.86	1.00	1.00	0.86	0.89	0.1

[a]Non-chronology burrows were monitored on an interval of 14 days.
[b]Chicks < 50 days old at disappearance were considered failed.
[c]Chicks ≥ 50 days old at disappearance were considered fledged.
[d]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

Table 13. Mean growth rates of Leach's storm-petrel chicks at Aiktak Island, Alaska. Data include chicks measured at least 2 times during the linear phase of growth (approximately mass 0-60g; wing chord 20-140mm); chicks that died or did not exhibit linear growth were excluded.

	Mass (g/day)				Wing chord (mm/day)[b]			
Year[a]	*n*	mean	SD	range	*n*	mean	SD	range
1996	36	2.1	0.4	1.3 - 3.4	35	2.8	0.4	1.8 - 3.4
1997	40	2.1	0.4	1.1 - 3.0	32	2.4	0.5	1.4 - 3.5
1998	40	1.9	0.6	0.6 - 3.2	24	2.3	0.6	1.2 - 3.4
1999	29	2.2	0.5	0.7 - 3.4	3	3.1	0.1	3.0 - 3.3
2000	36	2.4	0.7	1.4 - 4.5	20	3.3	0.8	1.3 - 5.0
2001	28	1.9	0.4	1.4 - 2.7	--[c]	--	--	--
2002	8	1.8	1.0	1.0 - 2.5	7	3.1	0.5	2.5 - 4.1
2004	41	1.8	0.5	0.9 - 3.1	24	2.7	0.9	0.9 - 4.2
2005	37	2.1	0.5	1.4 - 4.1	37	2.4	0.4	1.1 - 3.3
2006	26	2.0	0.5	1.1 - 3.4	25	2.5	0.3	1.8 - 3.0
2007	30	1.8	0.6	1.1 - 3.0	19	2.5	0.5	1.7 - 3.6
2008	30	1.8	0.7	0.3 - 3.7	21	2.5	0.4	1.8 - 3.0

[a]Data were not collected in 1995 and 2003.
[b]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.
[c]Wing chord data were not collected in 2001.

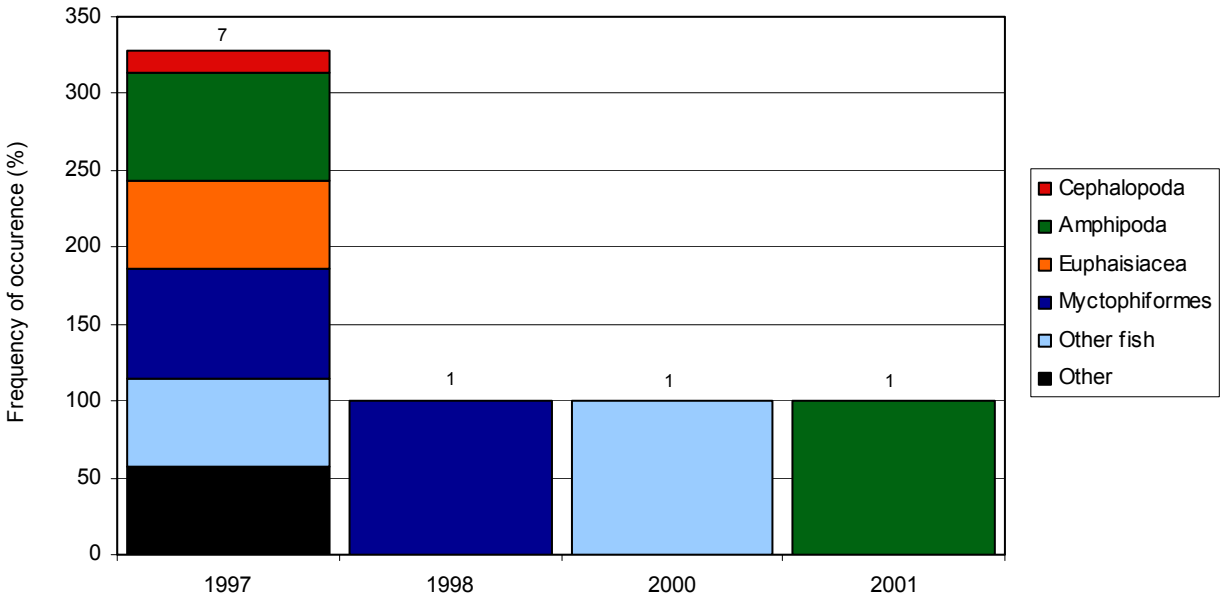


Figure 9. Percent occurrence of prey in diets of Leach's storm-petrels at Aiktak Island, Alaska. Numbers represent the percentage of food samples in which each species was present. Prey samples were collected in 2002 and 2004, and 2006-2008 but had not been analyzed at the time of this report. Numbers above columns indicate sample sizes.

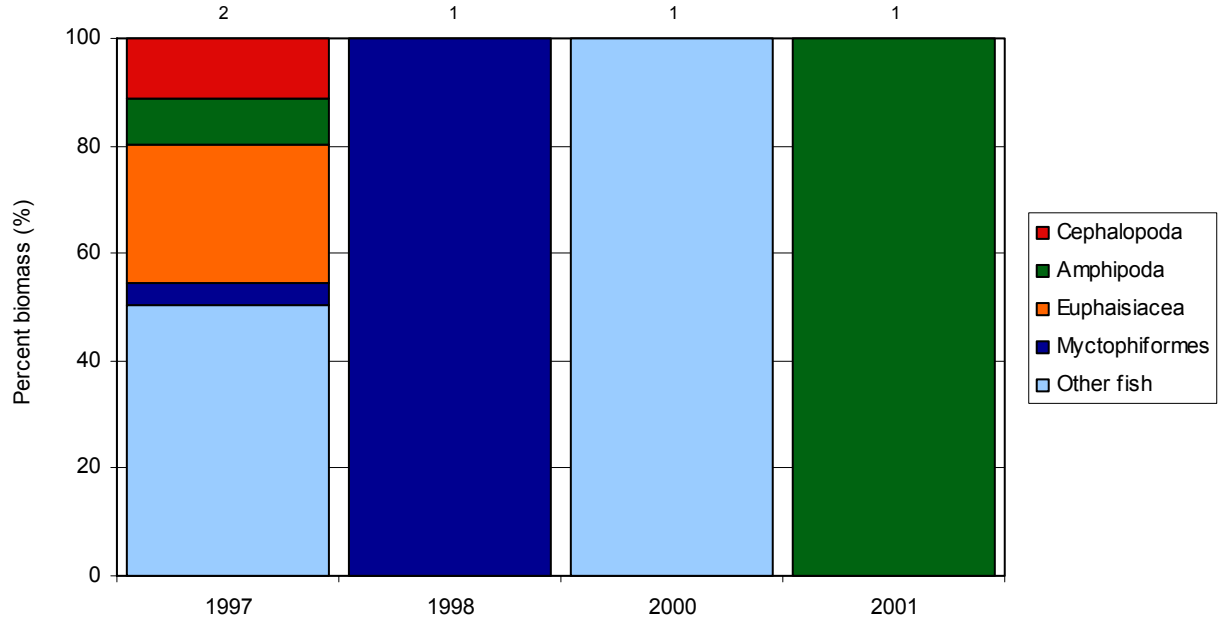


Figure 10. Relative biomass of prey in diets of Leach's storm-petrels at Aiktak Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each species. Prey samples were collected in 2002 and 2004, and 2006-2008 but had not been analyzed at the time of this report. Numbers above columns indicate sample sizes.

Table 14. Percent occurrence of prey in diets of Leach's storm-petrels at Aiktak Island, Alaska[a]. Numbers represent the percentage of food samples in which each species was present.

	1997	1998	2000	2001
No. samples	7	1	1	1
Cephalopoda				
Unid. squid	14.3	--	--	--
Amphipoda				
Gammaridea				
Lysianassidae	57.1	--	--	--
Hyperiidea				
Hyperoche medusarm	14.3	--	--	--
Unid. amphipod	--	--	--	100.0
Euphausiacea				
Euphausiid spp.	57.1	--	--	--
Unid. invertebrate	14.3	--	--	--
Myctophiformes				
Myctophidae				
Stenobrachius spp.	71.4	100.0	--	--
Scorpaeniformes				
Hexagrammidae				
Hexagrammos spp.	57.1	--	--	--
Unid. fish	--	--	100.0	--
Other				
Plastic	14.3	--	--	--
Plant seed	14.3	--	--	--
White lava rock	14.3	--	--	--

[a]Prey samples were collected in 2002, 2004, and 2006-2008 but had not been analyzed at the time of this report; samples were not collected in 1999, 2003, and 2005.

Table 15. Relative biomass of prey in diets of Leach's storm-petrels at Aiktak Island, Alaska[a]. Numbers represent the percentage of the mass of combined food samples comprised by each species.

	1997[b]	1998	2000	2001
No. samples	2	1	1	1
Total mass (g)	26.5	10.6	0.2	0.1
Cephalopoda				
Unid. squid	11.3	--	--	--
Amphipoda				
Gammaridea				
Lysianassidae	8.3	--	--	--
Unid. amphipod	--	--	--	100.0
Euphausiacea				
Euphausiid spp.	26.0	--	--	--
Myctophiformes				
Myctophidae				
Stenobrachius spp.	4.2	100.0	--	--
Scorpaeniformes				
Hexagrammidae				
Hexagrammos spp.	50.2	--	--	--
Unid. fish	--	--	100.0	--

[a] Prey samples were collected in 2002, 2004, and 2006-2008 but had not been analyzed at the time of this report; samples were not collected in 1999, 2003, and 2005.
[b]Biomass could be calculated for only two of seven prey samples in 1997 because mass of prey items in five samples were not recorded. Therefore, some prey items do not appear in biomass data from1997 although they were present in diet samples (see Table 14).

Table 16. Mass of food loads collected from Leach's storm-petrels at Aiktak Island, Alaska[a]. Data include only samples with solid food material, not those containing only oil.

Chick-rearing Period[c]	*n*	Mass of load (g)[b] mean	SD	range
2008				
Early	4	4.6	2.9	1.7 - 8.4
Mid	7	3.0	3.2	1.0 - 9.5
Late	1	5.4	--	--
Total				
1997	7	N/A[d]	N/A	N/A
1998	1	N/A	--	--
2000	1	1.0	--	--
2001	1	N/A	--	--
2002	2	2.1	1.3	1.1 - 3.0
2004	6	0.5	0.2	0.2 - 0.7
2006	1	2.1	--	--
2007	1	2.7	--	--
2008	12	3.7	3.0	1.0 - 9.5

[a]Food samples were not collected in 1999, 2003, or 2005; samples were collected in 1996 but data is missing.
[b]Mass values are corrected for estimated percent recovery of each sample.
[c]In 2008, food samples were collected nights of 5 August (early), 20 August (mid), and 26 August (late).
[d]Mass data not recorded.

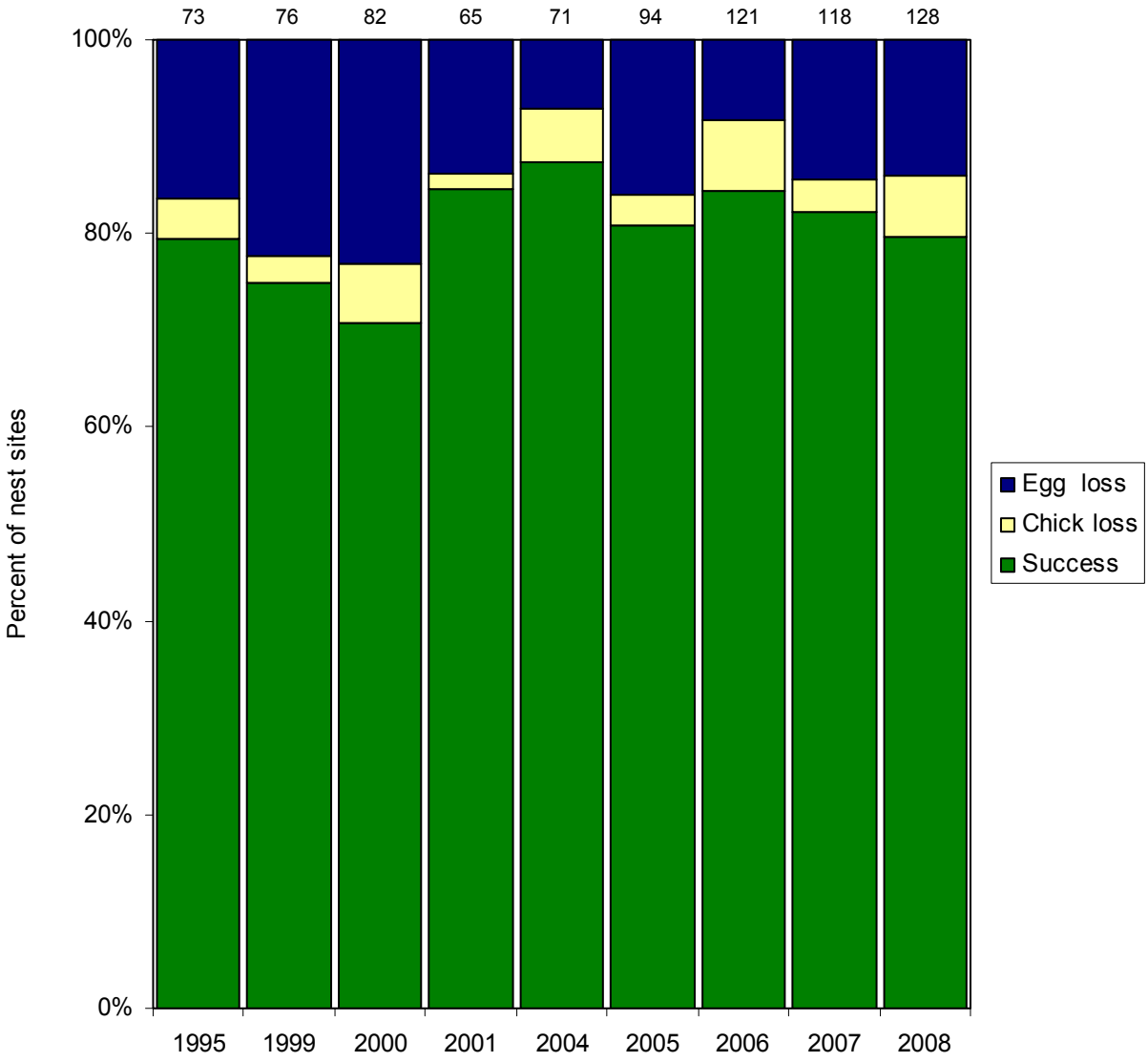


Figure 11. Reproductive performance of storm-petrels (Leach's, fork-tailed, and unknown petrel species) in non-chronology burrows at Aiktak Island, Alaska. Egg loss=(C-D)/C; Chick loss=(D-E)/C; Productivity=E/C, where C=number of eggs, D=number of eggs hatched, and E=number of chicks fledged or still alive at last check (codes come from following productivity tables). Success represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower. Numbers above columns indicate sample sizes.

Table 17. Productivity values of storm-petrels (Leach's, fork-tailed, and unidentified storm-petrel species) in non-chronology burrows[a] at Aiktak Island, Alaska[b].

Parameter	1995	1999	2000	2001	2004	2005	2006	2007	2008
No. burrows w/ known contents (A)	129	205	223	219	334	272	273	279	300
No. occupied burrows (B)	84	94	89	87	71	123	156	136	135
No. eggs w/ known fate (C)	73	76	82	65	71	94	121	118	128
eggs lost to: disappearance	4	2	9	1	1	1	0	3	4
abandonment	4	11	6	7	1	2	5	8	10
breakage	4	4	4	1	2	12	5	6	4
No. eggs still viable at last visit (unk. fate)	0	4	1	4	0	1	1	2	4
No. chicks (D)	61	59	63	56	66	79	111	101	110
chicks lost to: disappearance[c]	2	0	1	0	4	0	1	0	1
death	1	2	4	1	0	3	8	4	7
No. chicks potentially successful (E)	58	57	58	55	62	76	102	97	102
chicks fledged[d]	0	0	5	2	4	0	0	0	0
chicks still present at last visit	58	57	53	53	58	76	102	97	102
Hatching success (D/C)	0.84	0.78	0.77	0.86	0.93	0.84	0.92	0.86	0.86
Fledging success (E/D)[e]	0.95	0.97	0.92	0.98	0.94	0.96	0.92	0.96	0.93
Reproductive success (E/C)[e]	0.79	0.75	0.71	0.85	0.87	0.81	0.84	0.82	0.80

[a]Non-chronology burrows were monitored on an interval of $\geq$ 14 days.
[b]More detailed data exists in Helm and Zeman 2006 for 1996-1998 and 2002. Data were not collected in 2003.
[c]Chicks < 50 days old at disappearance were considered failed.
[d]Chicks $\geq$ 50 days old at disappearance were considered fledged.
[e]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

Table 18. Productivity values of storm-petrels (Leach's, fork-tailed, and unidentified storm-petrel species) in non-chronology burrows[a] at Aiktak Island, Alaska in 2008.

Parameter	Plot													All plots	Mean	SD
	9	10	11	13	16	17	18	19	20	21	22	24	26			
No. burrows w/ known contents (A)	42	26	23	11	8	17	27	29	17	23	18	10	49	300		
No. occupied burrows (B)	21	8	13	4	5	10	14	13	7	6	9	4	21	135		
No. eggs w/ known fate (C)	20	8	12	3	5	10	14	13	6	6	8	3	20	128		
eggs lost to: disappearance	1	0	0	0	0	0	2	0	0	0	0	0	1	4		
abandonment	1	1	2	0	0	1	1	1	0	1	0	0	2	10		
breakage	0	0	1	0	0	0	1	2	0	0	0	0	0	4		
No. eggs still viable at last visit (unk. fate)	1	0	1	1	0	0	0	0	0	0	1	0	0	4		
No. chicks (D)	18	7	9	3	5	9	10	10	6	5	8	3	17	110		
chicks lost to: disappearance[b]	0	0	0	0	0	0	0	0	0	0	0	0	1	1		
death	0	1	0	0	2	1	0	1	0	0	1	0	1	7		
No. chicks potentially successful (E)	18	6	9	3	3	8	10	9	6	5	7	3	15	102		
chicks fledged[c]	0	0	1	0	0	0	0	0	0	0	0	0	0	1		
chicks still present at last visit	18	6	8	3	3	8	10	9	6	5	7	3	15	101		
Hatching success (D/C)	0.90	0.88	0.75	1.00	1.00	0.90	0.71	0.77	1.00	0.83	1.00	1.00	0.85	0.86	0.89	0.1
Fledging success (E/D)[d]	1.00	0.86	1.00	1.00	1.00	0.89	1.00	0.90	1.00	1.00	0.88	1.00	0.88	0.93	0.95	0.1
Reproductive success (E/C)[d]	0.90	0.75	0.75	1.00	1.00	0.80	0.71	0.69	1.00	0.83	0.88	1.00	0.75	0.80	0.85	0.1

[a]Non-chronology burrows were monitored on an interval of $\geq$ 14 days.
[b]Chicks < 50 days old at disappearance were considered failed.
[c]Chicks $\geq$ 50 days old at disappearance were considered fledged.
[d]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values were likely lower.

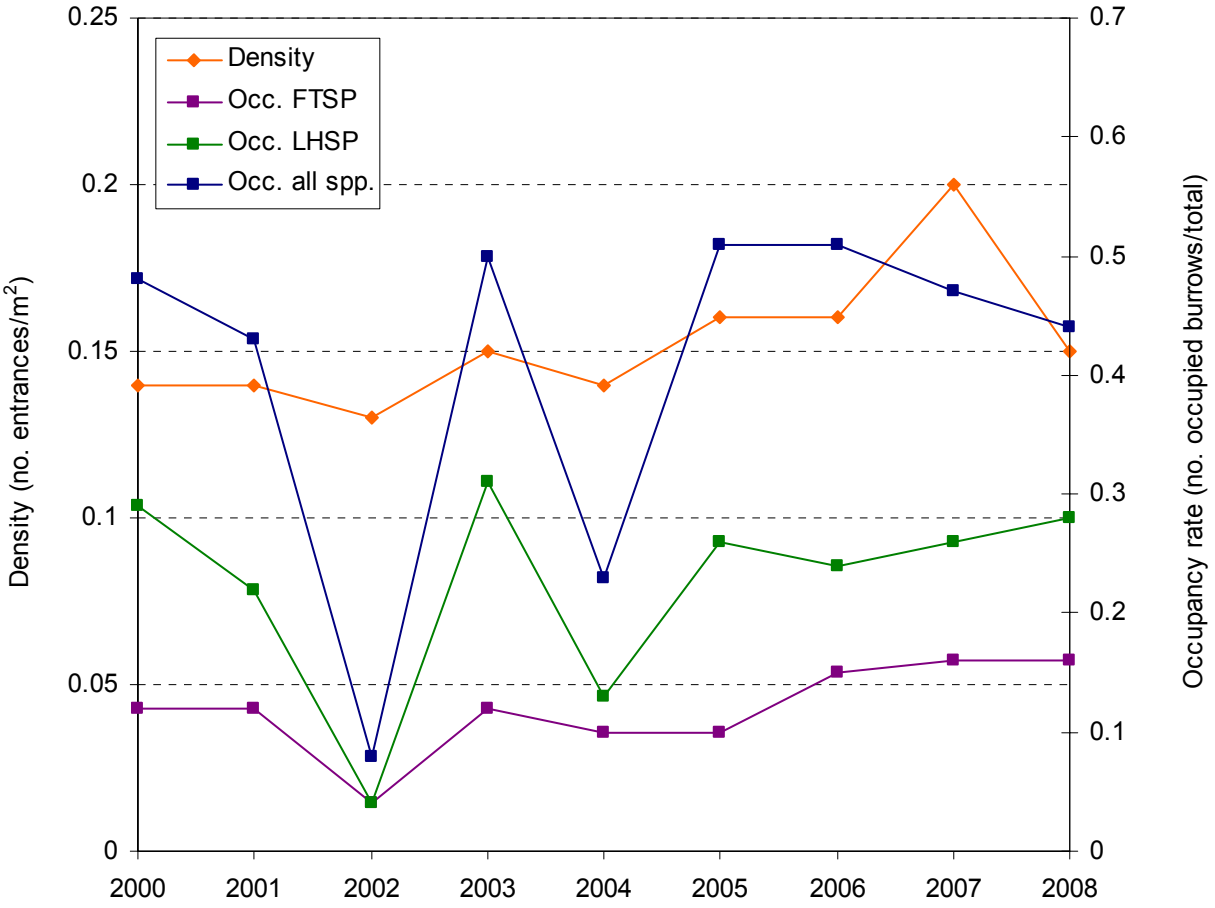


Figure 12. Burrow entrance density (all species) and occupancy rates (fork-tailed, Leach's, and all species) of storm-petrels at Aiktak Island, Alaska.

Table 19. Density and occupancy rates of storm-petrels (Leach's, fork-tailed, and all storm-petrel species) on index plots at Aiktak Island, Alaska[a].

Parameter	2000	2001	2002	2003	2004	2005	2006	2007	2008
Density[b]									
Total area (m^2)[c]	3917	3917	3917	3917	3917	3917	3917	3917	3917
No. burrow entrances[d]	534	554	520	584	544	633	609	769	584
Density of burrow entrances	0.14	0.14	0.13	0.15	0.14	0.16	0.16	0.20	0.15
Occupancy[e]									
No. burrows[f] occupied by:									
Fork-tailed storm-petrels	45	43	16	45	55	63	64	67	72
Leach's storm-petrels	115	78	16	114	73	119	105	108	127
All storm-petrels[g]	189	152	34	184	128	229	222	197	201
Total no. burrows w/ known status	393	358	451	340	552	451	439	413	452
Occupancy rate of:									
Fork-tailed storm-petrels	0.12	0.12	0.04	0.12	0.10	0.10	0.15	0.16	0.16
Leach's storm-petrels	0.29	0.22	0.04	0.31	0.13	0.26	0.24	0.26	0.28
All storm-petrels[g]	0.48	0.43	0.08	0.50	0.23	0.51	0.51	0.48	0.44

[a]Density and occupancy data were collected in some but not all plots in 1990 and 1995-1999 and thus are not comparable with current data.

[b]Density is expressed as the number of small/medium burrow entrances per m^2.

[c]Density and occupancy rates were calculated using all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot.

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

[e]Occupancy is expressed as the number of occupied burrows over the total number of burrows with known status; a burrow was considered occupied if it contained an adult bird on two consecutive checks, an egg, fresh membrane/eggshell fragments, or a chick.

[f]For occupancy, burrows are defined as only those with nest chambers; nests with multiple chambers are counted as separate "burrows".

[g]Includes unknown spp.

Table 20. Density and occupancy rates of storm-petrels on index plots at Aiktak Island, Alaska in 2008.

Parameter	Plot[a] 8	9	10	11	12	13	16	17	18	19	20	21	22	23	24	25	27	Total
Density[b]																		
Plot size (m^2)	100	200	150	50	50	50	100	50	494	125	75	119	288	455	52	1219	340	3917
No. burrow entrances[c]	41	51	39	19	19	8	14	23	60	42	26	33	18	61	17	43	70	584
Density of burrow entrances	0.41	0.26	0.26	0.38	0.38	0.16	0.14	0.46	0.12	0.34	0.35	0.28	0.06	0.13	0.33	0.04	0.21	0.15
Occupancy[d]																		
No. burrows[e] occupied by:																		
Fork-tailed storm-petrels	4	9	4	5	2	2	2	4	4	4	1	2	1	12	2	7	7	72
Leach's storm-petrels	6	12	4	8	4	2	3	6	10	9	5	3	8	16	2	9	20	127
All storm-petrels[f]	10	21	8	13	6	4	5	10	14	13	7	6	9	28	4	16	21	201
Total no. burrows w/ known status	31	42	26	23	19	11	8	17	27	29	17	23	18	56	10	40	55	452
Occupancy rate of:																		
Fork-tailed storm-petrels	0.13	0.21	0.15	0.22	0.11	0.18	0.25	0.24	0.15	0.14	0.06	0.09	0.06	0.21	0.20	0.18	0.13	0.16
Leach's storm petrels	0.19	0.29	0.15	0.35	0.21	0.18	0.38	0.35	0.37	0.31	0.29	0.13	0.44	0.29	0.20	0.23	0.36	0.28
All storm-petrels[f]	0.32	0.50	0.31	0.57	0.32	0.36	0.63	0.59	0.52	0.45	0.41	0.26	0.50	0.50	0.40	0.40	0.49	0.44

[a]Density and occupancy rates were calculated using all plots except plot 26, which is excluded due to the existence of artificial burrows within the plot.

[b]Density is expressed as the number of small/medium burrow entrances per m^2.

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

[d]Occupancy is expressed as the number of occupied burrows over the total number of burrows with known status; a burrow was considered occupied if it contained an adult bird on two consecutive checks, an egg, fresh membrane/eggshell fragments, or a chick.

[e]For occupancy, burrows are defined as only those with nest chambers; nests with multiple chambers are counted as separate "burrows".

[f]Includes unknown spp.

Table 21. Morphological measurements of adult fork-tailed and Leach's storm-petrels at Aiktak Island, Alaska.

		Mass (g)			Wing chord (mm)			Diagonal tarsus (mm)		
Year	*n*	mean	SD	range	mean	SD	range	mean	SD	range
Fork-tailed storm-petrel										
2005	22	67.5	5.9	58.5 - 80.0	156.5	4.4	146 - 163	27.9	0.9	26.0 - 29.0
2006	33	65.5	5.8	55.0 - 81.5	158.1	3.8	150 - 165	27.5	1.0	26.0 - 29.5
2007	30	65.0	4.5	55.0 - 74.0	157.0	4.9	147 - 166	27.1	0.9	25.1 - 28.5
2008	32	58.9	4.9	47.5 - 71.0	156.0	4.2	148 - 165	26.9	0.7	25.1 - 28.2
Leach's storm-petrel										
2005	72	47.1	4.2	39.0 - 58.0	153.5	3.1	148 - 160	24.5	0.8	23.0 - 26.0
2006	48	46.2	4.4	38.5 - 55.5	154.2	3.8	146 - 162	24.4	0.6	22.5 - 25.5
2007	56	46.0	4.4	38.0 - 54.0	155.6	4.1	147 - 166	24.3	0.9	22.9 - 27.3
2008	45	42.9	3.2	37.5 - 53.0	154.8	3.3	148 - 163	24.1	0.7	22.9 - 25.6

Table 22. Band resights of fork-tailed storm-petrels at Aiktak Island, Alaska in 2008. 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	7	54
No. birds resighted in 2008	1	3	0	4

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

Table 23. Band resights of Leach's storm-petrels at Aiktak Island, Alaska in 2008. 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]	50	66	28	144
No. birds resighted in 2008	7	5	5	17

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

Table 24. Reproductive performance of double-crested cormorants at Aiktak Island, Alaska[a].

Parameter	2000	2002	2004	2006	2007	2008
Total no. nests (A)	7	15	20	7	16	24
Min. no. chicks in nest:						
0	0	9	20	7	16	6
1	2	2	0	0	0	4
2	2	4	0	0	0	5
3	2	0	0	0	0	9
4	1	0	0	0	0	0
Min. no. chicks (B)	16	10	0	0	0	41
No. nests with ≥ 1 chick (C)	7	6	0	0	0	18
% nests with chicks [(C/A)*100]	100.0	40.0	0.0	0.0	0.0	75.0
Brood size:						
mean (B/C)	2.3	1.7	0.0	0.0	0.0	2.3
SD	0.9	3.7	--	--	--	0.8
n	7	6	0	0	0	18
Productivity (B/A)	2.3	0.7	0.0	0.0	0.0	1.7
Date of maximum nest count	20 Aug	N/A	22 Jun	11 Jul	10 Jun	17 Jun
Date of maximum chick count	20 Aug	N/A	N/A	N/A	N/A	20 Aug
No. nests w/ brooding adults at last check	0	0	0	0	0	1
% nests w/ chicks or brooding adults	100.0	40.0	0.0	0.0	0.0	76.0

[a]Double-crested cormorants bred at Aiktak in 1995-1998 and 2003 but productivity data were not collected. There was no evidence of nesting attempts in 1999, 2001, and 2005. Data from 2004 come from the annotated list in the 2004 report.

Table 25. Reproductive performance of red-faced cormorants at Aiktak Island, Alaska[a].

Parameter	1997	2001	2002	2004	2007	2008
Total no. nests (A)	53	21	49	49	13	248
Min. no. chicks in nest:						
0	37	8	12	49	13	113
1	4	3	3	0	0	41
2	6	3	19	0	0	71
3	6	6	15	0	0	20
4	0	1	0	0	0	3
Min. no. chicks (B)	34	32	86	0	0	255
No. nests with ≥ 1 chick (C)	16	13	37	0	0	135
% of nests with chicks [(C/A)*100]	30.2	61.9	75.5	0.0	0.0	54.4
Brood size:						
mean (B/C)	2.1	2.5	2.3	0.0	0.0	1.9
SD	15.0	2.8	8.0	--	--	0.7
n	16	13	37	0	0	135
Productivity (B/A)	0.6	1.5	1.8	0.0	0.0	1.0
Date of maximum nest count	N/A	N/A	N/A	22 Jun	10 Jun	17 Jun
Date of maximum chick count	N/A	N/A	N/A	N/A	N/A	20 Aug
No. nests w/ brooding adults at last check	0	0	0	0	0	4
% nests w/ chicks or brooding adults	30.2	61.9	75.5	0.0	0.0	55.2

[a]Red-faced cormorants bred at Aiktak in 1998 and 2003 but productivity data were not collected. There was no evidence of nesting attempts in 1995, 1996, 1999, 2000, 2005, and 2006. Data from 2004 come from the annotated list in the 2004 report.

Table 26. Reproductive performance of pelagic cormorants at Aiktak Island, Alaska[a].

Parameter	1995	1996	1997	2001	2002	2004	2006	2007	2008
Total no. nests (A)	9	6	3	14	18	4	19	1	69
Min. no. chicks in nest:									
0	N/A	N/A	2	3	7	4	19	1	12
1	N/A	N/A	1	4	2	0	0	0	10
2	N/A	N/A	0	4	6	0	0	0	31
3	N/A	N/A	0	3	3	0	0	0	15
4	N/A	N/A	0	0	0	0	0	0	1
Min. no. chicks (B)	21	12	1	21	23	0	0	0	121
No. nests with ≥ 1 chick (C)	9	5	1	11	11	0	0	0	57
% of nests with chicks [(C/A)*100]	100.0	83.3	33.3	78.6	61.1	0.0	0.0	0.0	82.6
Brood size:									
mean (B/C)	2.3	2.4	1.0	1.9	2.1	0.0	0.0	0.0	2.1
SD	N/A	N/A	0	1.6	2.9	--	--	--	0.7
n	9	5	1	11	11	0	0	0	57
Productivity (B/A)	2.3	2.0	0.3	1.5	1.3	0.0	0.0	0.0	1.8
Date of maximum nest count	N/A	N/A	N/A	N/A	N/A	22 Jun	17 Jul	10 Jun	22 July
Date of maximum chick count	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20 Aug
No. nests w/ brooding adults at last check	0	0	0	0	0	0	0	0	2
% nests w/ chicks or brooding adults	100.0	83.3	33.3	78.6	61.1	0.0	0.0	0.0	83.1

[a]Pelagic cormorants bred at Aiktak in 1998, 2000, and 2003 but productivity data were not collected. There was no evidence of nesting attempts in 1999 and 2005. Data from 2004 come from the annotated list in the 2004 report.

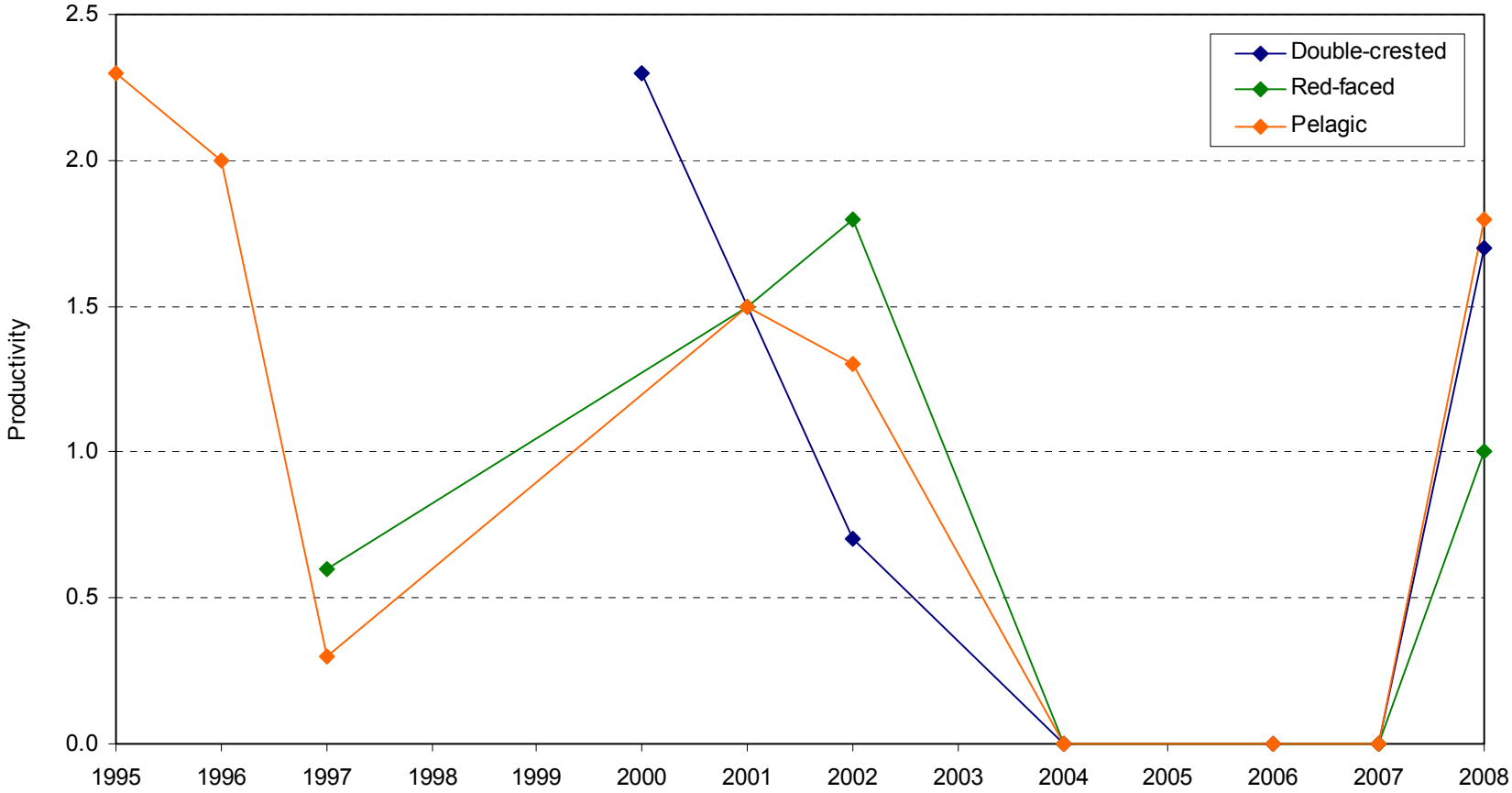


Figure 13. Overall productivity of double-crested, red-faced, and pelagic cormorants at Aiktak Islands, Alaska. Productivity represents the total number of chicks divided by the total number of nests, including those without chicks.

