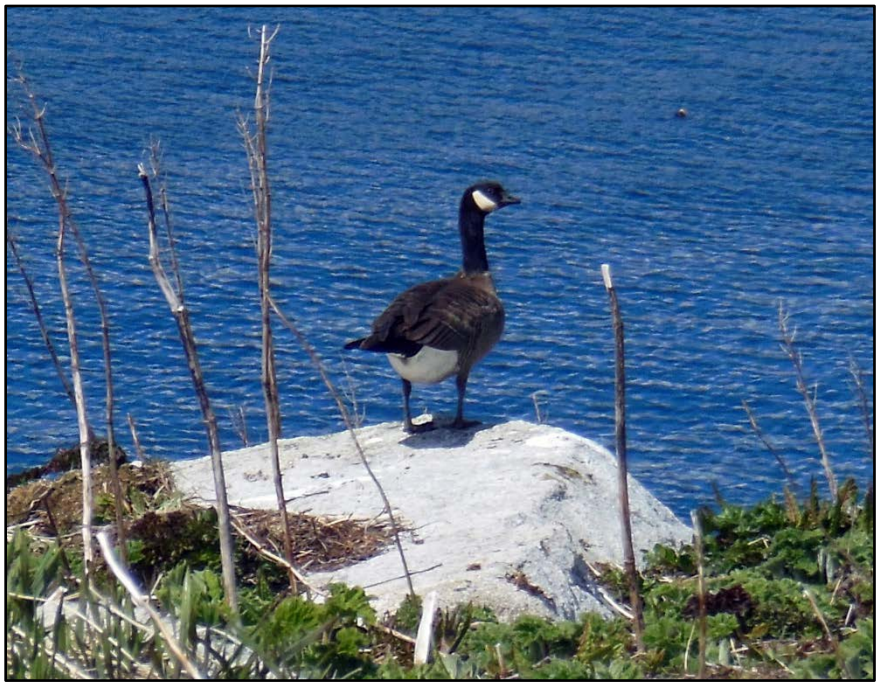
AMNWR 2017/18

BIOLOGICAL MONITORING AT CHOWIET ISLAND, ALASKA IN 2017



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Executive Order

Semidi Islands Wild Life Refuge

ALASKA

It is hereby ordered that Aghiyuk Island, Chowiet Island, Kateekuk Island, Anowik Island, Kiliktagik Island, Suklik Island, Aghik Island, Aliksemit Island, and South Island, together with all unnamed islands, rocks, and reefs, and all lands under water appurtenant thereto, lying between parallels 55° 57′ and 56° 15′ north latitude and meridians 156° 30′ and 157° 00′ longitude west of Greenwich, in the North Pacific Ocean southeast of the Alaska Peninsula, Alaska, and shown on United States Coast and Geodetic Survey Chart No. 8881, published in Washington, D.C., April, 1919, as within the Semidi Island Group, be, and the same are hereby, reserved from all forms of appropriation under the public land laws and set apart for the use of the Department of Agriculture as a refuge and breeding ground for wild birds and game and fur animals, subject to existing valid rights.

It is unlawful within this reservation (*a*) to hunt, trap, capture, willfully disturb, or kill any wild animal or bird of any kind whatever, to take or destroy the nests or eggs of any wild bird, to occupy or use any part of the reservation, or to enter thereon for any purpose, except under such rules and regulations as may be prescribed by the Secretary of Agriculture; (*b*) to cut, burn, or destroy any timber, underbrush, grass, or other natural growth; (*c*) willfully to leave fire or to suffer it to burn unattended near any forest, timber, or other inflammable material; (*d*) after building a fire in or near any forest, timber, or other inflammable material, to leave it without totally extinguishing it; and (*e*) willfully to injure, molest, or destroy any property of the United States.

Warning is given to all persons not to commit any of the acts herein enumerated, under the penalties prescribed by sections 106, 107, and 145 of chapter 4, title 18, United States Code (35 Stat. 1088, 1098, and 43 Stat. 98), or by section 10 of the Migratory Bird Conservation Act of February 18, 1929 (45 Stat. 1222, 1224; U. S. Code, Supp. V, title 16, sec. 715*i*).

This refuge shall be known as the Semidi Islands Wild Life Refuge.

HERBERT HOOVER

The White House,

June 17, 1932.

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INTRODUCTION

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

Chowiet Island, in the Semidi Islands, has been an annual monitoring site since 2002, with additional seabird data collected on the island since 1976. For comparisons among years, we present selected historic data sets from 1976 to 1991 (Leschner and Burrell 1977; Hatch and Hatch 1980, 1981, 1983a,b; Baggot et al. 1989; Dragoo et al. 1991a,b), unpublished data from 1993 and 1994 (Hatch unpubl. data) and data from 1995, 1998 (Nevins and Adams 1999), 2001 (Hatch unpubl. data), 2002 (Wang 2002), 2004 (Larned 2004), 2005 (Larned and Sapora 2005), 2006 (Fairchild et al. 2007), 2007 (Helm and Zeman 2007), 2009 (Andersen et al. 2010), 2010 (Shannon et al. 2011), 2011 (Engstrom et al. 2011), 2012 (Andersen et al. 2013), 2013 (Henschen et al. 2013), 2014 (Soucie et al. 2014), 2015 (Pollom et al. 2015), and 2016 (Pollom et al. 2016).

The specific monitoring goals in 2017 were to estimate productivity and/or population parameters for 11 indicator species representing four major feeding guilds: 1) diving fish-feeders (pelagic and red-faced cormorants [*Phalacrocorax pelagicus* and *P. urile*], common and thick-billed murres [*Uria aalge* and *U. lomvia*], horned and tufted puffins [*Fratercula corniculata* and *F. cirrhata*], and rhinoceros auklets [*Cerorhinca monocerata*]), 2) surface fish-feeders (black-legged kittiwakes [*Rissa tridactyla*]), 3) diving plankton-feeders (parakeet auklets [*Aethia psittacula*]), and 4) surface plankton-feeders (northern fulmars [*Fulmarus glacialis*]). Similar data were also collected on flexible-foraging glaucous-winged gulls (*Larus glaucescens*). Additional monitoring goals include the description of breeding chronology and food habits for one or more of the above species.

Detailed results of the 2017 monitoring program are contained in these appendices and archived at the AMNWR headquarters in Homer, Alaska. Summary data will also be included in the annual Alaska seabird monitoring summary report (e.g., Dragoo et al. 2017). Due to occasional reanalysis of some data, correction of typographical errors, and efforts to standardize presentation across sites, some values used in this report have changed from previous versions. The values presented here are considered the cleanest data set available at the time this report was issued and should supersede previous reports.

STUDY AREA

Chowiet Island is located in the Semidi Islands (56º02.688 N, 156º41.857 W), which consists of nine islands located on the continental shelf approximately 80 km south of the Alaska Peninsula and 160 km southwest of Kodiak Island (see Figures 1 and 2). Local oceanography is influenced by the Alaskan Coastal Current and the Alaska Stream (Hatch and Hatch 1983a, 1989).

Shorelines are generally precipitous; the highest elevation is approximately 300 m with sheer cliffs rising more than 200 m in many areas of the islands (Hatch and Hatch 1983b). Dominant vegetation is classified as Alaskan maritime and includes umbelliferous roots, beach rye-grasses, ferns, herbs, and a

few low shrubs (Hatch 1985). All islands are treeless except for Chowiet Island, which has a small number (<10) of Sitka spruce (*Picea sitchensis*), most likely introduced by fox ranchers in the early 1900s.

Fox ranching occurred on Chowiet and Aghiyuk islands from 1885 to about 1914 (Bower and Aller 1917), after which the natural die-off of the introduced arctic and red foxes (*Alopex lagopus* and *Vulpes fulva*, respectively) took place (Hatch and Hatch 1983b). The only land mammals that presently exist on the islands are arctic ground squirrels (*Urocitellus parryii*) and they occur on all of the Semidi Islands except for South, Suklik and Aghik (Hatch and Hatch 1983b).

Approximately 2.4 million seabirds consisting of twenty species, an estimated 25% of the total seabird biomass in the Gulf of Alaska, breed in the Semidis (Hatch and Hatch 1983a). A small population of cackling geese (*Branta hutchinsii*) breeds on Kaliktagik, Anowik (Hatch and Hatch 1983b), and Chowiet islands. The seabird population supports many avian predator species which also breed in the Semidis, including the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), glaucous-winged gull (*Larus glaucescens*), and common raven (*Corvus corax*).

METHODS

Personnel: The U.S. Fish and Wildlife Service field crew at Chowiet Island in 2017 consisted of Stacie Evans and Dan Schultz (15 May to 3 September).

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

- Rhinoceros auklet: We collaborated with graduate student Katie Studholme (Dalhousie University, Canada) on her study of the non-breeding distribution of rhinoceros auklets throughout their breeding range. On Chowiet, one geolocation tag (first deployed in 2014) was recovered from a breeding adult captured in a mist net at the same time that diet sampling occurred in 2017.

- Marine debris: We conducted marine debris surveys monthly at Landing Cove and South Bay beaches according to NOAA's marine debris protocol for standing-stock surveys.

- We collected abandoned alcid eggs and fragments for graduate student Duncan Jackson and Professor Tim Birkhead (University of Sheffield, United Kingdom) for a study of the design and surface properties of alcid eggs.

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

- In Table 67, glaucous-winged gull first lay date and mean lay date were corrected for 2015.

Reproductive success and chronology data for kittiwakes, murres, parakeet auklets and puffins were summarized using the AMNWR productivity database. Reproductive success and chronology data for cormorants, rhinoceros auklets and gulls were summarized by hand.

Population estimates on index plots for adult northern fulmars, murres, parakeet auklets, horned puffins, and black-legged kittiwakes, and glaucous-winged gull fledgling counts in 2014-2017 were summarized using the AMNWR population database. Population data for those species in 1976-2013 and rhinoceros

auklets in all years have not yet been added to the database and have been hand-summarized (these data will be added to and summarized by the database in the future).

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

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

Data for all other parameters were summarized by hand.

INTERESTING OBSERVATIONS

Low population counts:

Common murres, with a mean count on index plots of 1710, were down 54% from the historical average of 3168. Thick-billed murres, which comprise a much smaller proportion of the murre population, had a mean count on index plots of 67 compared to the historical average of 97.

South Island tour:

On 14 July the R/V *Tiĝlax̂*, while at Chowiet for resupply, circuited South Island to gauge cliff-nesting bird populations. Common murres were present on the cliffs but, compared to photos taken in August 2014, abundance appeared to be much lower.

High productivity:

Productivity was at a record high in 2017 for common murres; however, low populations should be considered in the overall reproductive success of common murres on Chowiet Island.

Low productivity:

Productivity was at near record lows in 2017 for horned and tufted puffins. Seven horned puffin chicks out of 118 active nests and one tufted puffin chick out of 63 active nests remained at the end of the season. While these were considered the only successful nests observed season, it is unclear whether these chicks would have survived to fledge because crews left the island before a known fate was recorded. Chicks in failed nests appeared lethargic and underweight and were often found dead on subsequent checks. Very few adult puffins were observed carrying bill loads throughout the season.

Large raft counts:

Parakeet auklet raft counts were the second largest recorded since counts began in 1998 with a mean of 419 and a maximum of 734. The maximum count was the same as 2016 and is the highest count recorded. Horned puffin mean counts were up 35% from the historical mean of 271.

Cormorants:

All accessible shorelines, including historical colony locations, were searched in late May through mid June of 2017, however no cormorant nests were discovered. In late August red-faced and pelagic cormorant fledglings were observed perched on rocks east of the glaucous-winged gull colonies in

South Bay. After some exploration, empty nests were discovered in a rocky crag that was not visible from any convenient vantage point. It is very likely that cormorants nested in this area in 2017, but were not documented by observers.

Aleutian cackling goose (*Branta hutchensii leucopareia*) nests:

Three Aleutian cackling goose nests were found on Chowiet Island this season, two at North Point and one at Otter Point (first documented nest at Otter Point). The behavior of multiple pairs of geese suggested the existence of additional nests at both locations (see annotated list for more details).

Common redpoll (*Acanthis flammea*) fledgling:

A common redpoll fledgling was observed begging for food near Stake 9 on 16 July. This is the first evidence of breeding documented on Chowiet for this species.

Sea surface temperature:

The mean weekly sea surface temperature in 2017 exceeded the long-term mean throughout most of the season.

ACKNOWLEDGEMENTS

The crew of the R/V *Tiĝlax̂* provided safe transport of crew and materials to and from Chowiet Island in 2017 as well as a mid-season resupply visit. Special thanks are extended to the refuge staff in Homer who made payroll and administrative tasks incredibly easy for us. Thanks to Lisa Spitler on Adak who provided a crucial communication link to the outside world. Thanks to Brie Drummond for working hard behind the scenes providing the report template, reviewing the report, and creating the seabird diet figures and tables in 2017. Stacie and Dan especially thank Nora, who sent incredible care packages, assisted field staff with logistics, data collection and analysis, and report preparation.

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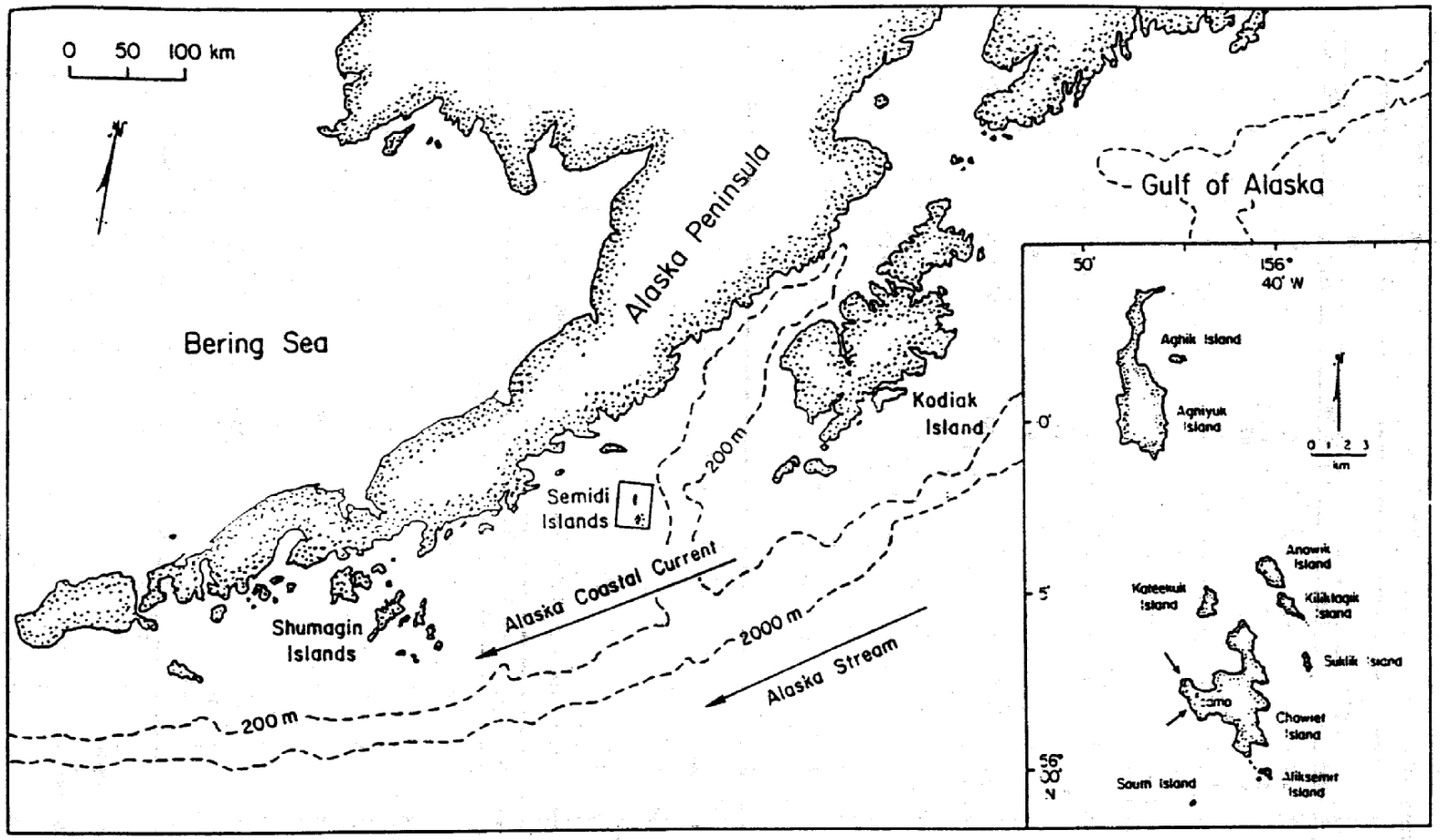

Figure 1. Location of the Semidi Islands in the western Gulf of Alaska.

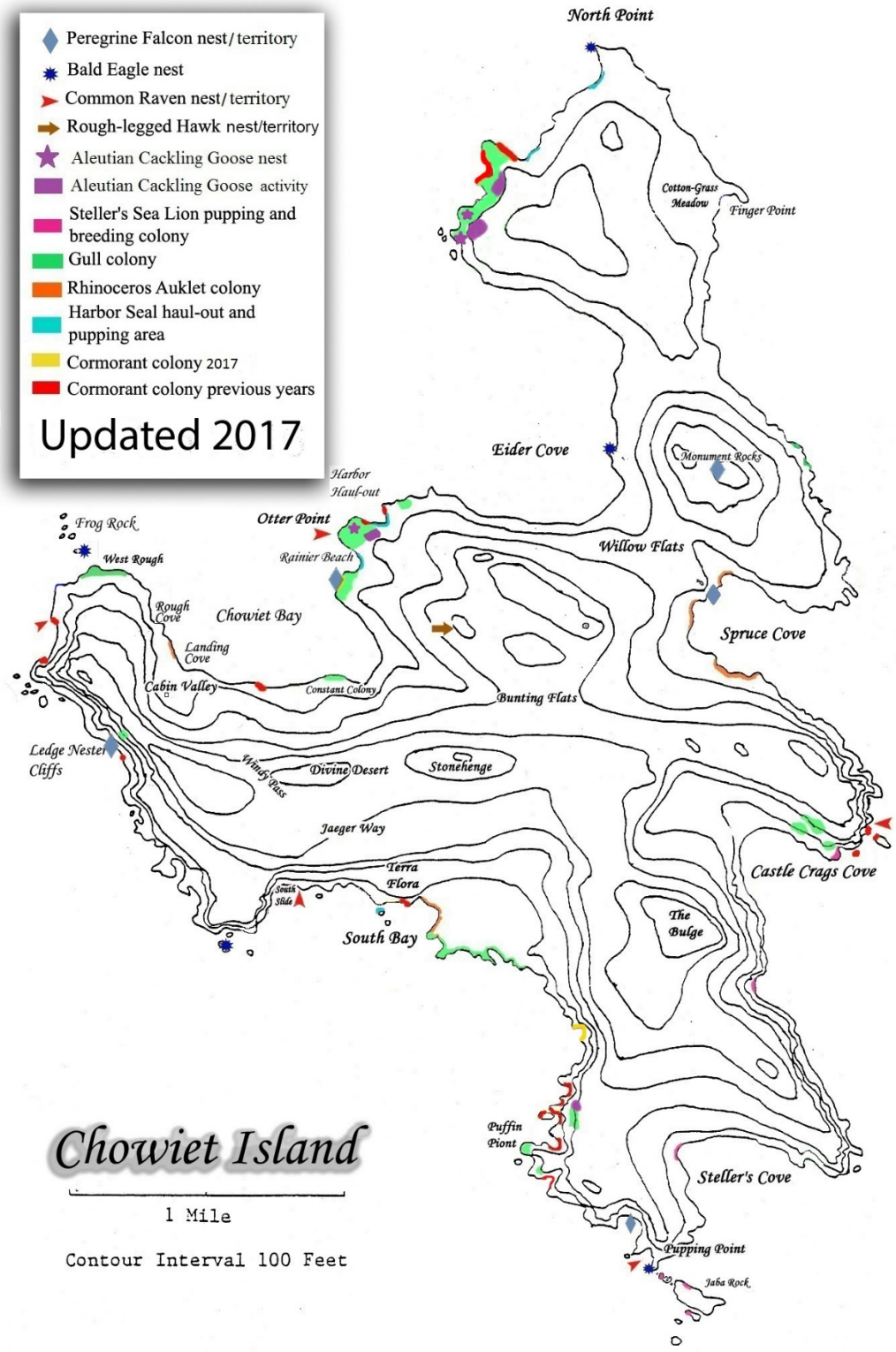

Figure 2. Map of Chowiet Island, Alaska.