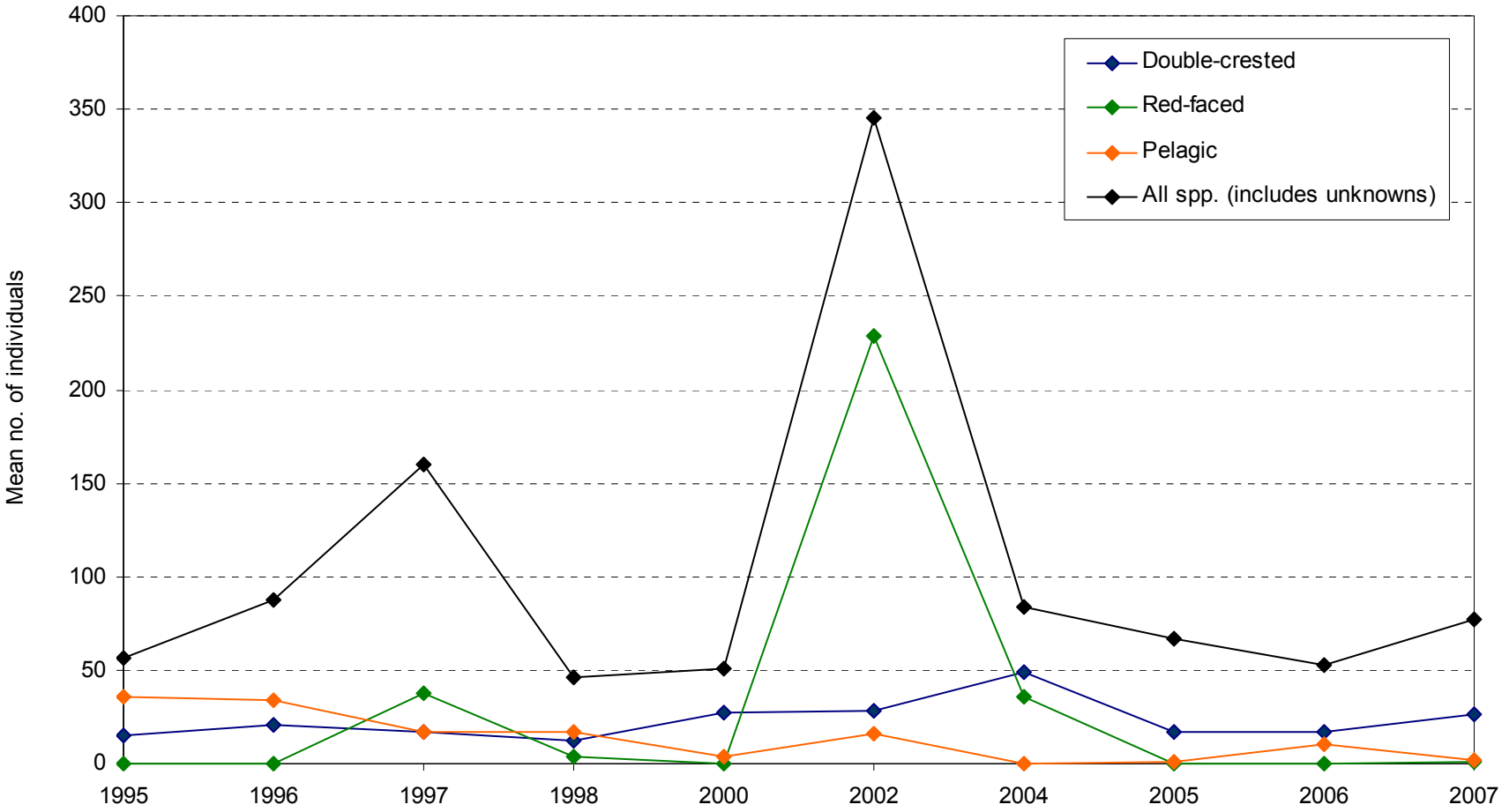


Figure 14. Mean numbers of double-crested, red-faced pelagic, and pelagic cormorants seen during circumnavigations at Aiktak Island, Alaska.

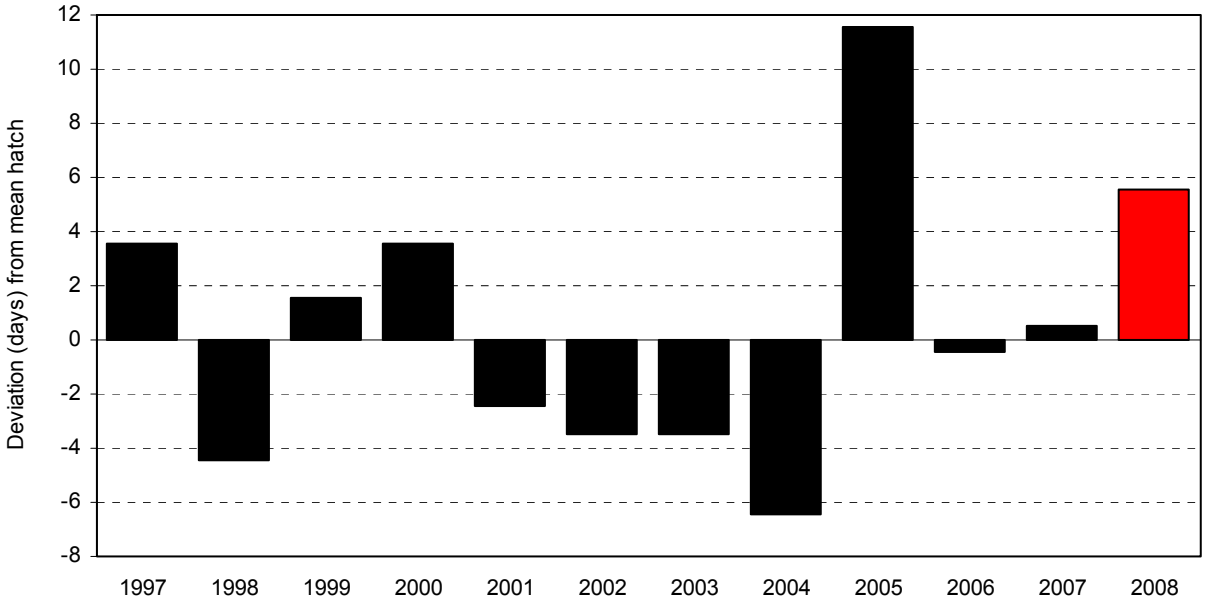


Figure 15. Annual hatch date deviation (from the 1997-2007 average of 22 June) of black oystercatchers at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

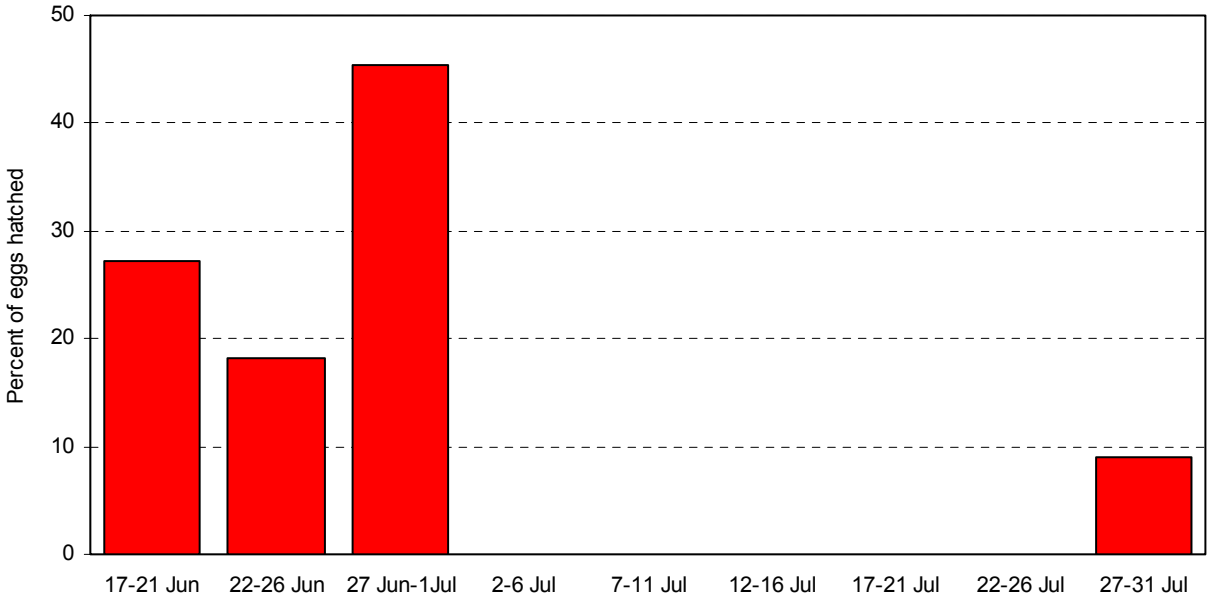


Figure 16. Hatching chronology of black oystercatchers at Aiktak Island, Alaska in 2008.

Table 27. Breeding chronology of black oystercatchers at Aiktak Island, Alaska. Hatch dates represent the date of the first chick hatched in each nest.

Year	Mean hatch	SD	*n*[a]	Median hatch	No. nests monitored[b]	First hatch	Last hatch
1997	27 Jun	6.2	7	28 Jun	10	18 Jun	5 Jul
1998	25 Jun	5.4	5	24 Jun	14	19 Jun	3 Jul
1999	25 Jun	5.4	5	24 Jun	12	19 Jun	3 Jul
2000	26 Jun	8.5	2	26 Jun	5	20 Jun	2 Jul
2001	21 Jun	8.2	10	22 Jun	12	9 Jun	6 Jul
2002	30 Jun	15.3	6	22 Jun	14	14 Jun	19 Jul
2003	20 Jun	8.0	6	17 Jun	15	13 Jun	5 Jul
2004	16 Jun	8.0	9	14 Jun	11	10 Jun	6 Jul
2005	6 Jul	8.7	4	4 Jul	20	27 Jun	17 Jul
2006	23 Jun	4.4	10	23 Jun	13	15 Jun	1 Jul
2007	24 Jun	8.2	6	22 Jun	11	17 Jun	7 Jul
2008	28 Jun	10.6	11	27 Jun	17	17 Jun	27 Jul

[a]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 5 days.
[b]All nests monitored are used to estimate first and last hatch dates and may include observations with egg to chick intervals > 5 days.

Table 28. Frequency distribution of hatch dates for black oystercatchers at Aiktak Island, Alaska. Hatch dates represent the date of the first chick hatched in each nest.

Julian	No. nests hatching on Julian date[a]											
date	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
160	--	--	--	--	1	--	--	--	--	--	--	--
161	--	--	--	--	--	--	--	--	--	--	--	--
162	--	--	--	--	--	--	--	2	--	--	--	--
163	--	1	--	--	--	--	--	--	--	--	--	--
164	--	--	--	--	--	--	1	2	--	--	--	--
165	--	--	--	--	--	1	--	--	--	--	--	--
166	--	--	--	--	2	--	--	1	--	1	--	--
167	--	1	--	--	1	--	2	--	--	--	--	--
168	--	--	--	--	1	--	1	1	--	--	3	--
169	1	--	--	--	--	--	--	--	--	--	--	1
170	--	--	1	--	--	--	--	2	--	1	--	--
171	--	1	--	--	--	--	--	--	--	--	--	--
172	1	--	1	1	--	--	--	--	--	--	--	1
173	--	--	--	--	--	3	--	--	--	3	--	1
174	--	--	--	--	--	--	1	--	--	2	--	--
175	--	--	1	--	--	--	--	--	--	1	--	--
176	--	--	1	--	--	--	--	--	--	--	--	1
177	--	--	--	--	2	--	--	--	--	--	--	--
178	1	--	--	--	2	--	--	--	1	--	2	1
179	1	1	--	--	--	--	--	--	--	1	--	2
180	1	--	--	--	--	--	--	--	--	--	--	--
181	--	--	--	--	--	--	--	--	--	--	--	--
182	--	--	--	--	--	--	--	--	1	1	--	1
183	--	--	--	--	--	--	--	--	--	--	--	2
184	--	--	1	1	--	--	--	--	--	--	--	--
185	1	--	--	--	--	--	--	--	--	--	--	--
186	1	--	--	--	--	--	1	--	--	--	--	--
187	--	--	--	--	1	--	--	--	--	--	--	--
188	--	--	--	--	--	--	--	1	1	--	1	--
189	--	--	--	--	--	--	--	--	--	--	--	--
190	--	--	--	--	--	--	--	--	--	--	--	--
191	--	--	--	--	--	--	--	--	--	--	--	--
192	--	--	--	--	--	--	--	--	--	--	--	--
193	--	--	--	--	--	--	--	--	--	--	--	--
194	--	--	--	--	--	--	--	--	--	--	--	--
195	--	--	--	--	--	--	--	--	--	--	--	--
196	--	--	--	--	--	--	--	--	--	--	--	--
197	--	--	--	--	--	--	--	--	--	--	--	--
198	--	--	--	--	--	--	--	--	1	--	--	--
199	--	--	--	--	--	--	--	--	--	--	--	--
200	--	--	--	--	--	2	--	--	--	--	--	--
201	--	--	--	--	--	--	--	--	--	--	--	--
202	--	--	--	--	--	--	--	--	--	--	--	--
203	--	--	--	--	--	--	--	--	--	--	--	--
204	--	--	--	--	--	--	--	--	--	--	--	--
205	--	--	--	--	--	--	--	--	--	--	--	--
206	--	--	--	--	--	--	--	--	--	--	--	--
207	--	--	--	--	--	--	--	--	--	--	--	--
208	--	--	--	--	--	--	--	--	--	--	--	--
209	--	--	--	--	--	--	--	--	--	--	--	1
n	7	4	5	2	10	6	6	9	4	10	6	11

[a]Data were not collected in 1995 and 1996.

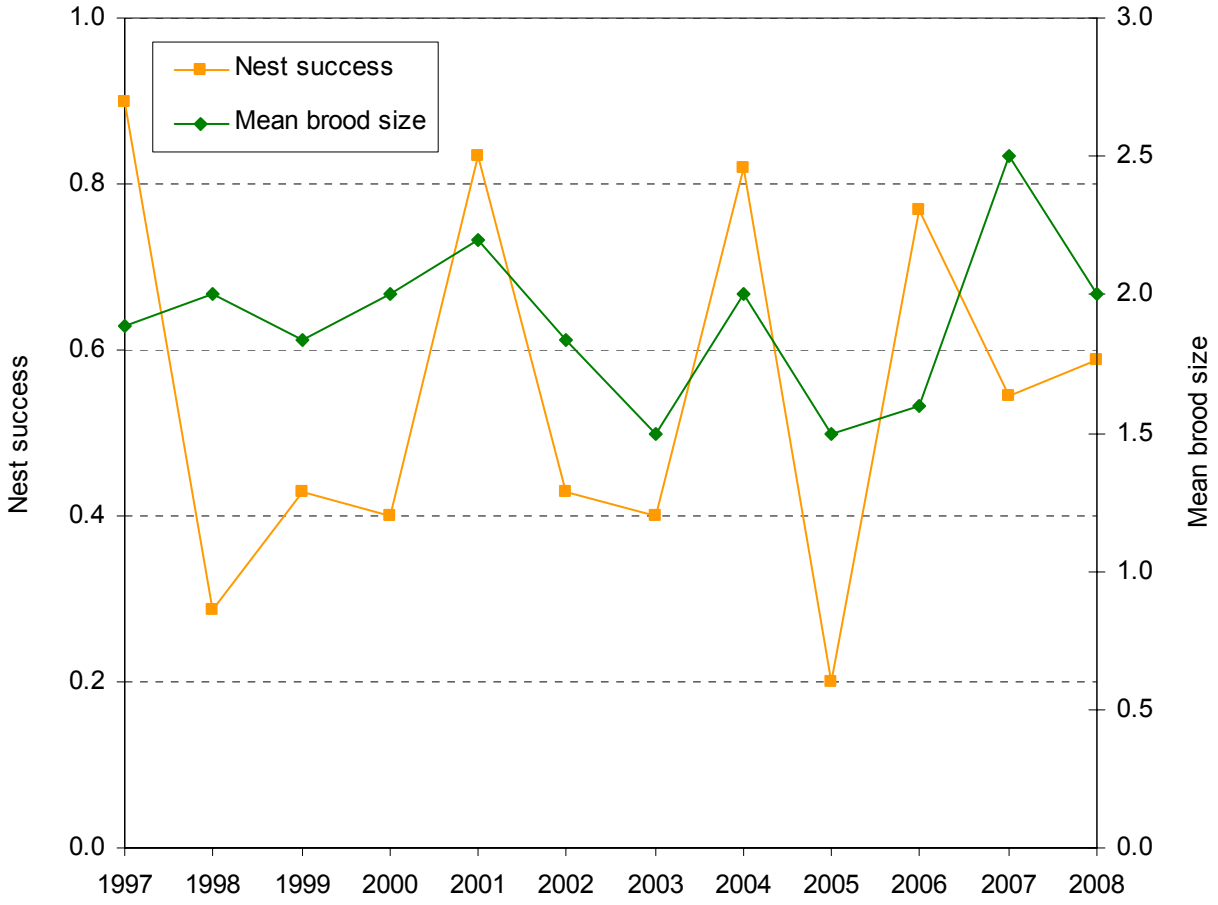


Figure 17. Reproductive performance of black oystercatchers at Aiktak Island, Alaska. Nest success is defined as the number of nests that hatched at least one chick divided by the total number of nests.

Table 29. Reproductive performance of black oystercatchers at Aiktak Island, Alaska[a]. Data include both first and second nest attempts for pairs that relaid after initial nest failure.

Parameter	1997	1998	1999	2000	2001	2002	2003	2004	2005[b]	2006	2007	2008
Total no. nests with eggs (A)	10	14	12	5	12	14	15	11	20	13	11	17
No. nests with *x* eggs:												
1	0	4	0	1	2	1	3	1	4	0	0	2
2	7	2	4	1	5	2	5	2	9	6	5	7
3	3	8	8	3	5	11	7	8	7	7	6	8
Total no. eggs (B)	23	32	32	12	27	38	34	29	43	33	28	40
Total no. nests with chicks (C)	9	4	5	2	10	6	6	9	4	10	6	10
Total no. chicks seen (D)	17	8	10	4	22	11	9	18	6	16	15	20
Mean clutch size (B/A)	2.3	2.3	2.7	2.4	2.3	2.7	2.3	2.7	2.2	2.5	2.6	2.4
Mean brood size (D/C)	1.9	2.0	2.0	2.0	2.2	1.8	1.5	2.0	1.5	1.6	2.5	2.0
Hatch success (D/B)	0.74	0.25	0.31	0.33	0.81	0.29	0.26	0.62	0.14	0.48	0.54	0.50
Nest success (C/A)	0.90	0.29	0.42	0.40	0.83	0.43	0.40	0.82	0.20	0.77	0.54	0.59

[a]Data are not available for 1995 and 1996.
[b]In 2005, an early-season storm on 27 May pushed kelp over many nests, causing a large number of pairs to relay.

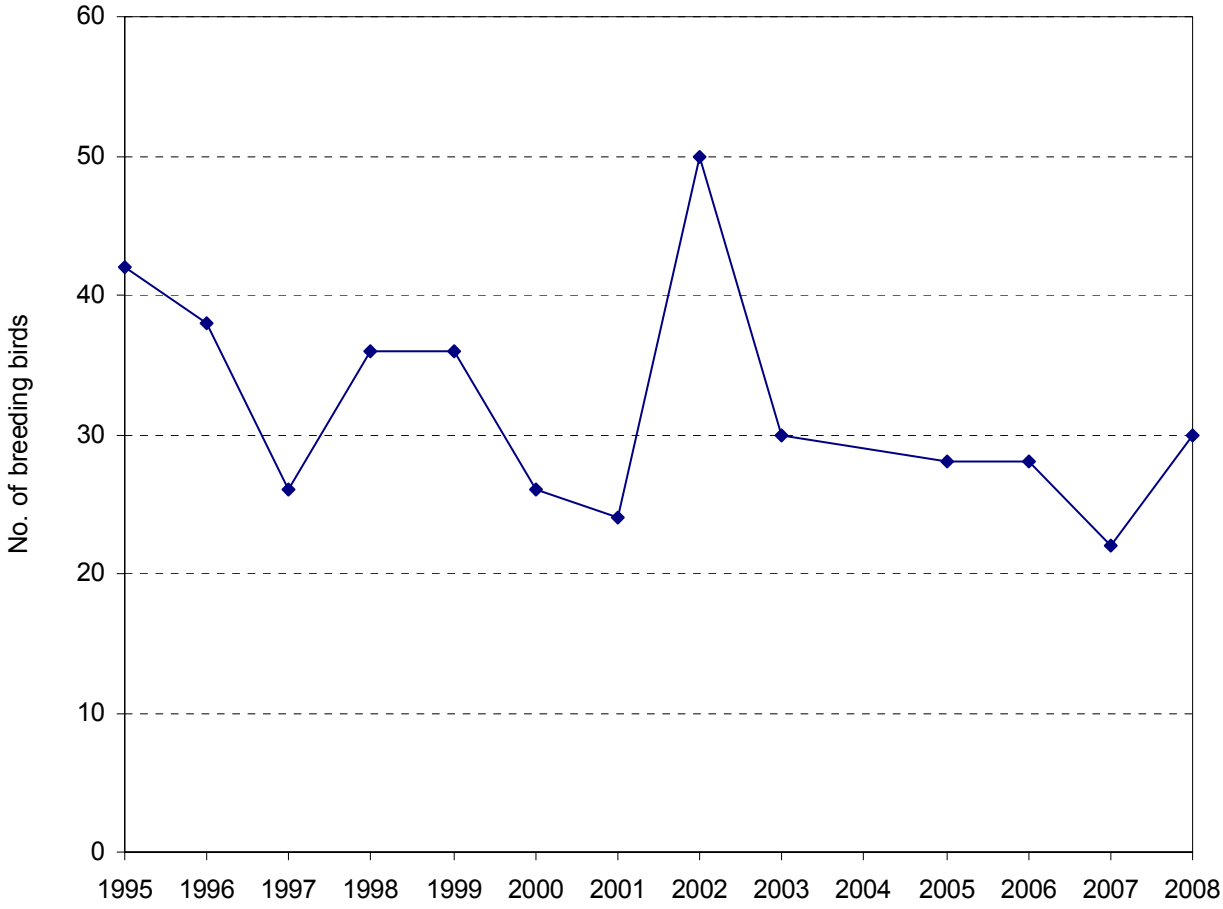


Figure 18. Number of breeding black oystercatchers counted at Aiktak Island, Alaska.

Table 30. Numbers of black oystercatchers breeding at Aiktak Island, Alaska. Data are based on the number of nests or breeding pairs observed on the island throughout the year and do not include flocks of migratory birds passing through the area in the fall.

Year	No. territories	No. total 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]	≥10	≥20
2005	14	28
2006	14	28
2007	11	22
2008	15	30

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

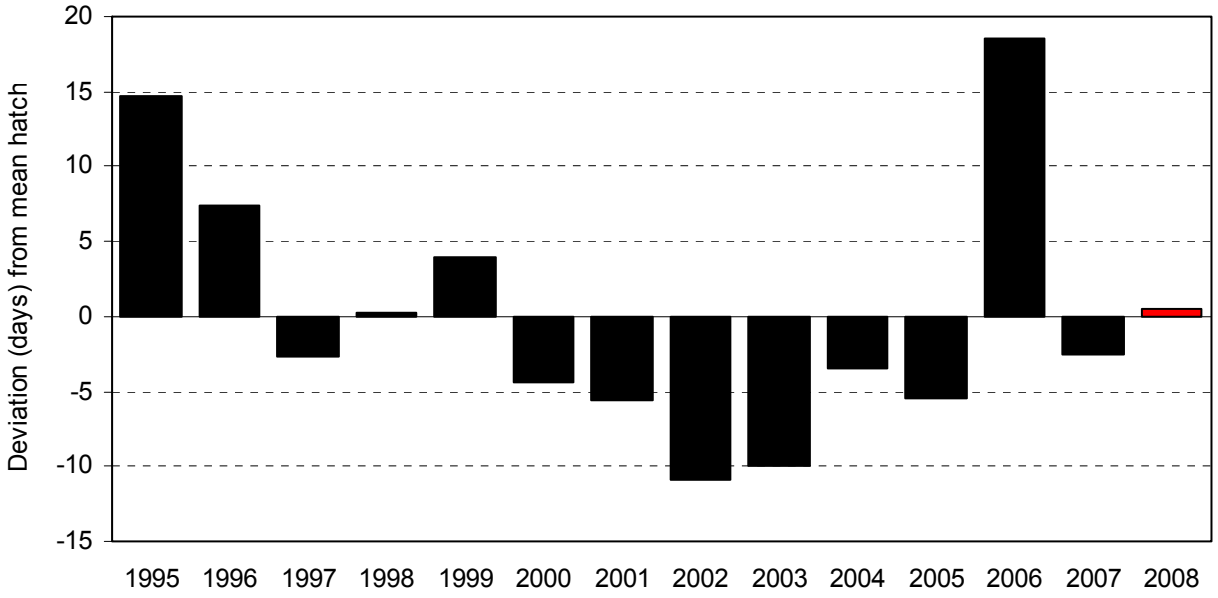


Figure 19. Yearly hatch date deviation (from the 1995-2007 average of 8 July) of glaucous-winged gulls at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

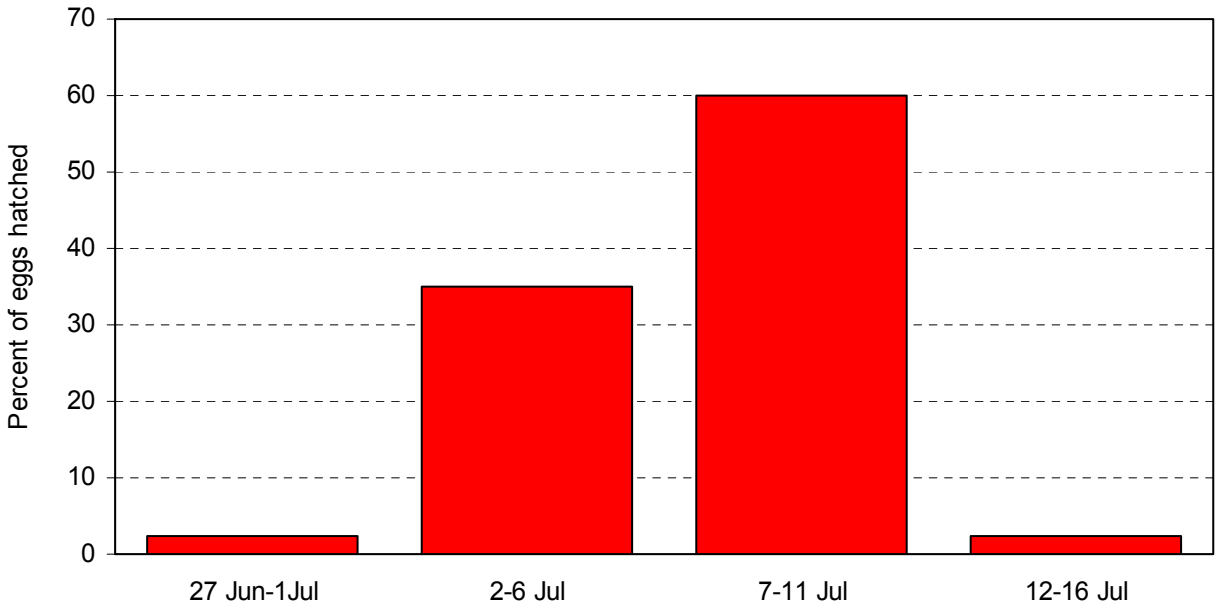


Figure 20. Hatching chronology of glaucous-winged gulls at Aiktak Island, Alaska in 2008.

Table 31. Breeding chronology of glaucous-winged gulls at Aiktak Island, Alaska. Hatch dates represent the date of the first chick hatched in each nest.

Year	Mean lay[a]	Mean hatch	SD	*n*[b]	Median hatch	Total no. nests[c]	First lay	Last lay	First hatch	Last hatch
1995	26 Jun	23 Jul	4.1	43	22 Jul	48	20 Jun	5 Jul	17 Jul	1 Aug
1996	18 Jun	15 Jul	4.1	76	14 Jul	93	13 Jun	13 Jun	10 Jul	26 Jul
1997	9 Jun	6 Jul	2.8	95	5 Jul	106	1 Jun	17 Jun	28 Jun	14 Jul
1998	12 Jun	9 Jul	2.9	90	8 Jul	106	6 Jun	20 Jun	3 Jul	17 Jul
1999	15 Jun	12 Jul	3.2	50	11 Jul	78	10 Jun	22 Jun	7 Jul	19 Jul
2000	6 Jun	3 Jul	5.0	70	4 Jul	68	31 May	22 Jun	7 Jun	19 Jul
2001	6 Jun	3 Jul	3.7	38	3 Jul	40	1 Jun	17 Jun	28 Jun	14 Jul
2002	1 Jun	28 Jun	2.5	95	27 Jun	100	26 May	6 Jun	22 Jun	3 Jul
2003	2 Jun	29 Jun	3.2	93	29 Jun	98	23 May	8 Jun	19 Jun	5 Jul[d]
2004	7 Jun	4 Jul	3.9	85	5 Jul	100	29 May	15 Jun	25 Jun	12 Jul
2005	5 Jun	3 Jul	3.1	79	3 Jul	117	31 May	14 Jun	27 Jun	11 Jul
2006	29 Jun	27 Jul	5.4	10[e]	25 Jul	47	24 Jun	8 Jul	21 Jul	4 Aug
2007	9 Jun	6 Jul	2.5	36	6 Jul	117	1 Jun	13 Jun	28 Jun	10 Jul
2008	11 Jun	8 Jul	2.4	40	8 Jul	157	3 Jun[f]	15 Jun	30 Jun	12 Jul

[a]Lay date is calculated by subtracting 27 days from the hatch date.
[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 5 days.
[c]All nests monitored are used to estimate first and last lay and hatch dates and may include observations with egg to chick intervals > 5 days.
[d]In 2003, four nests had yet to hatch before researchers departed the island early on 10 July.
[e]In 2006, sample size was small and recorded hatch dates were late due to high rates of egg loss during the early egg-laying period.
[f]Actual first lay dates were earlier: three nests with single eggs were found on the first check on 1 June. However, convention of subtracting 27 days from the hatch date puts their lay dates at 3 June.

Table 32. Frequency distribution of hatch dates for glaucous-winged gulls at Aiktak Island, Alaska. Hatch dates represent the date of the first chick hatched in each nest.

Julian	No. nests hatching on Julian date													
date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
170	--	--	--	--	--	--	--	--	1	--	--	--	--	--
171	--	--	--	--	--	--	--	--	--	--	--	--	--	--
172	--	--	--	--	--	--	--	--	--	--	--	--	--	--
173	--	--	--	--	--	--	--	3	--	--	--	--	--	--
174	--	--	--	--	--	--	--	2	--	--	--	--	--	--
175	--	--	--	--	--	--	--	7	--	--	--	--	--	--
176	--	--	--	--	--	--	--	7	25	--	--	--	--	--
177	--	--	--	--	--	--	--	--	--	3	--	--	--	--
178	--	--	--	--	--	--	--	39	4	--	2	--	--	--
179	--	--	1	--	--	11	7	--	4	--	3	--	1	--
180	--	--	--	--	--	--	--	18	43	6	10	--	--	--
181	--	--	--	--	--	--	2	4	1	--	5	--	--	--
182	--	--	--	--	--	22	3	10	--	--	11	--	--	1
183	--	--	13	--	--	--	7	3	1	--	8	--	1	--
184	--	--	2	3	--	--	4	2	4	30	12	--	--	--
185	--	--	--	--	--	--	5	--	--	--	4	--	15	1
186	--	--	44	2	--	16	1	--	10	--	14	--	--	1
187	--	--	--	--	--	2	2	--	--	25	3	--	8	2
188	--	--	20	39	6	11	4	--	--	--	2	--	--	10
189	--	--	--	8	--	--	1	--	--	2	1	--	8	--
190	--	--	--	5	1	--	--	--	--	5	2	--	--	6
191	--	--	8	21	--	2	1	--	--	5	--	--	3	11
192	--	18	4	--	22	--	--	--	--	--	2	--	--	5
193	--	--	--	--	--	--	--	--	--	7	--	--	--	2
194	--	4	2	7	1	1	--	--	--	2	--	--	--	1
195	--	13	1	--	--	1	1	--	--	--	--	--	--	--
196	--	5	--	--	16	1	--	--	--	--	--	--	--	--
197	--	--	--	--	--	--	--	--	--	--	--	--	--	--
198	7	19	--	5	1	--	--	--	--	--	--	--	--	--
199	--	--	--	--	--	2	--	--	--	--	--	--	--	--
200	--	3	--	--	3	--	--	--	--	--	--	--	--	--
201	--	1	--	--	--	1	--	--	--	--	--	--	--	--
202	14	--	--	--	--	--	--	--	--	--	--	1	--	--
203	1	8	--	--	--	--	--	--	--	--	--	2	--	--
204	1	3	--	--	--	--	--	--	--	--	--	--	--	--
205	--	--	--	--	--	--	--	--	--	--	--	1	--	--
206	9	1	--	--	--	--	--	--	--	--	--	1	--	--
207	--	--	--	--	--	--	--	--	--	--	--	2	--	--
208	8	1	--	--	--	--	--	--	--	--	--	--	--	--
209	--	--	--	--	--	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	--	--	--	--	--	--	--
211	--	--	--	--	--	--	--	--	--	--	--	--	--	--
212	--	--	--	--	--	--	--	--	--	--	--	--	--	--
213	3	--	--	--	--	--	--	--	--	--	--	--	--	--
214	--	--	--	--	--	--	--	--	--	--	--	1	--	--
215	--	--	--	--	--	--	--	--	--	--	--	--	--	--
216	--	--	--	--	--	--	--	--	--	--	--	2	--	--
n	43	76	95	90	50	70	38	95	93	85	79	10	36	40

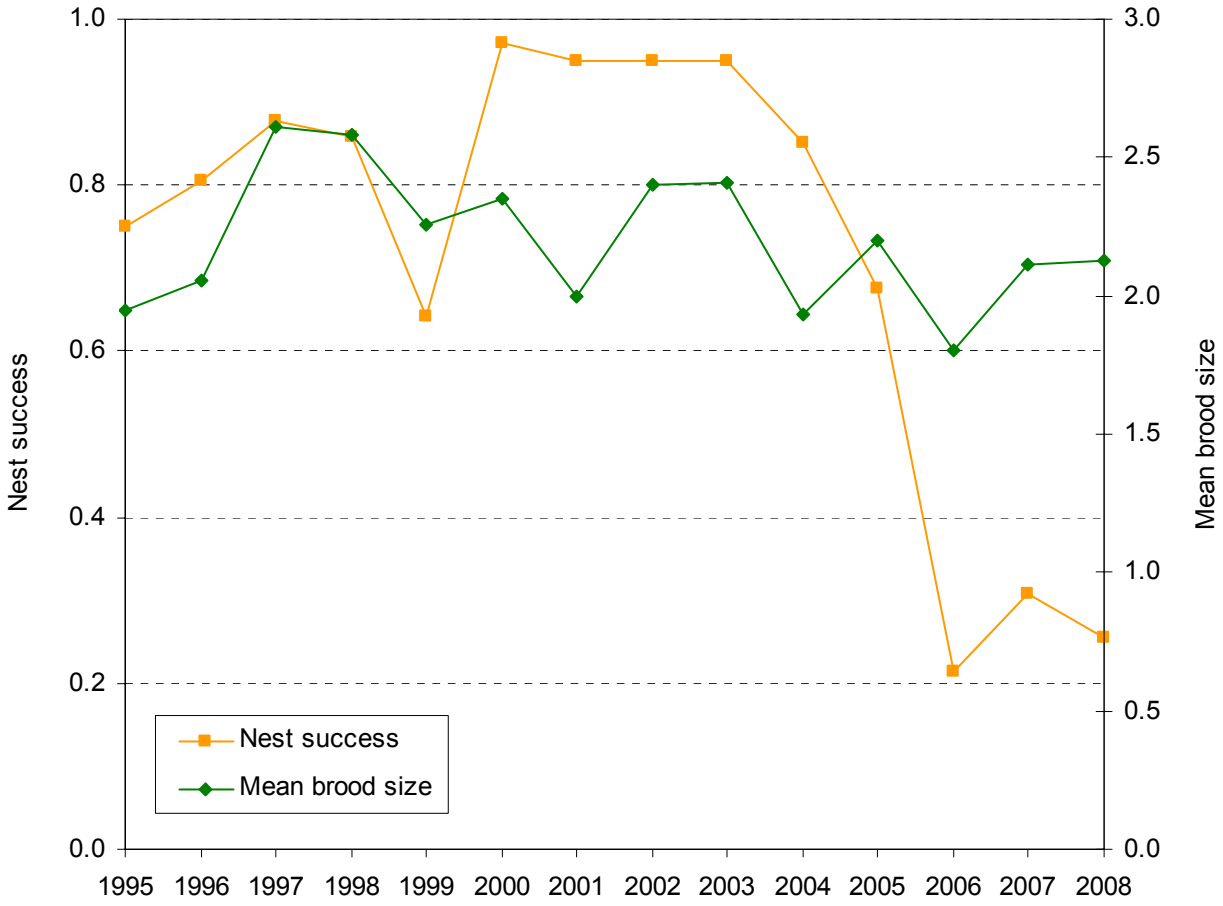


Figure 21. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska. Nest success is defined as the number of nests that hatched at least one chick divided by the total number of nests. Mean brood size is defined as the total number of chicks hatched divided by the total number of nests.

Table 33. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska.

Parameter	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006[a]	2007	2008
No. nests with known clutch size (A)	48	93	106	106	78	68	40	100	98	100	117	47	117	157
Total no. eggs laid (B)	97	207	283	275	175	175	95	285	256	243	300	72	245	313
No. nests containing *x* eggs:														
1	11	17	9	11	16	6	2	1	8	13	15	26	43	48
2	25	38	17	21	27	17	21	13	23	33	33	17	20	63
3	12	38	80	74	35	45	17	86	66	52	73	4	54	45
4	0	0	0	0	0	0	0	0	1	2	0	0	0	1
No. nests with $\geq$ 1 chick (C)	36	75	93	91	50	66	38	95	93	85	79	10	36	40
Total no. chicks seen (D)	70	154	243	235	113	155	76	229	224	164	174	18	73	85
No. nests containing *x* chicks:														
1	9	19	3	4	7	11	8	7	13	27	16	2	8	9
2	20	33	30	30	23	21	22	42	30	37	31	8	16	17
3	7	23	60	57	20	34	8	46	49	21	32	0	12	14
4	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mean clutch size (B/A)	2.0	2.2	2.7	2.6	2.2	2.6	2.4	2.9	2.6	2.4	2.6	1.5	2.1	2.0
Mean brood size (D/C)	1.9	2.1	2.6	2.6	2.3	2.4	2.0	2.4	2.4	1.9	2.2	1.8	2.1	2.1
Nesting success (C/A)	0.75	0.81	0.88	0.86	0.64	0.97	0.95	0.95	0.95	0.85	0.68	0.21	0.3	0.25
Hatching success (D/B)	0.72	0.74	0.86	0.85	0.65	0.89	0.80	0.80	0.88	0.67	0.58	0.25	0.3	0.27

[a]In 2006, sample size was small due to high rates of egg loss during the early egg-laying period.

Table 34. Reproductive performance of glaucous-winged gulls at Aiktak Island, Alaska in 2008.

Parameter	Plot				Total	Mean	SD
	40 [a]	41 [b]	42 [c]	43 [d]			
No. nests with known clutch size (A)	35	35	43	44	157		
Total no. eggs in known clutch nests (B)	73	75	86	79	313		
No. nests containing *x* eggs:							
1	9	5	13	21	48		
2	14	20	18	11	63		
3	12	10	11	12	45		
4	0	0	1	0	1		
No. nests with $\geq$ 1 chick (C)	7	8	17	8	40		
Total no. chicks seen (D)	15	15	36	19	85		
No. nests containing *x* chicks:							
1	2	3	2	2	9		
2	2	3	11	1	17		
3	3	2	4	5	14		
Mean clutch size (B/A)	2.1	2.1	2.0	1.8	2.0	2.0	0.1
Mean brood size (F/C)	2.1	1.9	2.1	2.4	2.1	2.1	0.2
Nesting success (C/A)	0.20	0.23	0.40	0.18	0.25	0.25	0.3
Hatching success (F/B)	0.21	0.20	0.42	0.24	0.27	0.27	0.1

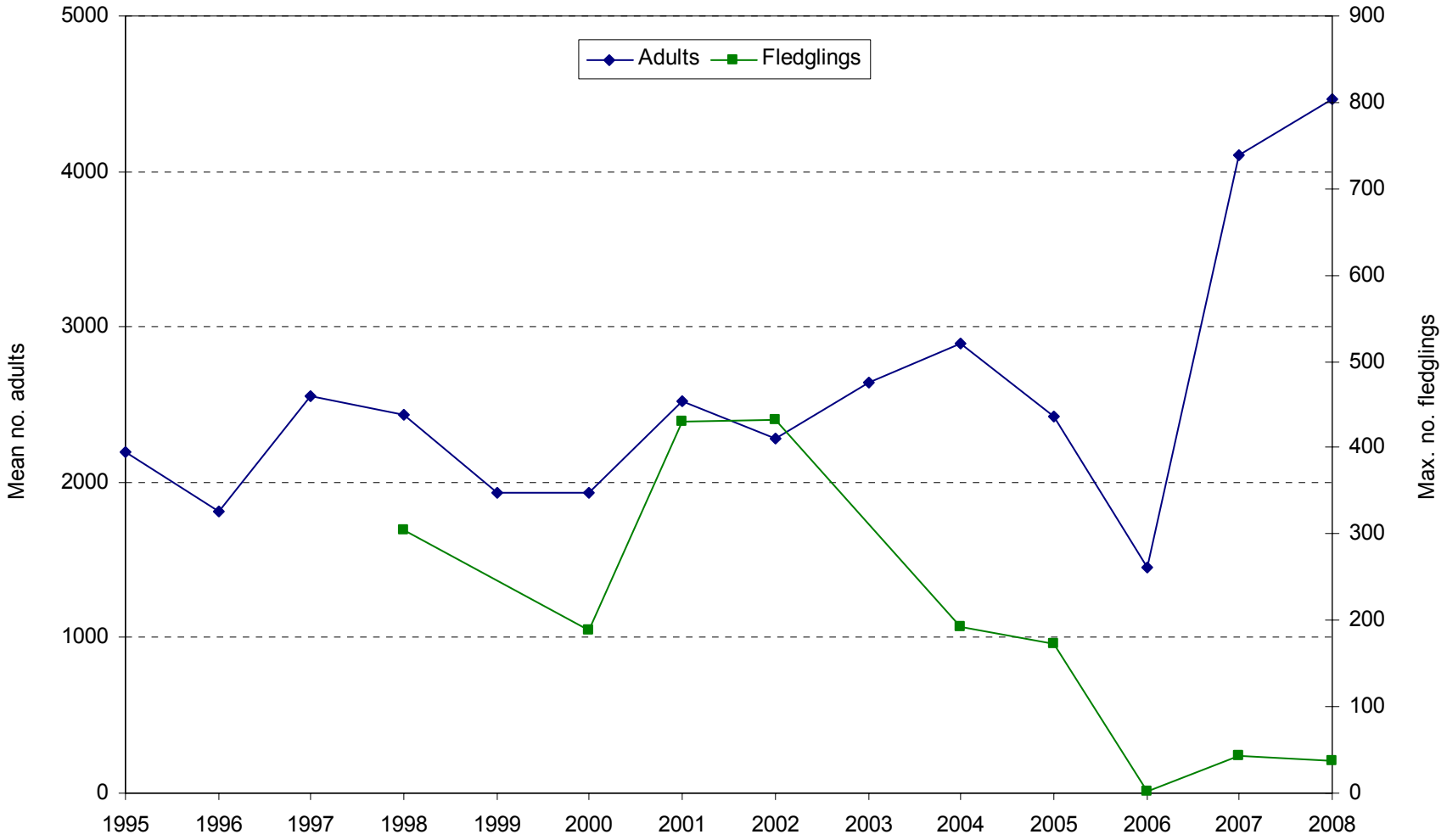


Figure 22. Mean numbers of glaucous-winged gull adults and maximum numbers of glaucous-winged fledglings counted on index plots (adults) or along beach transects (fledglings) at Aiktak Island, Alaska.

Table 35. Numbers of glaucous-winged gulls counted on index plots at Aiktak Island, Alaska.

	Replicate					Statistics				Survey
Year	1	2	3	4	5	mean	max.	*n*	SD	dates
1995	1994	2240	2527	--	--	2189.0	2527	3	266.8	9 Jun - 16 Jul
1996	1701	1875	1671	--	--	1810.8	1875	3	110.1	19 Jun - 18 Jul
1997	2689	3211	2329	--	--	2556.5	3211	3	443.5	30 May - 16 Jun
1998	2481	3039	2553	2592	1944	2434.5	3039	5	390.2	2 Jun - 15 Jun
1999	2004	1275	1631	2734	--	1928.6	2734	4	624.2	30 May - 11 Jun
2000	1975	1872	1926	1909	--	1936.4	1975	4	42.8	16 Jun - 25 Jun
2001	2564	2996	--	--	--	2520.3	2996	2	305.5	6 Jun - 8 Jun
2002	2233	2684	2719	2152	1887	2335.0	2719	5	358.4	29 May - 15 Jun
2003	2804	2725	2936	2718	2657	2768.0	2936	5	107.5	22 May - 6 Jun
2004	2280	2639	4007	3519	2889	3067.0	4007	5	693.2	24 May - 14 Jun
2005	2130	2887	2423	2695	2379	2502.8	2887	5	293.8	3 Jun - 19 Jun
2006	2333	1450	999	1530	1617	1585.8	2333	5	480.9	1 Jun - 17 Jun
2007	3412	4546	4176	4265	--	4099.8	4546	4	484.9	4 Jun - 14 Jun
2008	4494	4749	4187	4490	4420	4468.0	4749	5	200.9	3 Jun - 11 Jun

Table 36. Numbers of glaucous-winged gulls counted on index plots at Aiktak Island, Alaska in 2008.

	Date					Statistics		
Plot	3 Jun	4 Jun	7 Jun	9 Jun	11 Jun	mean	max.	SD
A	62	60	42	50	39			
B	1037	1001	773	759	1069			
C-west	1084	1486	1278	1388	1204			
C-north	1730	1619	1518	1719	1552			
D	23	17	18	12	0			
E	76	86	78	68	75			
F	40	44	31	37	29			
G	11	14	7	6	7			
H	49	49	44	49	49			
I	106	81	56	58	75			
Club A	10	24	69	43	57			
Club B	194	201	218	225	181			
Club C	72	67	55	76	74			
Total	4494	4749	4187	4490	4420	4468.0	4749	200.9

Table 37. Numbers of glaucous-winged gull fledglings counted on New Camp and Old Camp beaches at Aiktak Island, Alaska.

	Replicate						Statistics				Survey
Year[a]	1	2	3	4	5	6	max	mean	*n*	SD	dates
1998	28	31	38	106	305	--	305	101.6	5	118.2	14 Aug - 1 Sep
2000	37	87	189	120	113	171	189	119.5	6	55.5	13 Aug - 7 Sep
2001	112	431	62	--	--	--	431	201.7	3	200.2	17 Aug - 8 Sep
2002	81	376	404	433	361	--	433	331.0	5	142.4	10 Aug - 25 Aug
2004	20	22	50	133	193	--	193	83.6	5	76.5	10 Aug - 28 Aug
2005	14	17	18	50	123	172	172	65.7	6	66.6	4 Aug - 31 Aug
2006	0	0	1	--	--	--	1	0.3	3	0.6	23 Aug - 2 Sep
2007	3	9	15	31	43	--	43	20.2	5	16.5	13 Aug - 30 Aug
2008	1	23	37	--	--	--	37	20.3	3	18.1	20 Aug - 28 Aug

[a]Data were not collected in 1995-1997, 1999, and 2003.

Table 38. Numbers of glaucous-winged gull fledglings counted on New Camp and Old Camp beaches at Aiktak Island, Alaska in 2008.

	Date			Statistics		
Beach	20 Aug	25 Aug	28 Aug	max.	mean	SD
Old Camp Beach	1	14	5			
New Camp Beach	0	9	32			
Total	1	23	37	37	20.3	18.1

Table 39. Density of glaucous-winged gull nests on index plots at Aiktak Island, Alaska.

Year[a]	No. of nests containing *x* eggs					Total area (m^2)	Total. no. nests w/ eggs	Total no. nests	Total no. eggs	Mean clutch size	Density of nests w/ eggs	Density of of total nests
	0	1	2	3	4	(A)	(B)	(C)	(D)	(D/B)	(B/A)	(C/A)
1997	48	3	13	29	0	1885.2[b]	45	93	114	2.5	0.02	0.05
1998	48	2	7	19	0	1885.2	28	76	73	2.6	0.01	0.04
1999	53	3	18	10	0	1885.2	31	84	63	2.0	0.02	0.04
2000	8	7	16	15	0	1885.2	38	47	84	2.2	0.02	0.02
2001	17	2	15	36	0	1885.2	53	70	154	2.7	0.03	0.04
2002	30	1	12	47	0	1885.2	49	90	136	2.8	0.03	0.07
2003	41	1	9	39	0	1885.2	49	90	136	2.8	0.03	0.05
2004	24	7	18	32	0	1885.2	57	81	140	2.5	0.03	0.04
2005	39	14	8	20	0	1885.2	42	81	90	2.1	0.02	0.04
2006[c]	85	1	0	0	0	1885.2	1	86	1	1.0	0.00	0.05
2007	204	10	13	5	0	1885.2	28	232	54	1.9	0.02	0.12
2008	275	7	18	11	1	1885.2	37	312	80	2.1	0.02	0.17

[a]Data were not collected in 1995 and 1996.
[b]Total area consists of sum of six plots of 314.2 m^2 each.
[c]In 2006, gulls suffered exceptionally high rates of egg loss during the early egg-laying period.

Table 40. Density of glaucous-winged gulls on index plots at Aiktak Island, Alaska in 2008. Plots were surveyed on 20 June.

Parameter	Plot						Total	Mean	SD
	55	78	40	41	42	43			
Plot size m^2 (A)	314.2	314.2	314.2	314.2	314.2	314.2	1885.2		
No. nests containing x eggs									
0	35	44	48	42	57	49	275		
1	0	0	2	0	4	1	7		
2	1	0	5	3	7	2	18		
3	0	0	2	1	7	1	11		
4	0	0	0	0	1	0	1		
Total no. nests w/ eggs (B)	1	0	9	4	19	4	37		
Total no. nests (C)	36	44	57	46	76	53	312		
Total no. eggs (D)	2	0	18	9	43	8	80		
Mean clutch size (D/B)	2.0	--	2.0	2.3	2.3	2.0	2.2	2.1	0.2
Density of nests w/ eggs (B/A)	<0.01	0.00	0.03	0.03	0.06	0.03	0.02	0.02	<0.1
Density of total nests (C/A)	0.12	0.14	0.18	0.15	0.24	0.17	0.17	0.17	<0.1

Table 41. Percent occurrence of food items in regurgitated pellets of glaucous-winged gulls at Aiktak Island, Alaska[a]. Values represent the percentage of samples in which each species was present. Data comprise a mix of adult and chick regurgitations and pick-ups.

Food item	1995	1996	1997	1998	1999	2000[b]	2002
Number of pellets	5	99	84	77	32	26	21
Invertebrates (total)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Sea urchin	--	5.1	3.6	1.3	--	3.8	--
Limpet	--	1.0	--	1.3	--	--	--
Chiton	--	2.0	3.6	2.6	6.3	--	4.8
Crangonidae	--	--	--	--	3.1	--	--
Mytilus spp.	--	--	--	--	3.1	--	--
Mya spp.	--	--	--	--	3.1	--	--
Unid. pill bug	--	--	--	--	3.1	--	--
Unid. fly	60.0	--	--	--	--	--	--
Unid. parasite	--	--	--	--	3.1	--	--
Fish (total)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Pacific herring	--	82.8	78.6	67.5	46.9	11.5	23.8
Pacific sandlance	--	1.0	3.6	23.4	15.6	57.7	61.9
Capelin	--	3.0	--	--	--	--	--
Atka mackerel	--	1.0	--	--	--	--	--
Pollock	--	--	--	11.7	--	--	--
Gadidae	--	1.0	--	--	--	3.8	--
Pleuronectidae	--	--	--	1.3	--	--	--
Unid. fish eggs	--	1.0	--	1.3	--	--	--
Unid. fish	20.0	1.0	--	3.9	31.3	15.4	9.5
Birds (total)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Fork-tailed storm-petrel	--	--	--	2.6	--	--	--
Black-legged kittiwake (chick)	--	2.0	--	--	--	--	--
Glaucous-winged gull (chick)	--	--	--	--	9.4	--	--
Least auklet	--	3.0	--	--	--	--	--
Whiskered auklet	--	1.0	2.4	--	--	--	--
Ancient murrelet	--	--	1.2	--	--	--	--
Tufted puffin	--	2.0	2.4	--	--	--	--
Tufted puffin (chick)	--	4.0	--	--	--	--	--
Unid. murre (chick)	--	--	--	--	--	3.8	--
Unid. alcid	--	--	1.2	--	--	--	--
Unid. egg	--	1.0	--	--	--	--	--
Unid. small bird	--	2.0	--	2.6	--	--	--
Unid. feather	40.0	--	--	--	--	--	--
Mammals (total)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Microtine	--	--	--	1.3	3.1	--	--
Miscellaneous (total)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Plant material	40.0	--	--	--	6.3	--	--
Offal	--	--	--	--	--	3.8	--

[a]Data were not collected in 2001 and 2003; data were collected in 2004-2007 but have not been analyzed in time for this report.

[b]In addition to adult pellets, chick regurgitations were collected and included in the 2000 report.

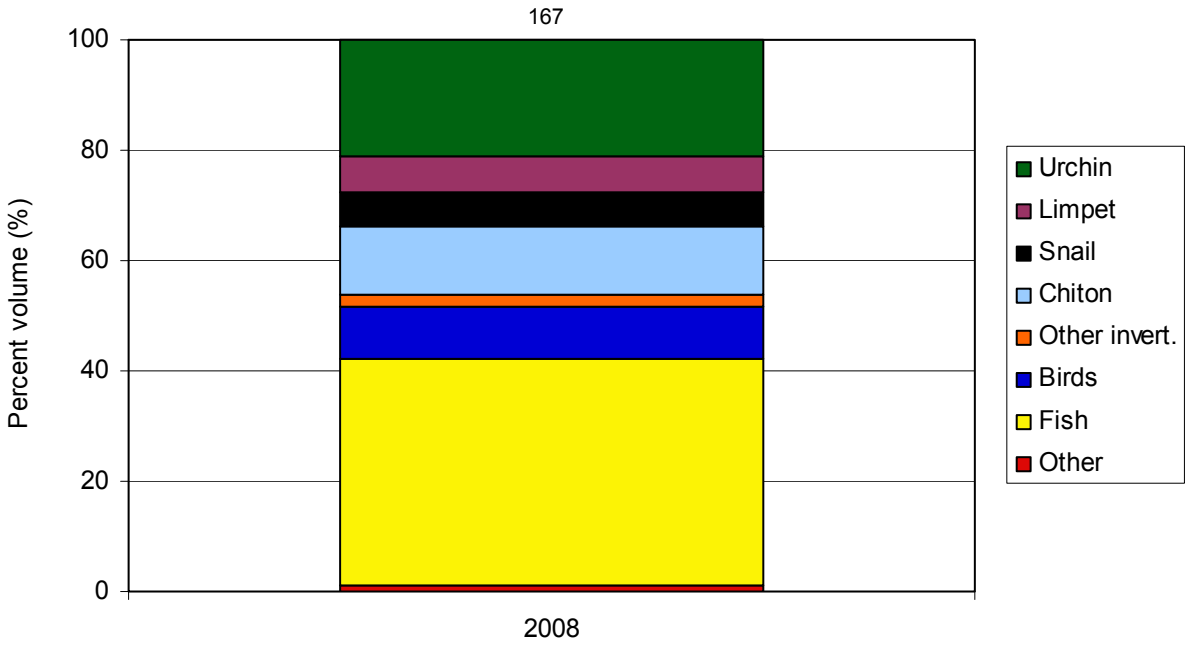


Figure 23. Percent volume of food items in regurgitated pellets of glaucous-winged gulls at Aiktak Island, Alaska. Values represent the average percent composition of a prey item in all pellets. The number above the column indicates same size.

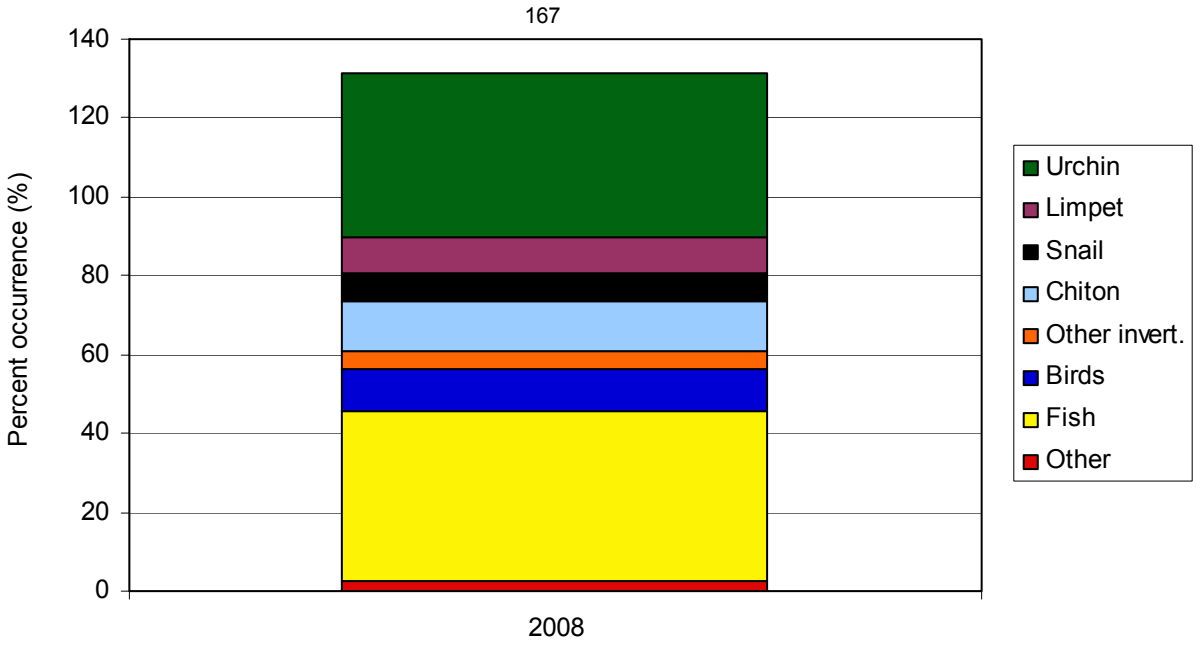


Figure 24. Percent occurrence of food items in regurgitated pellets of glaucous-winged gulls at Aiktak Island, Alaska. Values represent the percentage of pellets in which each species was present. The number above the column indicates same size.

Table 42. Percent volume of food items in regurgitated pellets of glaucous-winged gulls at Aiktak Island, Alaska in 2008. Values represent the average percent composition of a prey item in all pellets.

Food item	Beaches[a]	Interior[b]	Total
Number of pellets	97	70	167
Invertebrates (total)	**54.1**[c]	**40.4**	**48.4**
Sea urchin	33.4	4.3	21.2
Limpet	2.9	11.8	6.6
Crab	1.7	--	1.0
Blue mussel	1.0	1.4	1.2
Snail	10.2	--	5.9
Chiton	4.6	22.9	12.3
Unid. shellfish	0.3	--	0.2
Fish (total)	**40.2**	**42.9**	**41.3**
Birds (total)	**4.7**	**15.7**	**9.3**
Tufted puffin	0.0	2.9	1.2
Unidentified bird	1.6	7.1	3.9
Glaucous-winged gull egg	--	1.4	0.6
Unidentified egg	3.1	4.3	3.6
Other (total)	**1.0**	**1.1**	**1.0**
Kelp/seaweed	0.3	0.7	0.4
Pebbles	0.5	0.4	0.4
Sand	1.0	--	0.6

[a]Beach locations comprise New Camp Beach (82 pellets), Old Camp Beach (3 pellets), and Petrel Valley Cove (12 pellets).
[b]Interior locations comprise Gull Mountain (60 pellets), SW Slope (6 pellets), and above Arch's Cove (4 pellets).
[c]Values in bold are composite totals for invertebrates, fish, birds, and miscellaneous.

Table 43. Percent occurrence of food items in regurgitated pellets of glaucous-winged gulls at Aiktak Island, Alaska in 2008. Values represent the percentage of pellets in which each species was present.

Food item	Beaches[a]	Interior[b]	Total
Number of pellets	97	70	167
Invertebrates (total)	**56.7**[c]	**41.4**	**50.3**
Sea urchin	36.1	7.1	41.4
Limpet	6.2	12.9	9.0
Crab	5.2	--	3.0
Blue mussel	1.0	1.4	1.2
Snail	12.4	--	7.2
Chiton	5.2	22.9	12.6
Unid. shellfish	1.0	--	0.6
Fish (total)	**41.2**	**45.7**	**43.1**
Birds (total)	**6.2**	**17.1**	**10.8**
Tufted puffin	--	2.9	1.2
Unidentified bird	3.1	10.0	6.0
Glaucous-winged gull egg	--	1.4	0.6
Unidentified egg	3.1	7.1	4.8
Other (total)	**2.1**	**2.9**	**2.4**
Kelp/seaweed	1.0	1.4	1.2
Pebbles	1.0	1.4	1.2
Sand	1.0	--	0.6

[a]Beach locations comprise New Camp Beach (82 pellets), Old Camp Beach (3 pellets), and Petrel Valley Cove (12 pellets).
[b]Interior locations comprise Gull Mountain (60 pellets), SW Slope (6 pellets), and above Arch's Cove (4 pellets).
[c]Values in bold are composite totals for invertebrates, fish, birds, and miscellaneous. Summation of columns exceeds 100% because of overlap (i.e. occurrence of more than 1 prey species per pellet).

Table 44. Mass of food loads collected from glaucous-winged gull chicks at Aiktak Island, Alaska[a].

Chick-rearing Period[b]	*n*	Mass of load (g) mean	SD	range
2008				
Early	14	12.0	6.6	4.2 - 29.3
Mid	4	13.0	6.0	8.1 - 21.7
Total				
2007	30	6.5	5.0	1.1 - 22.2
2008	18	12.3	6.3	4.2 - 29.3

[a]Chick regurgitation samples were collected in 1996-2000, 2002, and 2004 but mass data were not recorded.

[b]Periods were defined as early: ≤ 10 days after mean hatch; mid: 11-20 days after mean hatch and late: ≥ 20 days after mean hatch. In 2008, food samples were collected 11-17 July (early) and 20-23 July (mid).

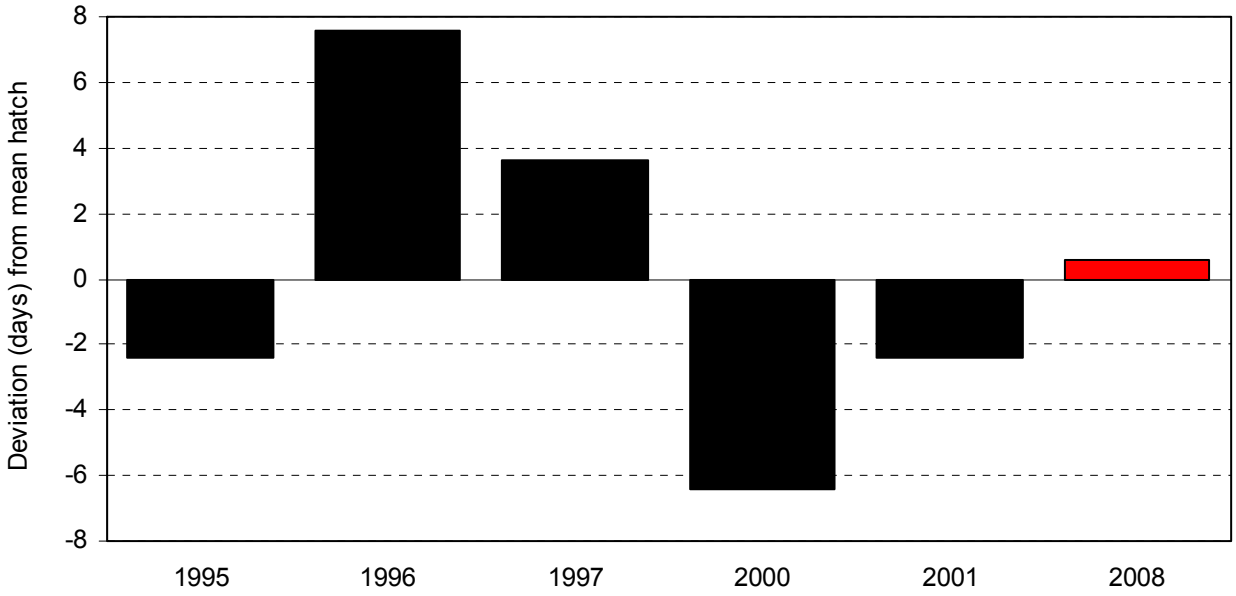


Figure 25. Yearly hatch date deviation (from the 1995-2001 average of 12 Aug) of common murres at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

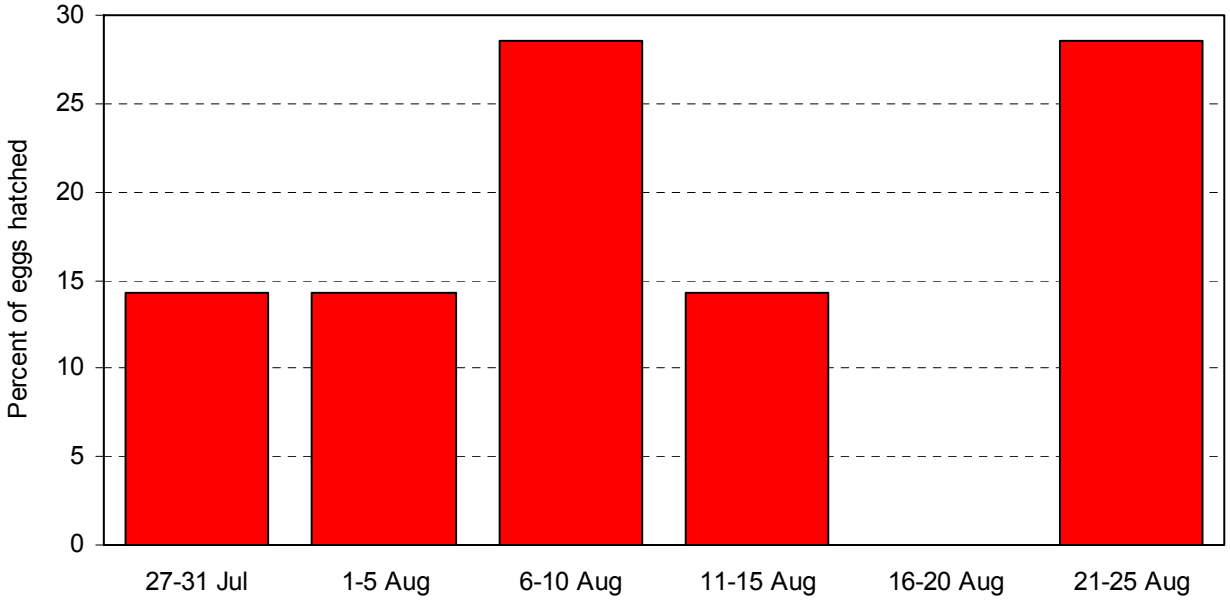


Figure 26. Hatching chronology of common murres at Aiktak Island, Alaska in 2008.

Table 45. Breeding chronology of common murres at Aiktak Island, Alaska.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First lay	Last lay	First hatch	Last hatch	First jump	Last jump
1995	10 Aug	7.0	21	10 Aug	117	1 Jul	<2 Aug	30 Jul	<27 Aug	22 Aug	>29 Aug
1996	19 Aug	5.6	46	21 Aug	183	2 Jul	<12 Aug	5 Aug	4 Sep	25 Aug	>10 Sep
1997	16 Aug	18.8	36	18 Aug	245	2 Jul	10 Aug	28 Jul	26 Aug	22 Aug	>2 Sep
2000	7 Aug	5.2	8	5 Aug	76	<26 Jul	<7 Aug	23 Jul	16 Aug	17 Aug	>31 Aug
2001	10 Aug	7.9	8	8 Aug	155	<4 Jul	<17 Aug	23 Jul	23 Aug	15 Aug	>10 Sep
2006[d]	--	0.0	0	--	5	<26 Jul	<1 Aug	--	--	--	--
2007[e]	--	0.0	0	--	13	<12 Jul	--	--	--	--	--
2008	12 Aug	9.4	7	9 Aug	20	28 Jun	>25 Jul	30 Jul	>26 Aug[f]	15 Aug	>26 Aug

[a]Murres failed to breed successfully in 1998, 1999, 2002, 2004, and 2005; data were not collected in 2003.

[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.

[c]All nests monitored are used to estimate first and last lay, hatch, and jump dates and may include observations with egg to chick or chick to nothing intervals > 7 days.

[d]In 2006, only incubating postures were observed so no hatch dates were recorded.

[e]In 2007, small numbers of eggs were monitored but all failed to hatch.

[f]In 2008, at least one bird was still incubating an egg at last visit.

Table 46. Frequency distribution of hatch dates for common murres at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date					
date	1995	1996	1997	2000	2001	2008
211	1	--	--	--	--	--
212	--	--	--	--	--	1
213	--	--	--	--	--	--
214	1	--	--	--	1	--
215	--	--	--	4	--	--
216	1	--	3	--	2	--
217	--	--	--	--	--	--
218	6	3	--	--	--	1
219	--	--	2	--	--	--
220	--	--	--	--	2	--
221	1	--	--	--	--	--
222	3	--	2	2	--	2
223	--	--	--	--	--	--
224	--	--	--	1	--	--
225	--	1	--	--	--	--
226	6	2	7	--	--	--
227	--	--	2	--	1	--
228	--	6	1	1	--	1
229	--	--	--	--	--	--
230	--	1	10	--	--	--
231	--	--	--	--	--	--
232	--	4	6	--	1	--
233	--	--	--	--	--	--
234	--	19	1	--	--	--
235	--	--	--	--	1	--
236	--	1	1	--	--	--
237	--	1	--	--	--	2
238	1	4	1	--	--	--
239	--	--	--	--	--	--
240	1	1	--	--	--	--
241	--	2	--	--	--	--
242	--	--	--	--	--	--
243	--	--	--	--	--	--
244	1	--	--	--	--	--
n	21	46	36	8	8	7

[a]Murres failed to breed successfully in 1998, 1999, 2002, 2004, 2005, and 2007. In 2006, only incubating postures and chicks were observed so no hatch dates were recorded. Data were not collected in 2003.

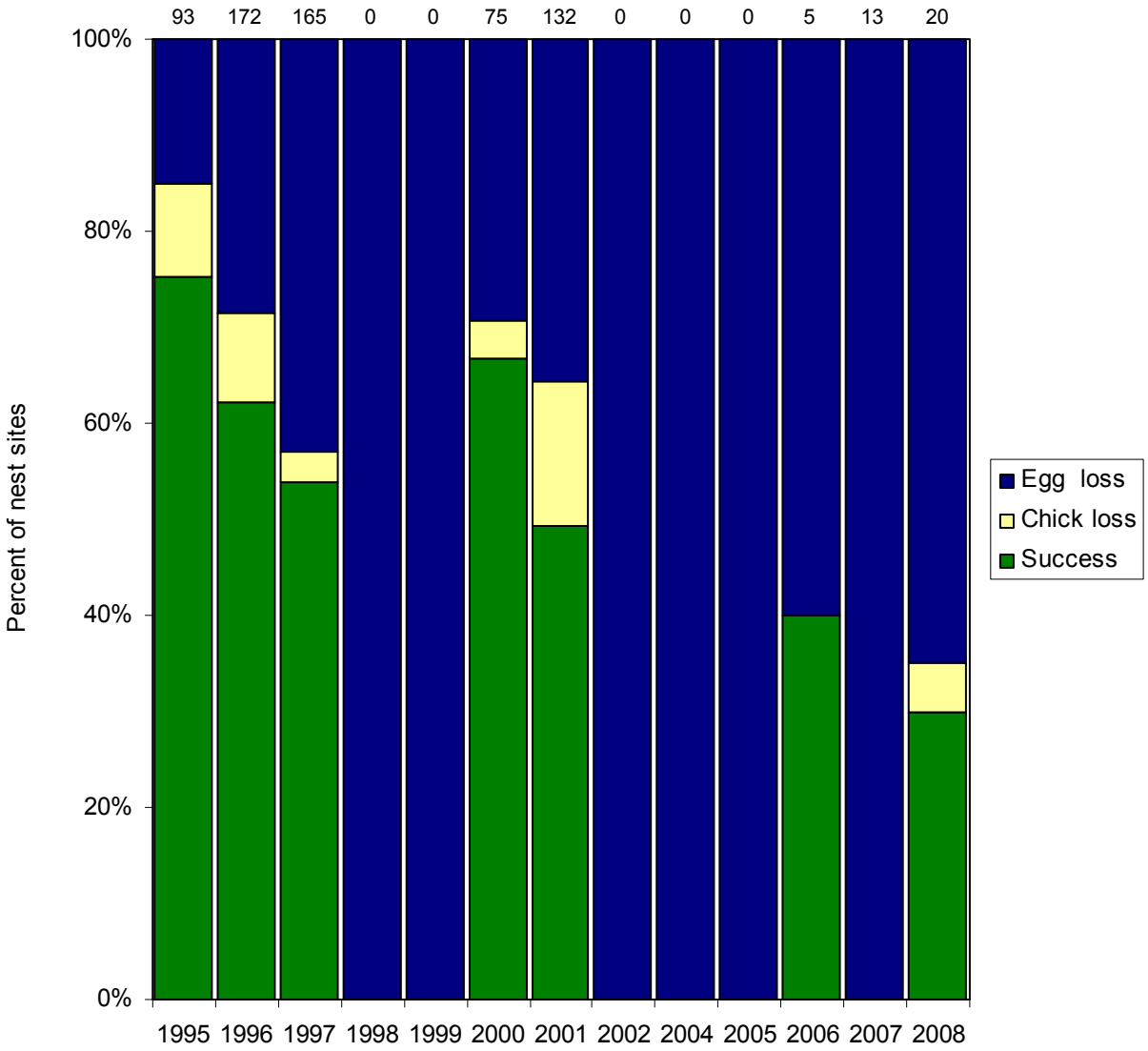


Figure 27. Reproductive performance of common murres on index plots at Aiktak Island, Alaska. Egg loss=(A-B)/A; Chick loss=(B-C)/A; Success=C/A, where A=number of eggs, B=number of eggs hatched, and C=number of chicks fledged (codes come from following productivity table). Numbers above columns indicate sample sizes.