FIGURES AND TABLES

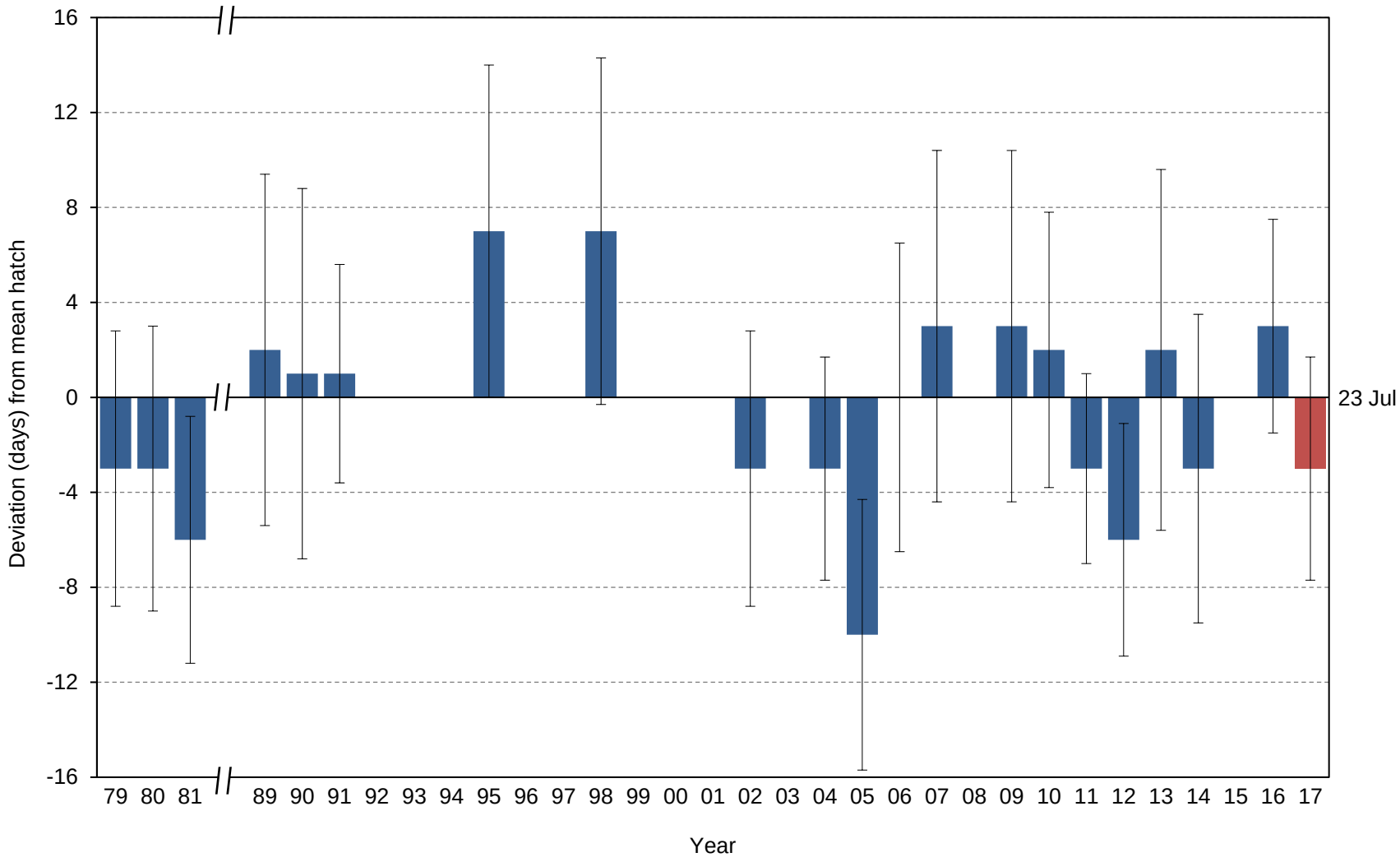

Figure 3. Yearly hatch date deviation (from the 1979-2016 average of 23 July) for common murres at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched in plots in 2015.

Table 1. Breeding chronology of common murres at Chowiet Island, Alaska. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched in plots in 2015.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First "jump"
1979	20 Jul	5.8	37	11 Jul	6 Aug	31 Jul
1980	19 Jul	6.0	52	10 Jul	15 Aug	7 Aug
1981	17 Jul	5.2	59	8 Jul	1 Aug	24 Jul
1989	25 Jul	7.4	37	11 Jul	16 Aug	6 Aug
1990	24 Jul	7.8	91	11 Jul	22 Aug	24 Jul
1991	24 Jul	4.6	80	15 Jul	8 Aug	5 Aug
1995	30 Jul	7.0	58	22 Jun	xx[b]	10 Aug
1998	30 Jul	7.3	12	19 Jul	15 Aug	1 Aug
2002	20 Jul	5.8	135	8 Jul	11 Aug	26 Jul
2004	19 Jul	4.7	119	9 Jul	5 Aug	28 Jul
2005	13 Jul	5.7	158	29 Jun	4 Aug	23 Jul
2006	23 Jul	6.5	171	13 Jul	24 Aug	2 Aug
2007	26 Jul	7.4	127	13 Jul	30 Aug	5 Aug
2009	26 Jul	7.4	47	12 Jul	18 Aug	2 Aug
2010	25 Jul	5.8	83	13 Jul	13 Aug	7 Aug
2011	20 Jul	4.0	21	10 Jul	28 Jul	30 Jul
2012	16 Jul	4.9	90	5 Jul	1 Aug	21 Jul
2013	25 Jul	7.6	143	8 Jul	18 Aug	29 Jul
2014	20 Jul	6.5	141	8 Jul	8 Aug	30 Jul
2016	25 Jul	4.5	107	18 Jul	10 Aug	4 Aug
2017	20 Jul	4.7	124	13 Jul	12 Aug	30 Jul

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]xx indicates data potentially exist but have not yet been summarized.

Table 2. Frequency distribution of hatch dates for common murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched plots in 2015.

Julian date[a]	No. nests hatching on Julian date									
	79	80	81	89	90	91	95	98	02	04
180	-	-	-	-	-	-	xx[b]	-	-	-
181	-	-	-	-	-	-	xx	-	-	-
182	-	-	-	-	-	-	xx	-	-	-
183	-	-	-	-	-	-	xx	-	-	-
184	-	-	-	-	-	-	xx	-	-	-
185	-	-	-	-	-	-	xx	-	-	-
186	-	-	-	-	-	-	xx	-	-	-
187	-	-	-	-	-	-	xx	-	-	-
188	-	-	-	-	-	-	xx	-	-	-
189	-	-	1	-	-	-	xx	-	1	-
190	-	-	-	-	-	-	xx	-	-	-
191	-	-	4	-	-	-	xx	-	2	1
192	3	3	-	1	1	-	xx	-	-	3
193	-	-	5	-	-	-	xx	-	7	-
194	3	3	-	-	2	-	xx	-	-	1
195	-	-	12	-	1	-	xx	-	-	1
196	5	10	-	-	11	1	xx	-	23	15
197	-	-	11	-	-	-	xx	-	12	-
198	3	5	-	4	3	2	xx	-	1	3
199	-	-	8	4	-	1	xx	-	24	1
200	5	11	-	-	15	6	xx	1	-	40
201	-	-	6	1	-	3	xx	-	11	8
202	8	6	-	1	3	15	xx	-	-	17
203	-	-	2	2	1	2	xx	-	20	-
204	5	6	-	5	16	4	xx	1	1	10
205	-	-	5	1	1	5	xx	1	9	-
206	-	2	-	6	3	18	xx	-	1	8
207	-	-	2	-	2	-	xx	2	6	-
208	2	3	-	2	5	5	xx	-	-	2
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234	-	-	-	-	1	-	xx	-	-	-
235	-	-	-	-	-	-	xx	-	-	-
236	-	-	-	-	-	-	xx	-	-	-
237	-	-	-	-	-	-	xx	-	-	-
238	-	-	-	-	-	-	xx	-	-	-
239	-	-	-	-	-	-	xx	-	-	-

Table 2 (continued). Frequency distribution of hatch dates for common murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched plots in 2015.

Julian date[a]	No. nests hatching on Julian date									
	79	80	81	89	90	91	95	98	02	04
240	-	-	-	-	-	-	xx	-	-	-
241	-	-	-	-	-	-	xx	-	-	-
242	-	-	-	-	-	-	xx	-	-	-
n	37	52	59	37	91	80	xx	12	135	119

Table 2 (continued). Frequency distribution of hatch dates for common murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched plots in 2015.

Julian date[a]	No. nests hatching on Julian date										
	05	06	07	09	10	11	12	13	14	16	17
180	1	-	-	-	-	-	-	-	-	-	-
181	-	-	-	-	-	-	-	-	-	-	-
182	-	-	-	-	-	-	-	-	-	-	-
183	-	-	-	-	-	-	-	-	-	-	-
184	-	-	-	-	-	-	-	-	-	-	-
185	-	-	-	-	-	-	-	-	-	-	-
186	16	-	-	-	-	-	-	-	-	-	-
187	-	-	-	-	-	-	1	-	-	-	-
188	1	-	-	-	-	-	-	-	-	-	-
189	2	-	-	-	-	-	-	1	2	-	-
190	29	-	-	-	-	-	-	-	-	-	-
191	20	-	-	-	-	1	-	-	-	-	-
192	-	-	-	-	-	-	10	-	2	-	-
193	5	-	-	1	-	-	-	1	-	-	-
194	5	7	1	1	2	-	27	1	15	-	13
195	3	1	-	-	-	-	-	1	-	-	-
196	40	2	2	-	-	2	-	12	4	-	1
197	-	7	1	-	-	-	-	-	22	-	-
198	1	18	8	1	-	4	11	2	23	-	35
199	-	12	-	-	1	-	1	5	1	-	-
200	23	10	9	6	25	2	21	11	-	7	25
201	4	6	-	-	-	6	2	1	-	-	-
202	-	25	2	4	-	2	9	24	30	12	29
203	-	12	22	1	-	-	-	1	4	-	-
204	3	6	13	2	9	1	1	12	1	-	7
205	-	12	6	-	12	-	-	3	1	30	-
206	1	15	9	2	4	1	2	23	11	16	-
207	-	3	1	16	-	-	-	1	2	-	-
208	1	1	10	2	2	1	3	6	5	-	7
209	-	1	3	-	-	1	-	10	-	23	-
210	-	9	18	1	17	-	-	6	1	4	-
211	-	3	1	-	-	-	-	-	1	-	1
212	-	2	1	-	-	-	-	3	9	-	4
213	1	2	-	-	-	-	-	2	-	4	-
214	1	3	-	5	8	-	2	1	-	6	-
215	-	3	1	-	-	-	-	-	-	-	-
216	1	5	9	-	-	-	-	-	1	1	1
217	-	-	-	-	1	-	-	-	-	-	-
218	-	-	-	-	-	-	-	-	3	2	-
219	-	3	-	1	-	-	-	5	-	-	-
220	-	-	-	1	1	-	-	5	3	-	-
221	-	-	4	-	-	-	-	-	-	-	-
222	-	1	2	-	-	-	-	-	-	1	-
223	-	-	-	-	-	-	-	-	-	1	-
224	-	-	1	2	-	-	-	-	-	-	1
225	-	-	-	-	1	-	-	2	-	-	-
226	-	1	1	-	-	-	-	1	-	-	-
227	-	-	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	1	-	-	-	3	-	-	-
231	-	-	-	-	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-	-	-	-
234	-	-	1	-	-	-	-	-	-	-	-
235	-	-	-	-	-	-	-	-	-	-	-
236	-	1	-	-	-	-	-	-	-	-	-
237	-	-	-	-	-	-	-	-	-	-	-
238	-	-	-	-	-	-	-	-	-	-	-
239	-	-	-	-	-	-	-	-	-	-	-

Table 2 (continued). Frequency distribution of hatch dates for common murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched plots in 2015.

Julian date[a]	No. nests hatching on Julian date										
	05	06	07	09	10	11	12	13	14	16	17
240	-	-	-	-	-	-	-	-	-	-	-
241	-	-	-	-	-	-	-	-	-	-	-
242	-	-	1	-	-	-	-	-	-	-	-
n	158	171	127	47	83	21	90	143	141	107	124

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.
[b]xx indicates data potentially exist but have not yet been summarized.

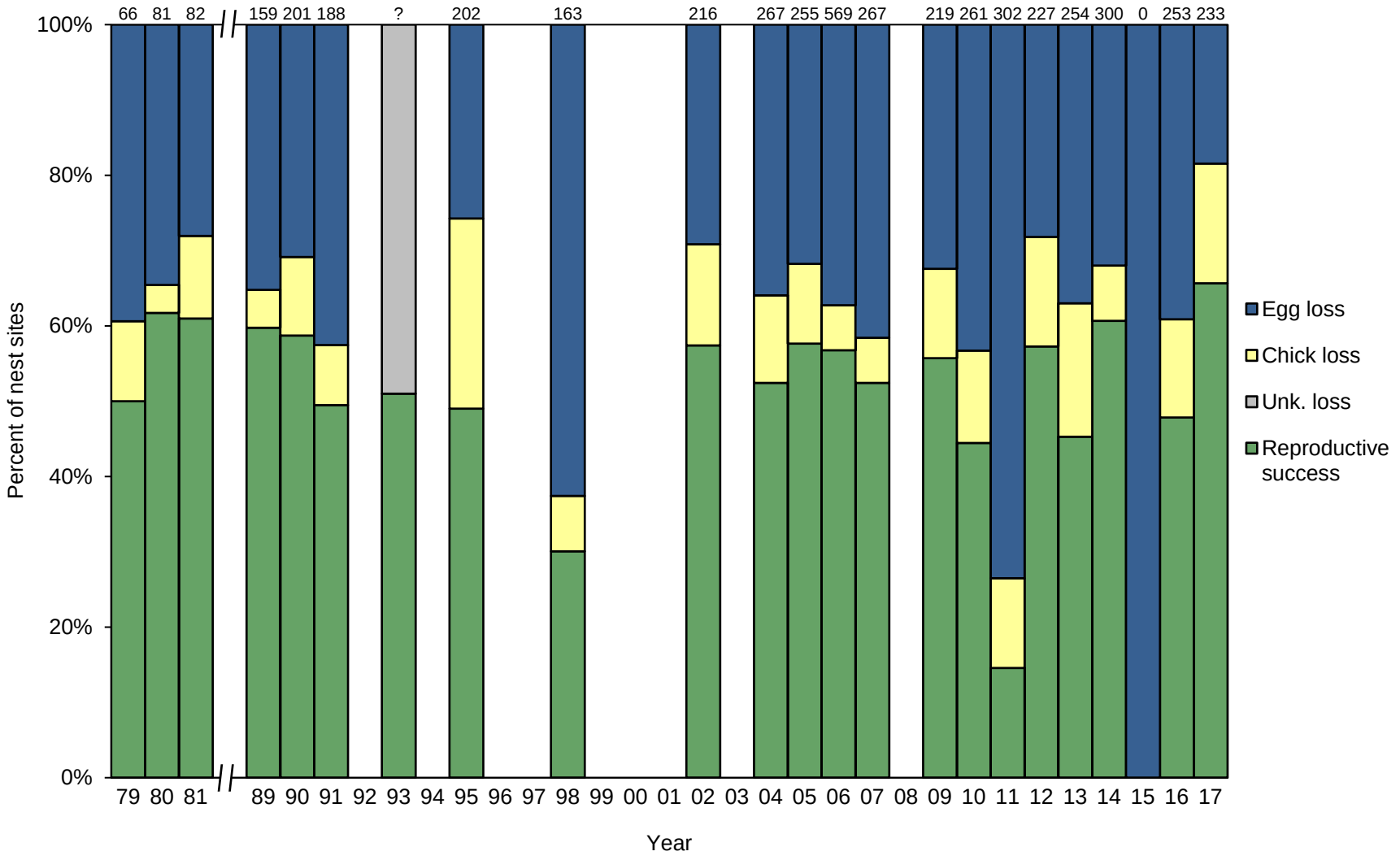

Figure 4. Reproductive performance of common murres at Chowiet Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Failure in years where no eggs were laid is considered 100% egg loss. Numbers above columns indicate sample sizes (B). No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008; data potentially exist in 1993 but have not yet been summarized.

Table 3. Reproductive performance of common murres at Chowiet Island, Alaska. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nesting success (D/B)[a]	Fledging success (F/D)[b]	Reproductive success (F/B)
1979	66	40	33	0.61	0.83	0.50
1980	81	53	50	0.65	0.94	0.62
1981	82	59	50	0.72	0.85	0.61
1989	159	103	95	0.65	0.92	0.60
1990	201	139	118	0.69	0.85	0.59
1991	188	108	93	0.57	0.86	0.49
1993	xx[c]	xx	xx	xx	xx	0.51
1995	202	150	99	0.74	0.66	0.49
1998	163	61	49	0.37	0.80	0.30
2002	216	153	124	0.71	0.81	0.57
2004	267	171	140	0.64	0.82	0.52
2005	255	174	147	0.68	0.84	0.58
2006	569	357	323	0.63	0.90	0.57
2007	267	156	140	0.58	0.90	0.52
2009	219	148	122	0.68	0.82	0.56
2010	261	148	116	0.57	0.78	0.44
2011	302	80	44	0.26	0.55	0.15
2012	227	163	130	0.72	0.80	0.57
2013	254	160	115	0.63	0.72	0.45
2014	300	204	182	0.68	0.89	0.61
2015	0	0	0	0.00	0.00	0.00
2016	253	154	121	0.61	0.79	0.48
2017	233	190	153	0.82	0.81	0.66

[a]For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B) equals total eggs (C), and nest sites w/ chicks (D) equals total chicks (E).

[b]For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D) equals total chicks (E), and nest sites w/ chicks fledged (F) equals total chicks fledged (G).

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

Table 4. Standard deviation in reproductive performance parameters of common murres at Chowiet Island, Alaska. Sampling for murres is clustered by plot except when sample sizes per plot are too small to allow for groupings or plot data are not available. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	No. plots[a]	Nest sites w/ eggs	Sampling design[b]	Nesting success	Fledging success	Reproductive success
1979	6	66	Cluster by plot	0.10	0.04	0.09
1980	6	81	Cluster by plot	0.06	0.02	0.06
1981	6	82	Cluster by plot	0.03	0.05	0.04
1989	7	159	Cluster by plot	0.08	0.02	0.08
1990	10	201	Cluster by plot	0.04	0.04	0.04
1991	7	188	Cluster by plot	0.06	0.04	0.05
1993	xx[c]	xx	xx	xx	xx	xx
1995	xx	xx	xx	xx	xx	xx
1998	7	163	Cluster by plot	0.09	0.06	0.08
2002	11	216	Cluster by plot	0.02	0.02	0.03
2004	10	267	Cluster by plot	0.05	0.03	0.05
2005	10	255	Cluster by plot	0.03	0.03	0.03
2006	11	569	Cluster by plot	0.02	0.02	0.02
2007	11	267	Cluster by plot	0.03	0.02	0.03
2009	10	219	Cluster by plot	0.04	0.03	0.04
2010	10	261	Cluster by plot	0.04	0.05	0.05
2011	11	302	Cluster by plot	0.05	0.07	0.02
2012	10	227	Cluster by plot	0.05	0.06	0.06
2013	9	254	Cluster by plot	0.04	0.04	0.03
2014	10	300	Cluster by plot	0.03	0.02	0.03
2015	11	0	-	-	-	-
2016	11	253	Cluster by plot	0.06	0.04	0.06
2017	11	233	Cluster by plot	0.04	0.03	0.05

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

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

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

Table 5. Reproductive performance of common murres at Chowiet Island, Alaska in 2017.