Table 47. Reproductive performance of common murres at Aiktak Island, Alaska.

Year[a]	No. sites w/ egg (A)	No. sites w/ chick (B)	No. sites w/ fledged chick (C)			Egg loss ((A-B)/A)	Chick loss ((B-C)/A)	Reproductive success[d] (C/A)
			Total	Fledged[b]	Still present[c]			
1995	93	79	70	70	0	0.15	0.10	0.75
1996	172	123	107	107	0	0.29	0.09	0.62
1997	165	94	89	89	0	0.43	0.03	0.54
1998	0	0	0	0	0	0.00	0.00	0.00
1999	0	0	0	0	0	0.00	0.00	0.00
2000	75	53	50	50	0	0.29	0.04	0.67
2001	132	85	65	65	0	0.36	0.15	0.49
2002	0	0	0	0	0	0.00	0.00	0.00
2004	0	0	0	0	0	0.00	0.00	0.00
2005	0	0	0	0	0	0.00	0.00	0.00
2006	5	2	2	1	1	0.60	0.00	0.40
2007	13	0	0	0	0	1.00	0.00	0.00
2008	20	7	6	3	3	0.65	0.05	0.30

[a]Data were not collected in 2003.

[b]Chicks were considered fledged if they were $\geq$ 15 days old at disappearance or $\geq$ 13 days old at last visit.

[c]Chicks < 13 days old at last visit.

[d]Due to delayed egg laying and few breeding attempts, reproductive success in 2006 and 2008 includes a small number of chicks still present at last check and should be considered a maximum estimate of productivity.

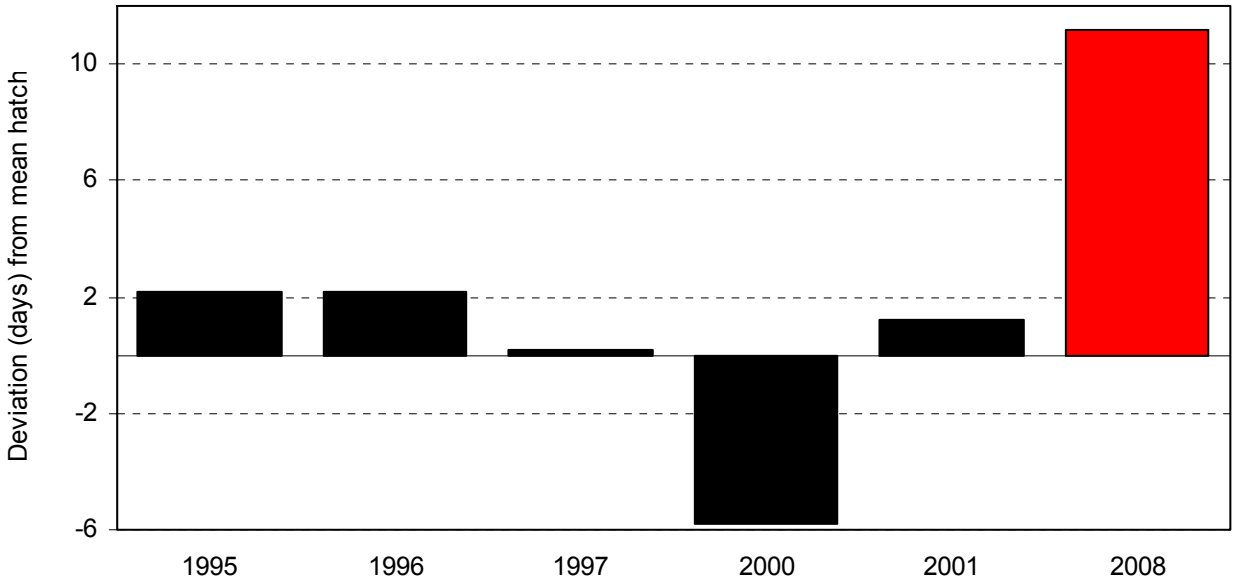


Figure 28. Yearly hatch date deviation (from the 1995-2001 average of 10 Aug) of thick-billed murres at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

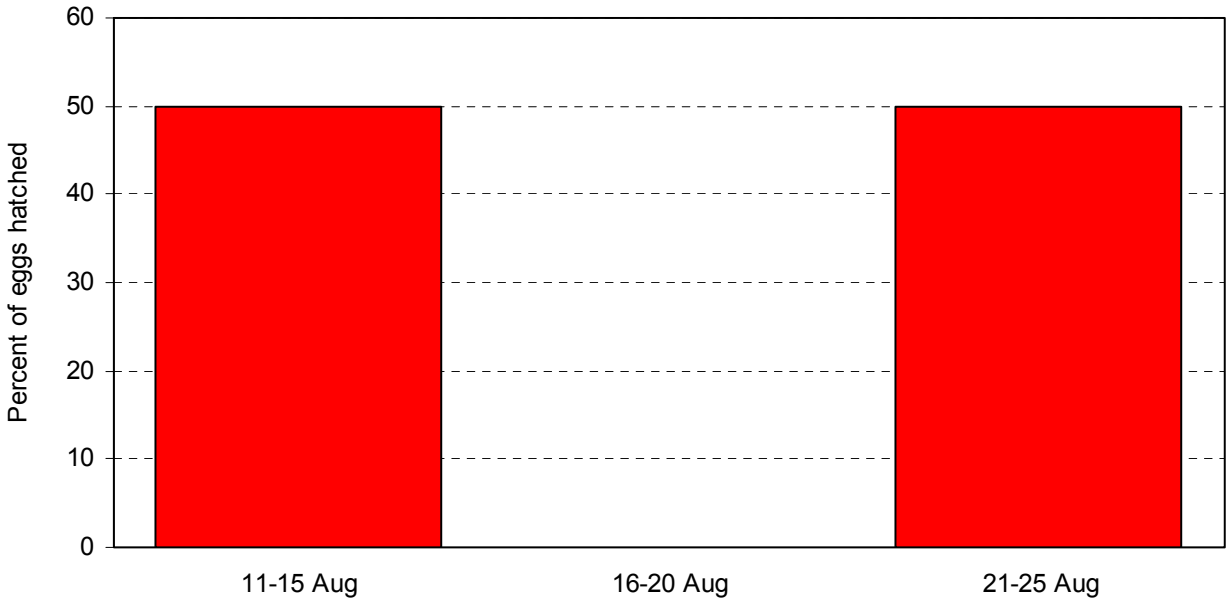


Figure 29. Hatching chronology of thick-billed murres at Aiktak Island, Alaska in 2008.

Table 48. Breeding chronology of thick-billed murres at Aiktak Island, Alaska.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First lay	Last lay	First hatch	Last hatch	First jump	Last jump
1995	12 Aug	7.6	7	10 Aug	70	1 Jul	<1 Aug	2 Aug	28 Aug	18 Aug	>29 Aug
1996	11 Aug	3.3	10	13 Aug	66	<5 Jul	<28 Jul	5 Aug	21 Aug	25 Aug	>10 Sep
1997	10 Aug	5.2	14	8 Aug	82	2 Jul	19 Jul	4 Aug	26 Aug	22 Aug	>2 Sep
2000	3 Aug	8.2	7	7 Aug	95	<27 Jul	7 Aug	23 Jul	20 Aug	7 Aug	>31 Aug
2001	11 Aug	7.3	5	8 Aug	124	<4 Jul	<17 Aug	23 Jul	23 Aug	18 Aug	>10 Sep
2006[d]	--	0.0	0	--	10	<26 Jul	--	--	--	--	--
2007[e]	--	0.0	0	--	11	<17 Jul	--	--	-	--	--
2008	20 Aug	6.37	2	20 Aug	6	14 Jul	23 Jul	15 Aug	24 Aug	>26 Aug[f]	>26 Aug

[a]Murres failed to breed successfully in 1998, 1999, 2002, 2004, and 2005; data were not collected in 2003.
[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.
[c]All nests monitored are used to estimate first and last lay, hatch, and jump dates and may include observations with egg to chick or chick to nothing intervals > 7 days.
[d]In 2006, only incubating postures and chicks were observed so no hatch dates were recorded.
[e]In 2007, small numbers of eggs were monitored but all failed to hatch.
[f]In 2008, all chicks were still present and too young to fledge at last check.

Table 49. Frequency distribution of hatch dates for thick-billed murres at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date					
date	1995	1996	1997	2000	2001	2008
205	--	--	--	2	--	--
206	--	--	--	--	--	--
207	--	--	--	--	--	--
208	--	--	--	--	--	--
209	--	--	--	--	--	--
210	--	--	--	--	--	--
211	--	--	--	--	--	--
212	--	--	--	--	--	--
213	--	--	--	--	--	--
214	--	--	--	--	--	--
215	--	--	--	--	--	--
216	--	--	4	--	1	--
217	--	--	--	--	--	--
218	2	1	--	--	--	--
219	--	--	3	1	--	--
220	--	--	--	1	2	--
221	--	--	2	--	--	--
222	3	2	--	2	--	--
223	--	--	--	--	--	--
224	--	--	2	1	1	--
225	--	1	--	--	--	--
226	1	5	2	--	--	--
227	--	--	--	--	--	--
228	--	--	--	--	--	1
229	--	--	--	--	--	--
230	--	1	--	--	--	--
231	--	--	--	--	--	--
232	--	--	--	--	--	--
233	--	--	--	--	--	--
234	--	--	1	--	--	--
235	--	--	--	--	1	--
236	--	--	--	--	--	--
237	--	--	--	--	--	1
238	--	--	--	--	--	--
239	--	--	--	--	--	--
240	1	--	--	--	--	--
n	7	10	14	7	5	2

[a]Murres failed to breed successfully in 1998, 1999, 2002, 2004, 2005, and 2007. In 2006, only incubating postures and chicks were observed so no hatch dates were recorded. Data were not collected in 2003.

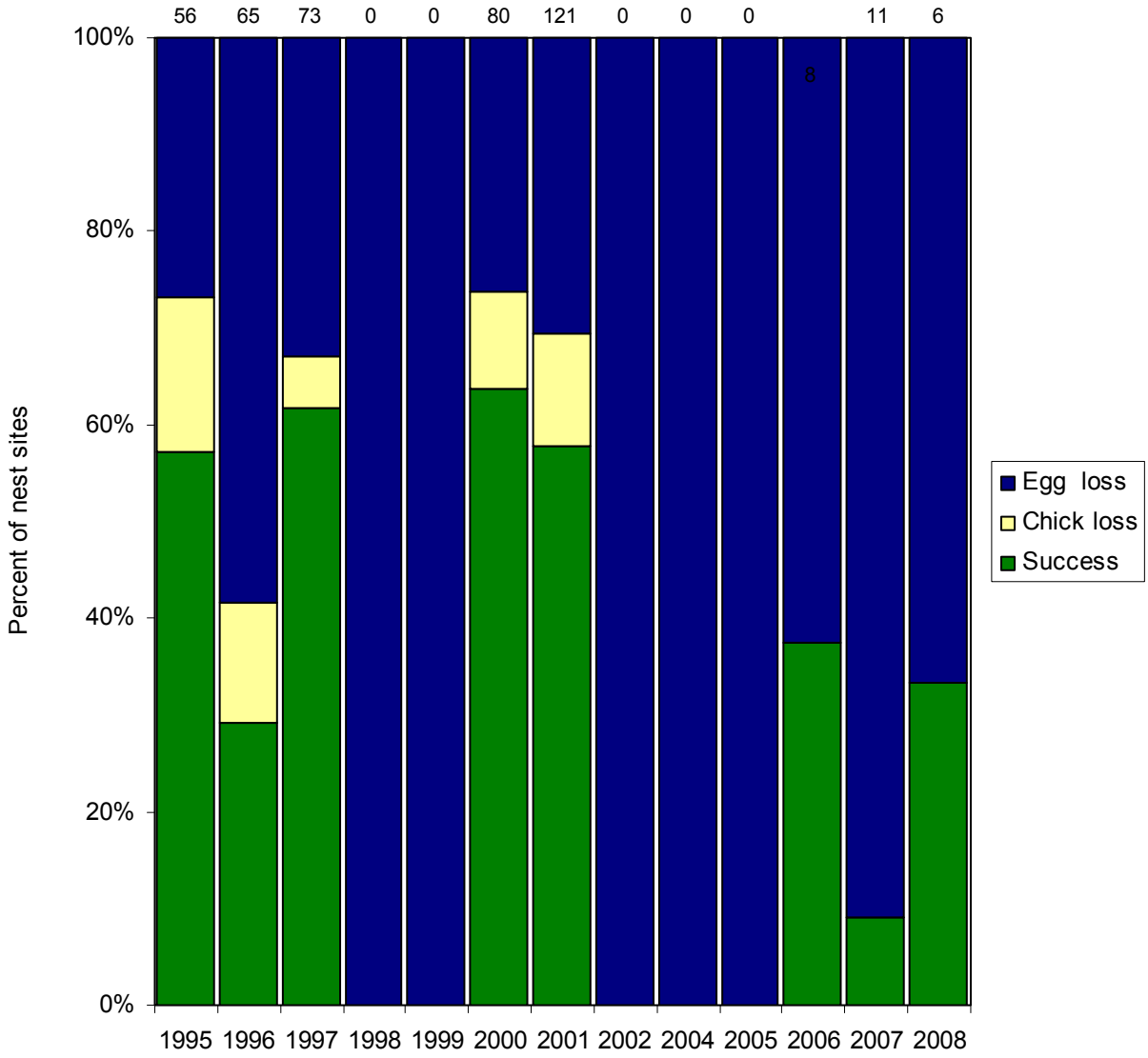


Figure 30. Reproductive performance of thick-billed murres on index plots at Aiktak Island, Alaska. Egg loss=(A-B)/A; Chick loss=(B-C)/A; Success=C/A, where A=number of eggs, B=number of eggs hatched, and C=number of chicks fledged (codes come from following productivity table). Numbers above columns indicate sample sizes.

Table 50. Reproductive performance of thick-billed murres at Aiktak Island, Alaska.

Year[a]	No. sites w/ egg (A)	No. sites w/ chick (B)	No. sites w/ fledged chick (C)			Egg loss ((A-B)/A)	Chick loss ((B-C)/A)	Reproductive success[d] (C/A)
			Total	Fledged[b]	Still present[c]			
1995	56	41	32	32	0	0.27	0.16	0.57
1996	65	27	19	19	0	0.59	0.12	0.29
1997	73	49	45	45	0	0.33	0.05	0.62
1998	0	0	0	0	0	0.00	0.00	0.00
1999	0	0	0	0	0	0.00	0.00	0.00
2000	80	59	51	51	0	0.26	0.10	0.64
2001	121	84	70	70	0	0.30	0.12	0.58
2002	0	0	0	0	0	0.00	0.00	0.00
2004	0	0	0	0	0	0.00	0.00	0.00
2005	0	0	0	0	0	0.00	0.00	0.00
2006	8	3	3	2	1	0.63	0.00	0.38
2007	10	1	1	1	0	0.91	0.00	0.09
2008	6	2	2	0	2	0.66	0.00	0.33

[a]Data were not collected in 2003.

[b]Chicks were considered fledged if they were $\geq$ 15 days old at disappearance or $\geq$ 13 days old at last visit.

[c]Chicks < 13 days old at last visit.

[d]Due to delayed egg laying and few breeding attempts, reproductive success in 2006 and 2008 includes a small number of chicks still present at last check and should be considered a maximum estimate of productivity.

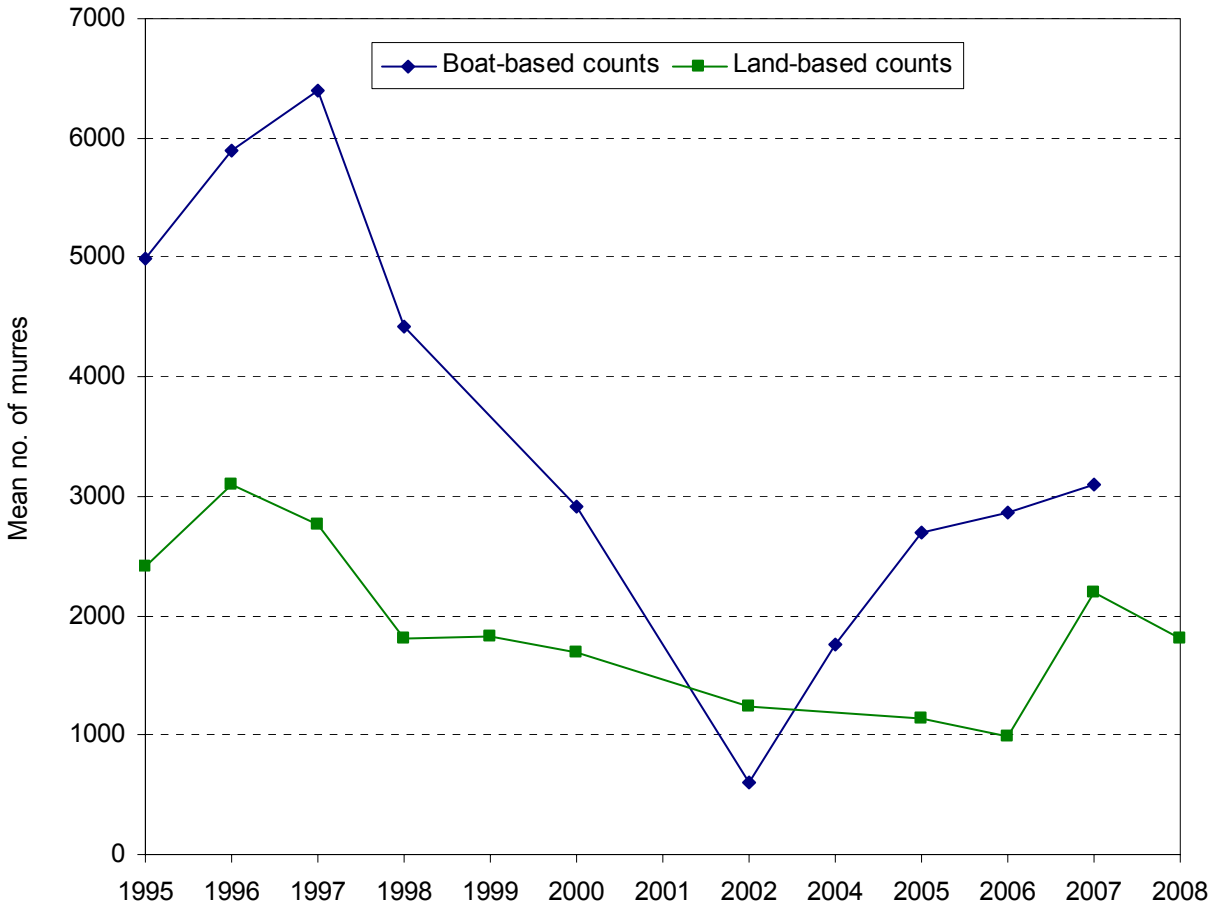


Figure 31. Mean numbers of murres (includes common, thick-billed, and unknown spp.) counted on land-based index plots and during circumnavigations at Aiktak Island, Alaska. Land-based counts represent the number of murres attending cliffs and do not include rafting birds. Boat based-counts include all murres attending cliffs and rafting on the water.

Table 51. Numbers of murres (includes common, thick-billed, and unknown spp.) counted on index plots from land at Aiktak Island, Alaska.

	Replicate									Statistics				Survey
Year[a]	1	2	3	4	5	6	7	8	9	max.	mean	*n*	SD	dates
1995	2597	2591	1937	2528	--	--	--	--	--	2597	2413.3	4	319.0	17 Jul - 28 Jul
1996	2873	2897	3190	3168	3193	3286	--	--	--	3286	3101.2	6	172.5	17 Jul - 7 Aug
1997	2553	1836	2310	3148	3414	3273	--	--	--	3414	2755.7	6	623.0	21 Jul - 12 Aug
1998	1840	581	894	1335	1617	2581	2554	2350	2455	2581	1800.8	9	747.3	22 Jul - 11 Aug
1999	1566	1518	2272	1969	--	--	--	--	--	2272	1831.3	4	356.7	24 Jul - 20 Aug
2000	1761	1726	1601	1819	1841	1426	1702	--	--	1841	1696.6	7	143.3	10 Jul - 22 Aug
2002	1240	1471	1115	1127	--	--	--	--	--	1471	1238.3	4	165.1	10 Jul - 5 Aug
2005	370	276	2147	1749	--	--	--	--	--	2147	1135.5	4	952.9	10 Jul - 1 Aug
2006	511	837	1966	268	178	2186	--	--	--	2186	991.0	6	873.7	14 Jul - 5 Aug
2007	1775	1944	2222	2403	2454	2332	--	--	--	2454	2118.3	6	271.7	28 Jul - 18 Aug
2008	1117	1215	2293	2419	1975	--	--	--	--	2419	1805.0	5	603.8	16 Jul - 6 Aug

[a]Data were not collected in 2001, 2003, and 2004.

Table 52. Numbers of murres counted on index plots from land at Aiktak Island, Alaska in 2008.

Plot	Species	Date					Statistics	
		16 Jul	21 Jul	26 Jul	29 Jul	6 Aug	mean	SD
1	TBMU	0	0	0	0	0		
	COMU	0	3	10	63	14		
	UNMU	0	0	0	0	0		
2	TBMU	0	0	0	0	0		
	COMU	0	109	18	130	107		
	UNMU	0	0	0	0	0		
3	TBMU	33	246	237	236	289		
	COMU	265	483	531	610	601		
	UNMU	0	0	0	0	0		
4	TBMU	0	0	0	0	0		
	COMU	0	0	0	0	0		
	UNMU	0	0	0	6	0		
5	TBMU	27	3	52	47	44		
	COMU	107	22	88	86	110		
	UNMU	0	0	0	0	0		
6	TBMU	0	0	0	0	0		
	COMU	0	0	0	0	0		
	UNMU	466	66	673	618	565		
7	TBMU	0	6	33	28	11		
	COMU	5	0	43	32	18		
	UNMU	0	0	0	0	0		
8	TBMU	0	0	58	43	17		
	COMU	0	0	144	181	74		
	UNMU	0	0	0	0	0		
9	TBMU	0	0	5	0	1		
	COMU	0	0	4	5	4		
	UNMU	0	0	0	0	0		
10	TBMU	106	126	228	154	53		
	COMU	108	157	169	180	67		
	UNMU	0	0	0	0	0		
Rafts[a]	UNMU	857	1222	0	0	0		
Total[a]	TBMU	166	375	613	508	415	416.6	166.6
	COMU	485	774	1007	1287	995	909.6	299.1
	UNMU	466	66	673	624	565	478.8	243.3
	ALL	1117	1215	2293	2419	1975	1805.0	603.8

[a]Totals do not include murres rafting on the water.

Table 53. Numbers of murres (includes common, thick-billed, and unknown spp.) counted during circumnavigations at Aiktak Island, Alaska.

	Replicate					Statistics		Survey
Year [a]	1	2	3	4	5	mean	SD	dates
1995	4800	5200	4968	--	--	4989.3	200.9	25 Jun - 5 Aug
1996	6124	3752	6022	7692	--	5897.5	1341.0	21 Jul - 15 Aug
1997	7095	4839	7259	--	--	6397.7	1352.3	23 Jul - 9 Aug
1998	5031	3796	--	--	--	4413.5	873.3	27 Jul - 3 Aug
2000	2790	2307	3023	3142	3304	2913.2	365.2	9 Jul - 11 Aug
2002	81	73	998	1256	--	602.0	531.8	26 May - 18 Jul
2004	2756	1234	2116	957	--	1765.8	764.2	22 Jul - 10 Aug
2005	2619	3348	2126	--	--	2697.7	614.8	22 Jul - 14 Aug
2006	1836	3875	--	--	--	2855.5	1441.8	21 Jul - 27 Aug
2007	2486	3617	3187	--	--	3096.7	570.9	22 Jul - 20 Aug

[a]Data were not collected in 1999, 2001, 2003, and 2008.

Figure 32. Maximum numbers of pigeon guillemots counted on land and boat-based surveys at Aiktak Island, Alaska.

Table 54. Maximum daily number of pigeon guillemots counted from land-based observation points at Aiktak Island, Alaska[a]. Data represent the highest single daily count of individuals each year.

Observation point	2003	2008
Pleasure Cove	2	1
Old Camp Beach	1	5
New Camp Beach	2	3
4 Sisters	2	0
Ivory Cove	0	0
Tower Cove	1	0
Arch's Cove	0	6
Petrel Valley Cove	0	4
Total	8	19
Date	21 Jun	19 Jun
Start time[b]	0845	0930
End time	1110	1045

[a]Data were not collected in 1995-1999. Counts were made in 2000-2002 and 2004-2007 but are not summarized because data are not comparable due to differences in observation points and times of day and season.
[b]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

Table 55. Numbers of pigeon guillemots counted from land-based observation points at Aiktak Island, Alaska in 2008.

	Date					Statistics		
Observation point	17 Jun	19 Jun	27 Jun	28 Jun	29 Jun	max.	mean	SD
Pleasure Cove	0	1	1	0	0			
Old Camp Beach	8	5	2	1	1			
New Camp Beach	1	3	0	2	0			
4 Sisters	0	0	3	0	0			
Ivory Cove	1	0	0	2	0			
Tower Cove	0	0	1	1	0			
Arch's Cove	0	6	2	1	3			
Petrel Valley Cove	0	4	2	2	3			
Total	10	19	11	9	7	19	11.2	4.6
Start time[a]	0930	0930	0930	0800	0915			
End time	1030	1045	1015	1015	1030			

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

Table 56. Numbers of pigeon guillemots counted from land-based observation points at Aiktak Island, Alaska in 2003[a].

	Date			Statistics		
Observation point	11 Jun	14 Jun	21 Jun	max.	mean	SD
Pleasure Cove	0	0	2			
Old Camp Beach	1	0	1			
New Camp Beach	1	2	2			
4 Sisters	0	0	2			
Ivory Cove	1	1	0			
Tower Cove	0	0	1			
Arch's Cove	3	3	0			
Petrel Valley Cove	0	1	0			
Total	6	7	8	8	7.0	1.0
Start time[b]	950	0835	0845			
End time	1115	1100	1110			

[a]Data were originally presented in previous reports (e.g. Helm et al. 2007) but has been cropped to meet requirements for time of day and season.

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

Table 57. Maximum numbers of pigeon guillemots counted during circumnavigations at Aiktak Island, Alaska[a].

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

[a]Data were not collected in 1995, 2003, and 2008.
[b]Counts in 2002 and 2004-2007 were conducted in the afternoon and thus may not be comparable to data from other years.
[c]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

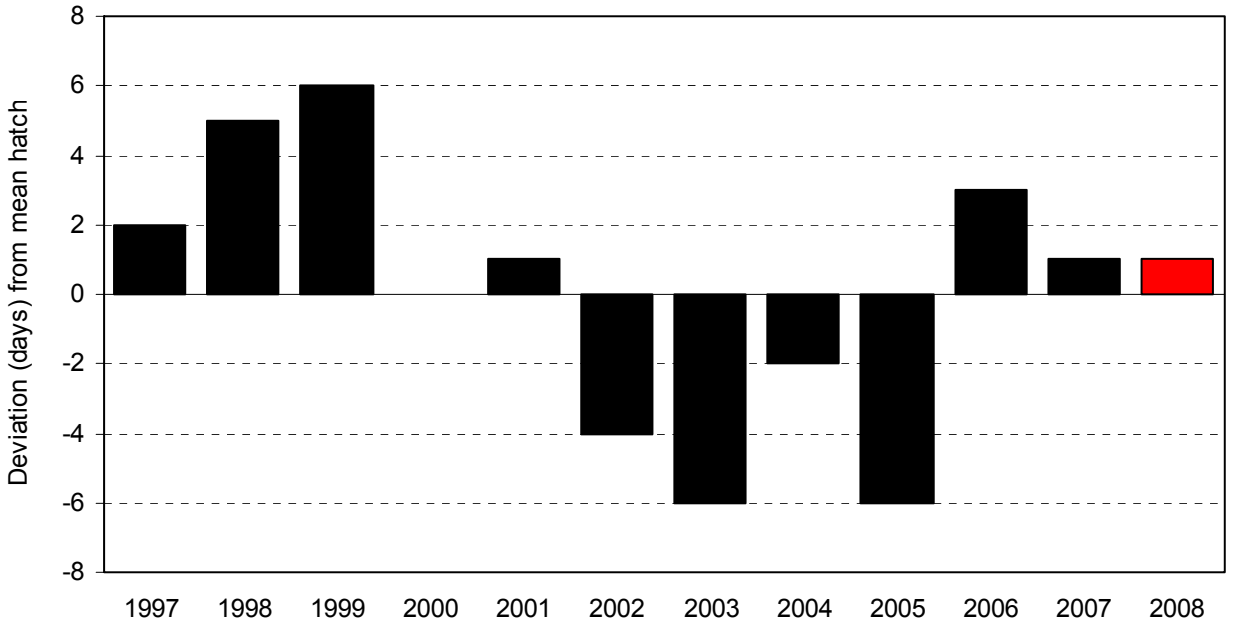


Figure 33. Yearly hatch date deviation (from the 1995-2007 average of 4 July) of ancient murrelets at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

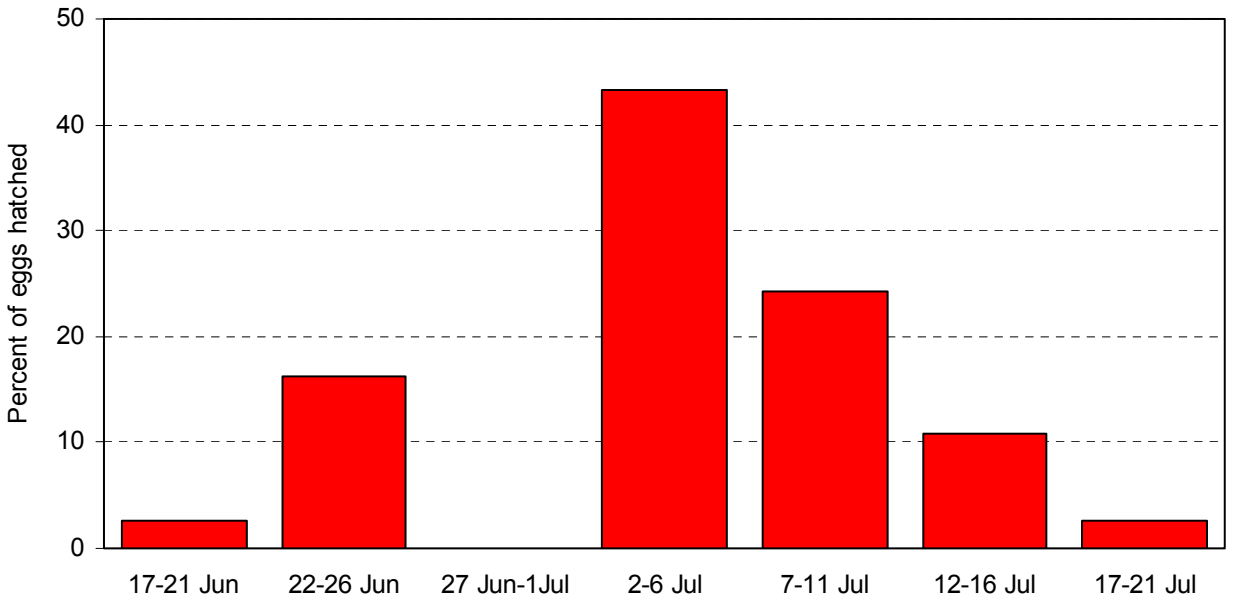


Figure 34. Hatching chronology of ancient murrelets at Aiktak Island, Alaska in 2008.

Table 58. Breeding chronology of ancient murrelets at Aiktak Island, Alaska. Hatch dates represent the date of the first chick hatched in each nest.

Year	Mean hatch	SD	*n*[a]	Median hatch	No. nests monitored[b]	First hatch	Last hatch
1997	6 Jul	8.4	8	3 Jul	15	29 Jun	22 Jul
1998	10 Jul	8.0	12	10 Jul	22	27 Jun	25 Jul
1999	11 Jul	6.1	21	11 Jul	30	29 Jun	23 Jul
2000	3 Jul	5.8	23	4 Jul	29	26 Jun	14 Jul
2001	29 Jun	4.1	22	29 Jun	35	26 Jun	14 Jul
2002	1 Jul	6.0	33	28 Jun	35	25 Jun	16 Jul
2003	27 Jun	5.0	21	25 Jun	40	19 Jun	5 Jul
2004	30 Jun	5.6	23	30 Jun	31	20 Jun	12 Jul
2005	28 Jun	4.4	27	26 Jun	44	19 Jun	5 Jul
2006	7 Jul	5.8	41	5 Jul	44	29 Jun	23 Jul
2007	5 Jul	6.6	41	5 Jul	51	23 Jun	23 Jul
2008	4 Jul	6.6	37	2 Jul	42	20 Jun	21 Jul

[a]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.
[b]All nests monitored are used to estimate first and last hatch dates and may include observations with egg to chick intervals > 7 days.

Table 59. Frequency distribution of hatch dates for ancient murrelets at Aiktak Island, Alaska[a]. Hatch dates represent the date of the first chick hatched in each nest.

Julian	No. nests hatching on Julian date											
date	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
170	--	--	--	--	--	--	3	--	1	--	--	--
171	--	--	--	--	--	--	--	--	--	--	--	--
172	--	--	--	--	1	--	--	1	--	--	--	1
173	--	--	--	--	2	--	--	--	--	--	--	--
174	--	--	--	--	--	--	--	1	5	--	2	--
175	--	--	--	--	--	--	--	--	--	--	--	--
176	--	----	--	1	10	9	--	--	--	--	--	--
177	--	--	--	--	1	--	--	3	9	--	--	--
178	--	1	--	7	--	--	--	--	--	--	--	6
179	--	--	--	--	--	8	--	5	--	--	--	--
180	1	1	1	--	10	--	5	--	--	6	11	--
181	1	--	--	2	--	2	--	--	--	--	--	--
182	1	--	--	--	--	--	--	5	8	--	--	--
183	1	1	--	2	--	4	--	--	--	--	--	--
184	1	--	1	--	6	1	--	3	--	--	1	14
185	--	--	--	--	--	1	--	--	--	--	--	--
186	1	--	--	5	--	--	4	--	4	18	13	1
187	--	--	--	--	--	1	--	2	--	--	--	--
188	--	1	6	--	1	1	--	--	--	1	--	1
189	--	--	--	--	--	--	--	1	--	--	--	--
190	--	--	1	3	--	--	--	--	--	--	2	9
191	--	3	--	--	--	3	--	--	--	--	--	--
192	--	--	4	3	--	--	--	--	--	12	8	--
193	--	--	--	--	--	--	--	--	--	--	--	--
194	--	--	3	--	--	--	--	2	--	--	--	--
195	--	3	--	--	--	1	--	--	--	--	--	--
196	--	--	2	1	--	--	--	--	--	--	--	--
197	1	--	--	--	--	1	--	--	--	--	--	4
198	--	--	--	--	--	--	--	--	--	2	3	--
199	--	1	--	--	--	--	--	--	--	--	--	--
200	--	--	1	--	--	--	--	--	--	--	--	--
201	--	--	--	--	--	--	--	--	--	--	--	--
202	--	--	1	--	--	--	--	--	--	--	--	--
203	1	--	--	--	--	--	--	--	--	--	--	1
204	--	--	1	--	--	--	--	--	--	2	1	--
205	--	--	--	--	--	--	--	--	--	--	--	--
206	--	1	--	--	--	--	--	--	--	--	--	--
n	8	12	21	23	22	33	21	23	27	41	41	37

[a]Data were not collected in 1995 and 1996.

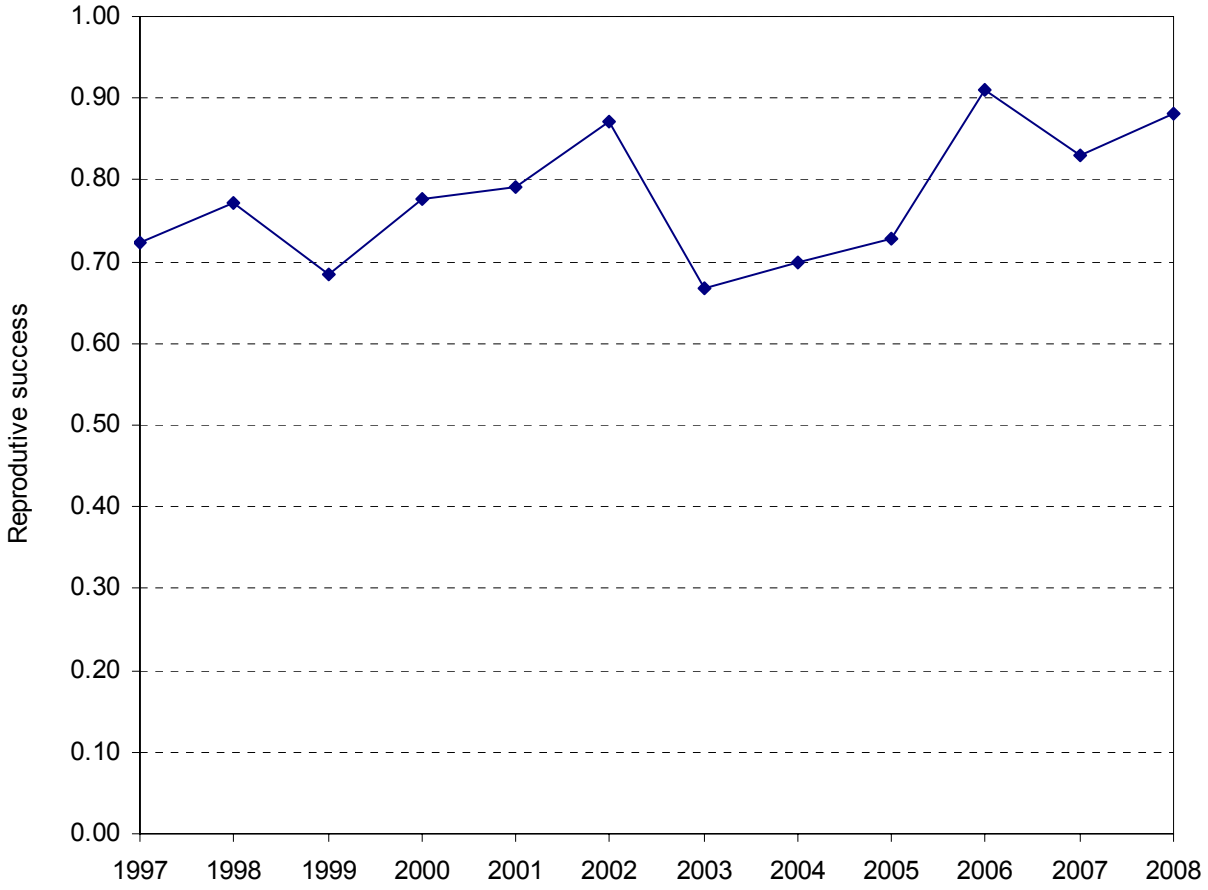


Figure 35. Reproductive performance of ancient murrelets at Aiktak Island, Alaska. Reproductive success is defined as the number of chicks that departed divided by the total number of eggs.

Table 60. Reproductive performance of ancient murrelets at Aiktak Island[a].

Parameter	1997	1998	1999	2000	2001	2002	2003[b]	2004	2005	2006	2007	2008
No. burrows with eggs (A)	15	22	30	29	35	35	40	31	44	44	51	42
Total no. eggs (B)	29	44	57	58	67	70	75	60	88	88	100	84
No. burrows with chicks (C)	13	19	22	24	29	33	28	23	33	41	45	37
Total no. chicks (D)	21	35	39	45	53	61	51	42	65	80	83	74
No. burrows with chicks fledged (E)	13	19	22	24	29	33	27	23	33	41	45	37
Total no. chicks fledged (F)	21	34	39	45	53	61	50	42	64	80	83	74
Mean clutch size (B/A)	1.9	2.0	1.9	2.0	1.9	2.0	1.9	1.9	2.0	2.0	2.0	2.0
Mean brood size (D/C)	1.6	1.8	1.8	1.9	1.8	1.9	1.8	1.8	2.0	2.0	1.8	2.0
Hatching success (D/B)	0.72	0.80	0.68	0.78	0.79	0.87	0.68	0.70	0.74	0.91	0.83	0.88
“Fledging” success (F/D)	1.00	0.97	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	1.00
Nest success (E/A)	0.87	0.86	0.73	0.83	0.83	0.94	0.70	0.74	0.75	0.93	0.88	0.88
Reproductive success (F/B)	0.72	0.77	0.68	0.78	0.79	0.87	0.67	0.70	0.73	0.91	0.83	0.88

[a]Data were not collected in 1995 and 1996.
[b]In 2003, this is a maximum estimate of productivity because there were still burrows with eggs at the time of field crew departure.

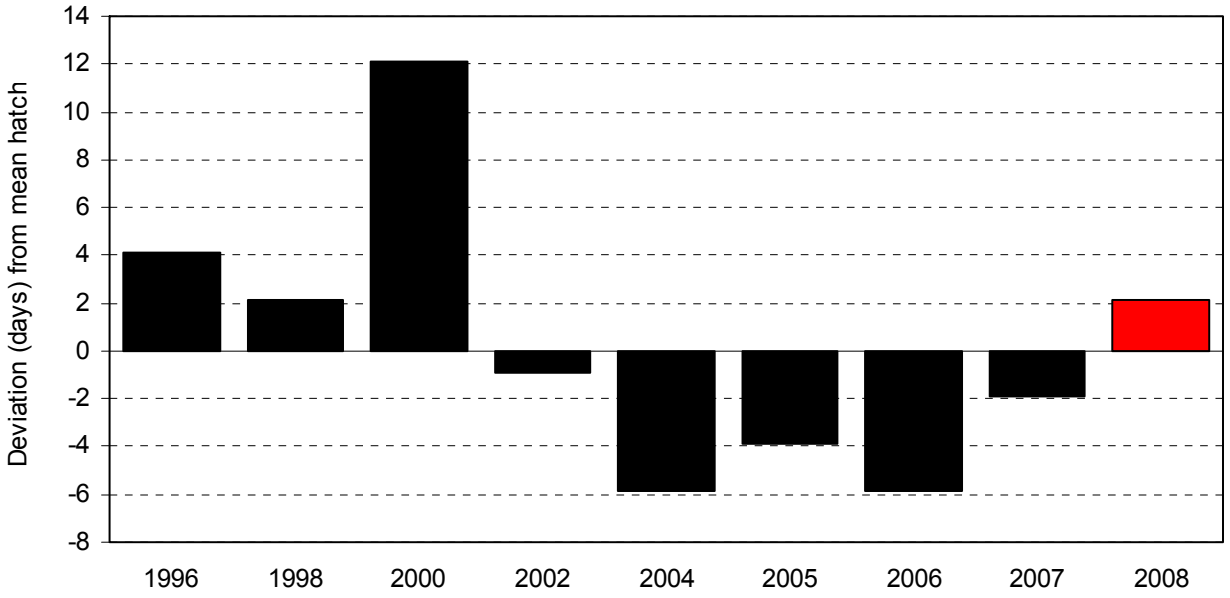


Figure 36. Yearly hatch date deviation (from the 1995-2007 average of 2 Aug) of horned puffins at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

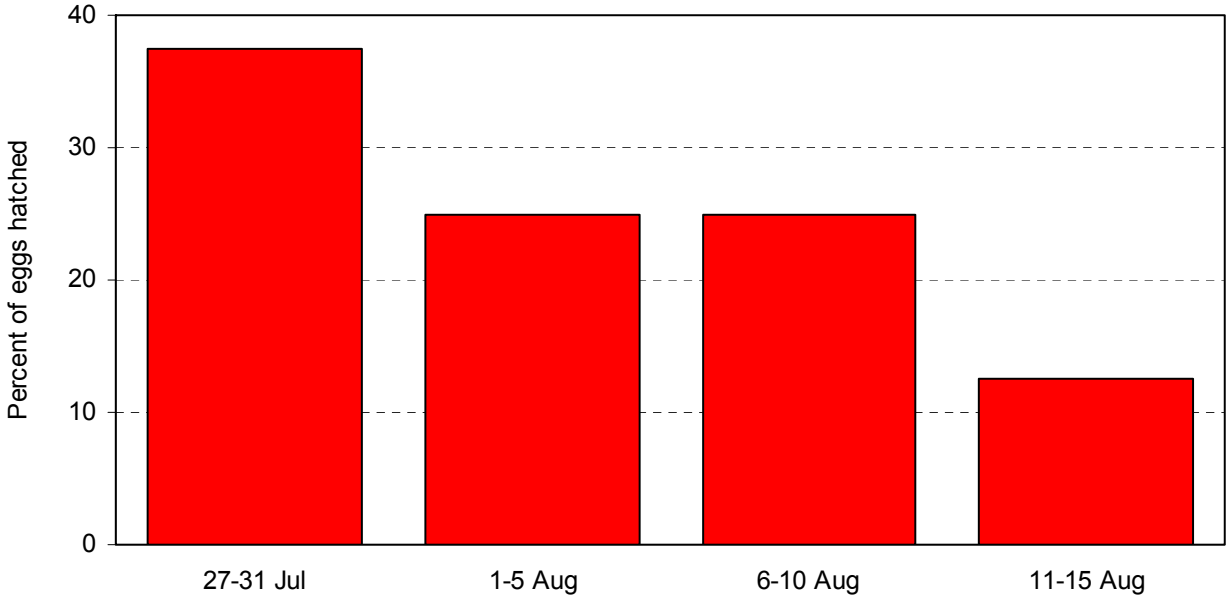


Figure 37. Hatching chronology of horned puffins at Aiktak Island, Alaska in 2008.

Table 61. Breeding chronology of horned puffins at Aiktak Island, Alaska.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First hatch	Last hatch	First fledge
1996	5 Aug	6.3	2	5 Aug	4	1 Aug	10 Aug	>13 Aug
1998	4 Aug	7.5	6	3 Aug	10	25 Jul	16 Aug	>3 Sep
2000	13 Aug	17.0	5	13 Aug	10	26 Jul	29 Aug	1 Sep
2002	1 Aug	0.0	1	1 Aug	1	1 Aug	1 Aug	N/A
2004	26 Jul	0.0	4	26 Jul	5	26 Jul	26 Jul	>27 Aug
2005	29 Jul	6.4	4	27 Jul	10	24 Jul	8 Aug	>30 Aug
2006	27 Jul	7.5	5	22 Jul	9	21 Jul	4 Aug	28 Aug
2007	31 Jul	6.5	6	29 Jul	17	25 Jul	12 Aug	>30 Aug
2008	3 Aug	6.5	7	1 Aug	11	28 Jul	15 Aug	>29 Aug

[a]Data were not collected in 1995, 1997, 1999, 2001, and 2003.
[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.
[c]All nests monitored are used to estimate first and last hatch and fledge dates and may include observations with egg to chick intervals > 7 days.

Table 62. Frequency distribution of hatch dates for horned puffins at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date								
date	1996	1998	2000	2002	2004	2005	2006	2007	2008
202	--	--	--	--	--	--	2	--	--
203	--	--	--	--	--	--	1	--	--
204	--	--	--	--	--	--	--	--	--
205	--	--	--	--	--	--	--	--	--
206	--	1	--	--	--	1	--	1	--
207	--	--	--	--	--	--	--	1	--
208	--	--	2	--	4	2	--	--	--
209	--	--	--	--	--	--	--	--	--
210	--	--	--	--	--	--	--	2	3
211	--	--	--	--	--	--	--	--	--
212	--	--	--	--	--	--	--	1	--
213	--	--	--	1	--	--	--	--	--
214	1	--	--	--	--	--	--	--	2
215	--	3	--	--	--	--	--	--	--
216	--	--	--	--	--	--	2	--	--
217	--	--	--	--	--	--	--	--	--
218	--	--	--	--	--	--	--	--	--
219	--	--	--	--	--	--	--	--	--
220	--	--	--	--	--	1	--	--	2
221	--	--	--	--	--	--	--	--	--
222	--	1	--	--	--	--	--	--	--
223	1	--	--	--	--	--	--	--	--
224	--	--	--	--	--	--	--	1	--
225	--	--	--	--	--	--	--	--	--
226	--	--	1	--	--	--	--	--	--
227	--	--	--	--	--	--	--	--	--
228	--	1	--	--	--	--	--	--	1
229	--	--	--	--	--	--	--	--	--
230	--	--	--	--	--	--	--	--	--
231	--	--	--	--	--	--	--	--	--
232	--	--	--	--	--	--	--	--	--
233	--	--	--	--	--	--	--	--	--
234	--	--	--	--	--	--	--	--	--
235	--	--	--	--	--	--	--	--	--
236	--	--	--	--	--	--	--	--	--
237	--	--	--	--	--	--	--	--	--
238	--	--	--	--	--	--	--	--	--
239	--	--	--	--	--	--	--	--	--
240	--	--	--	--	--	--	--	--	--
241	--	--	--	--	--	--	--	--	--
242	--	--	2	--	--	--	--	--	--
n	2	6	5	1	4	4	5	6	8

[a]Data were not collected in 1995, 1997, 1999, 2001, and 2003.

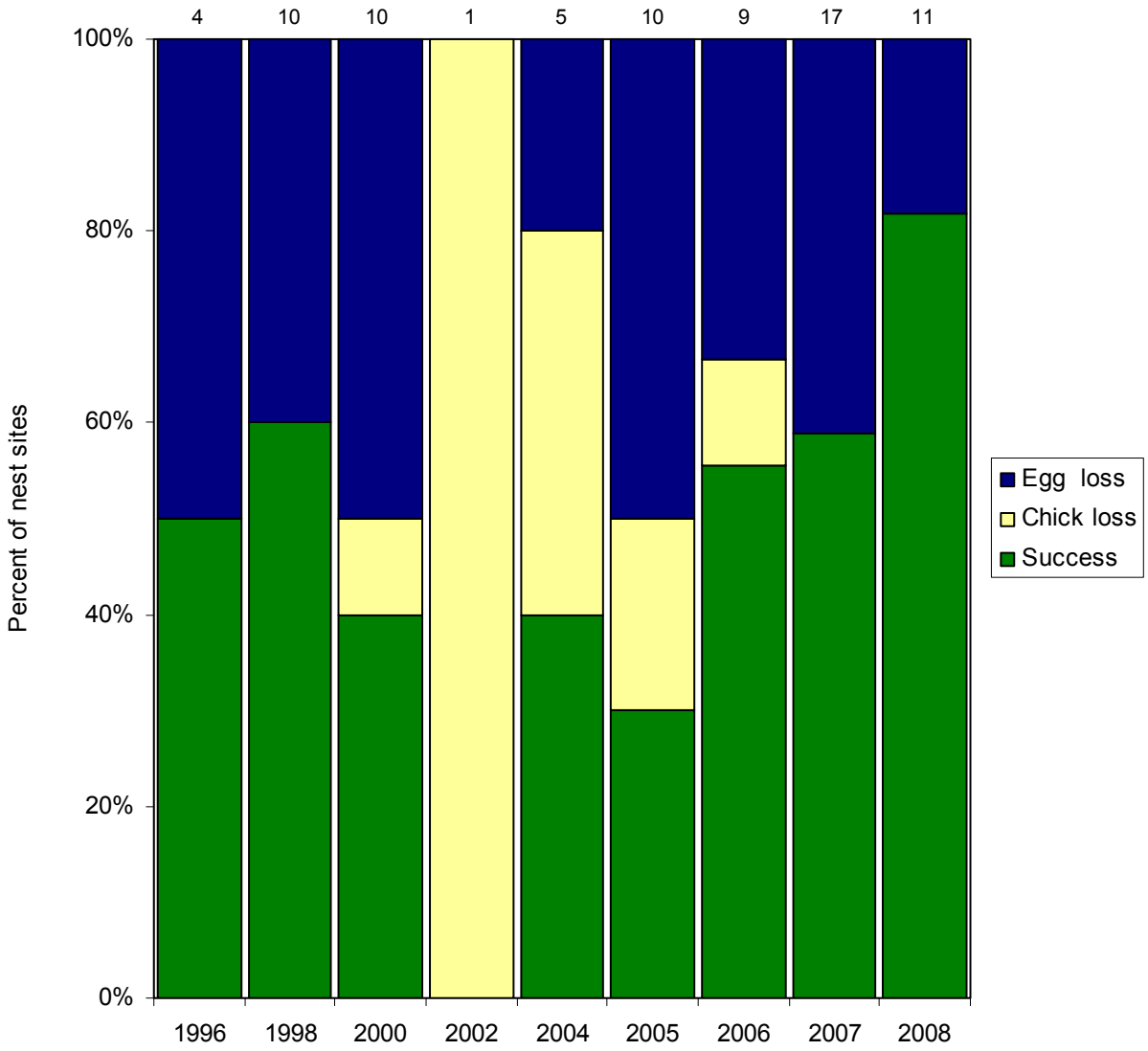


Figure 38. Reproductive performance of horned puffins at Aiktak Island, Alaska. Egg loss=(A-B)/A; Chick loss=(B-C)/A; Success=C/A, where A=number of eggs, B=number of eggs hatched, and C=number of chicks potentially fledged (codes come from following productivity table). Success represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values may be lower. Numbers above columns indicate sample sizes.

Table 63. Reproductive performance of horned puffins at Aiktak Island, Alaska[a].

Parameter	1996	1998	2000	2002	2004	2005	2006	2007	2008
Total no. eggs (A)	4	10	10	1	5	10	9	17	11
No. eggs lost to:									
disappearance	0	0	2	0	1	0	0	1	0
abandonment	0	2	1	0	0	5	3	4	2
breakage	2	2	2	0	0	0	0	2	0
Total no. chicks (B)	2	6	5	1	4	5	6	10	9
No. chicks lost to:									
disappearance	0	0	1	1	2	1	0	0	0
death	0	0	0	0	0	1	1	0	0
No. chicks potentially successful (C):	2	6	4	0	2	3	5	10	9
chicks fledged[b]	0	4	2	0	2	3	3	4	4
chicks still present at last visit[c]	2	2	2	0	0	0	2	6	5
Hatching success (B/A)	0.50	0.60	0.50	1.00	0.80	0.50	0.67	0.59	0.82
Fledging success (C/B)[d]	1.00	1.00	0.80	0.00	0.50	0.60	0.83	1.00	1.00
Reproductive success (C/A)[d]	0.50	0.60	0.40	0.00	0.40	0.30	0.56	0.59	0.82
Productivity (hs x fs)	0.50	0.60	0.40	0.00	0.40	0.30	0.56	0.59	0.82

[a]Data were not collected in 1995, 1997, 1999, 2001, and 2003.
[b]Chicks were considered fledged if they were $\geq$ 34 days old at disappearance or $\geq$ 30 days old at last visit.
[c]Chicks still present but < 30 days old at last visit.
[d]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values may be lower.

Table 64. Mean growth rates of horned puffin chicks at Aiktak Island, Alaska. Data include chicks measured at least 2 times during the linear phase of growth (up to approximately 450g); chicks that died were excluded.

		Mass (g/day)			Wing chord (mm/day)[b]		
Year[a]	*n*	mean	SD	range	mean	SD	range
2000	6	12.9	4.5	7.9 - 18.3	3.6	0.9	2.7 - 4.5
2005	3	8.0	2.3	5.7 - 10.2	3.4	0.2	3.2 - 3.6
2007	6	12.4	5.9	4.7 - 22.3	3.4	0.6	2.6 - 4.4

[a]Data were not collected in 1995-1999, 2001-2004, 2006, and 2008.
[b]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.

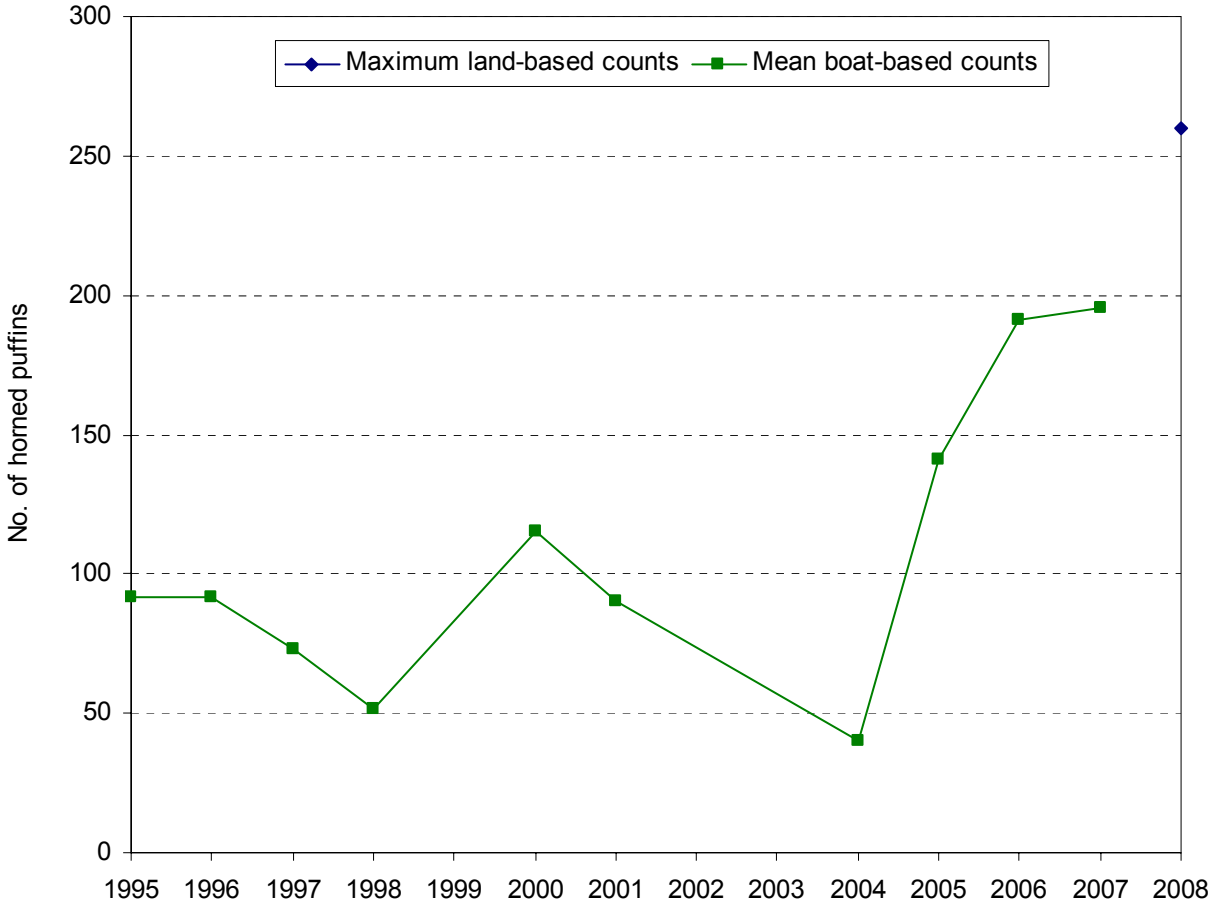


Figure 39. Maximum numbers of horned puffins counted from land-based observation points and mean numbers of horned puffins counted during circumnavigations at Aiktak Island, Alaska.

Table 65. Maximum daily number of horned puffins counted from land-based observation points at Aiktak Island, Alaska[a]. Data represent the highest single daily count of individuals each year.

Observation point	2008
Pleasure Cove	4
Old Camp Beach	25
New Camp Beach	2
4 Sisters	42
Ivory Cove	6
Tower Cove	10
Arch's Cove	17
Petrel Valley Cove	154
Total	260
Date	7 Jul
Start time[b]	1550
End time	1630

[a]Data were not collected in 1995-1999. Counts were made in 2000-2007 but are not summarized because data are not comparable due to differences in observation points and times of day and season.
[b]Times are Aleutian Standard Time (-1 hr from Alaska Standard Time).

Table 66. Numbers of horned puffins counted from land-based observation points at Aiktak Island, Alaska in 2008.

	Date							Statistics		
Observation point	3 Jul	4 Jul	7 Jul	12 Jul	14 Jul	17 Jul	22 Jul	max	mean	SD
Pleasure Cove	7	13	4	1	0	6	3			
Old Camp Beach	23	7	25	24	40	19	12			
New Camp Beach	6	0	2	12	5	2	0			
4 Sisters	16	24	42	29	12	41	35			
Ivory Cove	4	5	6	4	7	3	11			
Tower Cove	12	4	10	15	18	7	21			
Arch's Cove[d]	7	11	17	9	13	12	8			
Petrel Valley Cove	131	104	154	36	121	140	112			
Total	206	168	260	130	216	230	202	260	201.7	42.2
Start time[a]	1530	1530	1550	1530	1550	1600	1530			
End time	1630	1630	1630	1630	1700	1700	1615			

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

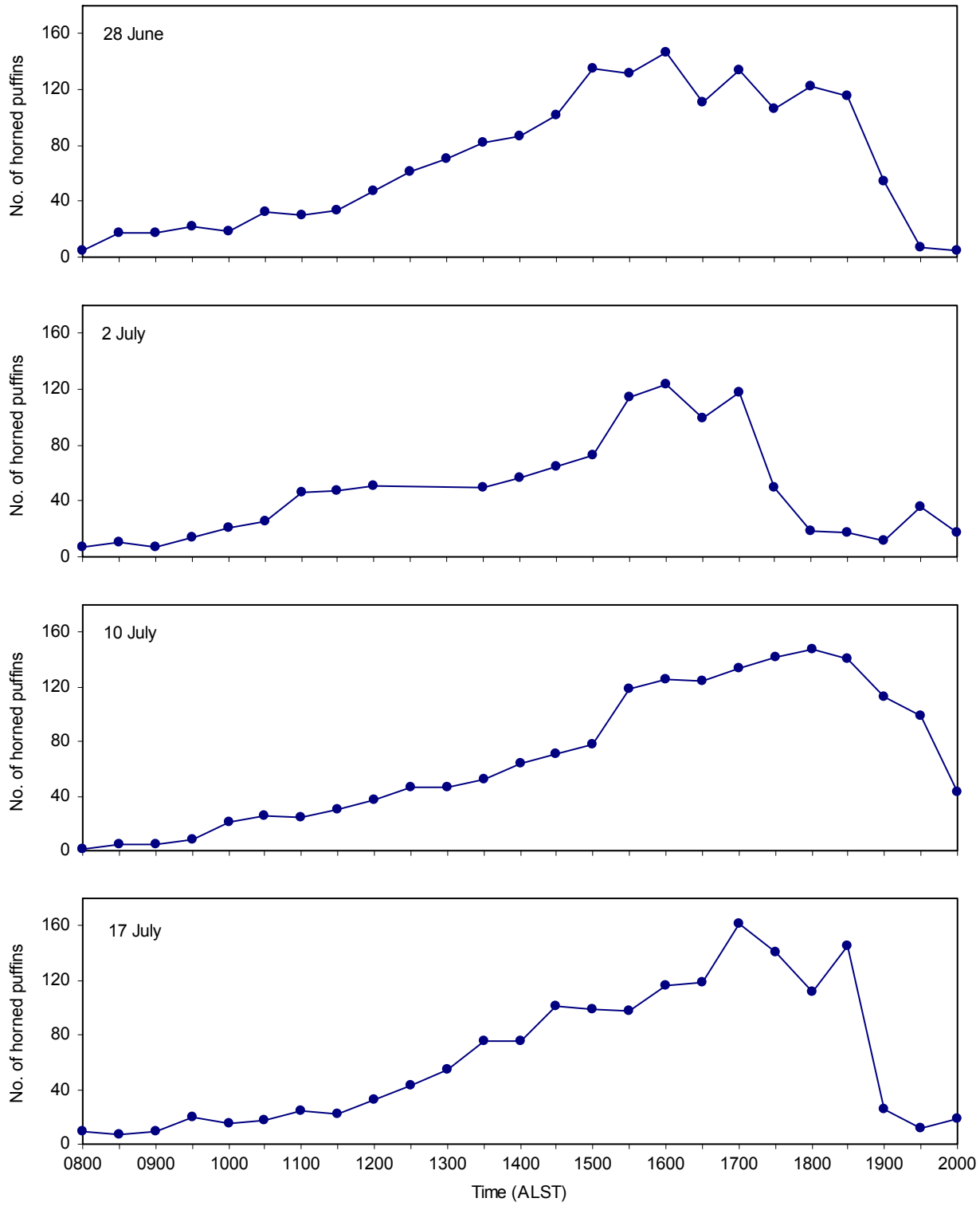


Figure 40. Attendance patterns of horned puffins on the water in Petrel Valley Cove during the incubation period at Aiktak Island, Alaska in 2008.

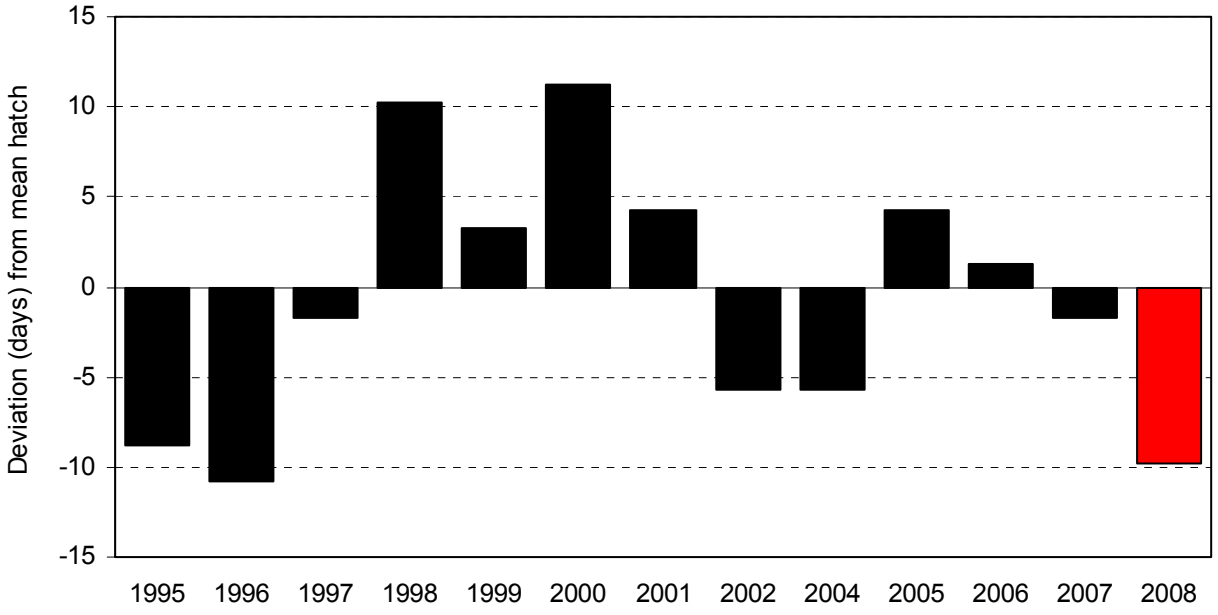


Figure 41. Yearly hatch date deviation (from the 1995-2007 average of 4 Aug) of tufted puffins at Aiktak Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date.

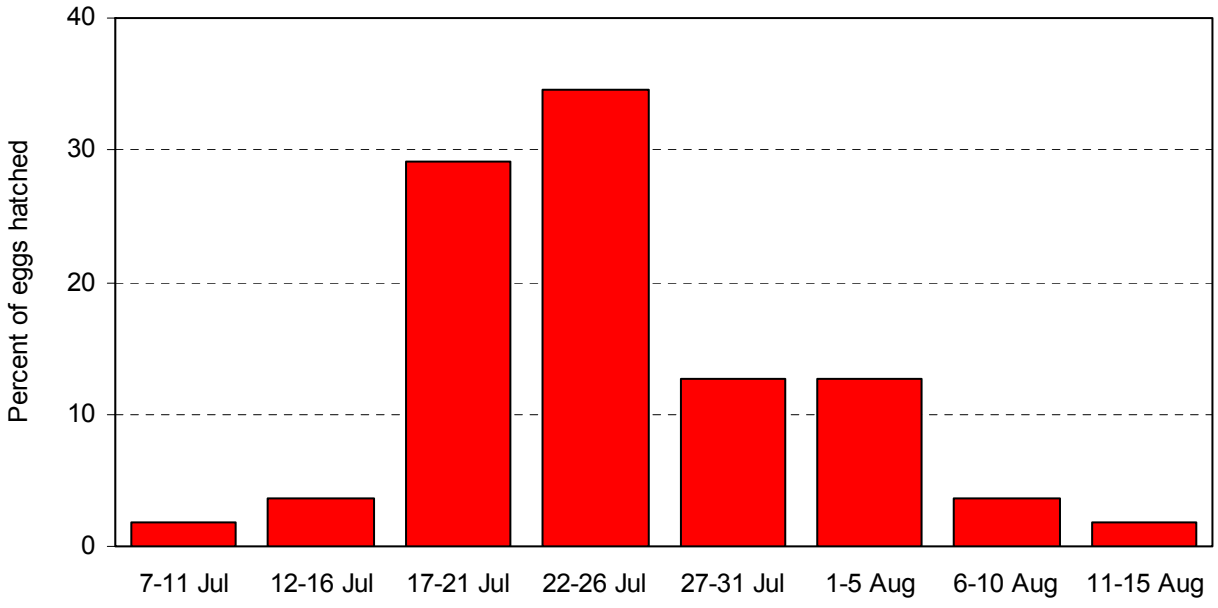


Figure 42. Hatching chronology of tufted puffins at Aiktak Island, Alaska in 2008.

Table 66. Breeding chronology for tufted puffins at Aiktak Island, Alaska.

Year[a]	Mean hatch	SD	*n*[b]	Median hatch	No. nests monitored[c]	First hatch	Last hatch	First fledge
1995	26 Jul	3.5	17	25 Jul	38	21 Jul	31 Jul	>31 Aug
1996	24 Jul	8.0	27	23 Jul	67	8 Jul	9 Aug	27 Aug
1997	2 Aug	4.0	23	4 Aug	81	23 Jul	8 Aug	>2 Sep
1998	14 Aug	7.2	7	11 Aug	85	13 Jul	23 Aug	>2 Sep
1999	17 Aug	2.2	5	17 Aug	58	30 Jul	27 Aug	>3 Sep
2000	14 Aug	0.0	1	14 Aug	62	16 Jul	15 Aug	>11 Sep
2001	8 Aug	11.1	6	10 Aug	57	19 Jul	21 Aug	30 Aug
2002	29 Jul	7.4	17	26 Jul	38	18 Jul	18 Aug	1 Sep
2004	28 Jul	4.0	46	26 Jul	61	26 Jul	17 Aug	>27 Aug
2005	8 Aug	6.6	8	8 Aug	79	21 Jul	14 Aug	>30 Aug
2006	5 Aug	9.9	12	3 Aug	73	22 Jul	25 Aug	>2 Sep
2007	2 Aug	7.6	10	31 Jul	84	26 Jul	19 Aug	>30 Aug
2008	24 Jul	6.8	55	22 Jul	136	11 Jul	15 Aug	22 Aug

[a]Data were not collected in 2003.
[b]Sample sizes used to calculate mean and median hatch dates are a sub-sample of total nests for which egg to chick interval is $\leq$ 7 days.
[c]All nests monitored are used to estimate first and last hatch and fledge dates and may include observations with egg to chick intervals > 7 days.

Table 67. Frequency distribution of hatch dates for tufted puffins at Aiktak Island, Alaska[a].

Julian	No. nests hatching on Julian date												
date	1995	1996	1997	1998	1999	2000	2001	2002	2004	2005	2006	2007	2008
190	--	1	--	--	--	--	--	--	--	--	--	--	--
191	--	--	--	--	--	--	--	--	--	--	--	--	--
192	--	--	--	--	--	--	--	--	--	--	--	--	--
193	--	--	--	--	--	--	--	--	--	--	--	--	1
194	--	--	--	--	--	--	--	--	--	--	--	--	1
195	--	--	--	--	--	--	--	--	--	--	--	--	--
196	--	--	--	--	--	--	--	--	--	--	--	--	--
197	--	--	--	--	--	--	--	--	--	--	--	--	--
198	--	7	--	--	--	--	--	--	--	--	--	--	1
199	--	3	--	--	--	--	--	--	--	--	--	--	--
200	--	--	--	--	--	--	1	1	--	--	--	--	12
201	--	--	--	--	--	--	--	--	--	--	--	--	--
202	2	1	--	--	--	--	--	--	--	--	--	--	2
203	--	--	--	--	--	--	--	--	--	--	--	--	2
204	4	3	1	--	--	--	--	4	--	--	--	--	16
205	--	--	--	--	--	--	--	--	--	--	--	--	--
206	4	--	--	--	--	--	--	--	--	--	3	--	--
207	--	--	--	--	--	--	--	4	--	--	--	1	2
208	--	3	3	--	--	--	--	--	32	--	--	2	1
209	--	2	--	--	--	--	--	--	--	--	--	--	--
210	4	--	--	--	--	--	--	1	--	--	--	--	7
211	1	--	--	--	--	--	--	--	--	--	--	--	--
212	2	1	3	--	--	--	--	3	--	1	3	2	--
213	--	3	--	--	--	--	--	--	--	--	--	2	--
214	--	--	1	--	--	--	--	--	13	3	--	1	5
215	--	--	2	--	1	--	--	--	--	--	--	--	--
216	--	--	10	1	--	--	--	2	--	--	--	--	--
217	--	1	--	--	--	--	--	--	--	--	--	--	1
218	--	--	--	--	--	--	1	--	--	--	1	--	1
219	--	--	1	--	3	--	1	--	--	--	1	--	--
220	--	1	2	1	--	--	--	1	--	--	--	--	2
221	--	--	--	--	1	--	--	--	--	--	--	--	--
222	--	1	--	--	--	--	--	--	--	--	--	--	--
223	--	--	--	2	--	--	--	--	--	--	--	--	--
224	--	--	--	--	--	--	1	--	--	--	1	1	--
225	--	--	--	--	--	--	1	--	--	1	1	--	--
226	--	--	--	--	--	--	--	--	--	3	--	--	--
227	--	--	--	--	--	1	--	--	--	--	--	--	--
228	--	--	--	--	--	--	--	--	--	--	--	--	1
229	--	--	--	--	--	--	--	--	--	--	--	--	--
230	--	--	--	--	--	--	--	1	1	--	1	--	--
231	--	--	--	--	--	--	--	--	--	--	--	1	--
232	--	--	--	2	--	--	--	--	--	--	--	--	--
233	--	--	--	--	--	--	1	--	--	--	--	--	--
234	--	--	--	--	--	--	--	--	--	--	--	--	--
235	--	--	--	1	--	--	--	--	--	--	--	--	--
236	--	--	--	--	--	--	--	--	--	--	1	--	--
n	17	27	23	7	5	1	6	17	46	8	12	10	55

[a]Data were not collected in 2003.