Parameter	Plot											Total	SD[b]
	P03 M06	P03 M13	P03 M14	P03 M15	P03 M16	P03 M17	P03 M18	P03 MJH2/4[a]	P09 M01	P09 M03	P09 M04		
Nest sites w/ eggs (B)	8	17	23	27	32	24	16	15	31	18	22	233	-
Nest sites w/ chicks (D)	6	17	21	24	27	23	12	11	25	11	13	190	-
Nest sites w/ chicks fledged (F)	4	15	20	19	21	20	10	8	20	7	9	153	-
Nesting success (D/B)[c]	0.75	1.00	0.91	0.89	0.84	0.96	0.75	0.73	0.81	0.61	0.59	0.82	0.04
Fledging success (F/D)[d]	0.67	0.88	0.95	0.79	0.78	0.87	0.83	0.73	0.80	0.64	0.69	0.81	0.03
Reproductive success (F/B)	0.50	0.88	0.87	0.70	0.66	0.83	0.63	0.53	0.65	0.39	0.41	0.66	0.05

[a]Plots were combined for statistical purposes.

[b]Standard deviations are calculated based on plot as a sample unit.

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

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

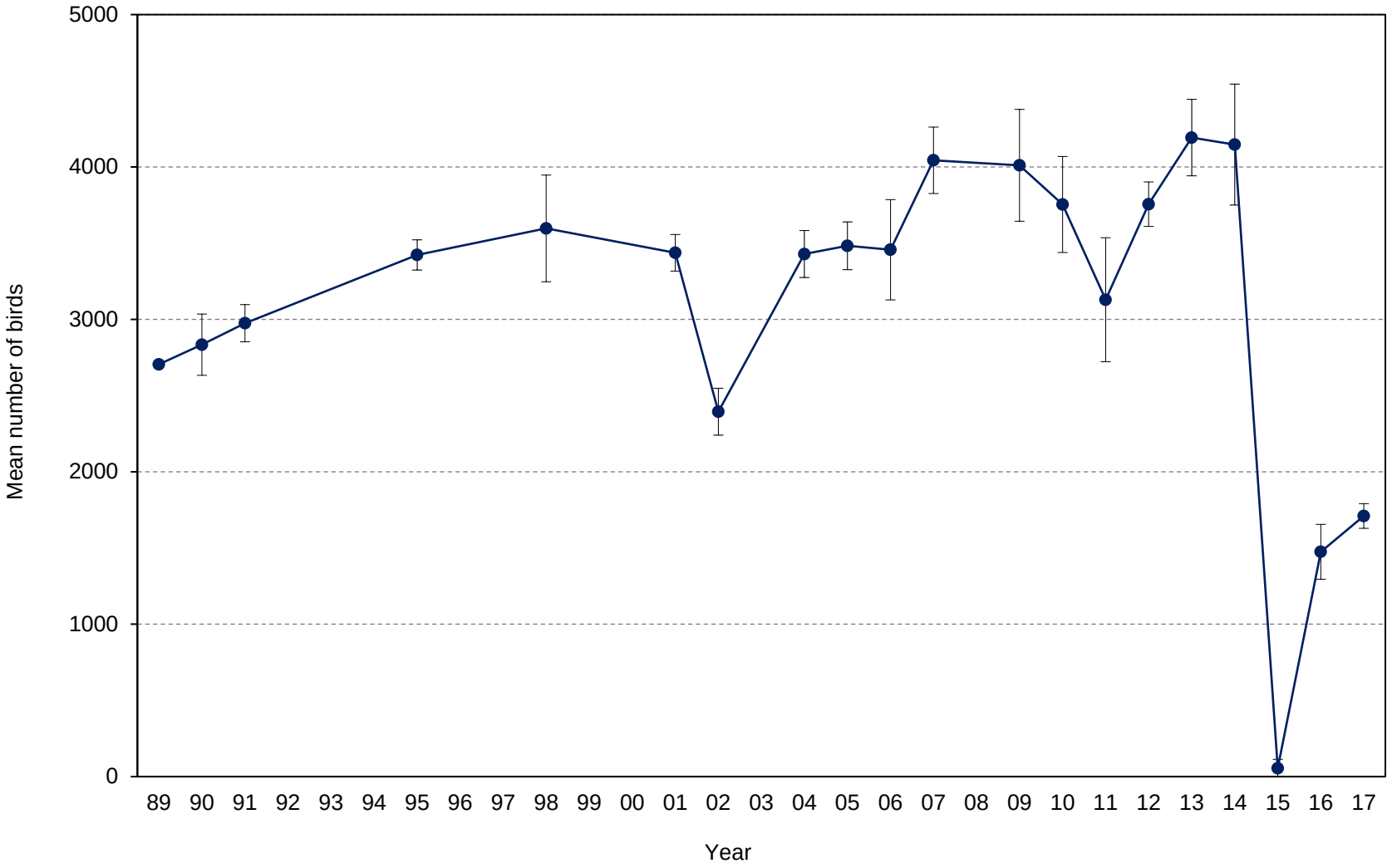

Figure 5. Mean numbers of common murres counted on index plots at Chowiet Island, Alaska. Error bars represent standard deviation. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008; data potentially exist in 1977-1981 but have not yet been summarized.

Table 6. Numbers of common murres counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	1977	1978	1979	1980	1981	1989	1990	1991	1993	1995	1998	2001	2002
1	xx[a]	xx	xx	xx	xx	xx	2408	2906	xx	3199	2999	3574	2448
2	xx	xx	xx	xx	xx	xx	2735	2714	xx	2938	3705	3386	2522
3	xx	xx	xx	xx	xx	xx	2658	3025	xx	3387	3818	3352	2407
4	xx	xx	xx	xx	xx	xx	2914	2993	xx	3561	3600	-	2125
5	xx	xx	xx	xx	xx	xx	2777	2850	xx	3416	3865	-	2317
6	xx	xx	xx	xx	xx	xx	2855	3031	xx	3328	-	-	2175
7	xx	xx	xx	xx	xx	xx	3071	3093	xx	-	-	-	2528
8	xx	xx	xx	xx	xx	xx	2888	3131	xx	-	-	-	2503
9	xx	xx	xx	xx	xx	xx	3051	3013	xx	-	-	-	2517
10	xx	xx	xx	xx	xx	xx	2991	3001	xx	-	-	-	-
Mean	xx	xx	xx	xx	xx	2705	2835	2976	xx	3305	3597	3437	2394
n	xx	xx	xx	xx	xx	10	10	10	xx	6	5	3	9
SD	xx	xx	xx	xx	xx	xx	201	122	xx	215	350	120	154
First count	20 Jun	22 Jun	20 Jun	20 Jun	20 Jun	21 Jun	25 Jun	28 Jun	xx	24 Jun	1 Jul	19 Jul	19 Jun
Last count	1 Aug	28 Jun	1 Aug	1 Aug	1 Aug	27 Jul	1 Aug	21 Jul	xx	28 Jul	21 Jul	23 Jul	29 Jul

Table 6 (continued). Numbers of common murres counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015[b]	2016	2017
1	3839	3122	3037	3875	4315	2920	2673	3919	3806	3513	133	1663	1693
2	3442	3348	3708	4228	4787	3698	2566	3650	4074	3745	73	1760	1726
3	3367	3428	3681	3699	4115	3973	3167	3679	4114	3890	108	1621	1630
4	3395	3623	2994	3819	3914	3849	2750	3738	4267	3795	4	1605	1631
5	3410	3568	3628	4248	3969	3822	3322	3679	4164	4250	3	1526	1679
6	3412	3554	3671	4106	3757	3837	3339	4084	3973	4545	9	1364	1695
7	3247	3617	2953	4248	3875	4098	3694	3766	4187	4583	-	1354	1752
8	3362	3621	3466	4287	4210	3757	3528	3787	4744	4570	-	1304	1683
9	3377	3460	3764	4098	3610	3740	3485	3588	4211	4494	-	1256	1915
10	3441	3484	3672	3830	3553	3850	2761	3683	4390	4080	-	1299	1691
Mean	3429	3483	3457	4044	4011	3754	3129	3757	4193	4147	55	1475	1710
n	10	10	10	10	10	10	10	10	10	10	6	10	10
SD	154	157	329	218	367	315	407	146	251	397	58	180	81
First count	26 Jun	21 Jun	21 Jun	26 Jun	6 Jul	22 Jun	20 Jun	23 Jun	21 Jun	20 Jun	6 Jul	20 Jun	20 Jun
Last count	19 Jul	31 Jul	30 Jul	28 Jul	31 Jul	27 Jul	29 Jul	29 Jul	29 Jul	28 Jul	18 Jul	17 Jul	20 Jul

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

[b]Low counts for most replicates in 2015 due to reproductive failure; murres abandoned the cliffs, rafting offshore for a few weeks after cliff abandonment. Additionally, four replicates in June, with higher numbers, were excluded due to counts for several plots being obtained from photos.

Table 7. Numbers of common murres counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date										Mean	SD
	20 Jun	21 Jun	25 Jun	29 Jun	4 Jul	5 Jul	10 Jul	11 Jul	16 Jul	20 Jul		
A03M01	41	41	43	46	40	38	45	37	43	37	-	-
A03M02	40	42	36	37	36	43	38	35	39	38	-	-
A03M03	40	37	35	36	38	35	38	37	40	38	-	-
A03M04	87	82	89	98	94	95	104	76	93	98	-	-
A03M05	22	22	15	21	21	18	22	20	17	18	-	-
A06M01	98	115	110	96	109	99	101	90	130	102	-	-
A09M01	42	48	53	52	52	52	51	52	48	50	-	-
A09M02	499	503	391	360	351	380	449	407	388	381	-	-
A10M01	482	525	562	558	585	601	577	573	732	578	-	-
A10M02	342	311	296	327	353	334	327	356	385	351	-	-
Total	1693	1726	1630	1631	1679	1695	1752	1683	1915	1691	1710	81

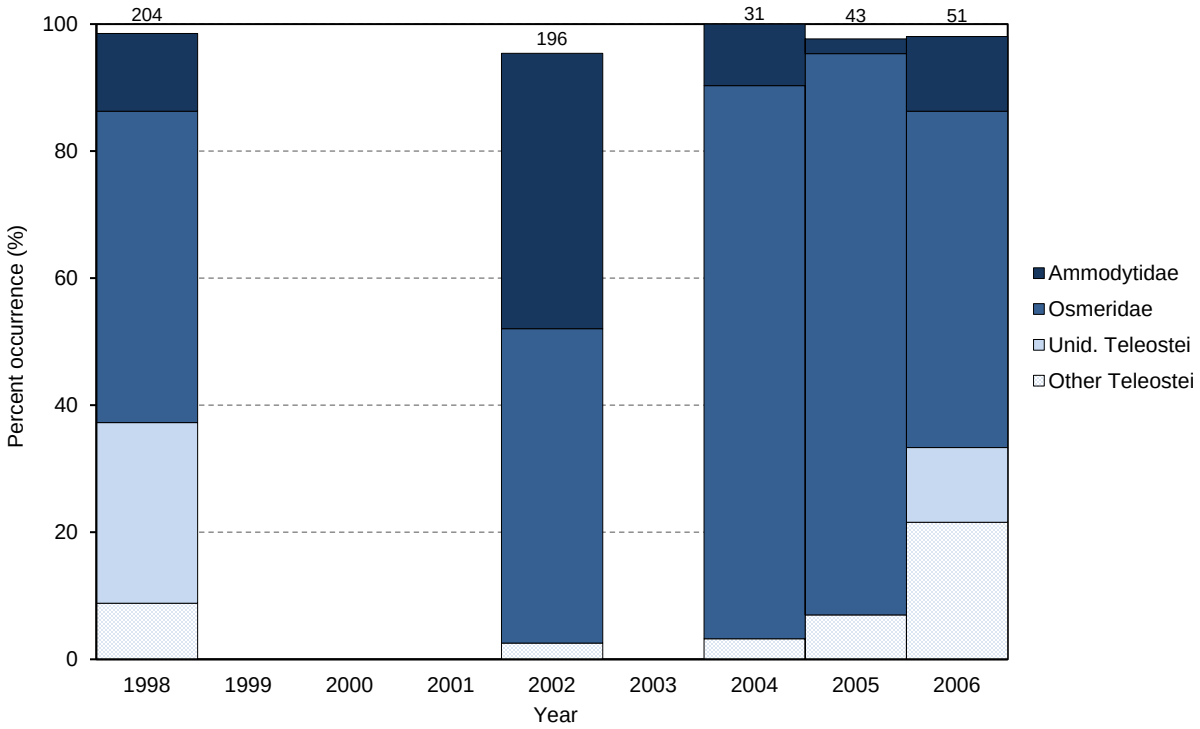

Figure 6. Frequency of occurrence of major prey items in diets of common murre chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999-2001, 2003, or after 2006.

Table 8. Frequency of occurrence of major prey items in diets of common murre chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. No diet samples were collected in 1999-2001, 2003, or after 2006. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2002	2004	2005	2006
No. samples	204	196	31	43	51
Invertebrates	1.0	1.5	-	2.3	2.0
Fish	**98.5**	**95.4**	**100.0**	**97.7**	**98.0**
Teleostei	**98.5**	**95.4**	**100.0**	**97.7**	**98.0**
Ammodytidae	**12.3**	**43.4**	**9.7**	**2.3**	**11.8**
Ammodytes spp.	12.3	43.4	9.7	2.3	11.8
Osmeridae	**49.0**	**49.5**	**87.1**	**88.4**	**52.9**
Mallotus villosus	46.1	43.4	71.0	83.7	45.1
Thaleichthys pacificus	-	1.0	12.9	2.3	7.8
Other Osmeridae	2.9	5.1	3.2	2.3	-
Unid. Teleostei	28.4	-	-	-	11.8
Other Teleostei	8.8	2.6	3.2	7.0	21.6
Other	0.5	3.1	-	-	-

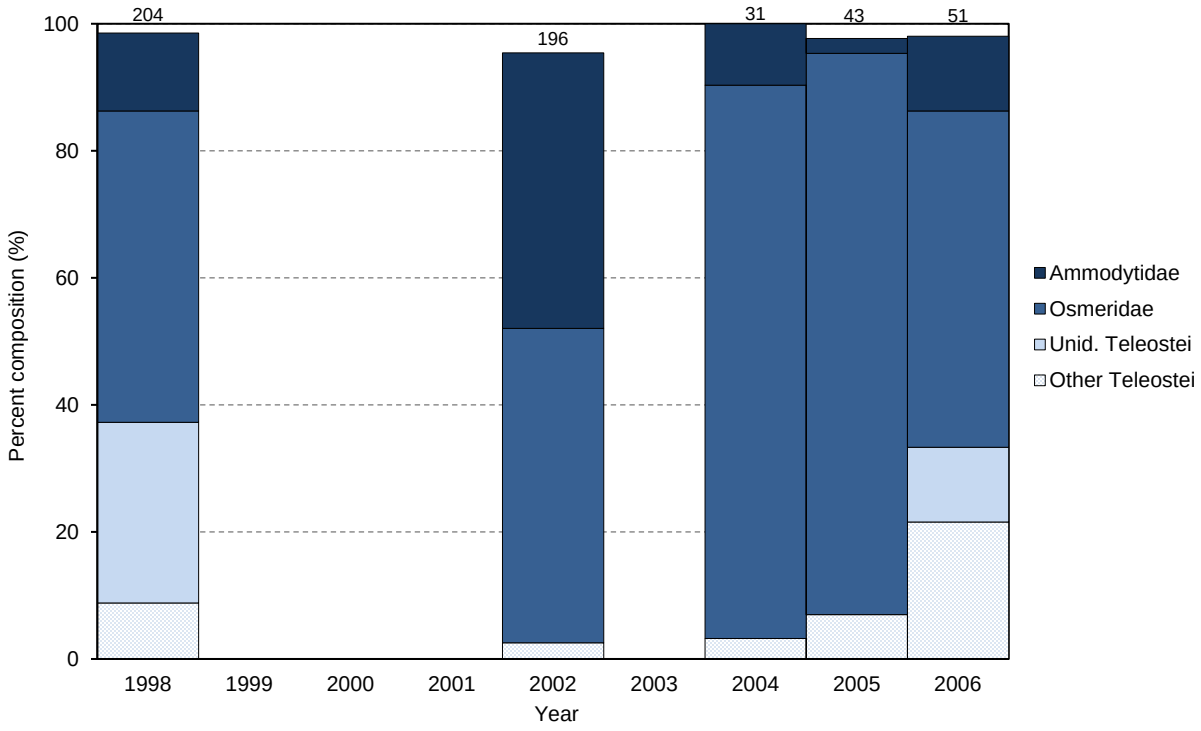

Figure 7. Percent composition of major prey items in diets of common murre chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999-2001, 2003, or after 2006.