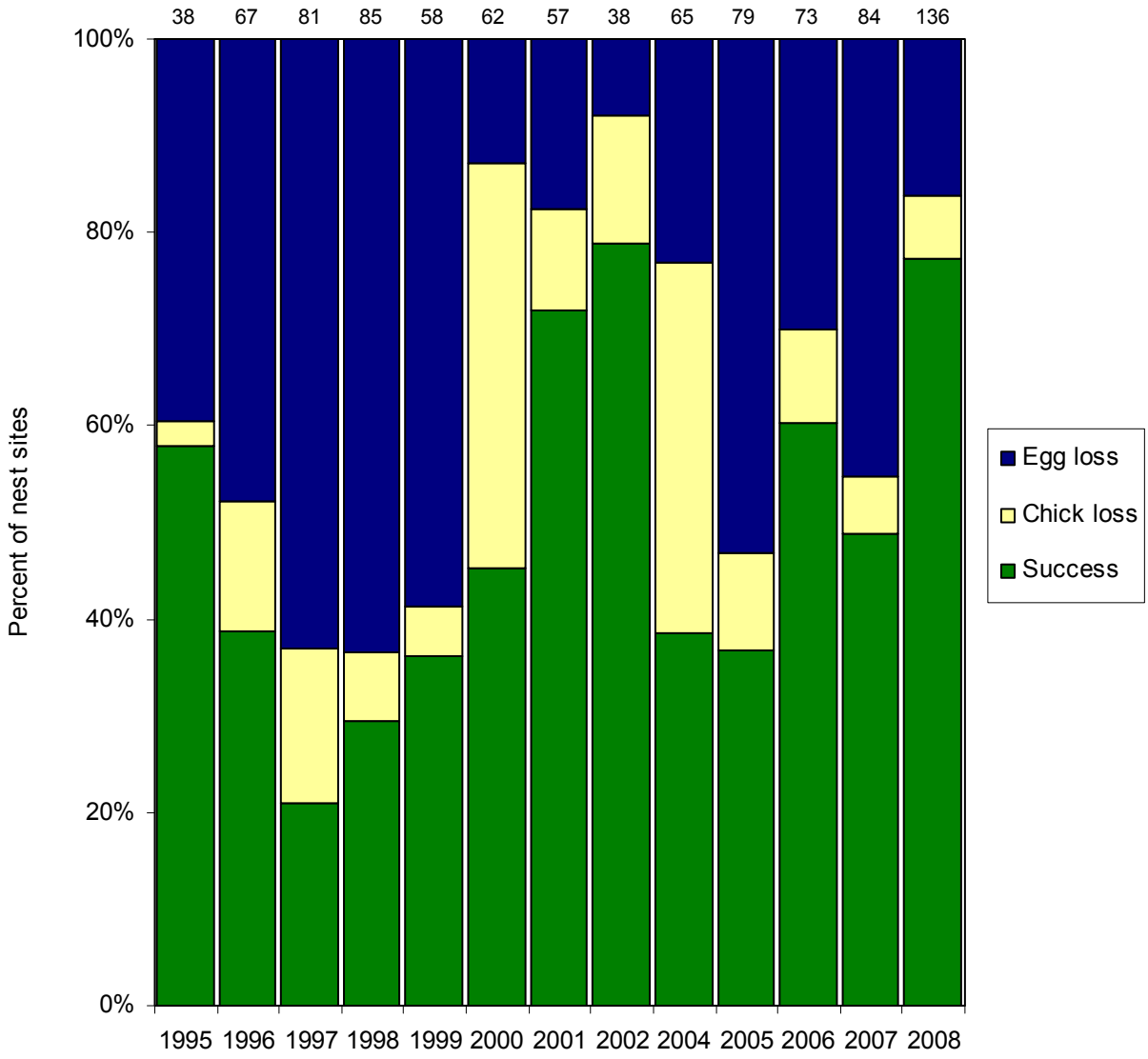


Figure 43. Reproductive performance of tufted puffins in artificial and natural burrows at Aiktak Island, Alaska. Egg loss=(A-B)/A; Chick loss=(B-C)/A; Success=C/A where A=number of eggs, B=number of eggs hatched, and C=total number of chicks potentially fledged (codes come from following productivity table). Success represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values may be lower. Numbers above columns indicate sample sizes.

Table 68. Reproductive performance of tufted puffins in artificial and natural burrows at Aiktak Island, Alaska[a].

Parameter	1995	1996	1997	1998	1999	2000	2001	2002	2004	2005	2006	2007	2008
Total no. eggs (A)	38	67	81	85	58	62	57	38	65	79	73	84	136
No. eggs lost to:													
disappearance	6	11	29	30	11	7	1	1	8	12	4	25	14
abandonment	8	16	17	17	20	0	9	1	5	15	18	11	8
breakage	1	5	5	7	3	1	0	1	2	15	0	2	0
Total no. chicks (B)	23	35	30	31	24	54	47	35	50	37	51	46	114
No. chicks lost to:													
disappearance	1	3	6	0	1	24	2	2	14	2	3	2	4
death	0	6	7	6	2	2	4	3	11	6	4	3	5
No. chicks potentially successful (C):	22	26	17	25	21	28	41	30	25	29	44	41	105
chicks fledged[b]	16	25	5	5	1	21	32	26	0	12	20	13	63
chicks present at last visit[c]	6	1	12	20	20	7	9	4	25	17	24	28	42
Hatching success (B/A)	0.61	0.52	0.37	0.36	0.41	0.87	0.82	0.92	0.77	0.47	0.70	0.55	0.84
Fledging success (C/B)[d]	0.96	0.74	0.57	0.81	0.88	0.52	0.87	0.86	0.50	0.78	0.86	0.89	0.92
Reproductive success (C/A)[d]	0.58	0.39	0.21	0.29	0.36	0.45	0.72	0.79	0.38	0.37	0.60	0.49	0.77
Productivity (hs x fs)	0.58	0.39	0.21	0.29	0.36	0.45	0.72	0.79	0.38	0.37	0.60	0.49	0.77

[a]Data were not collected in 2003.
[b]Chicks were considered fledged if they were $\geq$ 38 days old at disappearance or $\geq$ 33 days old at last visit.
[c]Chicks still present but < 33 days old at last visit.
[d]This value represents the maximum potential success, since it assumes all chicks still present at last check survived to fledging; actual values may be lower.

Table 69. Mean growth rates of tufted puffin chicks at Aiktak Island, Alaska. Data include chicks measured at least 2 times during the linear phase of growth (up to approximately 450g); chicks that died were excluded.

	Mass (g/day)				Wing chord (mm/day)[b]			
Year[a]	*n*	mean	SD	range	*n*	mean	SD	range
1996	*[c]	*	*	*	*	*	*	*
1997	*	*	*	*	*	*	*	*
1998	*	*	*	*	*	*	*	*
1999	*	*	*	*	*	*	*	*
2000	*	*	*	*	*	*	*	*
2001	*	*	*	*	*	*	*	*
2002	*	*	*	*	*	*	*	*
2004	23	7.6	1.8	3.0 - 11.4	25	2.0	1.1	0.6 - 4.7
2005	23	7.7	2.4	3.4 - 14.5	23	2.8	0.4	1.8 - 3.5
2006	20	9.7	3.4	5.1 - 18.3	15	2.8	0.4	2.0 - 3.5
2007	13	14.1	3.8	9.7 - 23.5	11	3.8	0.6	3.1 - 5.0
2008	17	12.7	5.4	0.9 - 20.1	17	3.4	0.7	2.0 - 4.6

[a]Data were not collected in 1995 and 2003.
[b]All rates of growth are based on relaxed wing chord measurements, except 1998 when only flat wing data were recorded.
[c]Data were collected in 1996-2002 but have not been summarized for this report.

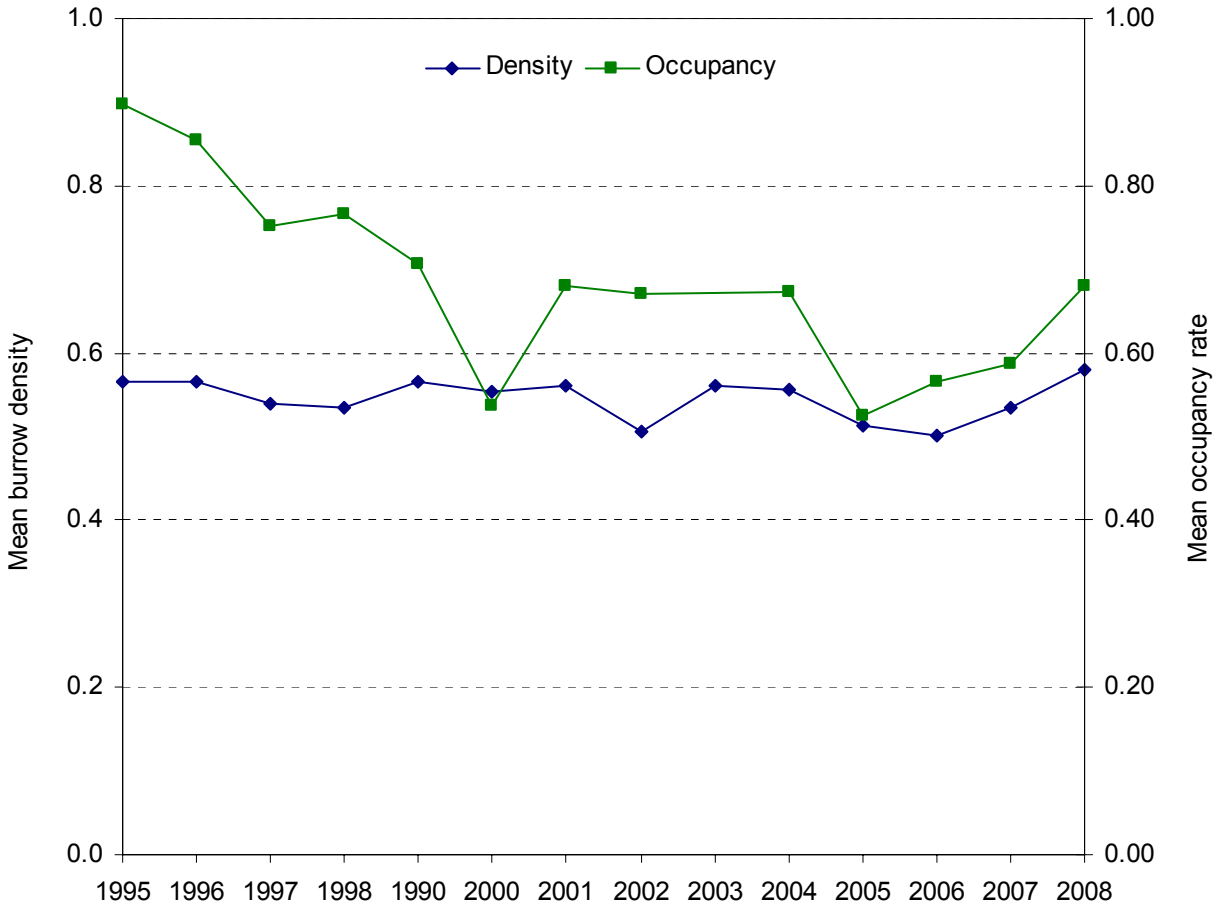


Figure 44. Mean burrow density and occupancy rate of tufted puffins on index plots at Aiktak Island, Alaska.

Table 70. Burrow density and occupancy rates of tufted puffins on index plots at Aiktak Island, Alaska.

	Plot											
Year	1	2	3	4	5	6	7	8	9	10	mean	SD
Density[a]												
1995	0.41	0.52	0.92	0.86	0.33	0.29	0.89	0.22	0.77	0.44	0.57	0.3
1996	0.39	0.63	0.93	0.87	0.36	0.31	0.85	0.18	0.71	0.42	0.57	0.3
1997	0.40	0.56	0.97	0.76	0.37	0.28	0.83	0.08	0.73	0.42	0.54	0.3
1998	0.35	0.54	0.92	0.76	0.37	0.31	0.74	0.20	0.80	0.35	0.53	0.3
1990	0.34	0.54	0.87	0.97	0.40	0.35	0.79	0.16	0.81	0.43	0.57	0.3
2000	0.32	0.53	0.96	0.86	0.38	0.35	0.81	0.22	0.72	0.39	0.55	0.3
2001	0.33	0.50	0.88	0.83	0.36	0.35	0.89	0.21	0.86	0.39	0.56	0.3
2002	0.22	0.45	0.66	0.67	0.41	0.35	0.83	0.26	0.83	0.37	0.51	0.2
2003	0.36	0.55	0.98	0.64	0.39	0.37	0.86	0.21	0.90	0.36	0.56	0.3
2004	0.33	0.47	0.90	0.80	0.40	0.35	0.85	0.20	0.85	0.41	0.56	0.3
2005	0.29	0.43	0.90	0.69	0.36	0.36	0.71	0.21	0.77	0.41	0.51	0.2
2006	0.30	0.42	0.80	0.72	0.32	0.33	0.79	0.21	0.81	0.32	0.50	0.3
2007	0.31	0.38	0.91	0.76	0.38	0.36	0.86	0.18	0.85	0.35	0.54	0.3
2008	0.33	0.46	0.98	0.83	0.35	0.43	0.95	0.23	0.90	0.34	0.58	0.3
Plot area (m^2):	314.2	314.2	314.2	314.2	314.2	314.2	150.0	98.5	98.5	98.5	--	--
Occupancy[b]												
1995	0.82	0.80	0.86	0.97	0.93	1.00	0.85	0.86	0.96	0.93	0.90	0.1
1996	0.87	0.95	0.85	0.96	0.67	0.96	0.90	0.62	0.95	0.81	0.85	0.1
1997	0.71	0.74	0.78	0.88	0.70	0.82	0.89	0.67	0.77	0.55	0.75	0.1
1998	0.70	0.82	0.83	0.81	0.77	0.81	0.87	0.69	0.74	0.63	0.77	0.1
1999	0.74	0.66	0.71	0.71	0.76	0.82	--	0.53	--	0.73	0.71	0.1
2000	0.54	0.36	0.56	0.52	0.51	0.64	0.55	0.63	0.49	0.56	0.54	0.1
2001	0.78	0.73	0.55	0.77	0.70	0.75	0.69	0.57	0.69	0.56	0.68	0.1
2002	0.58	0.62	0.81	0.61	0.78	0.75	0.52	0.65	0.77	0.62	0.67	0.1
2004	0.39	0.57	0.74	0.57	0.83	0.83	0.66	0.60	0.79	0.76	0.67	0.1
2005	0.60	0.50	0.37	0.69	0.58	0.63	0.51	0.35	0.63	0.39	0.53	0.1
2006	0.53	0.46	0.46	0.69	0.63	0.70	0.54	0.52	0.57	0.56	0.57	0.1
2007	0.52	0.64	0.51	0.53	0.61	0.69	0.76	0.53	0.66	0.41	0.59	0.1
2008	0.73	0.70	0.57	0.79	0.69	0.70	0.65	0.71	0.69	0.56	0.68	0.1

[a]Density is expressed as the number of large burrows per m^2.

[b]Occupancy rate is expressed as the number of occupied large burrows divided by the total number of large burrows. Large burrows were considered occupied if feathers, droppings, chicks, eggs, or eggshell fragments were observed in the entrance. Because not all burrows were relocated during the occupancy survey, the number of burrows used to calculate occupancy rates was not necessarily the same as that presented for density. Occupancy data were not collected in 2003.

Table 71. Burrow density and occupancy rates of tufted puffins on index plots at Aiktak Island, Alaska in 2008. Density surveys were conducted on 27 and 29 May. Occupancy surveys were conducted on 4 and 5 August.

Plot	Area (m^2)	No. burrows			Density of large burrows[a]	Occupancy rate of large burrows[b]
		Small (<9.5 cm)	Medium (9.5-14.5 cm)	Large (>14.5 cm)		
1	314.2	0	5	103	0.33	0.73
2	314.2	3	3	143	0.46	0.70
3	314.2	2	8	308	0.98	0.57
4	314.2	6	13	260	0.83	0.79
5	314.2	3	32	110	0.35	0.69
6	314.2	0	5	134	0.43	0.70
7	150.0	2	4	143	0.95	0.65
8	98.5	0	2	23	0.23	0.71
9	98.5	0	11	89	0.90	0.69
10	98.5	0	2	33	0.34	0.56

[a]Density is expressed as the number of large burrows per m^2.

[b]Occupancy rate is expressed as the number of occupied large burrows divided by the total number of large burrows. Large burrows were considered occupied if feathers, droppings, chicks, eggs, or eggshell fragments were observed in the entrance. Because not all burrows were relocated during the occupancy survey, the number of burrows used to calculate occupancy rates was not necessarily the same as that presented for density.

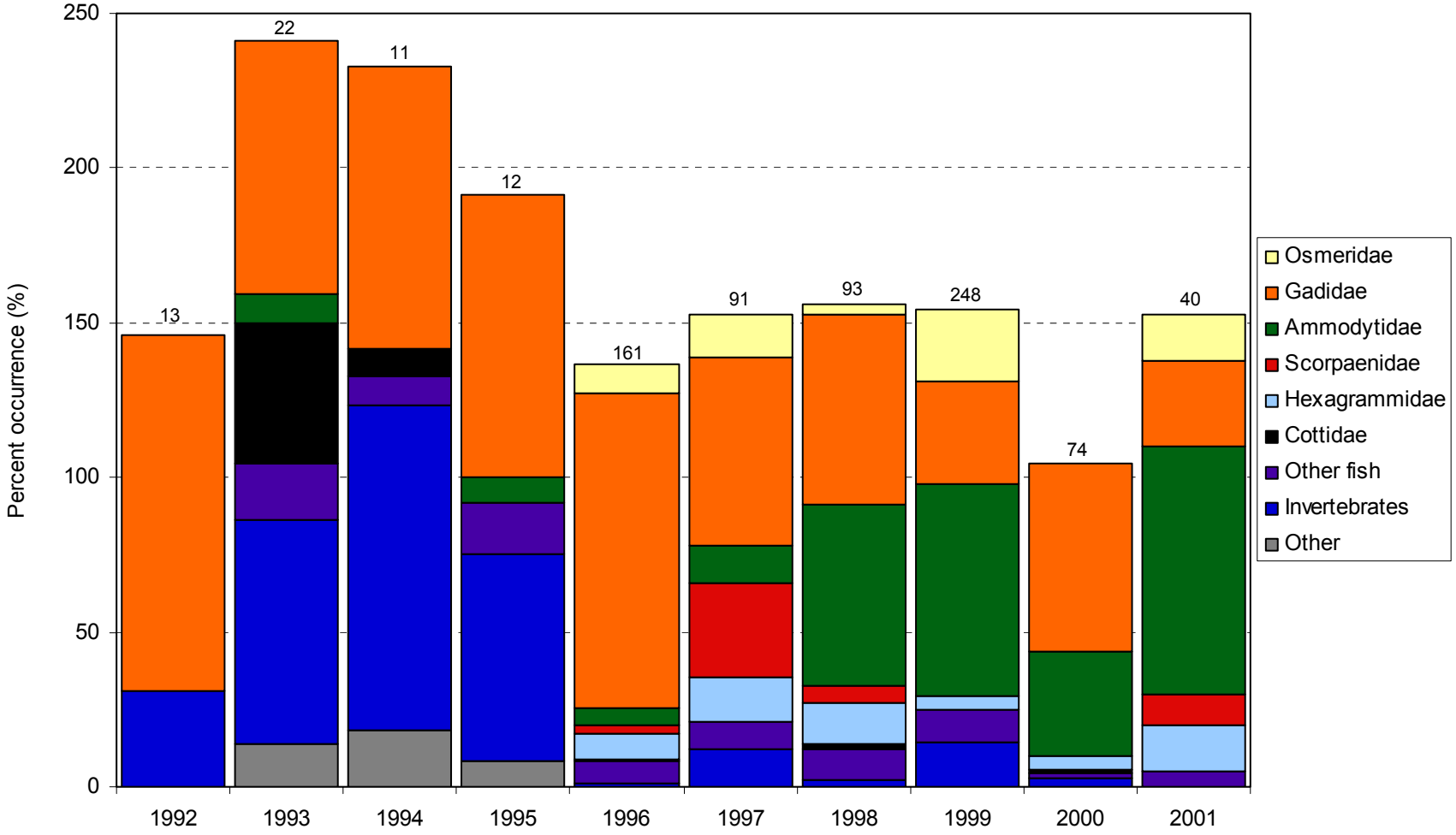


Figure 45. Percent occurrence of prey in diets of tufted puffins at Aiktak Island, Alaska. Values represent the percentage of food samples in which each species was present. Prey samples were collected in 2002 and 2004-2008 but had not been analyzed at the time of this report. Numbers above columns indicate sample sizes.

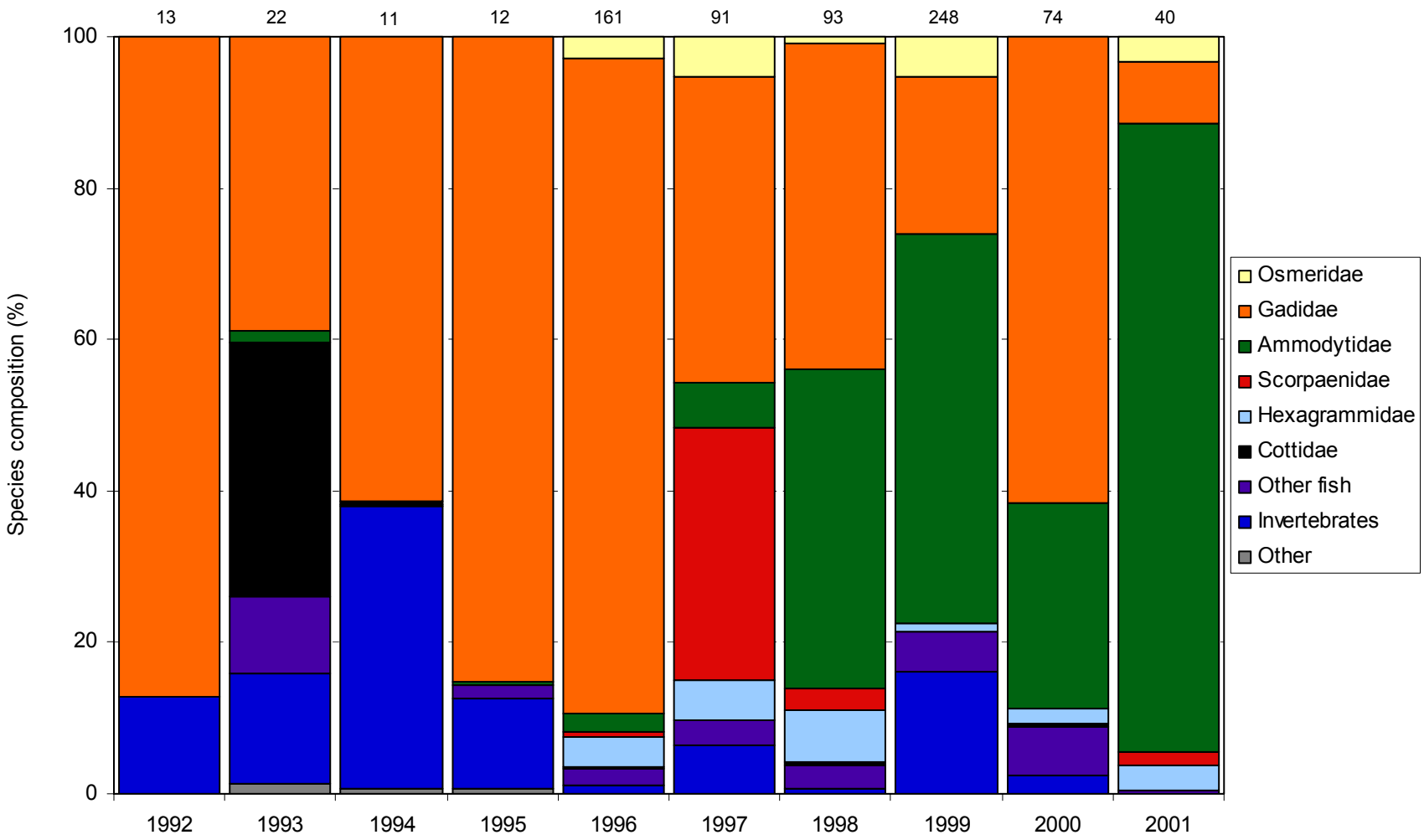


Figure 46. Species composition of prey in diets of tufted puffins at Aiktak Island, Alaska. Values represent the percentage of total number of individual prey items comprised by each species for each year. Prey samples were collected in 2002 and 2004-2008 but had not been analyzed at the time of this report. Numbers above columns indicate sample sizes.

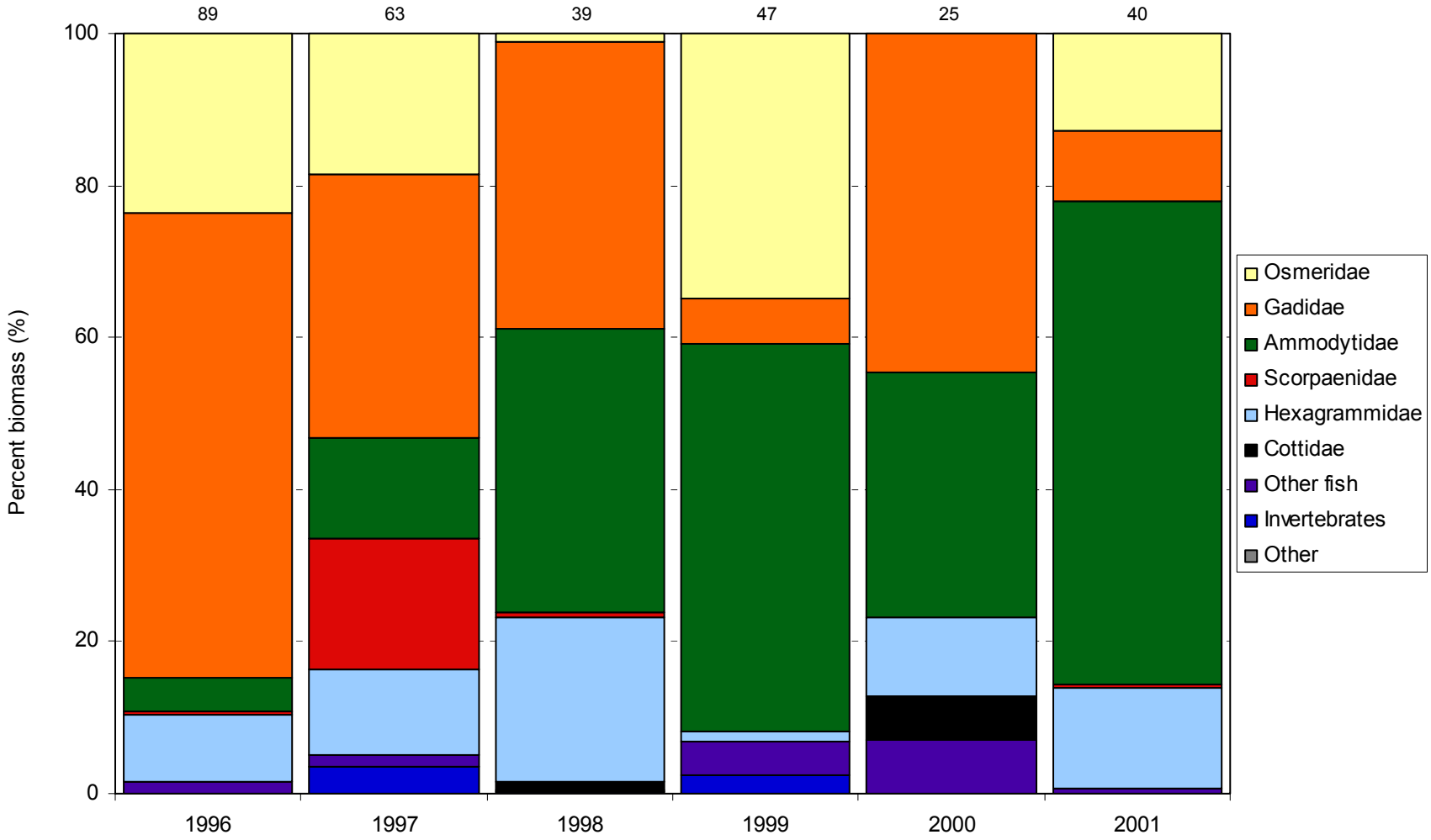


Figure 47. Relative biomass of prey in diets of tufted puffins at Aiktak Island, Alaska. Values represent the percentage of the mass of combined food samples comprised by each species. Prey samples were collected in 2002 and 2004-2008 but had not been analyzed at the time of this report; biomass could not be calculated from samples collected in 1992-1995. Numbers above columns indicate sample sizes.

Table 72. Percent occurrence of prey in diets of tufted puffins at Aiktak Island, Alaska[a]. Values represent the percentage of food samples in which each species was present. Data from 1992-1995 are adult diet samples from stomach contents, data from 1996-1999 are chick diet samples from burrow screening using field identification and measurements, and data from 2000-2001 are chick diet samples from burrow screening using laboratory identification and measurements.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
No. samples	13	22	11	12	161	91	93	248	74	40
No. individual items	125	286	258	333	777.5	431	475	284	247	237
Nereidae										
Nereis spp.	--	--	--	--	--	1.1	--	--	--	--
Unid. polychaete	30.8	31.8	36.4	50.0	1.2	--	1.1	6.3	--	--
Gonatidae										
Unid. squid	--	13.6	27.3	16.7	--	4.4	--	--	--	--
Octopodidae										
Unid. octopus	--	--	--	--	--	3.3	--	--	--	--
Euphausiidae										
Thysanoessa spinifera	--	--	--	--	--	2.2	--	--	--	--
Thysanoessa inermis	--	--	--	--	--	1.1	--	--	--	--
Unid. euphausid	--	--	--	--	--	--	--	8.3	--	--
Amphipoda										
Unid. amphipod	--	--	--	--	--	--	--	--	1.4	--
Decapoda										
Unid. shrimp	--	--	--	--	--	--	1.1	--	1.4	--
Osmeridae										
Mallotus villosus	--	--	--	--	9.3	14.3	3.2	22.9	--	15.0
Gadidae										
Theragra chalcogramma	100.0	81.8	81.8	91.7	83.9	47.3	55.9	25.0	40.5	20.0
Gadus macrocephalus	--	--	9.1	--	18.0	11.0	4.3	--	--	7.5
Microgadus proximus	--	--	--	--	--	--	--	--	1.4	--
Unid. gadid	15.4	--	--	--	--	2.2	1.1	8.3	18.9	--
Trichodontidae										
Trichodon trichodon	--	--	--	--	0.6	--	--	2.1	--	--
Zaproridae										
Zaprora silenus	--	--	--	--	0.6	--	--	--	1.4	--
Ammodytidae										
Ammodytes hexapterus	--	9.1	--	8.3	5.6	12.1	59.1	68.8	33.8	80.0
Scorpaenidae										
Sebastes aleutianus	--	--	--	--	1.9	--	--	--	--	--
Unid. rockfish	--	--	--	--	0.6	30.8	5.4	--	--	10.0
Anoplopomatidae										
Anoplopoma fimbria	--	--	--	--	1.2	2.2	--	--	--	5.0
Hexagrammidae										
Hexagrammos decagrammus	--	--	--	--	7.5	14.3	12.9	4.2	2.7	15.0
Unid. greenling	--	--	--	--	--	--	--	--	1.4	--
Pleurogrammos monoptergius	--	--	--	--	0.6	--	--	--	--	--
Cottidae										
Triglops pingelii	--	--	--	--	--	--	1.1	--	1.4	--
Triglops forficatus	--	--	--	--	0.6	--	--	--	--	--
Unid. sculpin	--	45.5	9.1	--	--	--	1.1	--	--	--
Pleuronectidae										
Unid. flatfish	--	--	--	8.3	3.7	3.3	5.4	8.3	--	--
Unid. fish	--	18.2	9.1	8.3	1.2	3.3	4.3	--	13.5	--
Unid. snail	--	--	27.3	41.7	--	--	--	--	--	--
Other (rocks and plastics)	--	13.6	18.2	8.3	--	--	--	--	--	--

[a]Prey samples were not collected in 2003; samples were collected in 2002 and 2004-2008 but have not been analyzed for this report.

Table 73. Species composition of prey in diets of tufted puffins at Aiktak Island, Alaska[a]. Values represent the percentage of total number of individual prey items comprised by each species for each year. Data from 1992-1995 are adult diet samples from stomach contents, data from 1996-1999 are chick diet samples from burrow screening using field identification and measurements, and data from 2000-2001 are chick diet samples from burrow screening using laboratory identification and measurements.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
No. samples	13	22	11	12	161	91	93	248	74	40
No. individual items	125	286	258	333	777.5	431	475	284	247	237
Nereidae										
Nereis spp.	--	--	--	--	--	1.2	--	--	--	--
Unid. polychaete	12.8	10.8	4.7	6.3	1.2	--	0.4	8.5	--	--
Gonatidae										
Unid. squid	--	3.8	7.8	1.2	--	0.9	--	--	--	--
Octopodidae										
Unid. octopus	--	--	--	--	--	0.7	--	--	--	--
Euphausiidae										
Thysanoessa spinifera	--	--	--	--	--	0.5	--	--	--	--
Thysanoessa inermis	--	--	--	--	--	3.2	--	--	--	--
Unid. euphausid	--	--	--	--	--	--	--	7.7	--	--
Amphipoda										
Unid. amphipod	--	--	--	--	--	--	--	--	0.4	--
Decapoda										
Unid. shrimp	--	--	--	--	--	--	0.2	--	2.0	--
Osmeridae										
Mallotus villosus	--	--	--	--	2.7	5.1	0.8	5.3	--	3.4
Gadidae										
Theragra chalcogramma	80.0	38.8	60.5	85.3	81.2	36.2	41.5	16.9	50.2	7.2
Gadus macrocephalus	--	--	0.8	--	5.5	3.7	1.3	--	--	0.8
Microgadus proximus	--	--	--	--	--	--	--	--	0.8	--
Unid. gadid	7.2	--	--	--	--	0.5	0.2	3.9	10.5	--
Trichodontidae										
Trichodon trichodon	--	--	--	--	0.1	--	--	1.4	--	--
Zaproridae										
Zaprora silenus	--	--	--	--	0.1	--	--	--	0.4	--
Ammodytidae										
Ammodytes hexapterus	--	1.4	--	0.3	2.3	6.0	42.3	51.4	27.1	83.1
Scorpaenidae										
Sebastes aleutianus	--	--	--	--	0.6	--	--	--	--	--
Unid. rockfish	--	--	--	--	0.1	33.4	2.7	--	--	1.7
Anoplopomatidae										
Anoplopoma fimbria	--	--	--	--	0.8	0.7	--	--	--	0.4
Hexagrammidae										
Hexagrammos decagrammus	--	--	--	--	3.9	5.3	6.9	1.1	1.6	3.4
Unid. greenling	--	--	--	--	--	--	--	--	0.4	--
Pleurogrammos monoptergius	--	--	--	--	0.1	--	--	--	--	--
Cottidae										
Triglops pingelii	--	--	--	--	--	--	0.2	--	0.4	--
Triglops forficatus	--	--	--	--	0.1	--	--	--	--	--
Unid. sculpin	--	33.6	0.4	--	--	--	0.2	--	--	--
Pleuronectidae										
Unid. flatfish	--	--	--	1.5	0.9	1.6	1.9	--	--	--
Unid. fish	--	10.1	0.4	0.3	0.3	0.9	1.3	3.9	6.1	--
Unid. snail	--	--	24.8	4.5	--	--	--	--	--	--
Other (rocks and plastics)	--	1.4	0.8	0.6	--	--	--	--	--	--

[a]Prey samples were not collected in 2003; samples were collected in 2002 and 2004-2008 but have not been analyzed for this report.

Table 74. Relative biomass of prey in diets of tufted puffins at Aiktak Island, Alaska[a]. Values represent the percentage of the mass of combined food samples comprised by each species. Data from 1996-1999 are chick diet samples from burrow screening using field identification and measurements, and data from 2000-2001 are chick diet samples from burrow screening using laboratory identification and measurements.

	1996	1997	1998	1999	2000	2001
No. samples[b]	89	63	39	47	25	40
Total mass (g)	898.8	517.0	299.5	397.0	211.8	405.8
Nereidae						
Unid. polychaete	0.1	--	0.3	1.9	--	--
Gonatidae						
Unid. squid	--	2.9	--	--	--	--
Octopodidae						
Unid. octopus	--	0.6	--	--	--	--
Euphausiidae						
Thysanoessa spinifera	--	<0.1	--	--	--	--
Unid. euphausid	--	--	--	0.6	--	--
Osmeridae						
Mallotus villosus	23.6	18.4	1.2	34.7	--	12.6
Gadidae						
Theragra chalcogramma	55.8	30.0	35.7	5.0	37.7	7.3
Gadus macrocephalus	5.3	4.6	2.0	--	--	2.0
Microgadus proximus	--	--	--	--	0.8	--
Unid. gadid	--	--	--	1.0	6.1	--
Trichodontidae						
Trichodon trichodon	0.6	--	--	2.3	--	--
Zaproridae						
Zaprora silenus	0.4	--	--	--	5.7	--
Ammodytidae						
Ammodytes hexapterus	4.5	13.4	37.2	51.0	32.4	63.6
Scorpaenidae						
Sebastes aleutianus	0.2	--	--	--	--	--
Unid. rockfish	0.2	17.2	0.7	--	--	0.5
Anoplopomatidae						
Anoplopoma fimbria	0.4	0.6	--	--	--	0.6
Hexagrammidae						
Hexagrammos decagrammus	8.8	11.2	21.7	1.4	4.7	13.3
Unid. greenling	--	--	--	--	5.7	--
Cottidae						
Triglops pingelii	--	--	--	--	5.7	--
Unid. sculpin	--	--	1.0	--	--	--
Pleuronectidae						
Unid. flatfish	0.1	0.1	--	--	--	--
Unid. fish	--	0.9	0.2	2.0	1.3	--

[a]Prey samples were not collected in 2003; samples were collected in 2002 and 2004-2008 but have not been analyzed for this report. Biomass could not be calculated from prey samples collected in 1992-1995 because mass data were not recorded.

[b]Biomass could be calculated for only prey samples with mass data; therefore, some prey items do not appear in biomass data although they were present in diet samples (see Tables 72 and 73).

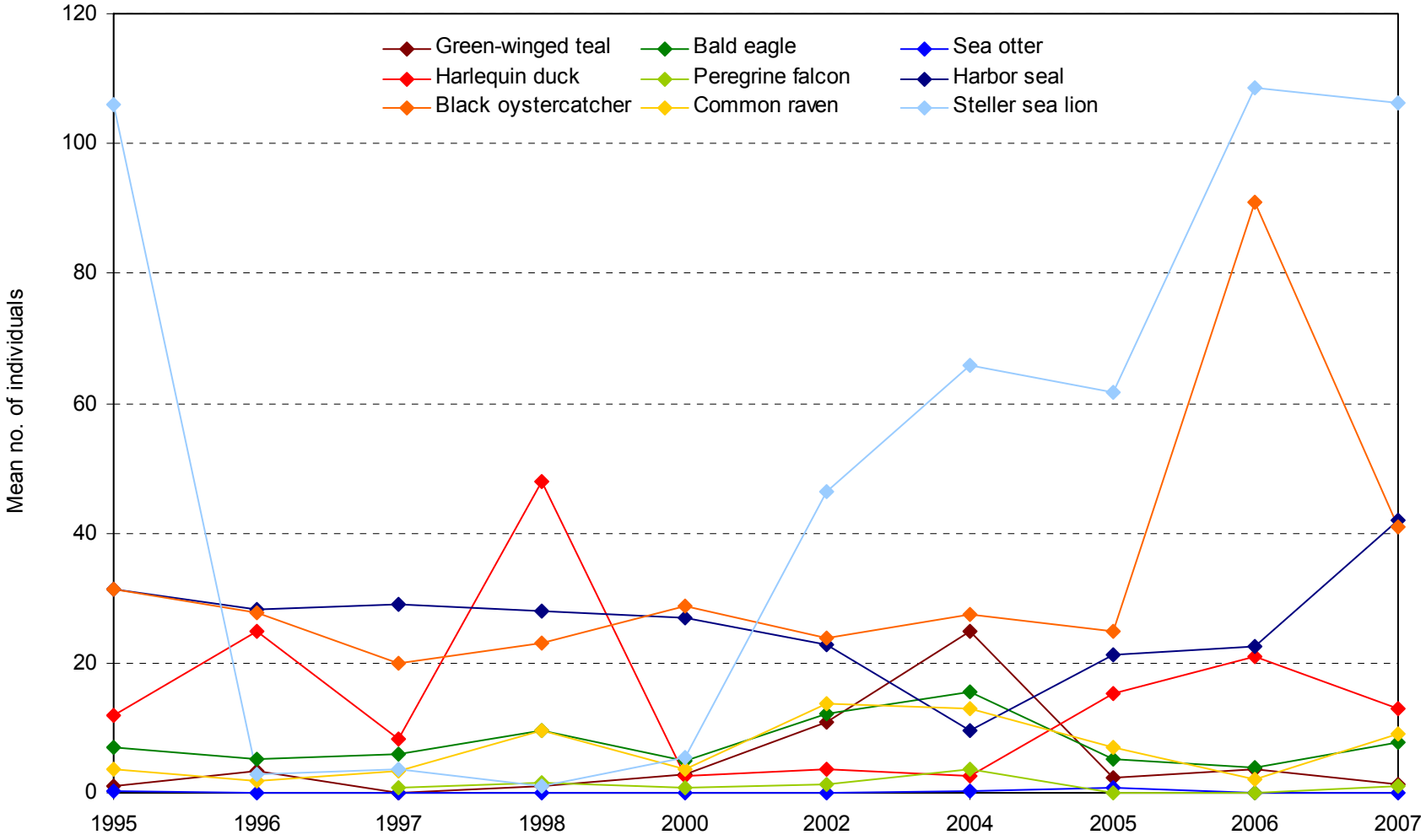


Figure 48. Mean numbers of individuals of selected species counted during circumnavigations at Aiktak Island, Alaska.

Table 75. Mean numbers of species counted during circumnavigation surveys at Aiktak Island, Alaska[a].

Species[b]	1995	1996	1997	1998	2000	2002	2004	2005	2006	2007
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
Green-winged teal	1.0	3.3	--	1.0	2.8	11.0	24.8	2.3	3.5	1.3
Harlequin duck	12.0	24.8	8.3	48.0	2.6	3.5	2.5	15.3	21.0	13.0
Short-tailed shearwater	--	--	--	--	--	--	--	--	--	0.3
Unid. shearwater	--	--	6.0	--	--	--	--	0.3	1.0	--
Cormorant spp.										
Pelagic	36.0	34.0	17.3	16.5	4.0	16.3	--	1.0	10.0	2.0
Red-faced	--	--	37.5	4.0	0.4	228.5	35.5	--	--	1.0
Double-crested	15.3	20.3	16.7	12.5	27.0	27.8	48.5	17.3	16.5	26.3
Unidentified	5.0	32.8	88.5	13.5	19.8	72.75	--	48.3	26.0	48.3
Bald eagle	7.0	5.3	6.0	9.5	5.0	12.3	15.6	5.3	4.0	7.7
Peregrine falcon	--	--	0.7	1.5	0.8	1.3	3.5	--	--	1.0
Black oystercatcher	31.3	27.8	20.0	23.0	28.8	23.8	27.5	25.0	91.0	41.0
Rock sandpiper	--	--	--	--	--	--	--	0.3	--	--
Unid. murre	4972.3	5661.4	6397.7	4413.5	2913.2	602.0	1765.8	2697.7	2855.5	3096.7
Pigeon guillemot	44.3	34.8	33.7	33.0	28.4	9.0	4.3	16.3	12.0	13.0
Horned puffin	91.7	91.3	73.3	51.5	115.0	90.5	40.3	140.7	191.5	195.3
Common raven	3.7	1.8	3.3	9.5	3.6	13.8	13.0	7.0	2.0	9.0
Harbor seal	31.3	28.3	29.0	28.0	27.0	22.8	9.5	21.3	22.5	42.0
Steller sea lion	106	2.8	3.7	1.0	5.4	46.5	65.8	61.7	108.5	106.3
Sea otter	0.3	--	--	--	--	--	0.3	0.7	--	--

[a]Data were not collected in 1999, 2001, 2003, or 2008.
[b]Tufted puffins and glaucous-winged gulls are not counted during circumnavigations due to their abundance.

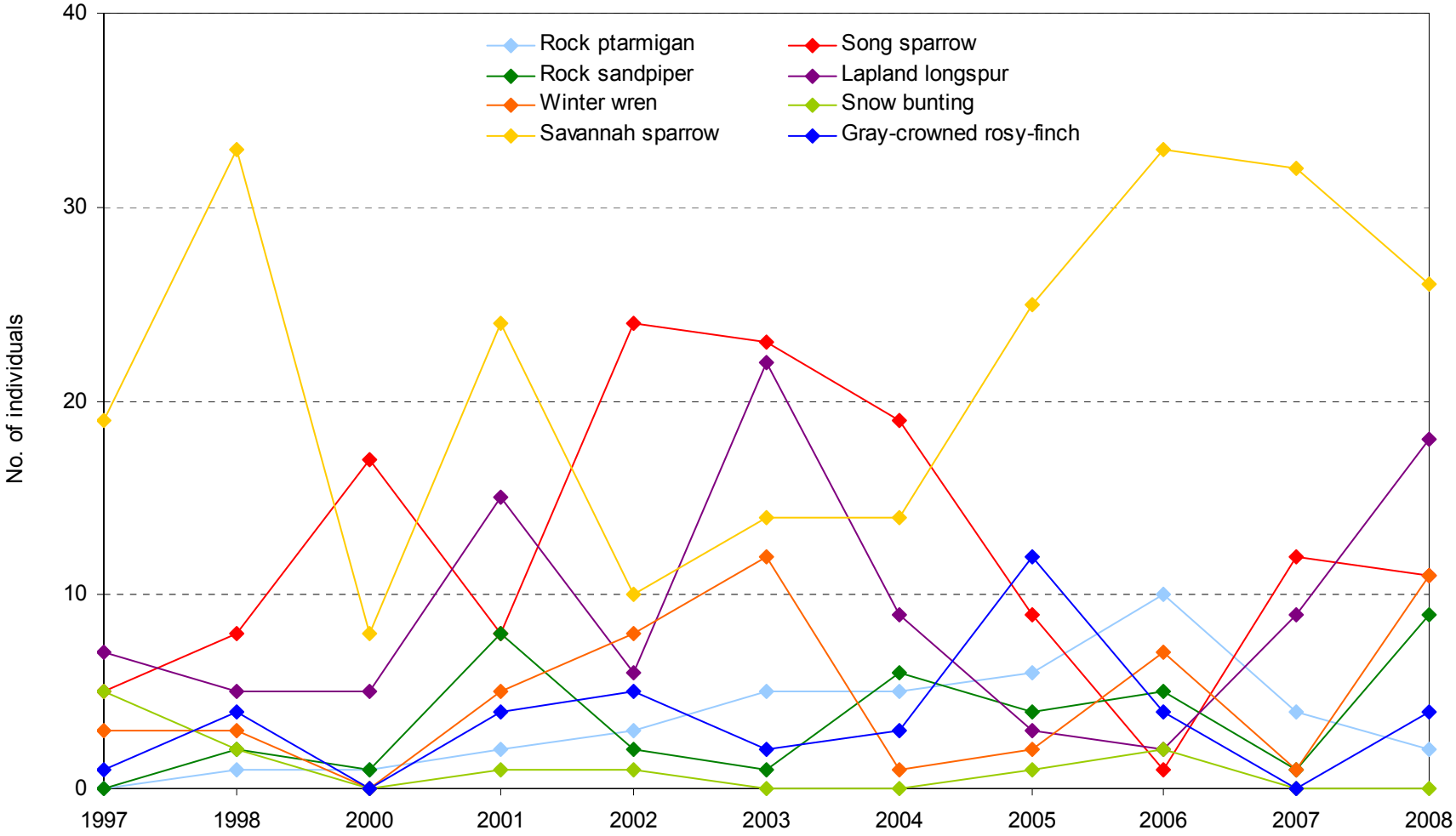


Figure 49. Numbers of birds of selected species detected during off-road point count surveys at Ugamak Island, Alaska.

Table 76. Numbers of birds detected during off-road point count survey at Ugamak Island, Alaska[a]. Data represent only individuals observed at survey points; asterisks denote species observed between points along the route but not at actual survey points.

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

[a]Data were not collected in 1996 (route established 8 September 1996) and 1999.

Table 77. Numbers of birds detected during off-road point count survey at Ugamak Island, Alaska, 10 June 2008.

Species	Survey point 1	2	3	4	5	6	7	8	9	10	11	12	Total on all points	% of points spp. observed
Rock ptarmigan	0	1	0	0	0	0	0	1	0	0	0	2	2	17
Bald eagle	0	1	0	0	0	0	0	0	0	0	0	2	3	17
Rough-legged hawk	0	0	0	1	0	0	0	0	0	0	0	0	1	8
Rock sandpiper	0	0	0	0	3	1	2	0	2	0	0	1	9	42
Glaucous-winged gull	0	4	0	0	0	0	0	0	0	0	0	0	4	8
Common raven	0	0	0	0	0	2	1	0	1	0	0	0	4	25
Winter wren	1	2	1	0	0	1	2	1	0	1	0	2	11	67
American pipit	0	0	0	1	1	0	1	1	0	0	0	0	4	33
Savannah sparrow	1	1	3	1	3	3	2	0	4	6	1	1	26	92
Fox sparrow	0	0	0	0	0	1	0	0	0	0	0	0	1	8
Song sparrow	5	2	1	1	1	1	0	0	0	0	0	0	11	50
Lapland longspur	0	1	4	2	2	3	0	1	3	2	0	0	18	67
Gray-crowned rosy-finch	0	0	0	1	0	0	0	0	0	0	3	0	4	17
Additional species observed between survey points:														
Green-winged teal													2	
Short-eared owl													1	
Snow bunting													1	

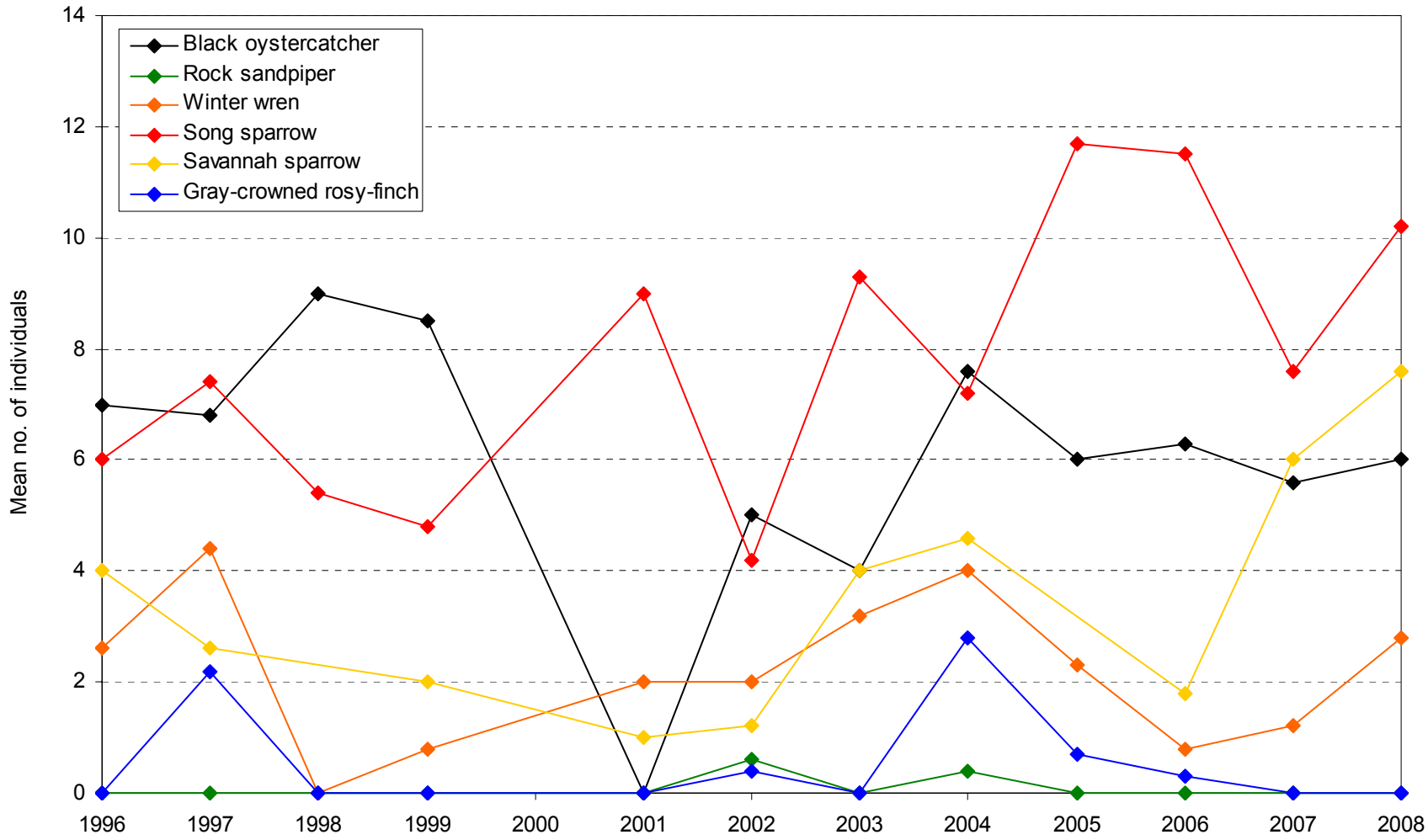


Figure 50. Mean numbers of birds detected on beach transect surveys along Old Camp Beach, Aiktak Island, Alaska.

Table 78 . Mean numbers of birds detected on beach transect surveys along Old Camp Beach, Aiktak Island, Alaska[a].

Species	1996	1997	1998	1999	2001	2002	2003	2004	2005	2006	2007	2008
n	5	5	5	4	1	5	6	5	3	4	5	5
Survey dates	21 Jun - 10 Jul	1 Jun - 10 Jun	11 Jun - 20 Jun	8 Jun - 18 Jun	7 Jun	2 Jun - 13 Jun	26 May - 13 Jun	30 May - 12 Jun	6 Jun - 12 Jun	1 Jun - 14 Jun	1 Jun - 14 Jun	1 Jun - 14 Jun
Black oystercatcher	7.0	6.8	9.0	8.5	0.0	5.0	4.0	7.6	6.0	6.3	5.6	6.0
Rock sandpiper	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.4	0.0	0.0	0.0	0.0
Winter wren	2.6	4.4	0.0	0.8	2.0	2.0	3.2	4.0	2.3	0.8	1.2	2.8
Savannah sparrow	4.0	2.6	N/A[b]	2.0	1.0	1.2	4.0	4.6	N/A	1.8	6.0	7.6
Song sparrow	6.0	7.4	5.4	4.8	9.0	4.2	9.3	7.2	11.7	11.5	7.6	10.2
Gray-crowned rosy-finch	0.0	2.2	0.0	0.0	0.0	0.4	0.0	2.8	0.7	0.3	0.0	0.0

[a]Data were not collected in 1995 or 2000.
[b]N/A indicates species was not counted during surveys, so presence is unknown.

Table 79. Numbers of birds detected on beach transect surveys along Old Camp Beach, Aiktak Island, Alaska in 2008.

	Date					Statistics	
Species	1 Jun	2 Jun	7 Jun	8 Jun	14 Jun	mean	SD
Black oystercatcher	4	5	7	8	6	6.0	1.6
Winter wren	2	3	2	4	3	2.8	0.8
Savannah sparrow	10	8	6	13	1	7.6	4.5
Song sparrow	6	11	10	13	11	10.2	2.6

Table 80. Annotated list of species observed at Aiktak Island, Alaska, 21 May - 31 August 2008.

Abundance categories were defined at Aiktak Island as follows:
Abundant: ≥ 50 individuals per day or 6 per hour
Common: 10-49 individuals per day or 2-5 per hour
Fairly common: 5-9 individuals per day or 1 per hour
Uncommon: 2-4 individuals per day or <1 per hour
Rare: ≤ 1 individual per day

For breeding status, please refer to Table 81.

Birds

Aleutian cackling goose (*Branta hutchinsii*). Uncommon. A large flock of 40-50 birds was seen flying around and periodically landing on the island on 21-23 May. On 6 June and 7-9 June, flocks of 12 and 32 individuals, respectively, were observed loafing on Southwest Slope.

Northern pintail (*Anas acuta)*. Rare. A single male partway between breeding and non-breeding plumages was observed foraging in nearshore kelp off New Camp Beach on 18 July. On 17 and 18 August, two birds were seen just offshore in front of camp.


Northern pintails

Green-winged teal (*Anas crecca*). Common. Both Eurasian (*A. c. crecca*) and American (*A. c. carolensis*) subspecies were commonly observed throughout the summer, most abundant in the marshy areas of the island or the nearshore kelp along the northern side of the island; intergrades were also common (including birds with both lateral and vertical white bars and birds lacking any bars). First ducklings were observed on 13 June in Petrel Valley, when 6 small ducklings and a female were flushed from the vegetation near Teal Pond. Throughout late June and July, ducklings were often seen or heard in Teal Pond and the various creeks around the island and at least three additional distinct broods were observed: a second brood in Petrel Valley with three ducklings, and broods of four and three ducklings near storm-petrel plot 11 and at the head of Ivory Cove, respectively. The first fledgling was observed foraging with a female in Ivory Cove on 11 July.


Green-winged teal duckling


Green-winged teal intergrade with no white bars

Harlequin duck (*Histrionicus histrionicus*). Common. Groups of 2-49 birds were observed regularly throughout the summer along the northern side of the island, feeding in nearshore waters or loafing on the rocks. Males were in breeding plumage from late May through mid July, when many began entering eclipse plumage; throughout August, most birds were unable to fly due to molting.


Harlequin ducks in early July

Black scoter (*Melanitta americana*). Rare. One female and two immature males were observed nearshore just east of Upland Access on 3 and 4 June.


Black scoters

Rock ptarmigan (*Lagopus mutus)*. Rare. A single bird was routinely flushed from the vegetation in Petrel Valley on 23-26 May. On 17 and 19 June, a male was observed in the dale above Ivory Cove. On Ugamak Island, a female and a male were seen during the off-road point count on 10 June.

Red-necked grebe (*Podiceps grisegena).* Rare. A single individual in full breeding plumage was seen nearshore just east of Upland Access on 3 June.

Fork-tailed storm-petrel *(Oceanodroma furcata).* Abundant. Birds nested primarily in soil burrows dug into banks along Petrel Valley and other creek drainages around the island, although a few birds were occasionally heard vocalizing from burrows among tufted puffin nests around the fringe of the island and about a dozen nests were found in rocky crevices among beach boulders at the top of the beach in Petrel Valley Cove and Pleasure Cove. Dozens of birds could be heard at night in Petrel Valley and along the bluffs above New Camp Beach. On index plots, fork-tailed storm-petrels occupied fewer burrows than Leach's storm-petrels. About 40% of birds were already incubating eggs on our first check of nests monitored for chronology and productivity in late May; the remainder laid during June and early July. First chicks hatched on 2 July but only a few chicks had fledged by our departure from the island in late August.

Leach's storm-petrel (*Oceanodroma leucorhoa)*. Abundant. Birds nested primarily in soil burrows dug into banks along Petrel Valley and other creek drainages around the island, although a few birds were occasionally heard vocalizing from burrows among tufted puffin nests around the fringe of the island and one individual was found nesting in an artificial puffin burrow. Dozens of birds could be heard at night in Petrel Valley and along the bluffs above New Camp Beach. On index plots, Leach's were almost twice as numerous as fork-tailed storm-petrels. A few birds were present but none were incubating eggs on our first check of nests monitored for chronology and productivity in late May; all laid during June and July. First chicks hatched on 15 July and none were old enough to have fledged by our departure from the island in late August.

Double-crested cormorant (*Phalacroorax auritus).* Abundant. Twenty-five nests were located on the cliffs on either side of Southwest Bight, mixed in with over 300 red-faced and pelagic cormorant nests. Nest building was still underway on our first visit in late May; a peak number of nests was counted on 17 June. By late August, 19 nests remained and successfully hatched chicks or were still being brooded. Chicks were first observed on 10 July, when medium-sized chicks were seen in at least 7 nests (see

Williams et al. 2002 for definitions of chick sizes). Based on chick sizes, double-crested cormorants appeared to hatch earlier than red-faced and pelagic nests, both of which contained only tiny chicks on 10 July. Most double-crested chicks were fully feathered and near adult size by mid August. The first fledgling was observed on 20 August. Throughout the summer, single or small groups of adult birds were frequently seen foraging in nearshore waters around the island and drying their wings on the rocks along New Camp and Old Camp beaches and in Petrel Valley Cove.

Red-faced cormorant (*Phalacrocorax urile)*. Abundant. A total of 252 nests were located on the cliffs on either side of Southwest Bight, mixed in with about 100 double-crested and pelagic cormorant nests. Nest building was still underway on our first visit in late May; a peak number of nests was counted on 17 June. A few birds were observed collecting nest material into late July. By August, 139 nests remained and successfully hatched chicks or were being brooding. A few birds were observed collecting nest material into late July. Chicks were first observed on 10 July, when tiny-sized chicks were seen in at least three nests (see Williams et al. 2002 for definitions of chick sizes). By 20 August, most chicks were large, nearly fully-feathered, and had begun wandering along the cliff ledges away from their nests, although a few chicks were still small and entirely downy at that time. First fledglings were seen on 26 August. Throughout the summer, single or small groups of adult birds were frequently seen foraging in nearshore waters around the island.

Pelagic cormorant (*Phalacrocorax pelagicus)*. Abundant. Seventy-one nests were located on either side of Southwest Bight, mixed in with nearly 300 double-crested and red-faced cormorant nests. Most pelagic nests were on the lower sections of the cliffs. Nest building was still underway on our first visit in late May; a peak number of nests was counted on 22 July. A few birds were observed collecting nest material into late July. By August, 59 nests remained and successfully hatched chicks or were being brooding; one bird was still incubating eggs on our last visit on 20 August. Chicks were first observed on 10 July, when tiny-sized chicks were seen in at least 6 nests (see Williams et al. 2002 for definitions of chick sizes). By 20 August, most chicks were large, nearly fully-feathered, and had begun wandering along the cliff ledges away from their nests, although a few chicks were still small and entirely downy at that time. First fledglings were seen on 26 August. Throughout the summer, single or small groups of adult birds were frequently seen foraging in nearshore waters around the island.


Double-crested cormorants


Pelagic cormorants


Red-faced cormorants

Bald eagle (*Haliaeetus leucocephalus*). Common. Two nests were located in late May and early June at Southeast Cape and on the cliffs of Southwest Bight. A third nest was suspected east of Petrel Valley Cove along the southern cliffs, based on the presence of a territorial pair. The nests at Southeast Cape and east of Petrel Valley Cove were likely in the same location as nests from 2007. All nests appeared to fail: by mid June, none of the nests were attended by adults and no chicks or fledglings were ever observed. Adults and subadults were seen daily perusing the tops of the bluffs and cliffs around the perimeter of the island, presumably hunting for puffins, as eagles were often observed eating puffin carcasses and numerous puffin remains were found all over the island. Most remains were of tufted puffins but an occasional horned puffin carcass was found on the beaches of Petrel Valley Cove and Pleasure Cove. Maximum numbers of 14 adults and 10 subadults were counted on 21 June and 27 May, respectively. Eagle numbers appeared to decline markedly by late July and remained low throughout August, possibly due to late summer salmon runs on neighboring Unimak Island (USFWS protocol files).

Rough-legged hawk *(Buteo lagopus)*. Absent. Not observed on Aiktak. A single subadult bird was observed on Ugamak Island during the off-road point count on 10 June.

Peregrine falcon (*Falco peregrinus*). Uncommon. Two breeding pairs were present during the summer. One nest was located on the cliffs of Southwest Bight, while a second territorial pair was seen and heard above the cliffs of the southeastern end of the island, although a nest was never observed. On 31 May, the nest at Southwest Bight contained an incubating or brooding adult. At least two tiny chicks, apparently unable to lift their heads, were observed on 4 June. By 14 June, four chicks could be seen in the nest, but by 3 July, only three chicks remained. By 10 July, all three had fledged and were frequently seen throughout the rest of the summer, chasing all manner of animals with varying success.


Semi-palmated plover

Semipalmated plover (*Charadrius semipalmatus*). Rare. Single individuals were occasionally observed foraging in the kelp wrack on New Camp Beach throughout the summer. Three birds were seen on 16 July.

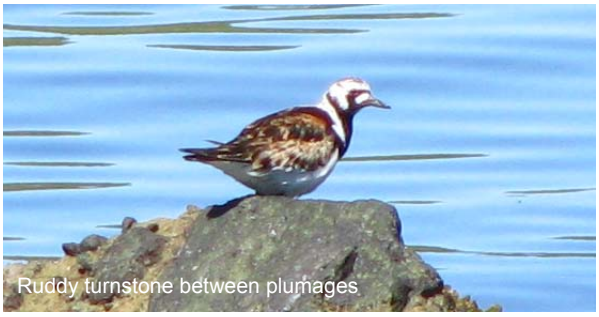
Black oystercatcher (*Haematopus bachmani*). Common. At least 15 breeding pairs nested on beaches and low rocky outcrops around the island, most concentrated on the northern side of the island. The areas frequented by oystercatchers along the beaches were littered with limpet shells. Some pairs were already incubating eggs by our arrival on the island on 21 May, while others laid in late May to early June. Three pairs relaid in mid to late June following nest failure, but all relay nests failed. First chicks were observed on 17 June and first fledglings on 21 July. At least three chicks survived to fledgling age from nests on New Camp Beach and near Upland Access and were present with attendant adults throughout most of August. By mid August, former breeding pairs began leaving their territories and gathering in large groups and flying around the island in flocks. In addition, small flocks of 6-12 birds were occasionally seen arriving from islands to the west and foraging for a day or two in the intertidal along Old Camp Beach and Petrel Valley Cove during August. A maximum of 39 birds was counted at the base of Sail Rock on 26 August.

Wandering tattler (*Heteroscelus incanus*). Rare. Single individuals were seen foraging in the intertidal west of Four Sisters on 23 May, New Camp Beach on 28 May, and Petrel Valley Cove on 1 August. On 24 May, three birds were observed on New Camp Beach and Pleasure Cove.


Wandering tattler

Ruddy turnstone (*Arenaria interpres*). Rare. Two males in breeding plumage were observed on New Camp Beach on 23 June. Single males partway between

breeding and non-breeding plumages were seen on New Camp Beach on 27 July, in Petrel Valley Cove on 1 August, and on New Camp Beach 21-25 August.


Ruddy turnstone between plumages

Least sandpiper (*Calidris minutilla*). Uncommon. One to three birds were often seen feeding in the wrack zone along New and Old Camp beaches and occasionally observed in the creek of Petrel Valley. Three juveniles were seen with two adults on Old Camp Beach on 28 July.

Rock sandpiper (*Calidris ptilocnemis*). Uncommon. One to three individuals were frequently observed on beaches on the north side of the island and Petrel Valley Cove. However, no juvenile birds or other signs of breeding were seen. On Ugamak Island, three birds were seen doing flight and distraction displays during the off-road point count on 10 June.


Least sandpiper

Short-billed dowitcher (*Limnodromus griseus*). Rare. A single individual was seen foraging in the kelp wrack on New Camp Beach 7-10 August. The bird was distinguished from long-billed dowitcher primarily by call.


Short-billed dowitcher

Red phalarope (*Phalaropus fulicarius*). Rare. A molting juvenile bird was observed nearshore off New Camp Beach on 3 August and off Old Camp Beach 8-10 August.


Red phalarope

Glaucous-winged gull (*Larus glaucescens*). Abundant. Gulls primarily nested 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 and New Camp beaches. Nest building was already underway on our arrival at the island on 21 May. The first eggs were observed on Gull Mountain on 1 June. Chicks hatched between 30 June and 12 July and the first fledgling was observed on Old Camp Beach on 19 August. Counts of birds on index plots was higher than in previous years but gulls suffered low breeding success for the third year in a row, driven by high egg loss during the incubation period. By the time of our departure from the island, a maximum of only 37 fledglings was counted on New and Old Camp beaches.

Common and thick-billed murre (*Uria aalge* and *U. lomvia)*. Abundant. Both species of murres were present on most index plots, except on plots 1 and 2, which were occupied only by common murres. On plots where birds could be identified to species, common murres comprised about 70% of all murres. Although large numbers of murres attended index plots, few birds showed any signs of even attempting to breed. During late May and June, rafts of a few

to many hundred murres could be seen regularly in the water off the southern side of the island. Birds began attending cliffs in late June but through the first half of July, attendance was sporadic on all plots except plot 3. Even when murres began consistently attending other plots in mid July, few birds appeared to lay eggs; most spent the season loafing around on the cliffs and facing seawards, with less than 5% of murres on index plots actually observed with eggs or in incubating posture. Most of the birds that did attempt to breed were in plot 3. Of the other plots, evidence of breeding was seen only on plots 6 (at least one bird), 8 (one bird), and 10 (three birds). On plots 1, 2, and 9, attendance was spotty throughout the season and no eggs or incubating adults were observed. Attendance was more stable on plots 5 and 7 but no birds showed signs of breeding. Murres have not bred in great numbers on Aiktak since 2001. Of the few birds that did breed successfully this year, only one common murre chick had fledged by the time we left the island in late August. Most chicks were still young and a few birds were still incubating eggs at our last visit on 26 August. Common ravens were seen carrying murre eggs on numerous occasions and a few times were observed taking eggs directly from incubating birds.

Pigeon guillemot (*Cepphus columba)*. Fairly common. Single and pairs of birds were seen frequently in nearshore waters around the island, most abundant in Arch's Cove and Petrel Valley Cove. A maximum of 19 guillemots was counted at index plots around the island on 19 June. Birds were observed carrying fish in Petrel Valley Cove in August; however, no fledglings were seen by our departure from the island in late August.

Ancient murrelet (*Synthliboramphus antiquus*). Abundant. Birds nested primarily in soil burrows along creek drainages and beach berms and in shallow holes under grass tussocks along the northern side of the island. One nest was found among the beach boulders at the top of the beach at Petrel Valley Cove. About 70% of birds in nests monitored for chronology and productivity were already on eggs in late May, while the remainder laid in late May to early June. Chicks hatched between 20 June and 21 July. At night throughout July, small numbers of adults and chicks could be seen or heard in the water or the vegetation along New Camp Beach as adults led chicks to sea.

Cassin's auklet (*Ptychoramphus aleuticus*). Absent. Not observed on Aiktak. About 15-20 birds came aboard the *M/V* Tiglax on a foggy night when the ship was anchored in the west end of the strait between Aiktak and Ugamak islands on 14 July. All birds were likely non-breeders, as none had brood patches.

Whiskered auklet (*Aethia pygmaea*). Absent. Not observed alive on Aiktak. A single dead adult was found in a gull nest on the west end of New Camp Beach. About 25-30 birds came aboard the *M/V* Tiglax on a foggy night when the ship was anchored in the west end of the strait between Aiktak and Ugamak islands on 14 July. All birds were likely non-breeders, as none had brood patches.

Horned puffin (*Fratercula corniculata*). Abundant. Several hundred birds nested among beach boulders, in rock crevices, and in cracks in the cliff around the island, most concentrated in Petrel Valley Cove. Rafts ranging from just a few individuals to over a hundred birds could be seen in nearshore waters around the island. Numbers of birds on the water varied markedly throughout the day; in Petrel Valley Cove where the highest number of birds congregated, peak attendance on the water during late June through July was in the late afternoon. Chicks in nests followed for productivity hatched between 28 July and 15 August; none had fledged by our departure from the island in late August.

Tufted puffin (*Fratercula cirrhata*). Abundant. Many thousands of puffins could be seen on most days around the island, either rafting in nearshore waters, flying around the bluff or clifftops fringing the island, or standing around near burrow entrances. However, puffin attendance was highly variable, differing by day, time of day, time of season, and across different parts of island. In late May, large numbers of birds were seen standing around on the colony surface around the island. Following a week in early June when hardly any puffins were observed either flying or standing on the surface, attendance became spotty for most of June and July. On some days, puffins could be observed flying around the clifftops nearly all day, while other days birds were seen flying for only a few hours at apparently random times of day. Some days, no puffins could be seen flying anywhere around the

island. Such variation did not appear to be dictated by inclement weather, as some of the largest flocks of birds were seen on rainy days and days in which no birds were flying could be calm and dry. Attendance on land during June and July was limited and not necessarily related to flying activity. Sometimes birds would fly for many hours and never land that day, while other times they would be present on the surface during the flying activity. They rarely spent more than an hour on the surface each day and often appeared skittish, usually failing to return for the duration of the day when flushed by personnel or predators. There did not appear to be an obvious temporal pattern to their surface attendance and it was impossible to predict when during the day, if ever, puffins would make their short, sporadic appearances on land. To make things more confusing, both flying and land activity varied across the island. On some days, puffins could be observed flying all over the island, while on other days, only certain areas showed signs of activity. However, in late July, puffin activity changed dramatically. Large flocks could still be observed flying around the clifftops but attendance on land became much more stable, with large numbers of birds standing around on bluff and cliffftops for long periods of the day all around the island on most days. When flushed by personnel or eagles, puffins were more likely and quicker to return to the colony than they had been earlier in the season. High and consistent puffin attendance on land continued through our departure from the island in late August.

Only about 30% of artificial burrows were occupied this year, which is similar to occupancy rates in recent years. In a combination of artificial and natural burrows monitored for productivity, reproductive success of tufted puffins was 77%, one of the highest recorded on Aiktak since monitoring began. Chicks in productivity nests hatched between 11 July and 15 August. A few chicks fledged between 22 and 27 August but most were still present at our last check on 29 August (although 60% of remaining chicks were old enough to designate as "fledged" at that time). From mid July through August, large numbers of adult birds could be seen carrying food while flying at all times of the day. Afternoon and evening hours were most efficient for food collection using burrow screens.