Table 9. Percent composition of major prey items in diets of common murre chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. No diet samples were collected in 1999-2001, 2003, or after 2006. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2002	2004	2005	2006
No. samples	204	196	31	43	51
No. individuals	204	196	31	43	51
Invertebrates	1.0	1.5	-	2.3	2.0
Fish	**98.5**	**95.4**	**100.0**	**97.7**	**98.0**
Teleostei	**98.5**	**95.4**	**100.0**	**97.7**	**98.0**
Ammodytidae	**12.3**	**43.4**	**9.7**	**2.3**	**11.8**
Ammodytes spp.	12.3	43.4	9.7	2.3	11.8
Osmeridae	**49.0**	**49.5**	**87.1**	**88.4**	**52.9**
Mallotus villosus	46.1	43.4	71.0	83.7	45.1
Thaleichthys pacificus	-	1.0	12.9	2.3	7.8
Other Osmeridae	2.9	5.1	3.2	2.3	-
Unid. Teleostei	28.4	-	-	-	11.8
Other Teleostei	8.8	2.6	3.2	7.0	21.6
Other	0.5	3.1	-	-	-

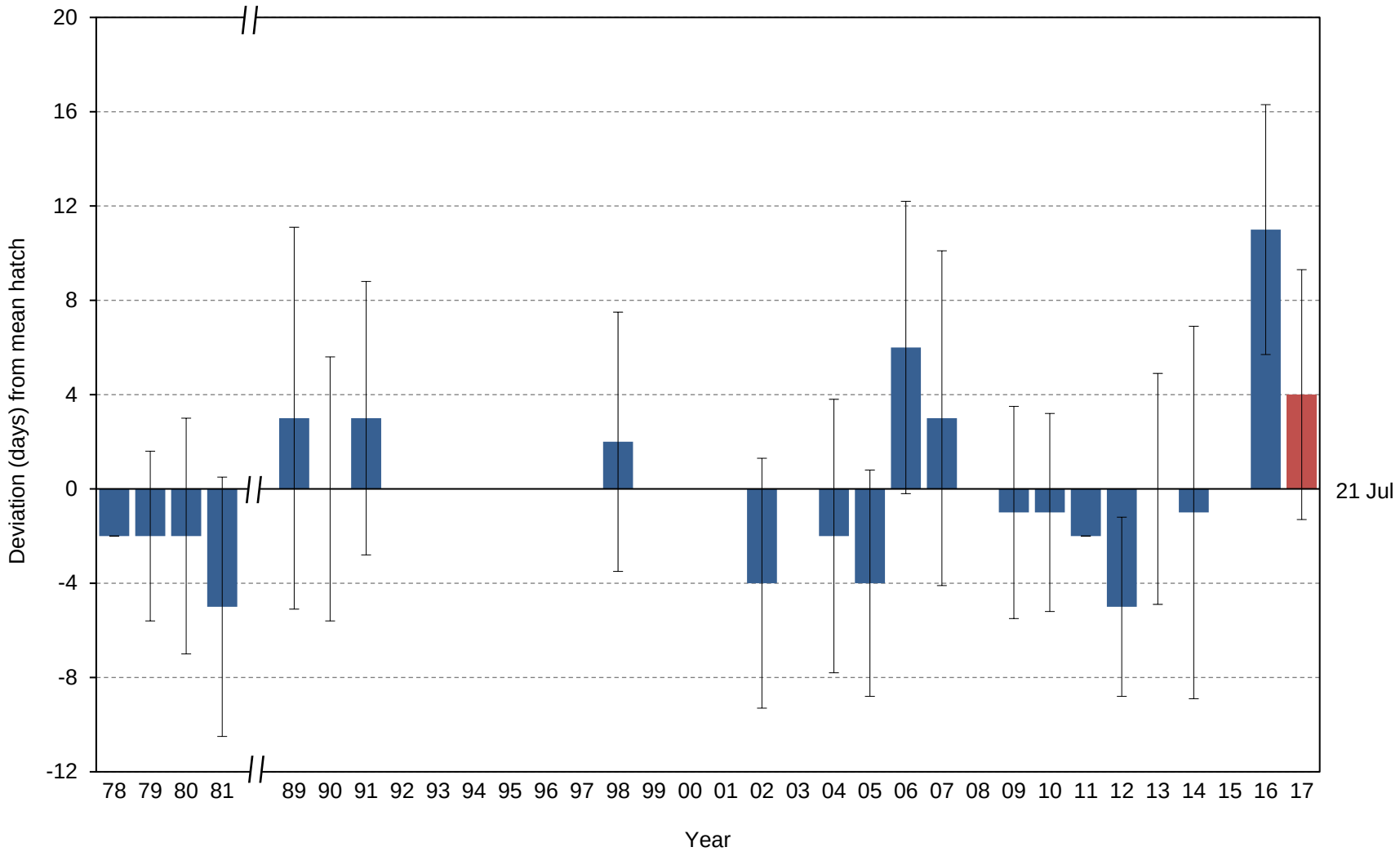

Figure 8. Yearly hatch date deviation (from the 1978-2016 average of 21 July) for thick-billed murres at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1981-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008 and no eggs hatched in plots in 2015; data potentially exist in 1995 but have not yet been summarized.

Table 10. Breeding chronology of thick-billed murres at Chowiet Island, Alaska. No data were collected in 1981-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched in plots in 2015.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First "jump"
1978	19 Jul[b]	-	-	-	-	-
1979	19 Jul	3.6	53	13 Jul	27 Jul	31 Jul
1980	18 Jul	5.0	58	10 Jul	1 Aug	26 Jul
1981	16 Jul	5.5	69	8 Jul	3 Aug	24 Jul
1989	24 Jul	8.1	36	11 Jul	16 Aug	28 Jul
1990	21 Jul	5.6	53	13 Jul	8 Aug	4 Aug
1991	24 Jul	5.8	83	11 Jul	18 Aug	1 Aug
1995	xx[c]	xx	xx	xx	xx	xx
1998	23 Jul	5.5	5	18 Jul	2 Aug	9 Aug
2002	17 Jul	5.3	42	8 Jul	2 Aug	26 Jul
2004	18 Jul	5.8	45	10 Jul	13 Aug	27 Jul
2005	17 Jul	4.8	73	9 Jul	29 Jul	29 Jul
2006	27 Jul	6.2	49	17 Jul	18 Aug	27 Jul
2007	24 Jul	7.1	68	13 Jul	16 Aug	2 Aug
2009	20 Jul	4.5	26	13 Jul	29 Jul	31 Jul
2010	20 Jul	4.2	45	13 Jul	2 Aug	29 Jul
2011	19 Jul	0.0	1	19 Jul	-	23 Jul
2012	15 Jul	3.8	43	5 Jul	26 Jul	26 Jul
2013	21 Jul	4.9	59	11 Jul	8 Aug	3 Aug
2014	20 Jul	7.9	46	3 Jul	14 Aug	30 Jul
2016	31 Jul	5.3	53	20 Jul	11 Aug	8 Aug
2017	25 Jul	5.3	59	17 Jul	12 Aug	3 Aug

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]Extrapolated from lay dates using mean incubation period.
[c]xx indicates data may potentially exist but have not yet been summarized.

Table 11. Frequency distribution of hatch dates for thick-billed murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1981-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; data from individual nests are not available in 1978 and no eggs hatched in plots in 2015.

Julian date[a]	No. nests hatching on Julian date									
	79	80	81	89	90	91	95	98	02	04
184	-	-	-	-	-	-	xx[b]	-	-	-
185	-	-	-	-	-	-	xx	-	-	-
186	-	-	-	-	-	-	xx	-	-	-
187	-	-	-	-	-	-	xx	-	-	-
188	-	-	-	-	-	-	xx	-	-	-
189	-	-	2	-	-	-	xx	-	1	-
190	-	-	-	-	-	-	xx	-	-	-
191	-	-	8	-	-	-	xx	-	4	-
192	-	2	-	1	-	1	xx	-	-	2
193	-	-	11	1	-	-	xx	-	5	1
194	6	7	-	-	3	-	xx	-	-	3
195	-	-	15	-	-	-	xx	-	-	1
196	6	13	-	-	5	5	xx	-	9	8
197	-	-	13	-	-	-	xx	-	6	-
198	6	10	-	8	7	3	xx	-	-	5
199	-	-	6	1	2	4	xx	2	5	1
200	15	5	-	-	12	8	xx	-	-	12
201	-	-	3	3	-	5	xx	-	5	1
202	8	6	-	1	10	4	xx	-	-	5
203	-	-	2	2	-	2	xx	-	1	-
204	7	6	-	4	2	5	xx	2	-	1
205	-	-	4	2	1	3	xx	-	3	-
206	4	4	-	4	2	23	xx	-	-	-
207	-	-	-	-	-	-	xx	-	-	-
208	1	2	-	1	1	2	xx	-	-	2
209	-	-	1	-	-	-	xx	-	2	-
210	-	1	-	2	4	11	xx	-	-	1
211	-	-	3	1	-	-	xx	-	-	1
212	-	1	-	1	2	1	xx	-	-	-
213	-	-	-	-	-	2	xx	-	-	-
214	-	1	-	-	-	1	xx	1	1	-
215	-	-	1	-	-	-	xx	-	-	-
216	-	-	-	-	-	-	xx	-	-	-
217	-	-	-	-	-	-	xx	-	-	-
218	-	-	-	-	1	1	xx	-	-	-
219	-	-	-	-	-	-	xx	-	-	-
220	-	-	-	1	1	1	xx	-	-	-
221	-	-	-	-	-	-	xx	-	-	-
222	-	-	-	-	-	-	xx	-	-	-
223	-	-	-	2	-	-	xx	-	-	-
224	-	-	-	-	-	-	xx	-	-	-
225	-	-	-	-	-	-	xx	-	-	-
226	-	-	-	-	-	-	xx	-	-	1
227	-	-	-	-	-	-	xx	-	-	-
228	-	-	-	1	-	-	xx	-	-	-
229	-	-	-	-	-	-	xx	-	-	-
230	-	-	-	-	-	1	xx	-	-	-
n	53	58	69	36	53	83	xx	5	42	45

Table 11 (continued). Frequency distribution of hatch dates for thick-billed murres at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1981-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; data from individual nests are not available in 1978 and no eggs hatched in plots in 2015.

Julian date[a]	No. nests hatching on Julian date										
	05	06	07	09	10	11	12	13	14	16	17
184	-	-	-	-	-	-	-	-	1	-	-
185	-	-	-	-	-	-	-	-	-	-	-
186	-	-	-	-	-	-	-	-	-	-	-
187	-	-	-	-	-	-	1	-	-	-	-
188	-	-	-	-	-	-	-	-	-	-	-
189	-	-	-	-	-	-	-	-	-	-	-
190	1	-	-	-	-	-	-	-	-	-	-
191	11	-	-	-	-	-	-	-	-	-	-
192	-	-	-	-	-	-	7	1	-	-	-
193	1	-	-	-	-	-	-	1	1	-	-
194	4	-	3	5	4	-	8	-	5	-	-
195	9	-	-	-	-	-	-	-	-	-	-
196	11	-	2	-	3	-	-	13	-	-	-
197	-	-	-	-	-	-	-	-	4	-	-
198	1	1	8	-	2	-	18	1	17	-	3
199	-	2	-	-	7	-	-	2	-	-	-
200	20	1	6	8	11	1	3	2	-	-	1
201	1	-	2	-	1	-	-	-	-	-	-
202	2	9	3	-	-	-	5	13	1	2	22
203	1	2	13	-	-	-	-	-	5	-	-
204	5	-	8	10	8	-	-	11	-	-	4
205	1	2	-	-	4	-	-	5	1	4	-
206	3	3	4	-	3	-	-	4	4	2	-
207	-	5	-	-	-	-	-	1	-	-	-
208	-	3	4	2	-	-	1	1	3	-	21
209	-	3	1	-	-	-	-	-	-	10	-
210	2	3	3	1	1	-	-	3	-	3	-
211	-	3	2	-	-	-	-	-	-	1	-
212	-	5	1	-	-	-	-	-	-	-	2
213	-	1	-	-	-	-	-	-	-	7	-
214	-	1	2	-	1	-	-	-	-	10	2
215	-	1	-	-	-	-	-	-	-	-	1
216	-	-	1	-	-	-	-	-	1	-	1
217	-	-	-	-	-	-	-	-	-	-	-
218	-	1	1	-	-	-	-	-	1	8	-
219	-	1	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	1	-	-	-
221	-	-	1	-	-	-	-	-	-	1	-
222	-	1	1	-	-	-	-	-	-	4	1
223	-	-	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	-	-	1	1
225	-	-	-	-	-	-	-	-	-	-	-
226	-	-	1	-	-	-	-	-	2	-	-
227	-	-	-	-	-	-	-	-	-	-	-
228	-	-	1	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-
230	-	1	-	-	-	-	-	-	-	-	-
n	73	49	68	26	45	1	43	59	46	53	59

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.
[b]xx indicates data potentially exist but have not yet been summarized.

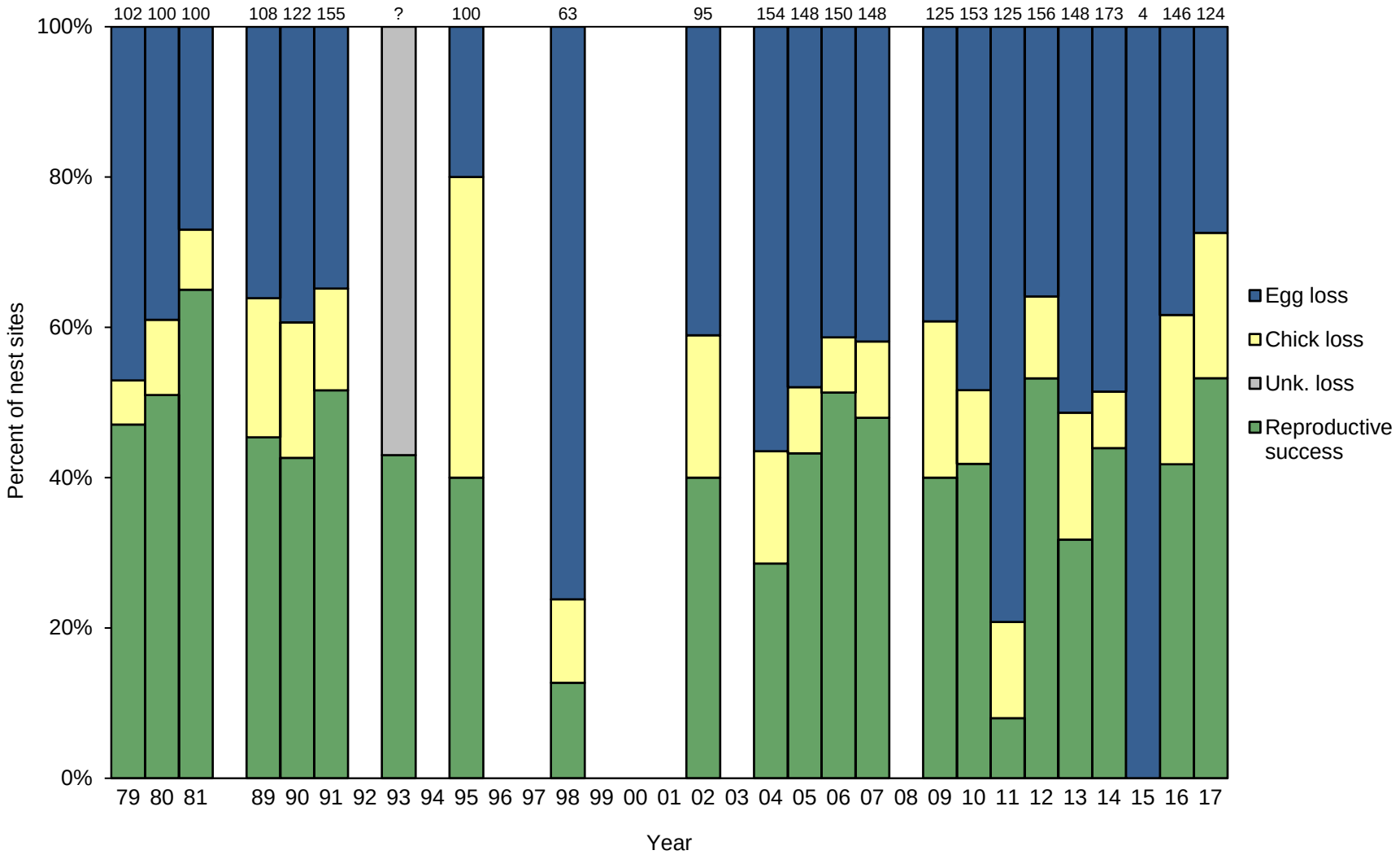

Figure 9. Reproductive performance of thick-billed murres at Chowiet Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Failure in years where no eggs were laid is considered 100% egg loss. Numbers above columns indicate sample sizes (B). No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008; data potentially exist in 1993 but have not yet been summarized.

Table 12. Reproductive performance of thick-billed murres at Chowiet Island, Alaska. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nesting success (D/B)[a]	Fledging success (F/D)[b]	Reproductive success (F/B)
1979	102	54	48	0.53	0.89	0.47
1980	100	61	51	0.61	0.84	0.51
1981	100	73	65	0.73	0.89	0.65
1989	108	69	49	0.64	0.71	0.45
1990	122	74	52	0.61	0.70	0.43
1991	155	101	80	0.65	0.79	0.52
1993	xx[c]	xx	xx	xx	xx	0.43
1995	100	80	40	0.80	0.50	0.40
1998	63	15	8	0.24	0.53	0.13
2002	95	56	38	0.59	0.68	0.40
2004	154	67	44	0.44	0.66	0.29
2005	148	77	64	0.52	0.83	0.43
2006	150	88	77	0.59	0.88	0.51
2007	148	86	71	0.58	0.83	0.48
2009	125	76	50	0.61	0.66	0.40
2010	153	79	64	0.52	0.81	0.42
2011	125	26	10	0.21	0.38	0.08
2012	156	100	83	0.64	0.83	0.53
2013	148	72	47	0.49	0.65	0.32
2014	173	89	76	0.51	0.85	0.44
2015	4	0	0	0.00	0.00	0.00
2016	146	90	61	0.62	0.68	0.42
2017	124	90	66	0.73	0.73	0.53

[a]For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B) equals total eggs (C), and nest sites w/ chicks (D) equals total chicks (E).

[b]For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D) equals total chicks (E), and nest sites w/ chicks fledged (F) equals total chicks fledged (G).

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

Table 13. Standard deviation in reproductive performance parameters of thick-billed murres at Chowiet Island, Alaska. Sampling for murres is clustered by plot except when sample sizes per plot are too small to allow for groupings or plot data are not available. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	No. plots[a]	Nest sites w/ eggs	Sampling design[b]	Nesting success	Fledging success	Reproductive success
1979	6	102	Cluster by plot	0.08	0.03	0.07
1980	6	100	Cluster by plot	0.02	0.04	0.01
1981	6	100	Cluster by plot	0.04	0.02	0.03
1989	4	108	Cluster by plot	0.09	0.05	0.10
1990	5	122	Cluster by plot	0.04	0.06	0.04
1991	7	155	Cluster by plot	0.05	0.04	0.06
1993	xx[c]	xx	xx	xx	xx	xx
1995	xx	xx	xx	xx	xx	xx
1998	4	63	Cluster by plot	0.11	0.22	0.08
2002	4	95	Cluster by plot	0.05	0.05	0.06
2004	6	154	Cluster by plot	0.06	0.07	0.04
2005	7	148	Cluster by plot	0.05	0.03	0.06
2006	5	150	Cluster by plot	0.04	0.05	0.05
2007	7	148	Cluster by plot	0.06	0.04	0.05
2009	8	125	Cluster by plot	0.05	0.08	0.06
2010	7	153	Cluster by plot	0.02	0.03	0.03
2011	8	125	Cluster by plot	0.05	0.05	0.02
2012	7	156	Cluster by plot	0.03	0.03	0.04
2013	6	148	Cluster by plot	0.04	0.04	0.03
2014	6	173	Cluster by plot	0.04	0.03	0.04
2015	2	4	Cluster by plot	0.00	0.00	0.00
2016	6	146	Cluster by plot	0.06	0.06	0.07
2017	5	124	Cluster by plot	0.04	0.03	0.04

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

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

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

Table 14. Reproductive performance of thick-billed murres at Chowiet Island, Alaska in 2017.

Parameter	Plot					Total	SD[b]
	P03 M01/03/04/ 05/06/07[a]	P03 MJH1/3[a]	P03 MJH2/4[a]	P03 MJW1	P09 M02		
Nest sites w/ eggs (B)	33	40	24	9	18	124	-
Nest sites w/ chicks (D)	22	26	19	8	15	90	-
Nest sites w/ chicks fledged (F)	15	19	15	5	12	66	-
Nesting success (D/B)[c]	0.67	0.65	0.79	0.89	0.83	0.73	0.04
Fledging success (F/D)[d]	0.68	0.73	0.79	0.63	0.80	0.73	0.03
Reproductive success (F/B)	0.45	0.48	0.63	0.56	0.67	0.53	0.04

[a]Plots were combined for statistical purposes.

[b]Standard deviations are calculated based on plot as a sample unit.