Throughout August, puffins appeared to get lost in the thick vegetation and were found wandering the trails all over the island almost daily. In addition, occasional puffins were found flapping in the creek in front of camp and swimming in Teal Pond.

Short-eared owl (*Asio flammeus*). Rare. Single individuals were seen occasionally throughout the summer, flying low over Petrel Valley and the slopes around storm-petrel plot 11. On 12 July, an owl was observed capturing a savannah sparrow in Petrel Valley and flying over to Ugamak with the prey in its talons. Two curious fledglings hung about camp during the evenings of 19-21 August, swooping close to the cabin, diving on personnel, and attacking the radio antenna before perching on top of it. There was no evidence that birds nested on Aiktak and it is likely that all sightings over the summer were birds coming from Ugamak Island, where nests have been found in past years (Helm and Zeman 2006). No nests were found during the off-road point count on Ugamak on 10 June, but sea lion researchers on the east end of the island reported large numbers of owl pellets around their cabin this summer.


Short-eared owl in flight


Short-eared owl fledgling on antenna

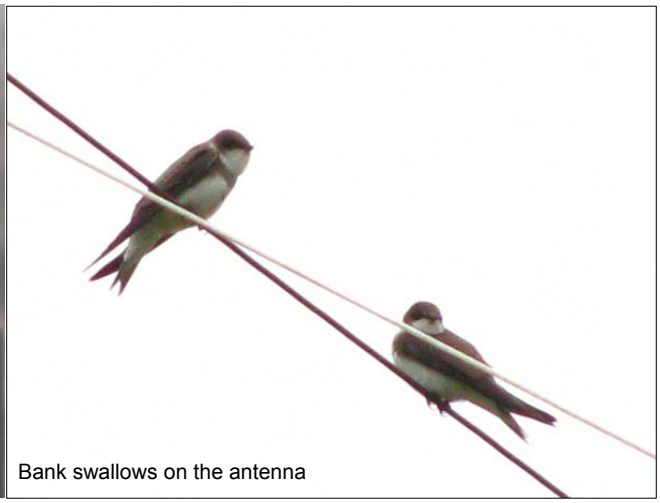
Common raven (*Corvus corax*). Fairly common. A nest with a single large chick attended by an adult pair was observed on the southern cliffs between poles 6 and 51 on 3 June. By 7 June, the chick had fledged, making short flights from the cliff several meters away from the nest. A second pair of ravens

was observed along the north side of the island but no nest or sign of chicks were found. During July and August, both pairs were seen scouring the southern cliffs and harassing murres. Ravens were often seen flying around the island with murres eggs and on several occasions were observed directly taking eggs from incubating murres, usually working in pairs to simultaneously flush birds off the cliff and steal the eggs. In one occasion, a raven was seen physically pulling a murre off the cliff by grasping the murre's wing in its bill, while a second raven swooped in for the egg.

Tree swallow *(Tachycineta bicolor*). Rare. A single female was observed around the cabin during a fierce storm on 29-31 May. The bird looked bedraggled and spent most time huddled on the attic vent on the west side of the cabin; occasionally it flapped futilely at the cabin window as if searching for a way inside.

Bank swallow (*Riparia riparia*). Uncommon. Small groups of 2-9 birds were occasionally observed flying up and down Petrel Valley from late May through early July. Birds were most common on dry, calm days and appeared to be feeding on insects just above the creek. No swallows were observed during the second half of the season.


Tree swallow


Bank swallows on the antenna

Winter wren (*Troglodytes troglodytes*). Common. Birds were observed most frequently along the beaches, concentrated on the beach at Petrel Valley Cove and the south end of Pleasure Cove. First fledglings were seen on 11 July, when an attendant adult and three fledglings were observed in Petrel Valley Cove.

American "buff-bellied" pipit (*Anthus rubescens*). Uncommon. One to three individuals were seen on New Camp in late August, though none were seen earlier in the summer. Four birds were seen on Ugamak Island during the off-road point count on 10 June; nests were found on Ugamak last year (Helm et al. 2007).

Savannah sparrow (*Passerculus sandwichensis*). Abundant. Birds were seen regularly throughout the summer, common both along beaches and in the interior. No nests were found but first fledglings were observed on 3 July above Arch's Cove.

Song sparrow (*Melospiza melodia*). Abundant. Birds were observed all over the island, most frequently along beaches and in the lower elevation areas of the interior. The first fledgling was seen on 2 June at camp. Throughout the latter half of the summer, fledglings were heard practicing their songs frequently along New and Old Camp beaches and around camp.

Lapland longspur (*Calcarius lapponicus*). Rare. Two individuals were seen in Petrel Valley on 30 May. No further presence or evidence of breeding was observed during the summer. At Ugamak Island, longspurs were the second most abundant species observed during the off-road point-count on 10

June; no nests were found but males were observed performing flight displays, suggesting they were breeding on Ugamak.

Snow bunting (*Plectrophenax nivalis)*. Absent. Not seen on Aiktak. A single male was observed on Ugamak Island during the off-road point count on 10 June.

Gray-crowned rosy finch (*Leucosticte tephrocotis*). Uncommon. Small groups of one to four birds were observed regularly in Petrel Valley, Pleasure Cove, above and at the base of Petrel Valley Cove, and along the bluffs along the southern cliffs. The first fledglings were seen in Petrel Valley Cove on 10 July.

Marine Mammals

Sea otter (*Enhydra lutris*). Rare. Single individuals were seen regularly throughout the summer, usually floating and diving in the nearshore kelp beds off the western and southern sides of the island. Two otters were observed playing below murre plot 10 on 5 August.


Sea otter in kelp bed

Harbor seal (*Phoca vitulina*). Common. Individuals and small groups of up to 20 seals were often observed hauled out on the rocky ledges around the island. Larger groups were usually found in Phoca Cove just east of Four Sisters and at the south side of East Island; individuals and smaller groups were also present in Petrel Valley Cove and along New Camp Beach. A maximum of 29 animals was observed on 22 June, when 15 were seen in Phoca Cove and 14 were observed on East Island. On 2 June, a small pup with an umbilical cord still attached was seen in Phoca Cove. Throughout the rest of the summer, several pups were seen in Phoca Cove with groups of adults.


Harbor seal


Bull sea lion on Little West Island

Steller sea lion (*Eumetopias jubatus*). Fairly Common. Individual and small groups of bulls were seen frequently hauled out on Little West Island, Pleasure Cove, and Old Camp Beach throughout the summer. In addition, groups of up to 20 animals were observed regularly hauled out along the southeast end of the island between Arch's Cove and Sail Rock. In mid to late August, larger groups of 50-100 sea lions, probably coming over from the rookery on Ugamak Island after the conclusion of the breeding season there, were observed along the

southern end of the island from Sail Rock to Southwest Bight.

Humpback whale (*Megaptera novoangliae).* Rare. Two individuals were seen in the western end of Ugamak Strait, midway between Aiktak and Ugamak islands, on 25 June. Animals dove and surfaced repeatedly for about a half hour, making occasional loud moaning noises, before swimming away north around the corner of Ugamak. Two more humpback whales, possibly the same individuals, were seen in Ugamak Strait the following day on 26 June.

Minke whale (*Balaenoptera acutorostrata*). Rare. A single animal was observed traveling east just 50 meters offshore in Southwest Bight on 7 June.

Orca (*Orcinus orca*). Rare. Lone large males were seen in Ugamak Strait just offshore the Dike on 21 May and 19 June. On 2 August, a large male and a smaller individual were observed in Southwest Bight, just about 100 meters offshore.

Orca in Ugamak Strait

* All images by B.A. Drummond

Table 81. Breeding status and abundance of birds and marine mammals observed on Aiktak Island, Alaska. Breeding status codes: C=confirmed (observations of current nests, eggs, or chicks, adults carrying nesting materials or food to nests or chicks, recently fledged young, distraction displays), P=probable (observations of pairs or territorial behavior), X=possible but not likely (species seen or heard, but no other evidence for breeding). Abundance codes: 5=abundant (>50/day or 6/hr), 4=common (10-50/day or 2-5/hr), 3=fairly common (5-9/day or 1/hr), 2=uncommon (2-4/day or <1/hr), 1=rare (≤1/day).

Species	2000	2001	2002	2003[a]	2004	2005	2006	2007	2008
Greater white-fronted goose	--	--	--	--	--	--	--	X-1	--
Emperor goose	X-2	X-2	X-1	--	X-1	X-2	X-2	X-1	--
Brant goose	--	--	--	--	X-1	X-1	--	X-2	--
Aleutian cackling goose	--	X-1	X-1	--	X-1	X-1	X-4	X-1	X-2
Eurasian wigeon	--	--	--	--	--	--	--	X-1	--
American wigeon	--	--	--	--	--	--	--	X-1	--
Mallard	--	--	--	--	--	X-2	X-2	--	--
Northern shoveler	--	X-?[b]	X-1	X-1	X-1	--	--	--	--
Northern pintail	X-1	X-1	X-1	--	--	X-2	--	X-1	X-1
Green-winged teal	C-?	C-4	C-?	C-4	C-4	C-4	C-4	C-4	C-4
King eider	--	--	--	--	X-1	--	--	--	--
Harlequin duck	X-3	X-3	X-4	X-4	X-4	X-4	X-4	X-4	X-4
Surf scoter	--	--	--	--	X-1	--	--	--	--
White-winged scoter	--	--	X-1	--	X-1	--	--	--	--
Black scoter	--	--	--	--	--	--	X-1	--	X-1
Long-tailed duck	--	--	--	--	X-1	--	--	--	--
Common merganser	--	--	--	--	--	X-2	--	X-1	--
Red-breasted merganser	X-1	X-1	X-1	--	X-1	X-2	X-2	X-1	--
Rock ptarmigan	--	--	--	X-1	X-1	--	X-1	--	X-1
Common loon	--	--	--	--	X-1	--	--	--	--
Red-necked grebe	--	--	--	--	--	X-1	--	X-1	X-1
Northern fulmar	X-1	--	X-1	--	X-1	--	--	X-1	--
Sooty shearwater	--	--	--	--	--	--	--	X-1	--
Short-tailed shearwater	--	--	--	--	--	X-1	X-1	X-1	--
Fork-tailed storm-petrel	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5
Leach's storm-petrel	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5
Double-crested cormorant	C-4	X-?	C-4	C-5	C-5	X-3	C-4	C-4	C-5
Pelagic cormorant	C-2	C-?	C-4	C-4	C-4	X-3	C-4	C-2	C-5
Red-faced cormorant	X-2	C-?	C-5	C-5	C-5	X-1	P-1	C-2	C-5
Bald eagle	C-?	C-?	C-4	C-3	C-3	C-3	C-3	C-4	C-4
Golden eagle	--	--	--	--	X-1	--	--	--	--
Peregrine falcon	C-2	C-?	C-?	C-2	C-2	C-2	P-2	C-2	C-2
Semipalmated plover	X-1	--	--	X-1	X-1	X-1	X-1	X-2	X-1
Black oystercatcher	C-4	C-4	C-4	C-4	C-4	C-4	C-4	C-5	C-4
Terek sandpiper	X-1	--	--	--	--	--	--	--	--
Grey-tailed tattler	--	--	--	--	--	--	--	X-1	--
Wandering tattler	X-1	X-1	X-1	X-1	X-1	X-1	X-2	X-2	X-1
Lesser yellowlegs	--	--	--	--	--	X-1	--	--	--
Wood sandpiper	--	X-1	--	--	--	--	X-1	--	--
Bristle-thighed curlew	--	--	--	--	--	--	--	X-1	--
Bar-tailed godwit		X-2	--	--	--	--	--	--	--
Ruddy turnstone	X-2	X-1	X-1	--	--	X-1	X-1	X-2	X-1
Semipalmated sandpiper	--	--	--	--	--	--	--	X-1	--
Western sandpiper	--	--	--	--	--	--	--	X-1	--
Least sandpiper	X-2	X-?	X-2	X-2	X-2	P-4	P-4	P-4	P-2
Rock sandpiper	X-2	X-2	X-1	--	X-1	P-2	X-2	X-4	X-2
Short-billed dowitcher	X-1	X-1	X-1	--	--	--	X-1	--	X-1
Red-necked phalarope			--	--	X-1	--	--	--	--
Red phalarope	--	--	--	--	--	--	--	--	X-1
Slaty-backed gull	--	--	--	--	X-1	--	--	X-1	--
Glaucous-winged gull	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5
Black-legged kittiwake	--	X-1	--	--	--	X-1	X-1	--	--
Common murre	C-5	C-5	X-5	C-5	X-5	X-5	C-5	C-5	C-5
Thick-billed murre	C-6	C-5	X-5	C-5	X-5	X-5	C-5	C-5	C-5

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

[b]Data from 2000-2002 comes from annotated lists and population count data in historic annual reports (Thomson and Smith 2000, Stukowski and Oleszczuk 2001, Dykstra and Wynn 2000); question marks indicate breeding status or abundance that could not be determined from those sources.

Table 81 continued. Breeding status and abundance of birds and marine mammals observed on Aiktak Island, Alaska. Breeding status codes: C=confirmed (observations of current nests, eggs, or chicks, adults carrying nesting materials or food to nests or chicks, recently fledged young, distraction displays), P=probable (observations of pairs or territorial behavior), X=possible but not likely (species seen or heard, but no other evidence for breeding). Abundance codes: 5=abundant (>50/day or 6/hr), 4=common (10-50/day or 2-5/hr), 3=fairly common (5-9/day or 1/hr), 2=uncommon (2-4/day or <1/hr), 1=rare (≤1/day).

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008
Pigeon guillemot	C-4	?-3	C-3	P-2	P-2	C-3	C-4	C-3	P-3
Marbled murrelet	--	--	--	--	--	--	--	X-1	--
Ancient murrelet	C-?	C-?	C-?	C-5	C-5	C-5	C-5	C-5	C-5
Parakeet auklet	X-1	--	X-1	--	--	--	--	X-1	--
Least auklet	--	--	X-1	--	--	--	--	--	--
Whiskered auklet	--	--	--	--	--	--	--	X-1	--
Rhinoceros auklet	X-1	--	--	--	--	X-1	--	--	--
Horned puffin	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5	C-5
Tufted puffin	C-5	C-?	C-?	C-5	C-5	C-5	C-5	C-5	C-5
Short-eared owl	X-1	P-2	X-1	X-1	X-1	X-1	X-1	X-2	X-1
Belted kingfisher	--	--	--	--	X-1	--	X-1	--	--
Common raven	P-3	C-3	C-3	C-3	C-3	P-3	P-3	C-4	C-3
Purple martin	--	--	--	--	--	X-1	--	--	--
Tree swallow	--	--	--	--	X-1	X-2	X-2	--	X-1
Violet-green swallow	--	--	X-1	--	--	--	--	--	--
Bank swallow	X-2	X-1	X-1	X-2	X-2	--	X-2	X-1	X-2
Cliff swallow	--	X-1	--	--	--	--	--	X-1	--
Barn swallow	--	--	X-1	--	X-1	--	--	--	--
Winter wren	C-?	C-?	C-?	C-4	C-4	C-4	C-4	C-4	C-4
American “buff-bellied” pipit	X-2	X-2	X-1	--	--	X-2	X-2	X-2	X-2
Ruby-crowned kinglet	X-1	--	--	--	--	--	--	--	--
Savannah sparrow	C-?	C-?	C-?	C-4	C-4	C-4	C-4	C-5	C-5
Fox sparrow	X-1	X-1	--	--	X-1	--	X-1	X-1	--
Song sparrow	C-?	C-?	C-?	C-4	C-4	C-4	C-4	C-4	C-4
Golden-crowned sparrow	X-1	--	--	--	X-1	X-1	--	--	--
White-crowned sparrow	--	X-1	--	--	--	--	--	--	--
Lapland longspur	--	--	--	--	X-1	X-1	--	--	X-1
Snow bunting	--	--	--	--	X-1	--	--	--	--
Gray-crowned rosy-finch	C-?	C-2	C-2	X-2	X-2	C-2	C-2	C-3	C-2
Sea otter	X-1	X-1	X-1	X-1	X-1	X-1	X-1	C-1	X-1
Harbor seal	?-4	?-4	?-?	C-4	C-4	C-4	C-4	C-3	C-4
Steller sea lion	?-?	?-?	?-4	X-4	X-4	X-4	X-4	X-3	X-3
Harbor porpoise	--	--	--	--	--	--	--	X-1	--
Humpback whale	X-1	--	--	--	X-1	--	--	X-1	X-1
Minke whale	--	--	--	--	--	--	--	--	X-1
Gray whale	--	--	--	--	X-1	--	--	--	--
Orca	X-1	--	--	--	X-1	X-1	X-2	X-1	X-1

Table 82. Appearance of first fledglings at Aiktak Island, Alaska. Question marks indicate fledglings were not observed but probably existed; question marks with superscript "AD" indicate fledglings were not observed but likely appeared after departure from the island; dashes indicate the species did not breed successfully that year; "N/A" indicate fledging data could not be determined using historic reports.

Species	2000	2001	2002	2003[a]	2004	2005	2006	2007	2008
Aleutian green-winged teal									
Ducklings	19 Jun	13 Aug	4 Jun	5 Jun	9 Jun	12 Jun	?	5 Jun	13 Jun
Fledglings	N/A	N/A	2 Aug	?^{AD}	11 Jul	?	?	7 Aug	11 Jul
Fork-tailed storm-petrel	N/A	N/A	?	?^{AD}	19 Aug	30 Aug	?^{AD}	?^{AD}	?
Leach's storm-petrel	N/A	N/A	?^{AD}	?^{AD}	?^{AD}	?^{AD}	?^{AD}	?^{AD}	?^{AD}
Double-crested cormorant	N/A	N/A	25 Aug	?^{AD}	--	--	--	--	20 Aug
Pelagic cormorant	N/A	N/A	17 Aug	?^{AD}	--	--	--	--	25 Aug
Red-faced cormorant	N/A	N/A	14 Aug	?^{AD}	--	--	--	--	25 Aug
Bald eagle	N/A	N/A	--	?^{AD}	19 Aug	?	17 Aug	10 Aug	--
Peregrine falcon	16 Jul	17 Jul	unk. date[b]	7 Jul	9 Jul	?	?	14 Jul	10 Jul
Black oystercatcher									
Walked from nest	N/A	N/A	?	?	12 Jun	2 Jul	?	17 Jun	22 Jun
Flew from nest area	29 Jul	N/A	23 Jul	?	30 Jul	?	26 Jul	27 Jul	21 Jul
Glaucous-winged gull	11 Aug	mid Aug	13 Aug	?^{AD}	10 Aug	20 Jul	27 Aug	8 Aug	19 Aug
Common murre	N/A	N/A	--	?^{AD}	--	--	?^{AD}	?^{AD}	?
Thick-billed murre	N/A	N/A	--	?^{AD}	--	--	29 Aug	?^{AD}	?^{AD}
Pigeon guillemot	N/A	N/A	?	?^{AD}	?	21 Aug	27 Aug	?^{AD}	?^{AD}
Ancient murrelet	N/A	N/A	?	?	27 Jun	21 Jun	21 Jun	25 Jun	6 Jul
Horned puffin	N/A	N/A	?	?^{AD}	?	?^{AD}	28 Aug	?^{AD}	?^{AD}
Tufted puffin	27 Aug	N/A	6 Sep	?^{AD}	?	?^{AD}	?^{AD}	?^{AD}	?
Common raven	N/A	N/A	13 Jun	6 Jun	6 Jun	?	?	< 26 May	7 Jun
Winter wren	N/A	N/A	8 Jul	25 Jun	25 Jun	?	8 Jul	2 Jul	11 Jul
Savannah sparrow	N/A	N/A	?	15 Jun	15 Jun	?	4 Jul	24 Jun	3 Jul
Song sparrow	N/A	N/A	7 Jul	14 Jun	15 Jun	?	10 Jun	4 Jun	2 Jun
Gray crowned rosy-finch	N/A	8 Sep	?	?	?	18 Aug	10 Aug	20 Jul	10 Jul

[a]Data may be incomplete in 2003 due to the early departure of field crew (10 July).
[b]Fledglings observed but date not recorded.

Table 83. Dates of first flowering of commonly observed plants at Aiktak Island, Alaska.

Family	Scientific Name	2003	2004	2005	2006	2007	2008
Lycopodiaceae	*Lycopodium selago selag*	--	--	16 May	late May	--	--
	L. annotinum annotinum	--	--	16 May	late May	--	--
Equisetaceae	*Equisetum arvense*	3 Jun	--	18 Jun	27 May	late May	early Jun
Athyriaceae	*Cystopteris fragilis fragilis*	--	--	early Jun	1 Jun	--	--
	Athyrium filix-femma cyclosorum	--	--	early Jun	early Jun	--	--
Graminae	*Poa* spp.	22 May	15 Jul	--	--	--	--
	Elymus arenarius mollis	20 Jun	10 Jul	--	--	early Jul	12 Jul
	Calamagrostis spp.	25 Jun	15 Jul	--	--	--	--
	Festuca rubra aucta	14 Jun	15 Jul	--	--	--	--
	Phleum commutatum americanum	early Jun	10 Jul	--	--	--	--
	Hordeum brachyantherum	--	17 Jul	--	--	--	--
Cyperacea	*Eriophorum russeolum* spp.	15 Jun	26 Jun	5 Jul	18 Jun	--	late Jun
	E. angustifolium subarcticum	--	27 Jun	--	--	--	--
	Carex macrochaeta	--	1 Jun	--	--	--	--
	C. saxatilis laxa	--	1 Jun	--	--	--	--
	Carex spp.	4 Jun	--	--	--	--	7 Jun
Juncaceae	*Luzula multiflora multiflora*	--	1 Jul	--	--	--	--
	L. multiflora Kobayasii	--	1 Jul	--	--	--	--
	Juncus arcticus sitchensis	--	1 Jul	--	--	--	--
Liliaceae	*Fritillaria camschatcensis*	8 Jun	12 Jun	4 Jun	6 Jun	27 Jun	26 Jun
Orchidaceae	*Platanthera convallariaefolia*	2 Jul	1 Jul	early Jul	25 Jun	27 Jun	2 Jul
	P. 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
Salicaceae	*Salix arctica crassijulis*	19 Jun	26 Jun	--	14 Jun	26 May	22 Jun
	S. reticulata	--	--	--	29 Jul	29 Jul	--
Polygonaceae	*Oxyria digyna*	--	--	--	--	27 Jun	--
	Rumex fenestratus	--	3 Jul	early Jul	20 Jun	late Jun	2 Jul
	Polygonum viviparum	--	--	--	23 Jul	1 Aug	25 Jul
Portulaceae	*Claytonia sibirica*	<18 May	13 May	16 May	24 May	29 May	3 Jun
Caryophyllaceae	*Honkenya peploides major*	--	13 May	30 May	19 Jun	--	9 Jun
	Cerastium beeringianum grandiflorum	--	12 Jun	--	27 May	late May	13 Jun
	Stellaria media	--	--	--	--	late Jun	--
	S. ruscifolia	--	--	--	31 May	--	--
	S. sitchana	--	--	--	13 Aug	--	--
Ranunculaceae	*Caltha palustris asarifolia*	--	17 May	24 May	28 May	late Jun	11 Jun
	Aconitum maximum	--	16 Jul	--	14 Jul	--	25 Jul
	A. delphinifolium delphinifolium	--	16 Jul	mid Jul	mid Jul	2 Aug	late Jul
	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
Cruciferae	*Draba hyperborea*	26 May	13 Jun	--	26 May	--	1 Jun
	D. borealis	26 May	25 May	late May	27 May	--	early Jun
	D. nivalis	--	--	--	14 Jun	--	--
	Cardemine umbellata	15 Jun	15 Jun	5 Jul	31 May	mid Jun	mid Jul
	Arabis lyrata	--	15 Jun	--	--	--	--
	Cochlearia officialis oblongifolia	--	--	--	28 Jul	--	--
Saxifragaceae	*Saxifraga punctata insularis*	25 Jun	25 Jun	--	19 Jun	1 Jul	15 Jun
	S. bracteata	5 Jun	5 Jun	--	31 May	--	20 Jun
	Parnassia palustris	--	--	--	8 Aug	--	--
	P. Kotzebuei	--	--	--	27 Jun	--	--
Rosaceae	*Rubus arcticus stellatus*	14 Jun	30 May	19 Jun	6 Jun	late Jun	3 Jul
	Potentilla villosa	30 May	10 Jun	16 Jun	6 Jun	mid Jun	20 Jun
	Geum macrophyllum	19 Jun	16 Jun	--	27 Jun	26 Jul	11 Jul
	Sanguisorba stipulata	--	20 Jun	29 Jul	--	mid Jul	
Leguminosae	*Lupinus nootkatensis*	<18 May	13 May	25 May	28 May	28 May	13 Jun
Geraniaceae	*Geranium erianthum*	early Jun	29 May	4 Jun	2 Jun	27 Jun	29 Jun
Violaceae	*Viola langsdorffii*	23 May	17 May	31 May	28 May	29 May	9 Jun
Onagraceae	*Epilobium glandulosum*	7 Jul	6 Jul	--	4 Jul	8 Aug	20 Jul
	E. treleaseanum	--	--	--	28 Jul	--	--
	E. angustifolium	--	14 Aug	6 Aug	29 Jul	--	28 Aug
	E. behringianum	--	--	27 Jul	--	--	--
	E. hornemannii	--	--	27 Jul	--	--	--
	E. leptocarum	--	29 Jul	--	--	--	--

Table 83 continued. Dates of first flowering of commonly observed plants at Aiktak Island, Alaska.

Family	Scientific Name	2003	2004	2005	2006	2007	2008
Umbelliferae	*Heracleum lanatum*	25 Jun	2 Jul	5 Jul	11 Jul	13 Jul	15 Jul
	Angelica lucida	15 Jun	30 Jun	5 Jul	28 Jun	1 Jul	10 Jul
	Ligusticum scoticum-Hultenii	27 Jun	30 Jun	late Jun	--	26 Jul	7 Aug
	Conioselinum chinense	--	20 Jul	4 Aug	28 Jul	10 Aug	19 Aug
Ericaceae	*Rhodedendron camtschaticum*	7 Jul	26 Jun	8 Jul	17 Jul	23 Jul	31 Jul
Primulaceae	*Trientalis europaea*	25 Jun	30 Jun	5 Jul	14 Jun	--	11 Jul
	Androsace chameajasme Lehmanniana	8 Jun	7 Jun	--	--	--	--
Gentianaceae	*Gentiana amarelle acuta* var. Plebeya	--	--	28 Jul	--	--	--
Polemoniaceae	*Polemonium acutiforum*	25 Jun	15 Jun	10 Jul	20 Jun	late Jun	14 Jul
Hydrophyllaceae	*Romanzoffia unalaschecensis*	--	10 Jun	--	--	--	--
Boraginacea	*Mertensia maritima*	--	--	--	--	7 Jul	--
Scrophulariaceae	*Mimulua guttatus*	7 Jul	5 Jul	6 Jul	29 Jun	16 Jul	25 Jul
	Pedicularis langsdorffii langsdorffii	15 Jun	23 Jun	15 Jun	22 Jun	14 Jul	11 Jul
	Veronica selleri	11 Jun	11 Jun	--	--	--	29 Jun
	V. wormskjoldii	--	--	--	15 Jun	--	--
	Castilleja unalaschcenis	8 Jun	15 Jun	5 Jul	9 Jun	30 Jun	11 Jul
	Rhinanthus minor boreales	--	27 Jul	29 Jul	8 Aug	8 Aug	12 Aug
	Lagotes glauca	--	--	--	8 Jun	--	25 Jun
Rubiaceae	*Galium aparine*	--	26 Jun	5 Jul	23 Jul	--	24 Jul
Campanulaceae	*Campanula lasiocarpa lasiocarpa*	--	28 Jul	1 Aug	23 Jul	--	5 Aug
	C. chamissonis	--	--	--	30 Jul	27 Aug	
Compositae	*Petasites frigidus*	25 Jun	17 May	--	31 May	late May	23 May
	Achillea borealis	15 Jun	2 Jun	--	19 Jun	27 Jun	11 Jul
	Senecio pseudo-arnica	3 Jul	17 Jul	7 Jul	10 Jul	23 Jul	20 Jul
	Taraxacum trigonolobum	15 Jun	23 Jun	30 Jun	13 Jun	22 Jul	3 Jul
	Erigeron peregrinus	7 Jul	2 Jul	6 Jul	29 Jun	--	19 Jul
	Anaphalis margaritacea	--	--	29 Jul	25 Jul	18 Aug	12 Aug
	Solidago multiradiata	--	1 Aug	--	22 Aug	--	--

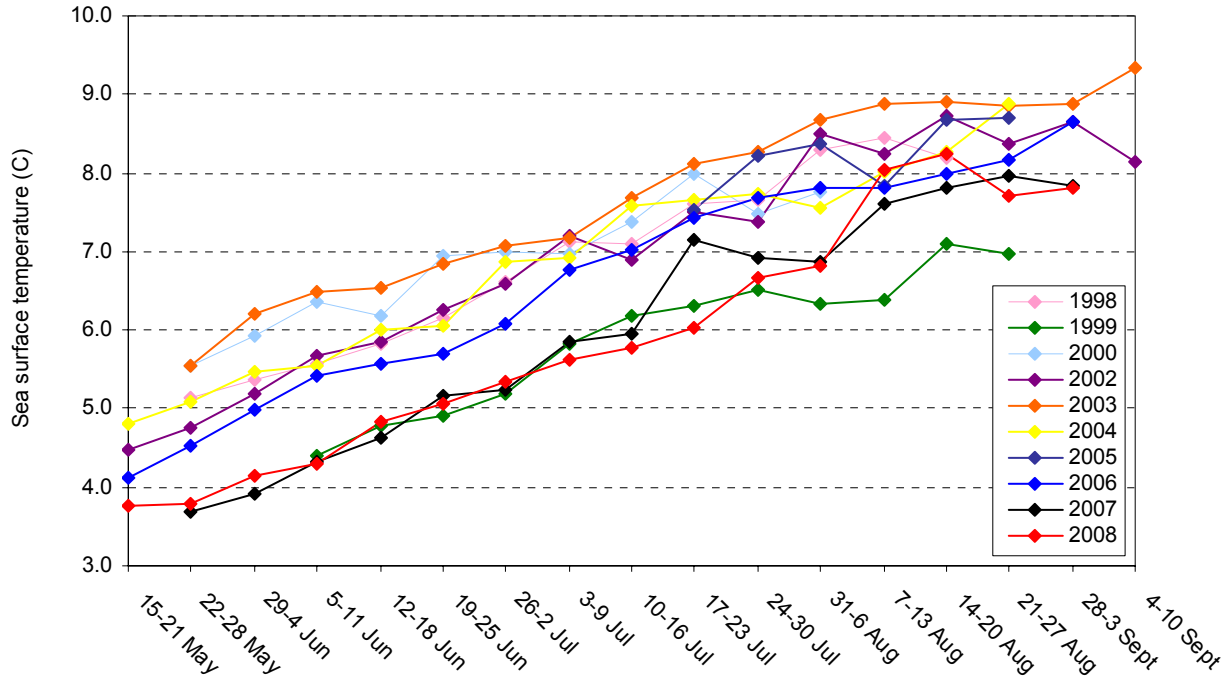


Figure 51. Mean weekly sea surface temperature (˚C) at Aiktak Island, Alaska. Values represent means of daily mean temperatures.

Table 84. Mean weekly sea surface temperature (˚C) at Aiktak Island, Alaska[a]. Values represent means of daily mean temperatures.

Date	1998	1999	2000	2002	2003	2004	2005	2006	2007	2008
15-21 May	--	--	--	4.49	--	4.80	--	4.13	--	3.77
22-28 May	5.14	--	5.55	4.77	5.54	5.08	--	4.54	3.69	3.79
29-4 Jun	5.37	--	5.94	5.18	6.21	5.46	--	5.00	3.91	4.14
5-11 Jun	5.56	4.39	6.36	5.67	6.49	5.55	--	5.41	4.33	4.30
12-18 Jun	5.84	4.78	6.18	5.84	6.54	6.01	--	5.57	4.63	4.84
19-25 Jun	6.16	4.91	6.95	6.26	6.85	6.06	--	5.69	5.16	5.07
26-2 Jul	6.62	5.19	7.01	6.58	7.08	6.88	--	6.09	5.24	5.34
3-9 Jul	7.13	5.83	6.97	7.21	7.18	6.93	--	6.78	5.85	5.62
10-16 Jul	7.11	6.18	7.39	6.89	7.69	7.57	--	7.02	5.96	5.78
17-23 Jul	7.60	6.32	7.98	7.51	8.11	7.66	7.54	7.44	7.16	6.03
24-30 Jul	7.66	6.50	7.48	7.39	8.26	7.74	8.21	7.68	6.91	6.67
31-6 Aug	8.29	6.34	7.75	8.49	8.67	7.54	8.37	7.82	6.86	6.83
7-13 Aug	8.45	6.39	--	8.24	8.87	8.03	7.84	7.82	7.61	8.04
14-20 Aug	8.20	7.10	--	8.73	8.91	8.26	8.68	8.00	7.80	8.24
21-27 Aug	--	6.98	--	8.37	8.84	8.89	8.71	8.16	7.96	7.72
28-3 Sep	--	--	--	8.65	8.88	--	--	8.64	7.83	7.81
4-10 Sep	--	--	--	8.15	9.34	--	--	--	--	--

[a]Data were not collected in 1997 and 2001.

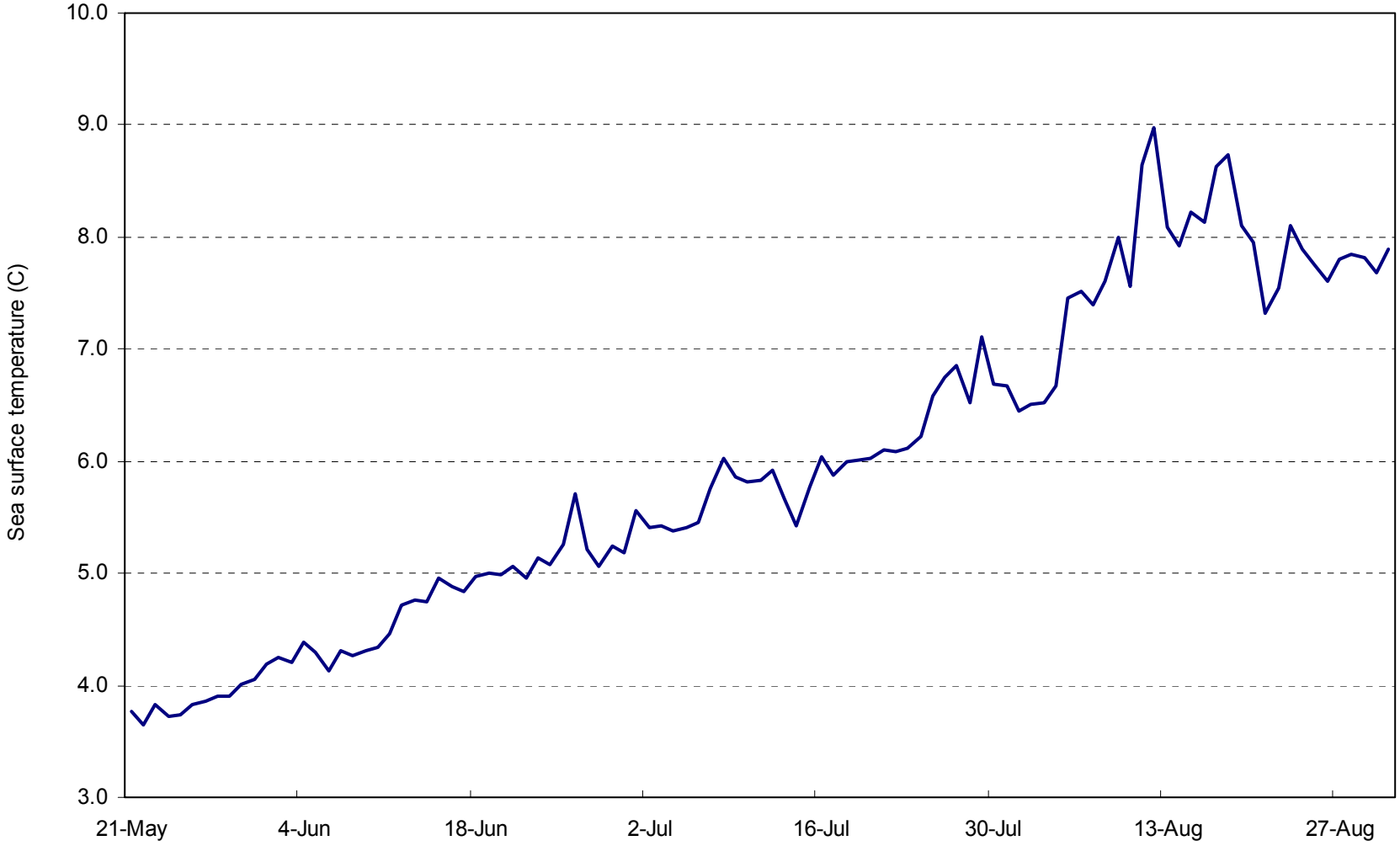


Figure 52. Sea surface temperature (˚C) at Aiktak Island, Alaska in 2008. Values represent daily mean temperature.