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

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

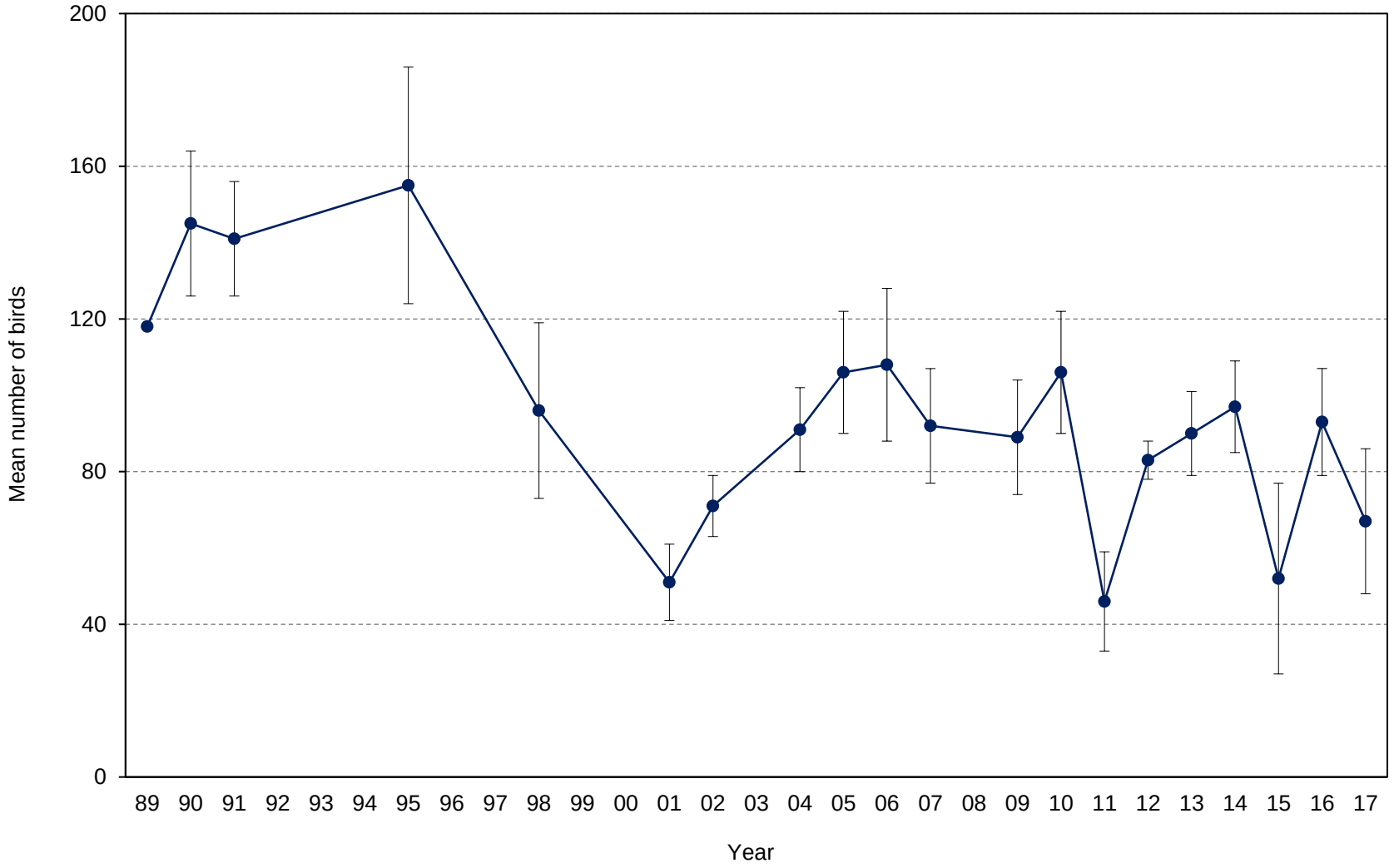

Figure 10. Mean numbers of thick-billed murres counted on index plots at Chowiet Island, Alaska. Error bars represent standard deviation. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008; data potentially exist in 1977-1981 but have not yet been summarized.

Table 15. Numbers of thick-billed murres counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	1977	1978	1979	1980	1981	1989	1990	1991	1993	1995	1998	2001	2002
1	xx[a]	xx	xx	xx	xx	xx	139	156	xx	177	76	53	78
2	xx	xx	xx	xx	xx	xx	152	137	xx	151	90	59	72
3	xx	xx	xx	xx	xx	xx	114	161	xx	186	110	40	78
4	xx	xx	xx	xx	xx	xx	139	146	xx	117	74	-	76
5	xx	xx	xx	xx	xx	xx	130	140	xx	174	129	-	75
6	xx	xx	xx	xx	xx	xx	144	131	xx	141	-	-	63
7	xx	xx	xx	xx	xx	xx	185	161	xx	-	-	-	66
8	xx	xx	xx	xx	xx	xx	137	132	xx	-	-	-	56
9	xx	xx	xx	xx	xx	xx	155	134	xx	-	-	-	71
10	xx	xx	xx	xx	xx	xx	152	113	xx	-	-	-	-
Mean	xx	xx	xx	xx	xx	118	145	141	xx	158	96	51	71
n	xx	xx	xx	xx	xx	4	10	10	xx	6	5	3	9
SD	xx	xx	xx	xx	xx	xx	19	15	xx	26	23	10	8
First count	20 Jun	22 Jun	20 Jun	20 Jun	20 Jun	21 Jun	25 Jun	28 Jun	xx	24 Jun	1 Jul	19 Jul	19 Jun
Last count	1 Aug	28 Jun	1 Aug	1 Aug	1 Aug	27 Jul	1 Aug	21 Jul	xx	28 Jul	21 Jul	23 Jul	29 Jul

Table 15 (continued). Numbers of thick-billed murres counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015[b]	2016	2017
1	108	96	100	64	108	88	39	77	72	104	92	97	44
2	101	73	120	81	99	88	35	85	105	89	70	115	41
3	86	108	127	80	116	90	38	78	100	115	65	84	54
4	107	92	82	96	81	127	55	84	97	94	62	115	59
5	75	109	130	98	91	112	58	83	100	82	76	90	60
6	90	119	113	80	89	118	61	81	89	95	37	94	68
7	87	130	68	102	79	128	54	77	87	113	45	91	95
8	94	107	118	111	89	113	50	92	83	87	34	94	77
9	83	115	117	106	71	108	51	87	80	108	14	79	92
10	82	112	107	102	69	89	21	85	82	83	26	72	83
Mean	91	106	108	92	89	106	46	83	90	97	52	93	67
n	10	10	10	10	10	10	10	10	10	10	10	10	10
SD	11	16	20	15	15	16	13	5	11	12	25	14	19
First count	26 Jun	21 Jun	21 Jun	26 Jun	6 Jul	22 Jun	20 Jun	23 Jun	21 Jun	20 Jun	22 Jun	20 Jun	20 Jun
Last count	19 Jul	31 Jul	30 Jul	28 Jul	31 Jul	27 Jul	29 Jul	29 Jul	29 Jul	28 Jul	18 Jun	17 Jul	20 Jul

[a]xx indicates data potentially exist but have not yet been summarized.
[b]Low counts for most replicates in 2015 due to reproductive failure; murres abandoned the cliffs, rafting offshore for a few weeks after cliff abandonment.

Table 16. Numbers of thick-billed murres counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date										Mean	SD
	20 Jun	21 Jun	25 Jun	29 Jun	4 Jul	5 Jul	10 Jul	11 Jul	16 Jul	20 Jul		
A03M04	7	4	7	6	6	7	16	12	17	11	-	-
A03M05	4	8	13	9	5	10	11	9	16	10	-	-
A06M01	0	0	0	0	0	0	0	0	1	1	-	-
A09M02	33	29	34	44	49	51	68	56	58	61	-	-
Total	44	41	54	59	60	68	95	77	92	83	67	19

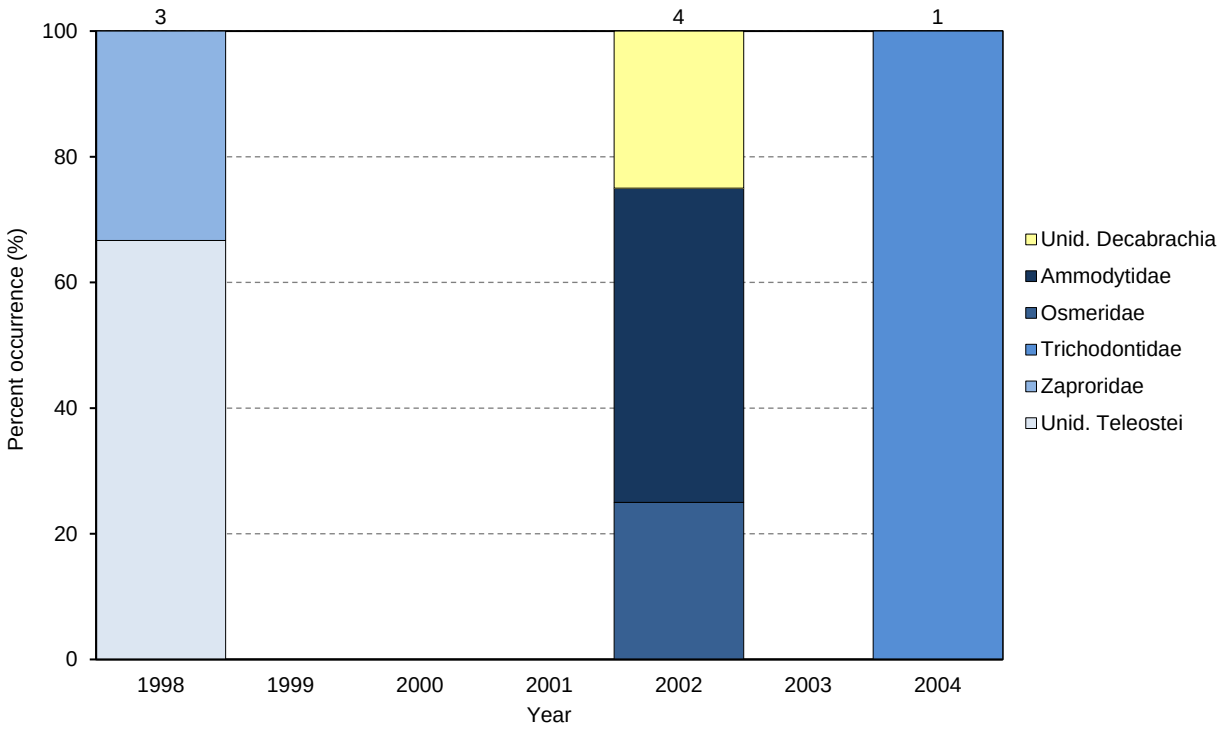

Figure 11. Frequency of occurrence of major prey items in diets of thick-billed murre chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999-2001, 2003, or after 2004.

Table 17. Frequency of occurrence of major prey items in diets of thick-billed murre chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. No diet samples were collected in 1999-2001, 2003, or after 2004. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2002	2004
No. samples	3	4	1
Invertebrates	**-**	**25.0**	**-**
Cephalopoda	**-**	**25.0**	**-**
Unid. Decabrachia	-	25.0	-
Fish	**100.0**	**75.0**	**100.0**
Teleostei	**100.0**	**75.0**	**100.0**
Ammodytidae	**-**	**50.0**	**-**
Ammodytes spp.	-	50.0	-
Osmeridae	**-**	**25.0**	**-**
Mallotus villosus	-	25.0	-
Trichodontidae	**-**	**-**	**100.0**
Trichodon trichodon	-	-	100.0
Zaproridae	**33.3**	**-**	**-**
Zaprora silenus	33.3	-	-
Unid. Teleostei	66.7	-	-

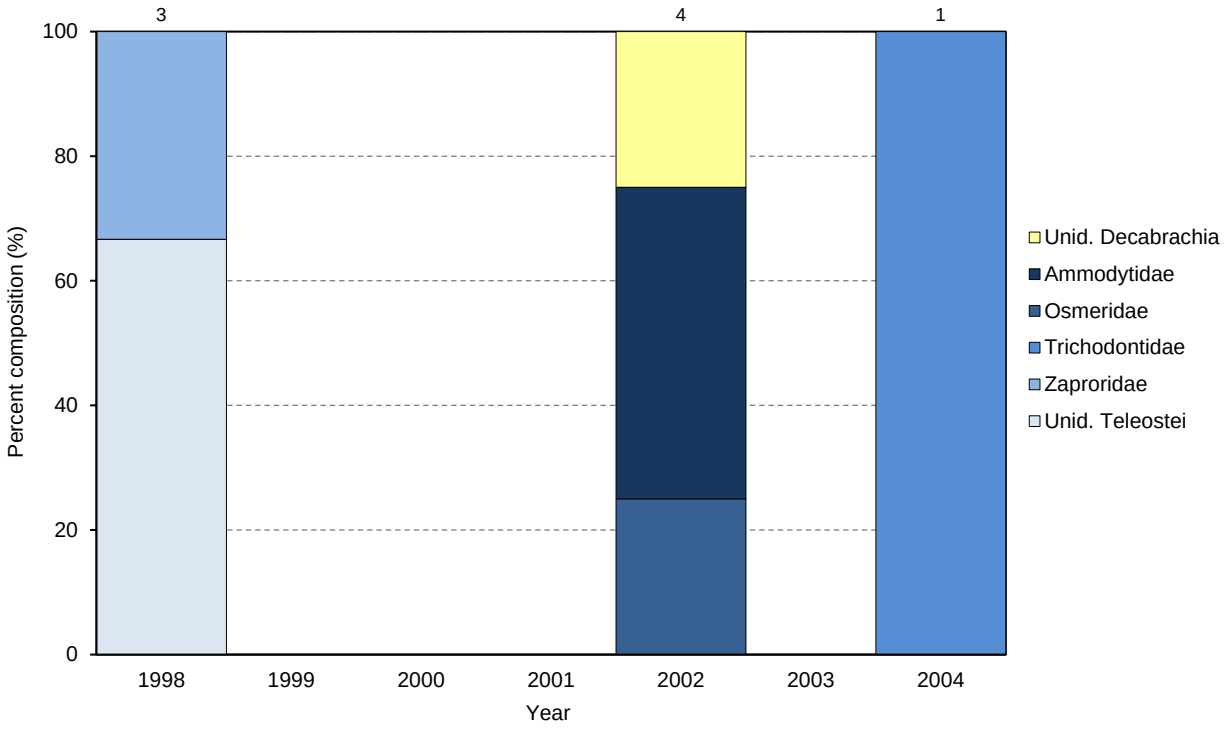

Figure 12. Percent composition of major prey items in diets of thick-billed murre chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1999-2001, 2003, or after 2004.

Table 18. Percent composition of major prey items in diets of thick-billed murre chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads observed from adults returning to the colony to feed chicks. No diet samples were collected in 1999-2001, 2003, or after 2004. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2002	2004
No. samples	3	4	1
No. individuals	3	4	1
Invertebrates	**-**	**25.0**	**-**
Cephalopoda	**-**	**25.0**	**-**
Unid. Decabrachia	-	25.0	-
Fish	**100.0**	**75.0**	**100.0**
Teleostei	**100.0**	**75.0**	**100.0**
Ammodytidae	**-**	**50.0**	**-**
Ammodytes spp.	-	50.0	-
Osmeridae	**-**	**25.0**	**-**
Mallotus villosus	-	25.0	-
Trichodontidae	**-**	**-**	**100.0**
Trichodon trichodon	-	-	100.0
Zaproridae	**33.3**	**-**	**-**
Zaprora silenus	33.3	-	-
Unid. Teleostei	66.7	-	-

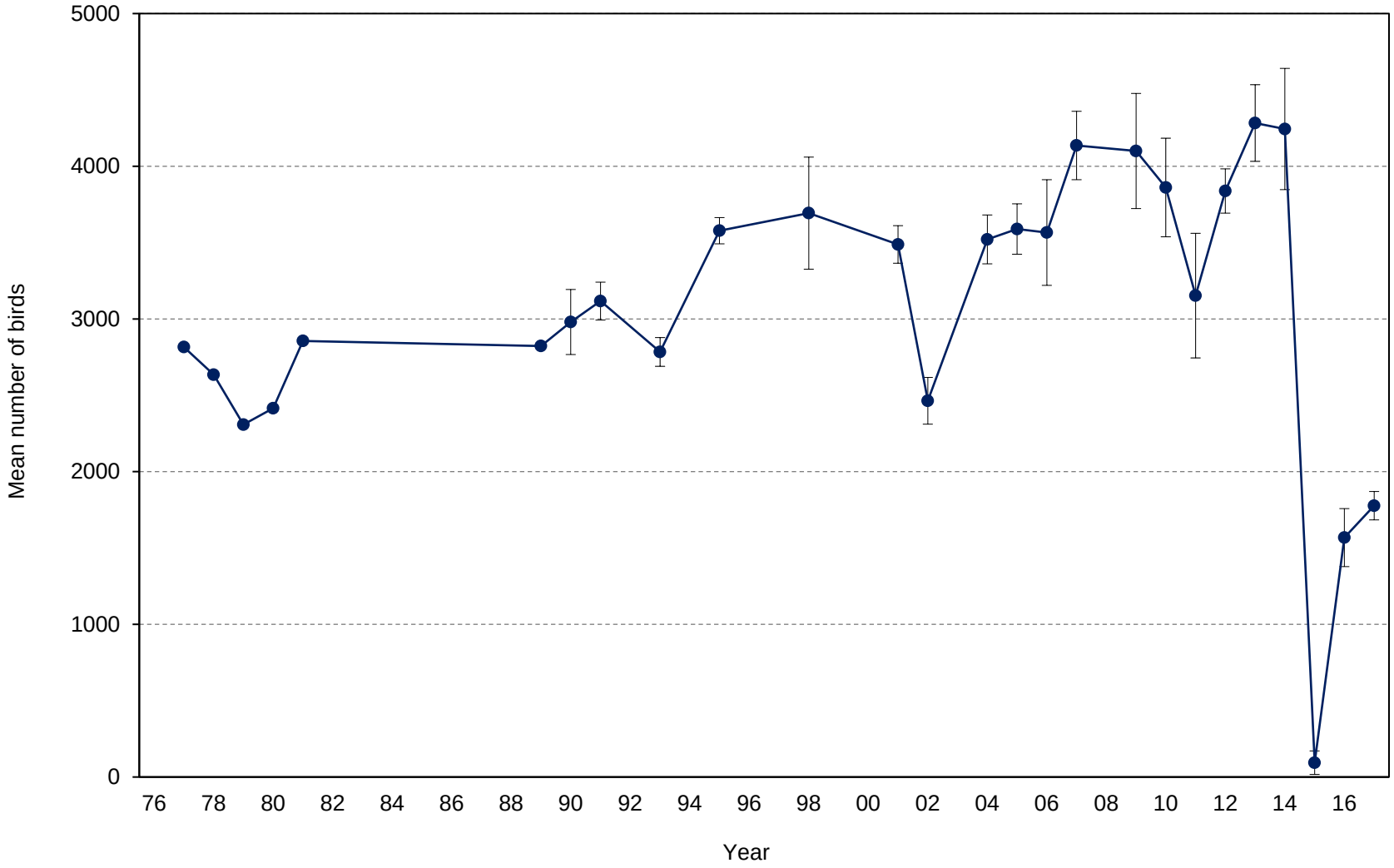

Figure 13. Mean numbers of murres (common, thick-billed, and unknown murres) counted on index plots at Chowiet Island, Alaska. Error bars represent standard deviation. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Table 19. Numbers of murres (common, thick-billed, and unknown murres) counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	1977	1978	1979	1980	1981	1989	1990	1991	1993	1995	1998	2001	2002
1	xx[a]	xx	xx	xx	xx	xx	2547	3062	xx	3376	3075	3627	2526
2	xx	xx	xx	xx	xx	xx	2887	2851	xx	3089	3795	3445	2594
3	xx	xx	xx	xx	xx	xx	2772	3186	xx	3573	3928	3392	2485
4	xx	xx	xx	xx	xx	xx	3053	3139	xx	3678	3674	-	2201
5	xx	xx	xx	xx	xx	xx	2907	2990	xx	3590	3994	-	2392
6	xx	xx	xx	xx	xx	xx	2999	3162	xx	3469	-	-	2238
7	xx	xx	xx	xx	xx	xx	3256	3254	xx	-	-	-	2594
8	xx	xx	xx	xx	xx	xx	3025	3263	xx	-	-	-	2559
9	xx	xx	xx	xx	xx	xx	3206	3147	xx	-	-	-	2588
10	xx	xx	xx	xx	xx	xx	3143	3114	xx	-	-	-	-
Mean	2816	2635	2308	2415	2856	2823	2980	3117	2784	3463	3693	3488	2464
n	xx	xx	xx	xx	xx	13	10	10	10	6	5	3	9
SD	xx	xx	xx	xx	xx	xx	212	124	94	211	367	123	153
First count	20 Jun	22 Jun	20 Jun	20 Jun	20 Jun	21 Jun	25 Jun	28 Jun	xx	24 Jun	1 Jul	19 Jul	19 Jun
Last count	1 Aug	28 Jun	1 Aug	1 Aug	1 Aug	27 Jul	1 Aug	21 Jul	xx	28 Jul	21 Jul	23 Jul	29 Jul

Table 19 (continued). Numbers of murres (common, thick-billed, and unknown murres) counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015[b]	2016	2017
1	3947	3218	3137	3939	4423	3008	2712	3994	3878	3617	209	1760	1737
2	3543	3421	3828	4309	4886	3786	2582	3732	4179	3834	110	1875	1767
3	3453	3536	3808	3779	4231	4063	3188	3756	4214	4005	153	1705	1684
4	3502	3715	3076	3915	3995	3976	2778	3820	4364	3889	38	1720	1690
5	3485	3677	3758	4346	4060	3934	3353	3761	4264	4332	17	1616	1739
6	3502	3673	3784	4186	3846	3955	3362	4164	4062	4640	35	1458	1763
7	3334	3747	3021	4350	3954	4226	3722	3841	4274	4696	-	1445	1847
8	3456	3728	3584	4398	4299	3870	3549	3878	4827	4657	-	1398	1760
9	3460	3575	3881	4204	3681	3848	3513	3672	4291	4602	-	1335	2007
10	3523	3596	3779	3932	3622	3939	2774	3767	4472	4163	-	1371	1774
Mean	3521	3589	3566	4136	4100	3861	3153	3839	4283	4244	94	1568	1777
n	10	10	10	10	10	10	10	10	10	10	6	10	10
SD	160	165	346	224	377	323	408	145	251	397	77	190	93
First count	26 Jun	21 Jun	21 Jun	26 Jun	6 Jul	22 Jun	22 Jun	23 Jun	21 Jun	20 Jun	6 Jul	20 Jun	20 Jun
Last count	19 Jul	31 Jul	30 Jul	28 Jul	31 Jul	27 Jul	29 Jul	29 Jul	29 Jul	28 Jul	18 Jul	17 Jul	20 Jul

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

[b]Low counts for most replicates in 2015 due to reproductive failure; murres abandoned the cliffs, rafting offshore for a few weeks after cliff abandonment. Additionally, four replicates in June, with higher numbers, were excluded due to counts for several common murrre plots being obtained from photos.

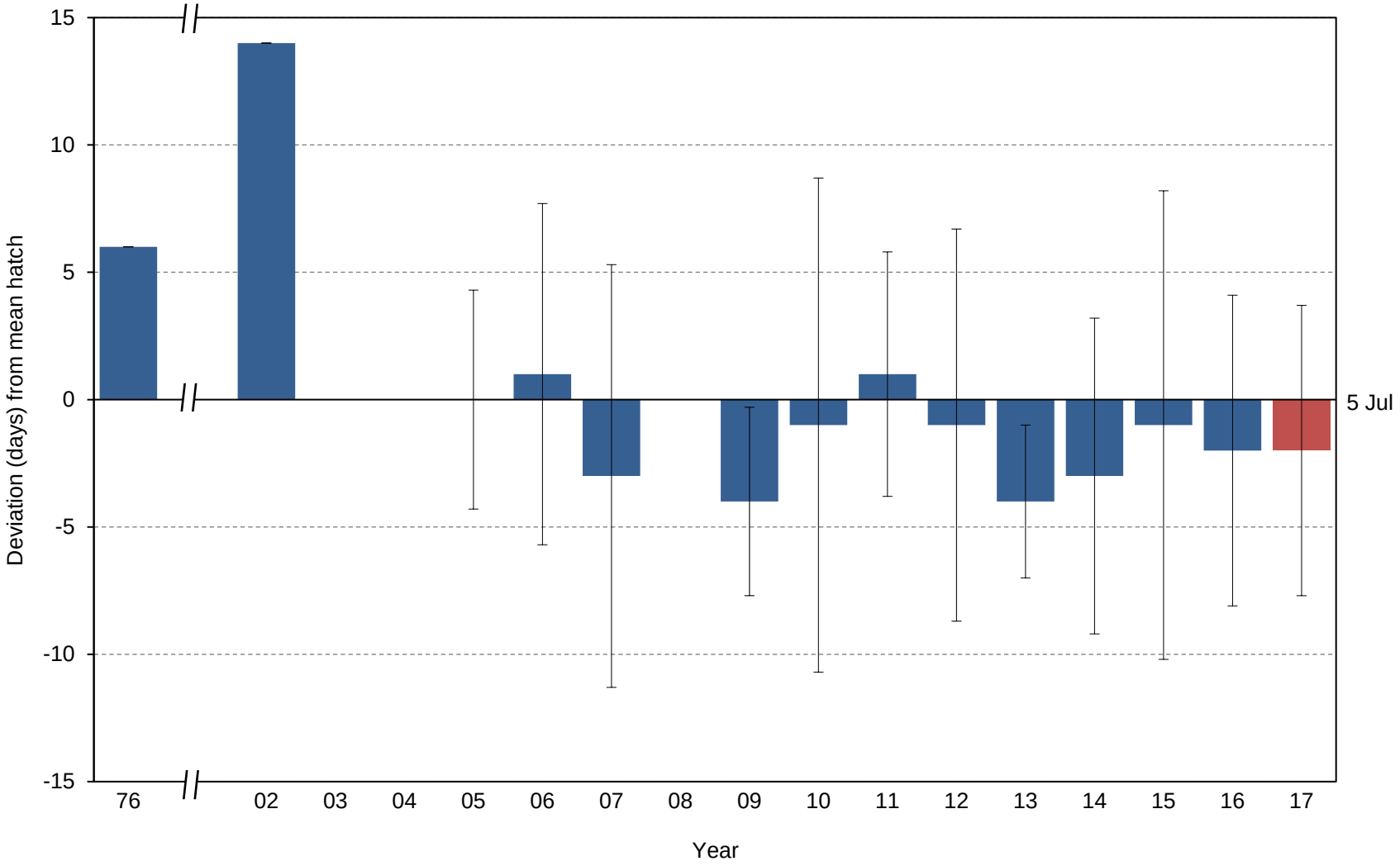

Figure 14. Yearly hatch date deviation (from the 1976-2016 average of 5 July) for parakeet auklets at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1977-1997, 1999-2001, 2003-2004, or 2008; no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 1998.

Table 20. Breeding chronology of parakeet auklets at Chowiet Island, Alaska. No data were collected in 1977-1997, 1999-2001, 2003-2004, or 2008; no hatch dates were recorded with the appropriate egg to chick interval (≤ 7 days) in 1998.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge
1976	10 Jul	-	5	25 Jun	16 Jul	-
1998	-	-	-	-	-	17 Aug
2002	19 Jul	0.0	2	19 Jul	-	-
2005	5 Jul	4.3	13	27 Jun	13 Jul	1 Aug
2006	6 Jul	6.7	7	30 Jun	21 Jun	28 Jul
2007	2 Jul	8.3	7	23 Jun	21 Jul	2 Aug
2009	1 Jul	3.7	9	25 Jun	7 Jul	1 Aug
2010	4 Jul	9.7	10	23 Jun	31 Jul	31 Jul
2011	6 Jul	4.8	4	29 Jun	11 Jul	7 Aug
2012	3 Jul	7.7	10	24 Jun	22 Jul	29 Jul
2013	1 Jul	3.0	13	25 Jun	5 Jul	28 Jul
2014	2 Jul	6.2	20	24 Jun	15 Jul	27 Jul
2015	4 Jul	9.2	10	23 Jun	19 Jul	28 Jul
2016	2 Jul	6.1	14	24 Jun	22 Jul	29 Jul
2017	3 Jul	5.7	41	25 Jun	19 Jul	28 Jul

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

Table 21. Frequency distribution of hatch dates for parakeet auklets at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1977-1997, 1999-2001, 2003-2004, or 2008 and no hatch dates were recorded with the appropriate egg to chick interval in 1998; data from individual nests are not available in 1976.

Julian date[a]	No. nests hatching on Julian date												
	02	05	06	07	09	10	11	12	13	14	15	16	17
174	-	-	-	1	-	1	-	-	-	-	3	-	-
175	-	-	-	-	-	-	-	-	-	2	-	-	-
176	-	-	-	-	1	-	-	1	1	4	-	1	4
177	-	-	-	-	-	-	-	-	1	-	-	-	-
178	-	1	-	-	1	-	-	-	-	-	-	-	1
179	-	-	-	2	-	-	-	-	-	-	-	-	2
180	2	1	-	-	2	2	1	4	-	3	2	1	13
181	-	-	1	-	-	2	-	-	4	-	-	-	-
182	-	-	2	2	1	-	-	-	-	1	-	6	2
183	-	-	-	-	-	1	-	-	-	-	-	-	-
184	-	5	-	-	-	-	1	-	3	-	-	1	1
185	-	-	-	1	3	-	-	2	3	-	-	-	-
186	-	1	-	-	-	3	-	-	1	6	1	4	11
187	-	2	3	-	-	-	-	-	-	-	-	-	-
188	-	-	-	-	1	-	-	-	-	-	-	-	-
189	-	-	-	-	-	-	-	-	-	2	-	-	-
190	-	1	-	-	-	-	1	2	-	-	-	-	2
191	-	-	-	-	-	-	-	-	-	-	-	-	-
192	-	1	-	-	-	-	1	-	-	-	1	-	2
193	-	-	-	-	-	-	-	-	-	-	-	-	-
194	-	1	-	-	-	-	-	-	-	1	2	-	-
195	-	-	-	-	-	-	-	-	-	-	-	-	-
196	-	-	-	-	-	-	-	-	-	1	-	-	2
197	-	-	-	-	-	-	-	-	-	-	-	-	-
198	-	-	-	-	-	-	-	-	-	-	-	-	-
199	-	-	-	-	-	-	-	-	-	-	-	-	-
200	-	-	-	-	-	-	-	-	-	-	1	-	1
201	-	-	-	-	-	-	-	-	-	-	-	-	-
202	-	-	1	1	-	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	-	-	-	-	-	-	-
204	-	-	-	-	-	-	-	1	-	-	-	1	-
205	-	-	-	-	-	-	-	-	-	-	-	-	-
206	-	-	-	-	-	-	-	-	-	-	-	-	-
207	-	-	-	-	-	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	-	-	-	-	-	-
209	-	-	-	-	-	-	-	-	-	-	-	-	-
210	-	-	-	-	-	-	-	-	-	-	-	-	-
211	-	-	-	-	-	-	-	-	-	-	-	-	-
212	-	-	-	-	-	1	-	-	-	-	-	-	-
n	2	13	7	7	9	10	4	10	13	20	10	14	41

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

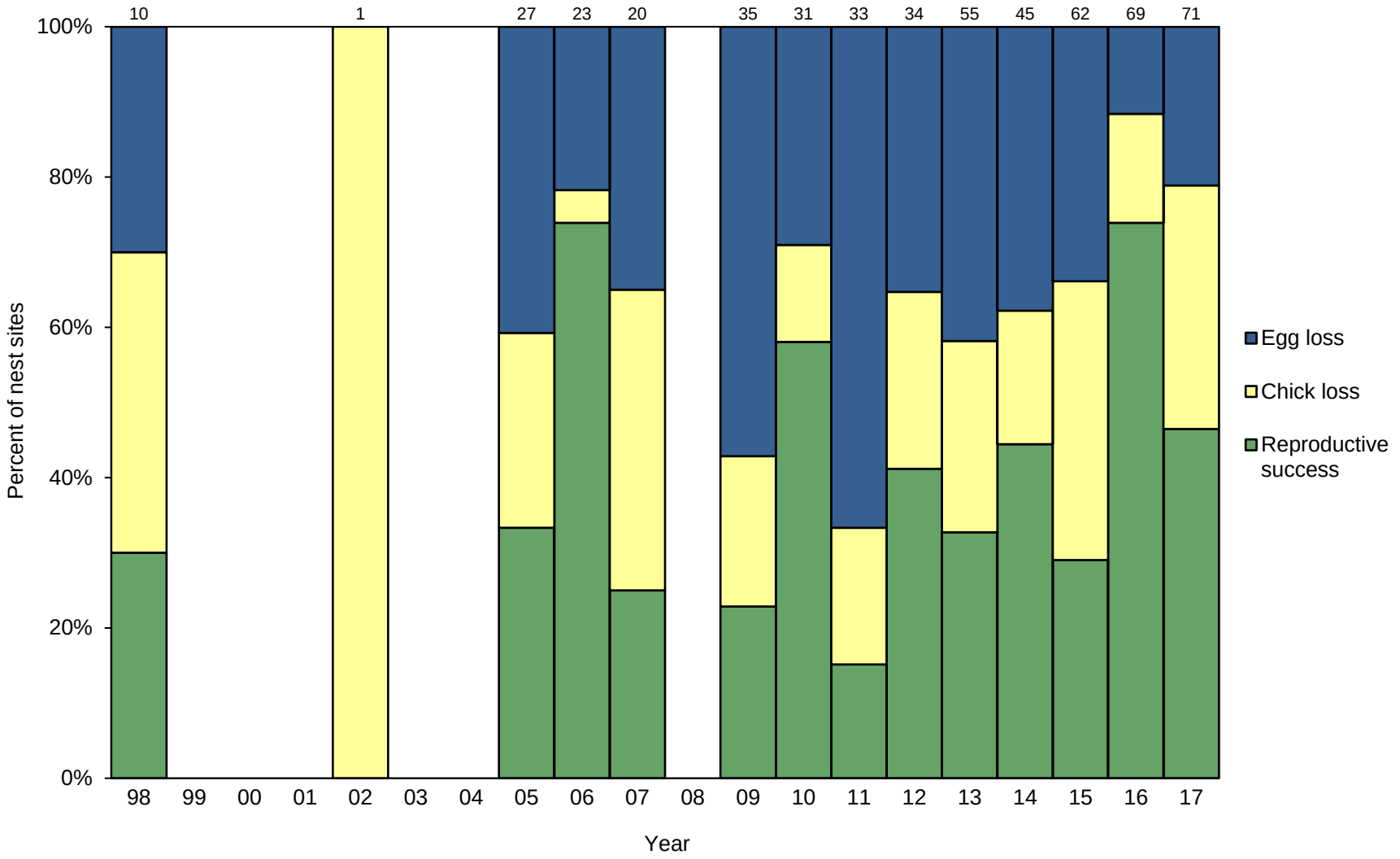

Figure 15. Reproductive performance of parakeet auklets at Chowiet Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Numbers above columns indicate sample sizes (B). No data were collected in 1977-1997, 1999-2001, 2003-2004, or 2008; data potentially exist in 1976 but have not yet been summarized.

Table 22. Reproductive performance of parakeet auklets at Chowiet Island, Alaska. No data were collected in 1977-1997, 1999-2001, 2003-2004, or 2008.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nesting success (D/B)[a]	Fledging success (F/D)[b]	Reproductive success (F/B)
1976	7	5	xx[c]	0.71	xx	xx
1998	10	7	3	0.70	0.43	0.30
2002	1	1	0	1.00	0.00	0.00
2005	27	16	9	0.59	0.56	0.33
2006	23	18	17	0.78	0.94	0.74
2007	20	13	5	0.65	0.38	0.25
2009	35	15	8	0.43	0.53	0.23
2010	31	22	18	0.71	0.82	0.58
2011	33	11	5	0.33	0.45	0.15
2012	34	22	14	0.65	0.64	0.41
2013	55	32	18	0.58	0.56	0.33
2014	45	28	20	0.62	0.71	0.44
2015	62	41	18	0.66	0.44	0.29
2016	69	61	51	0.88	0.84	0.74
2017	71	56	33	0.79	0.59	0.46

[a]For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B) equals total eggs (C), and nest sites w/ chicks (D) equals total chicks (E).

[b]For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D) equals total chicks (E), and nest sites w/ chicks fledged (F) equals total chicks fledged (G).

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

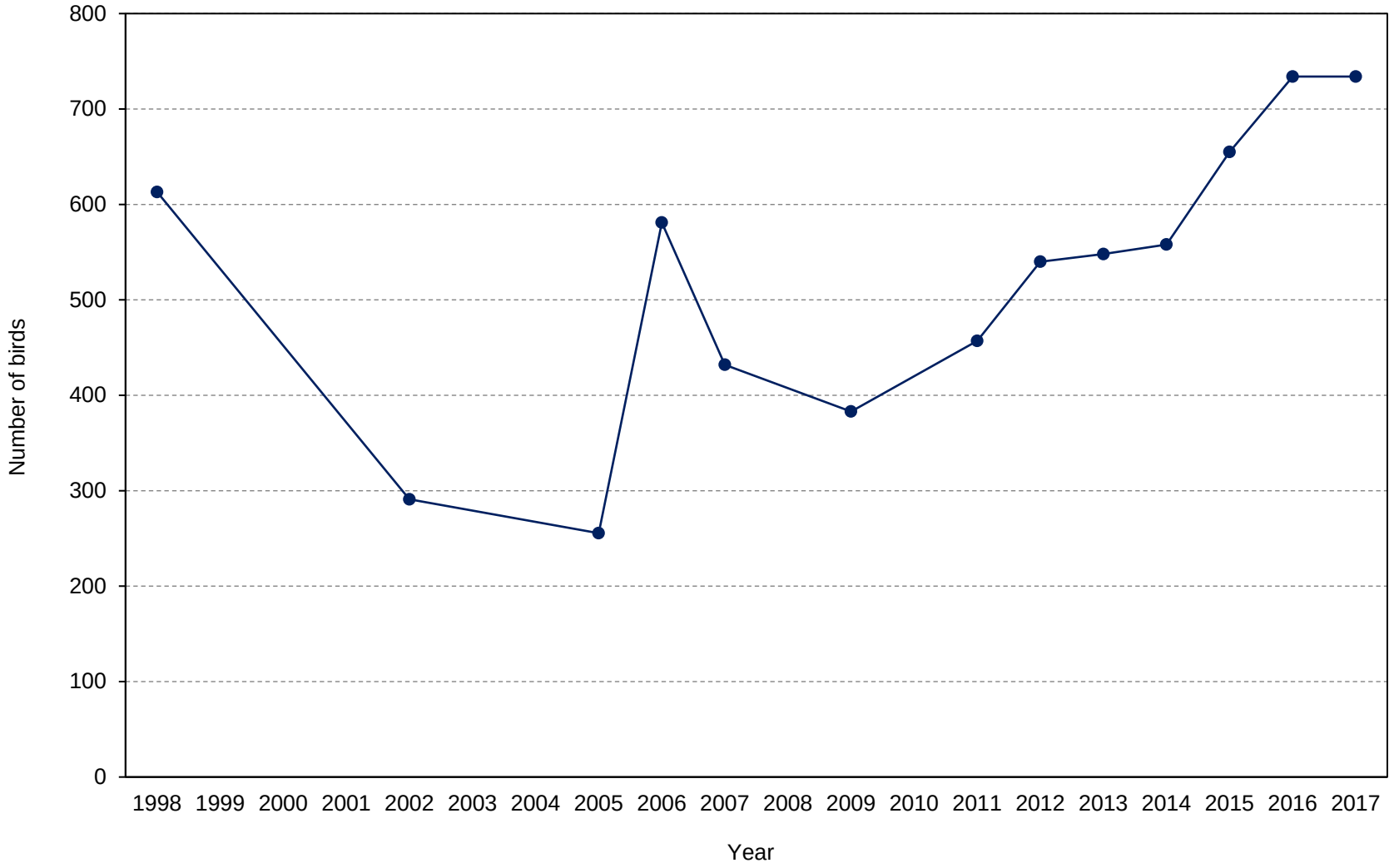

Figure 16. Maximum numbers of parakeet auklets counted on a water index plot at Chowiet Island, Alaska. Data include only counts conducted from 1 June to 15 July (mid egg-laying through hatching) each year. No counts were conducted in 1978-1992, 1996-1997, 1999-2001, 2003-2004, 2008, or 2010; data potentially exist in 1977 and 1993-1995 but have not yet been summarized.

Table 23. Numbers of parakeet auklets counted on a water index plot at Chowiet Island, Alaska. Data include only counts conducted from 1 June to 15 July (mid egg-laying through hatching) each year. No counts were conducted in 1978-1992, 1996-1997, 1999-2001, 2003-2004, 2008, or 2010.

Replicate	1977	1993	1994	1995	1998	2002	2005	2006	2007	2009	2011	2012	2013	2014	2015	2016	2017
1	xx[a]	xx	xx	xx	299	138	245	293	137	264	194	208	276	186	397	687	111
2	xx	xx	xx	xx	342	231	221	243	212	383	167	167	278	328	264	535	405
3	xx	xx	xx	xx	417	228	241	111	287	342	313	407	190	360	262	677	362
4	xx	xx	xx	xx	613	134	119	267	211	349	412	467	176	558	267	587	734
5	xx	xx	xx	xx	613	274	131	269	133	266	352	262	176	251	269	395	371
6	xx	xx	xx	xx	427	126	137	194	187	274	457	159	273	223	404	496	491
7	xx	xx	xx	xx	270	291	256	292	216	364	217	67	376	226	655	392	660
8	xx	xx	xx	xx	356	240	144	290	292	310	321	287	548	349	385	637	340
9	xx	xx	xx	xx	314	-	205	388	401	175	-	540	510	235	466	734	532
10	xx	xx	xx	xx	-	-	-	560	199	259	-	283	346	472	116	469	275
11	xx	xx	xx	xx	-	-	-	306	432	262	-	-	359	478	-	-	244
12	xx	xx	xx	xx	-	-	-	376	375	205	-	-	354	-	-	-	499
13	xx	xx	xx	xx	-	-	-	581	67	135	-	-	269	-	-	-	-
14	xx	xx	xx	xx	-	-	-	-	133	-	-	-	-	-	-	-	-
Mean	xx	xx	xx	xx	406	208	189	321	234	276	304	285	318	333	349	561	419
Max.	xx	xx	xx	xx	613	291	256	581	432	383	457	540	548	558	655	734	734
n	xx	xx	xx	xx	9	8	9	13	14	13	8	10	13	11	10	10	12
SD	xx	xx	xx	xx	128	66	55	131	109	74	104	148	116	124	148	123	176
First count	xx	xx	xx	xx	3 Jun	4 Jun	4 Jun	1 Jun	1 Jun	2 Jun	5 Jun	5 Jun	5 Jun	2 Jun	2 Jun	2 Jun	2 Jun
Last count	xx	xx	xx	xx	13 Jul	11 Jul	14 Jul	12 Jul	11 Jul	11 Jul	8 Jul	4 Jul	14 Jul	27 Jun	22 Jun	20 Jun	19 Jun
Count protocol[b]	A	A	A	A	B	B	C	D	C	C	E	E	E	E	E	E	E

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

[b]A=all replicates represent single count per day, all between 0700-0930h; B=all replicates represent single count per day, all between 0730h-0930h; C=all replicates represent the mean of two or more counts per day within 5%, all between 0730-0930h; D=some replicates represent single count per day, some represent the mean of two counts per day within 5%, all between 0730-0930h. E=all replicates represent the mean of two or more counts per day within 5%, all between 0700-0930.

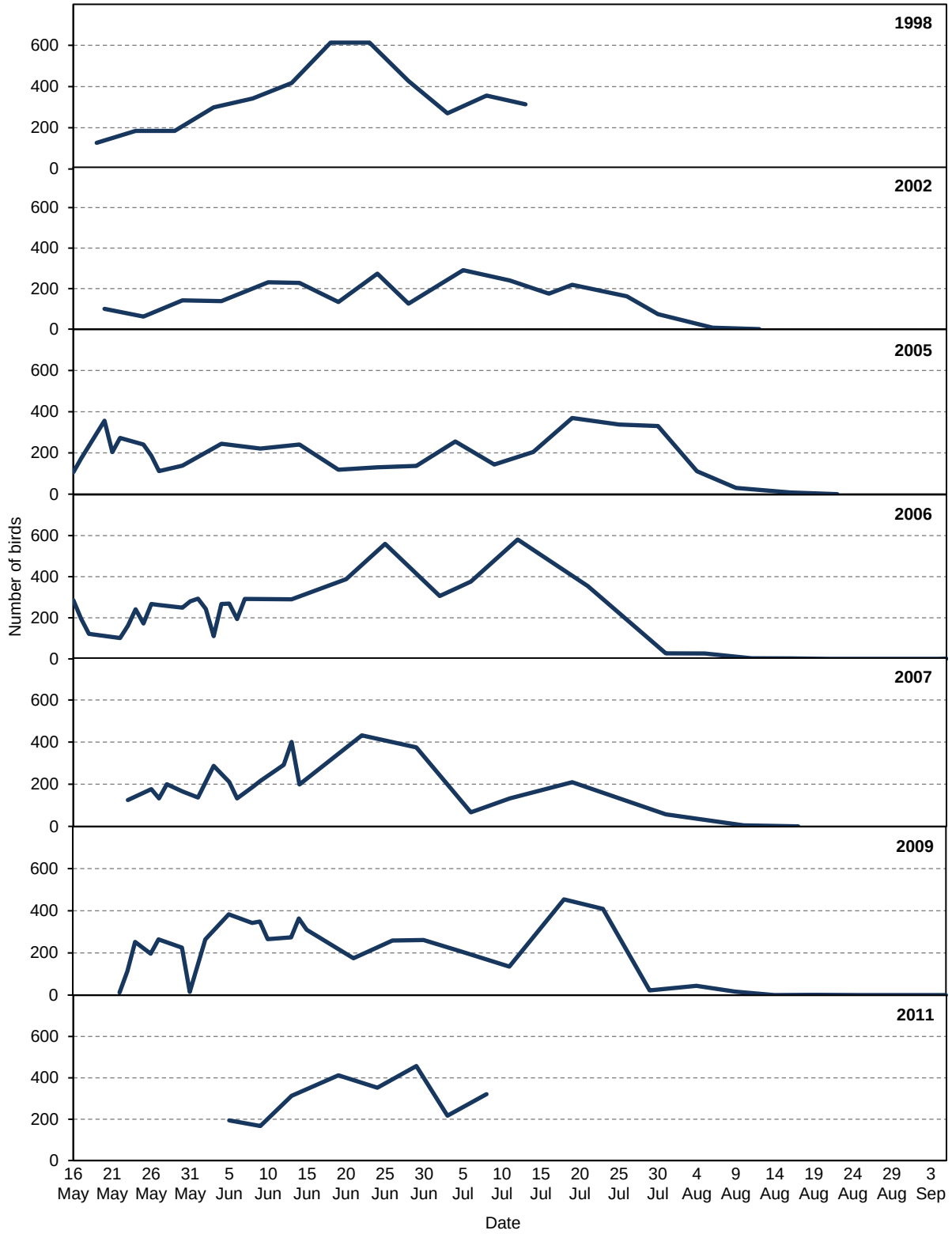

Figure 17. Numbers of parakeet auklets counted on a water index plot at Chowiet Island, Alaska. Starting in 2011, counts were conducted only during the period in the breeding season with lowest day-to-day variability; thus fewer counts during a smaller count window were conducted. No counts were conducted in 1999-2001, 2003-2004, 2008, or 2010.

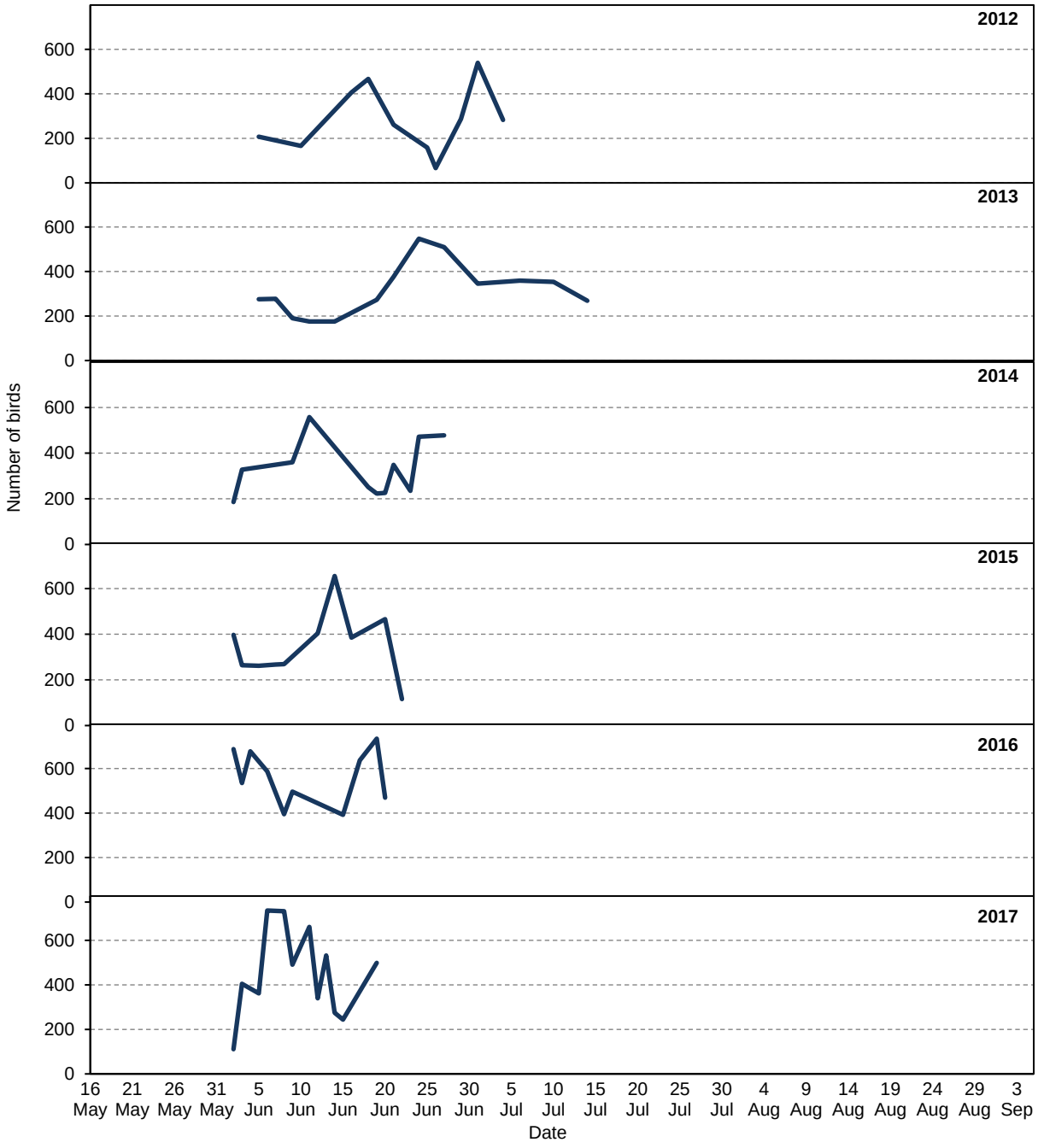

Figure 17 (continued). Numbers of parakeet auklets counted on a water index plot at Chowiet Island, Alaska. Starting in 2011, counts were conducted only during the period in the breeding season with lowest day-to-day variability; thus fewer counts during a smaller count window were conducted. No counts were conducted in 1999-2001, 2003-2004, 2008, or 2010.

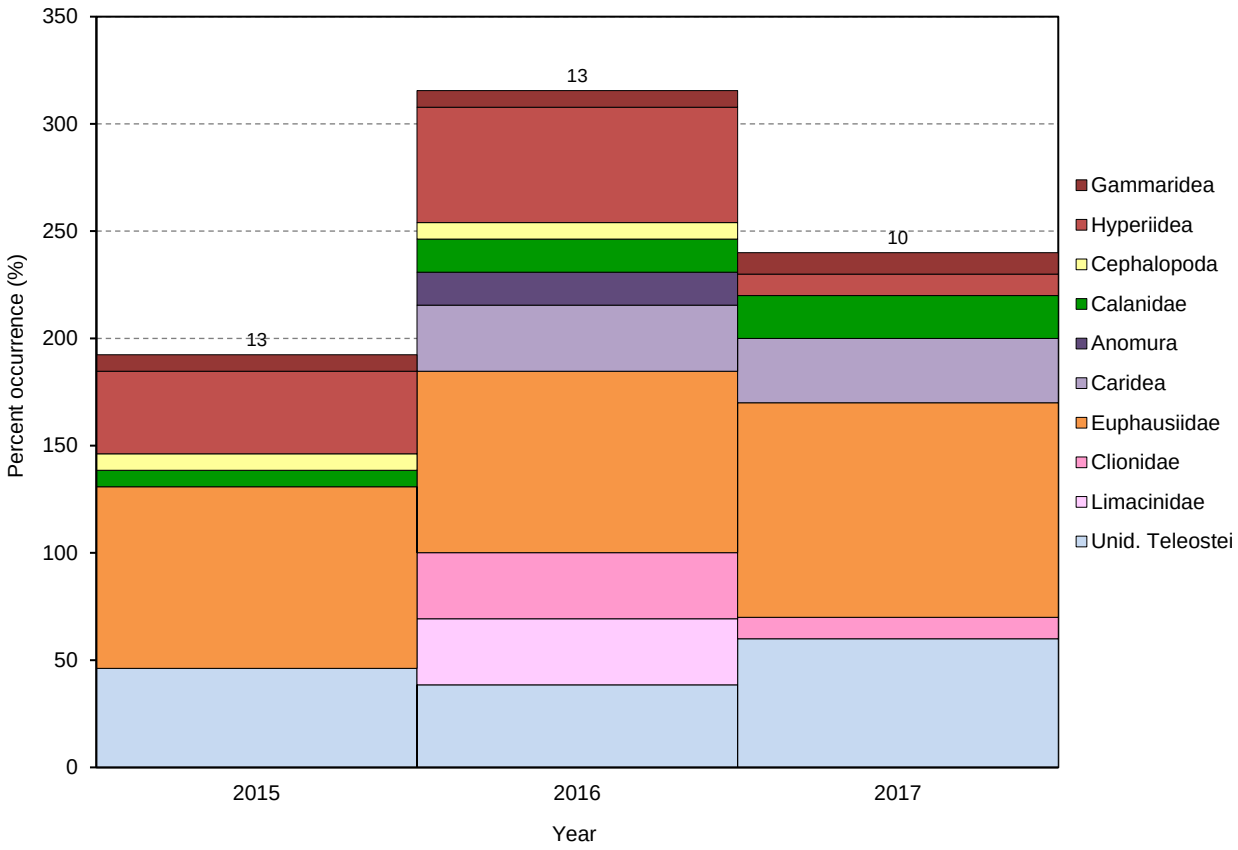

Figure 18. Frequency of occurrence of major prey items in diets of parakeet auklet chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes.

Table 24. Frequency of occurrence of major prey items in diets of parakeet auklet chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2015	2016	2017
No. samples	13	13	10
Invertebrates	**100.0**	**100.0**	**100.0**
Amphipoda	**46.2**	**61.5**	**20.0**
Gammaridea	**7.7**	**7.7**	**10.0**
Apherusa spp.	7.7	7.7	-
Other Gammaridea	-	-	10.0
Hyperiidea	**38.5**	**53.8**	**10.0**
Hyperia medusarum	30.8	53.8	-
Other Hyperiidea	7.7	-	10.0
Cephalopoda	7.7	7.7	-
Copepoda	**7.7**	**15.4**	**20.0**
Calanidae	**7.7**	**15.4**	**20.0**
Calanus marshallae	**-**	7.7	10.0
Neocalanus cristatus	7.7	7.7	10.0
Other Calanidae	-	7.7	-
Other Copepoda	-	-	10.0
Decapoda	**-**	**38.5**	**30.0**
Anomura	**-**	**15.4**	**-**
Paguridae	-	15.4	-
Caridea	**-**	**30.8**	**30.0**
Pandalidae	**-**	23.1	30.0
Other Caridea	-	7.7	-
Euphausiacea	**84.6**	**84.6**	**100.0**
Euphausiidae	**84.6**	**84.6**	**100.0**
Euphausia pacifica	7.7	-	20.0
Thysanoessa inermis	53.8	53.8	100.0
T. spinifera	46.2	46.2	100.0
Thysanoessa spp.	23.1	46.2	10.0
Unid. Euphausiidae	23.1	7.7	20.0
Other Euphausiidae	-	-	10.0
Gastropoda	**-**	**46.2**	**10.0**
Clionidae	**-**	**30.8**	**10.0**
Clione spp.	-	23.1	10.0
Other Clionidae	-	7.7	-
Limacinidae	**-**	**30.8**	**-**
Limacina helicina	-	30.8	-
Fish	**46.2**	**38.5**	**60.0**
Teleostei	**46.2**	**38.5**	**60.0**
Unid. Teleostei	46.2	38.5	60.0

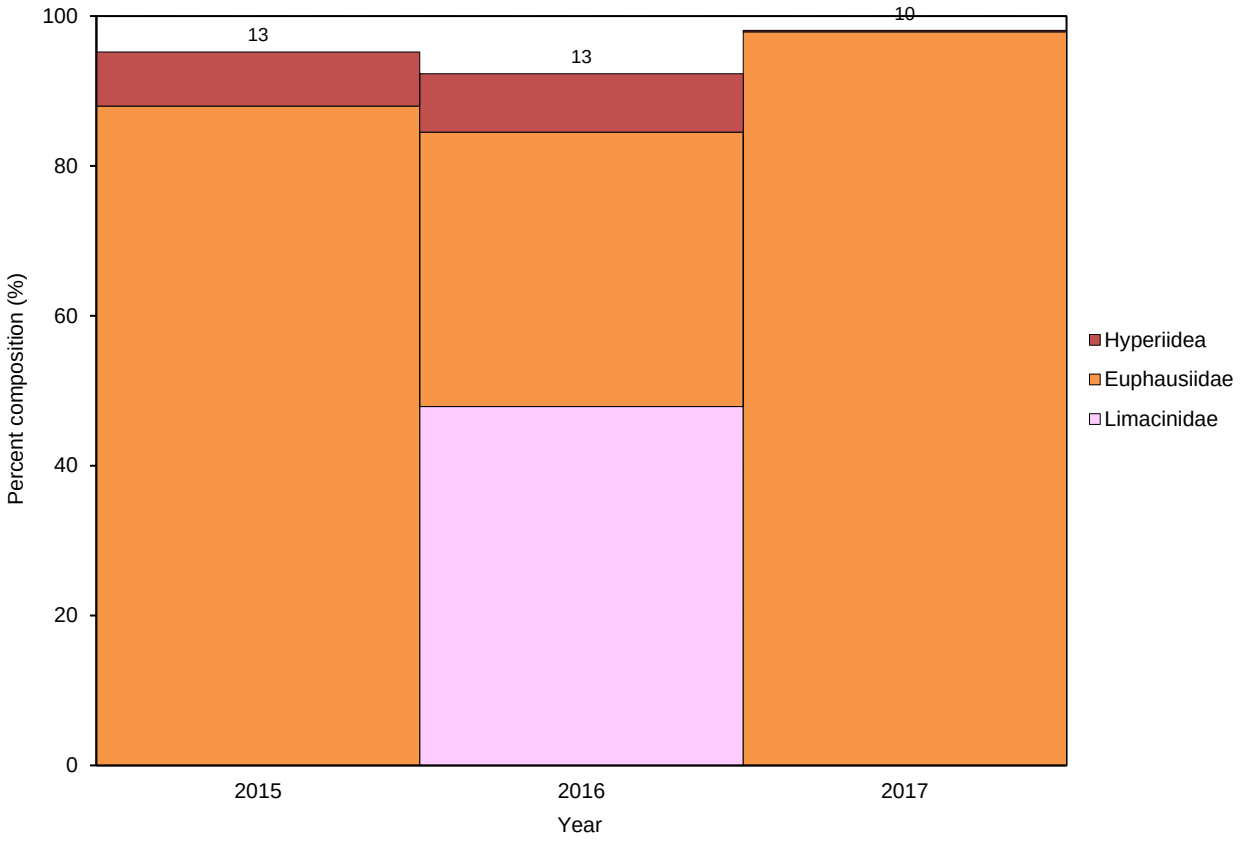

Figure 19. Percent composition of major prey items in diets of parakeet auklet chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of regurgitations collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes.

Table 25. Percent composition of major prey items in diets of parakeet auklet chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2015	2016	2017
No. samples	13	13	10
No. individuals	526	879	1210
Invertebrates	**97.3**	**98.3**	**99.4**
Amphipoda	**7.4**	**8.0**	**0.4**
Hyperiidea	**7.2**	**7.8**	**0.2**
Hyperia medusarum	7.0	7.8	-
Other Hyperiidea	0.2	-	0.2
Other Amphipoda	0.2	0.1	0.2
Euphausiacea	**88.0**	**36.6**	**97.9**
Euphausiidae	**88.0**	**36.6**	**97.9**
Thysanoessa inermis	54.4	16.5	81.2
T. spinifera	26.4	12.5	14.0
Other Euphausiidae	7.2	7.6	2.6
Gastropoda	**-**	**51.8**	**0.4**
Limacinidae	**-**	**47.9**	**-**
Limacina helicina	-	47.9	-
Other Gastropoda	-	3.9	0.4
Other Invertebrates	1.9	1.9	0.7
Fish	2.7	1.7	0.6

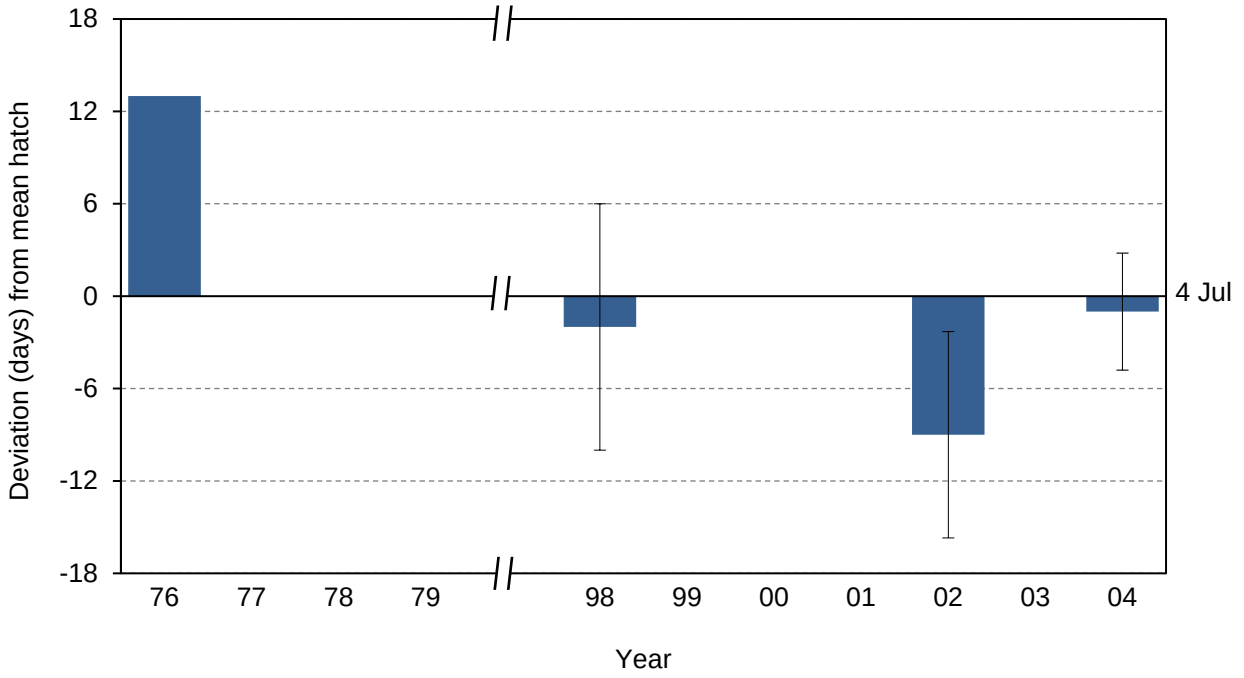

Figure 20. Yearly hatch date deviation (from the 1976-2004 average of 4 July) for rhinoceros auklets at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 1978, 1980-1997, 1999-2001, or 2003; data potentially exist in 1977 and 1979 but have not yet been summarized. Monitoring has not occurred since 2004 due to concerns about erosion and investigator disturbance at the South Bay colony.

Table 26. Breeding chronology of rhinoceros auklets at Chowiet Island, Alaska. No data were collected in 1978, 1980-1997, 1999-2001, or 2003. Monitoring has not occurred since 2004 (except limited fledge data in 2010) due to concerns about erosion and investigator disturbance at the South Bay colony.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge
1976	16 Jul	xx[b]	xx	xx	xx	19 Aug
1977	xx	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx
1998	2 Jul	8.x	24	xx	xx	xx
2002	26 Jun	7.x	14	16 Jun	6 Jul	1 Aug
2004	2 Jul	4.x	13	28 Jun	8 Jul	-
2010	-	-	-	-	-	14 Aug

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]xx indicates data potentially exist but have not yet been summarized.

Table 27. Frequency distribution of hatch dates for rhinoceros auklets at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1978, 1980-1997, 1999-2001, or 2003. Monitoring has not occurred since 2004 due to concerns about erosion and investigator disturbance at the South Bay colony.

Julian date[a]	No. nests hatching on Julian date					
	76	77	79	98	02	04
167	xx[b]	xx	xx	xx	1	-
168	xx	xx	xx	xx	-	-
169	xx	xx	xx	xx	1	-
170	xx	xx	xx	xx	2	-
171	xx	xx	xx	xx	-	-
172	xx	xx	xx	xx	1	-
173	xx	xx	xx	xx	-	-
174	xx	xx	xx	xx	1	-
175	xx	xx	xx	xx	1	-
176	xx	xx	xx	xx	1	-
177	xx	xx	xx	xx	1	-
178	xx	xx	xx	xx	-	-
179	xx	xx	xx	xx	-	-
180	xx	xx	xx	xx	1	5
181	xx	xx	xx	xx	-	-
182	xx	xx	xx	xx	-	-
183	xx	xx	xx	xx	1	-
184	xx	xx	xx	xx	1	-
185	xx	xx	xx	xx	-	5
186	xx	xx	xx	xx	-	-
187	xx	xx	xx	xx	2	-
188	xx	xx	xx	xx	-	-
189	xx	xx	xx	xx	-	-
190	xx	xx	xx	xx	-	3
191	xx	xx	xx	xx	-	-
192	xx	xx	xx	xx	-	-
193	xx	xx	xx	xx	-	-
194	xx	xx	xx	xx	-	-
195	xx	xx	xx	xx	-	-
196	xx	xx	xx	xx	-	-
197	xx	xx	xx	xx	-	-
198	xx	xx	xx	xx	-	-
199	xx	xx	xx	xx	-	-
200	xx	xx	xx	xx	-	-
201	xx	xx	xx	xx	-	-
n	xx	xx	xx	24	14	13

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.
[b]xx indicates data potentially exist but have not yet been summarized.

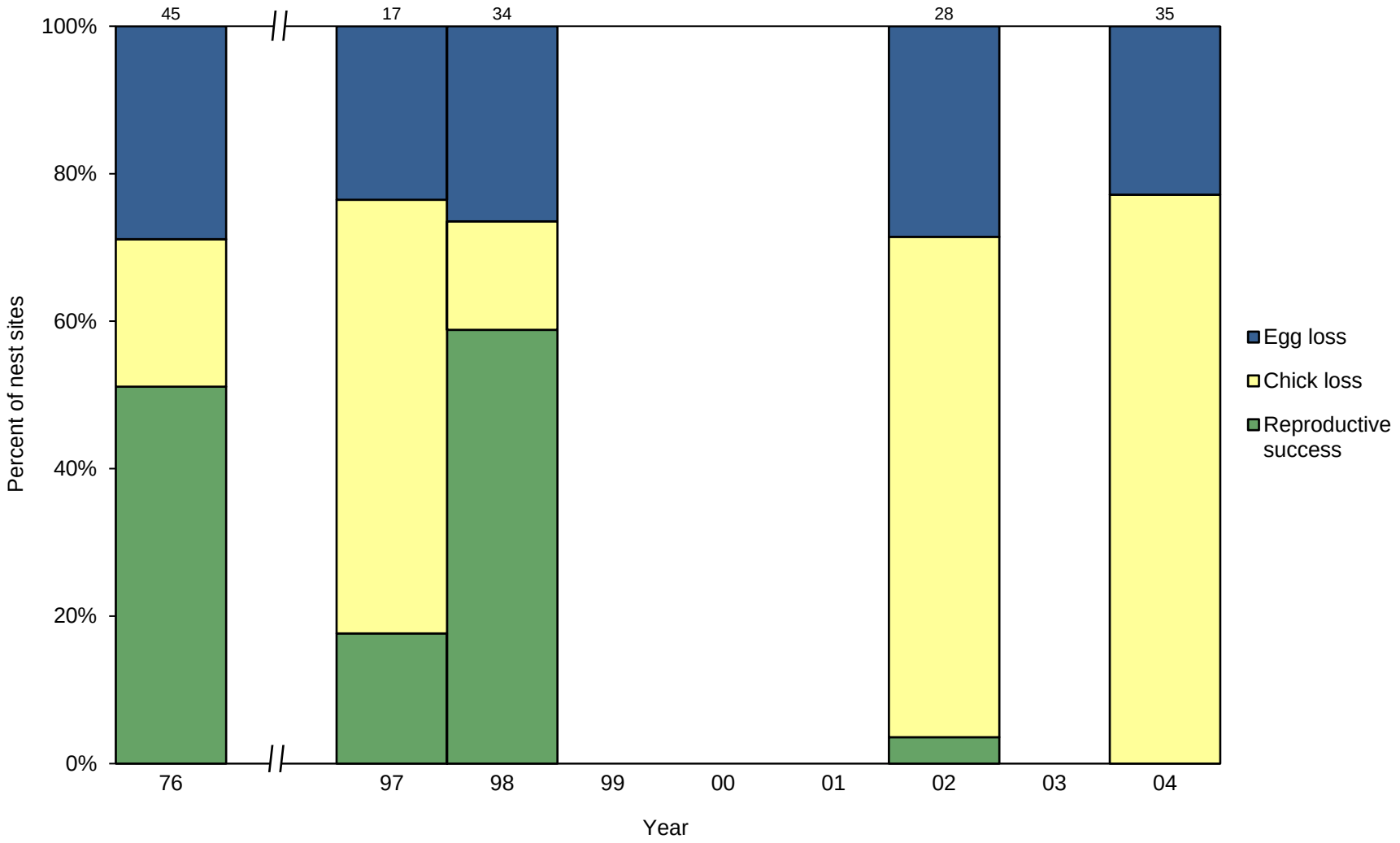

Figure 21. Reproductive performance of rhinoceros auklets at Chowiet Island, Alaska. Egg loss=(B-D)/B; Chick loss=(D-F)/B; Reproductive success=F/B, where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged. Numbers above columns indicate sample sizes (B). No data were collected in 1978, 1980-1996, 1999-2001, or 2003; data potentially exist in 1977 and 1979 but have not yet been summarized. Monitoring has not occurred since 2004 due to concerns about erosion and investigator disturbance at the South Bay colony. Some data exist in 2010 but only after chicks hatched so values are not comparable to those from previous years.

Table 28. Reproductive performance of rhinoceros auklets at Chowiet Island, Alaska. No data were collected in 1978, 1980-1996, 1999-2001, or 2003. Monitoring has not occurred since 2004 due to concerns about erosion and investigator disturbance at the South Bay colony. Some data exist in 2010 but only after chicks hatched, so values are not comparable to those from previous years (see Konyukhov 2011 for details).

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nesting success (D/B)[a]	Fledging success (F/D)[b]	Reproductive success (F/B)
1976	45	32	23	0.71	0.72	0.51
1977	xx[c]	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx
1997	17	13	3	0.76	0.23	0.18
1998	34	25	20	0.74	0.80	0.59
2002	28	20	1	0.71	0.05	0.04
2004	35	27	0	0.77	0.00	0.00

[a]For single-egg species, nesting success (D/B) is the same as hatching success (E/C) because nest sites w/ eggs (B) equals total eggs (C), and nest sites w/ chicks (D) equals total chicks (E).

[b]For single-egg species, fledging success (F/B) is the same as chick success (G/E) because nest sites w/ chicks (D) equals total chicks (E), and nest sites w/ chicks fledged (F) equals total chicks fledged (G).

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

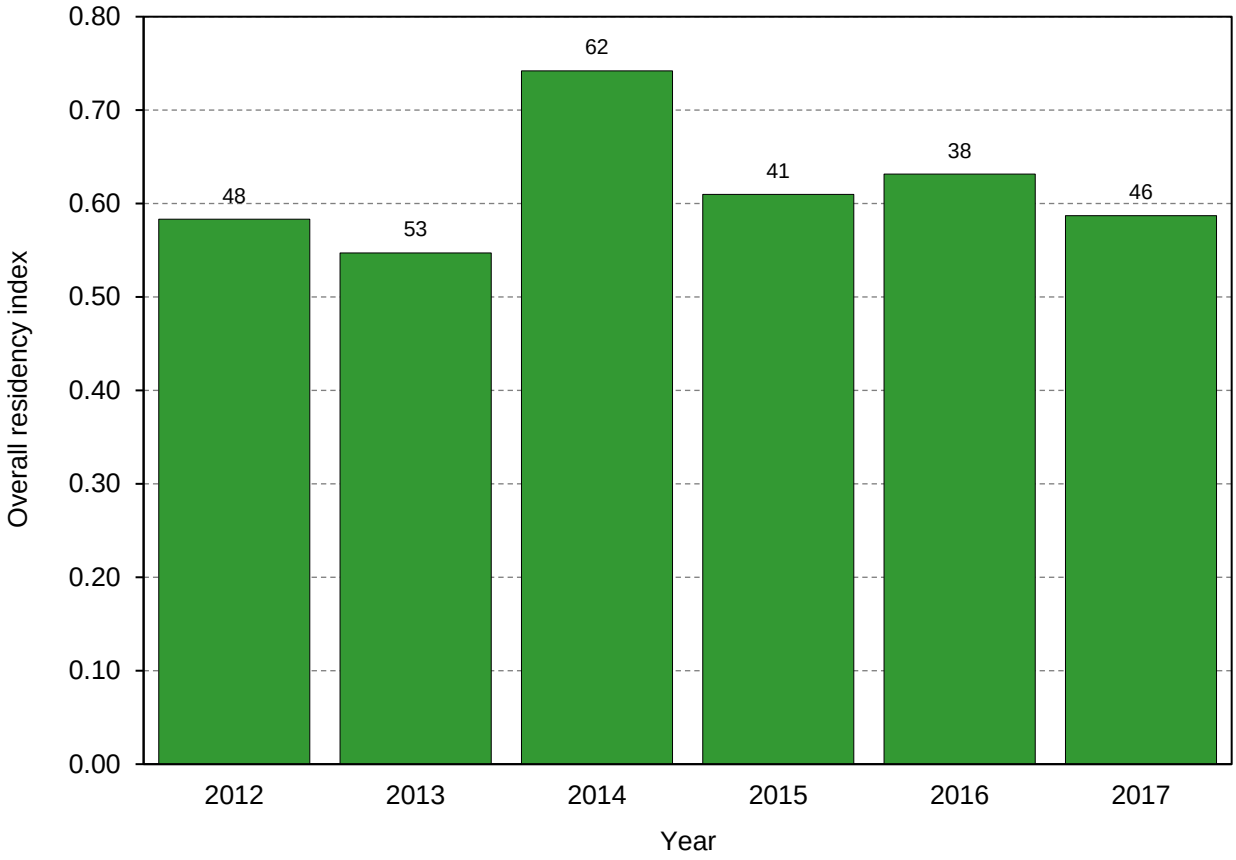

Figure 22. Residency indices of rhinoceros auklets at Chowiet Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed. Overall residency index= f/b, where b=nests with evidence of apparent occupancy early in the season (representing eggs) and f=nests with evidence of apparent occupancy late in the season (representing large chicks/potential fledglings). Numbers above columns indicate sample sizes (b). The residency index includes a sub-set of active nests (those found active during the early visit) and may not equal values of active nests reported in apparent occupancy rates.

Table 29. Residency indices of rhinoceros auklets at Chowiet Island, Alaska. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed, based on the assumption that evidence of apparent occupancy during early and late periods in the breeding season represent the presence of eggs and large chicks/potential fledglings, respectively. Surveys are conducted around hatching (late June to mid-July) and late in chick-rearing (late July to mid-August). Evidence of apparent occupancy includes observations of feathers, droppings, prey, eggs, eggshell fragments, or chicks in the burrow. The residency index includes a sub-set of active nests (those found active during the early visit) and may not equal values of active nests reported in apparent occupancy rates.

Year	Medium/large (≥ 9.5 cm) burrows[a] with apparent occupancy		Overall residency index[b]
	Early (b)	Late (f)	(f/b)
2012	48	28	0.58
2013	53	29	0.55
2014	62	46	0.74
2015	41	25	0.61
2016	38	24	0.63
2017	46	27	0.59

[a]By definition, burrows must be ≥ 30 cm in length.
[b]Overall residency index (f/b) is a surrogate for reproductive success (F/B).

Table 30. Residency indices of rhinoceros auklets at Chowiet Island, Alaska in 2017. Residency indices are considered surrogates for measures of reproductive performance when actual nest contents cannot be observed, based on the assumption that evidence of apparent occupancy during early and late periods in the breeding season represent the presence of eggs and large chicks/potential fledglings, respectively. Surveys are conducted around hatching (late June to mid-July) and late in chick-rearing (late July to mid-August). Evidence of apparent occupancy includes observations of feathers, droppings, prey, eggs, eggshell fragments, or chicks in the burrow. The residency index includes a sub-set of active nests (those found active during the early visit) and may not equal values of active nests reported in apparent occupancy rates.

Parameter	South Bay Plots			Spruce Cove Plots			Total	Mean	SD
	1	2	3	4	5	6			
Medium/large (≥ 9.5 cm) burrows[a] with apparent occupancy									
Early (b)	12	6	8	7	8	5	46	-	-
Late (f)	4	3	5	4	6	5	27	-	-
Overall residency index (f/b)[b]	0.33	0.50	0.63	0.57	0.75	1.00	0.59	0.63	0.23
Survey dates									
Early	28 Jun	28 Jun	28 Jun	1 Jul	1 Jul	1 Jul	-	-	-
Late	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	-	-	-

[a]By definition, burrows must be $\geq$ 30 cm in length.
[b]Overall residency index (f/b) is a surrogate for reproductive success (F/B).

Table 31. Mean growth rates of rhinoceros auklet chicks at Chowiet Island, Alaska. Data include chicks measured at least three times during the linear phase of growth (defined as chick age 10-40 days; Leschner and Burrell 1977). No data exist in 1996-1997, 1999-2001, or 2003. No chicks have been measured since 2004 due to limited availability of accessible chicks and concerns about balancing the importance of chick growth data with the disturbance caused by data collection.

Year	Mass (g/day)				Wing chord (mm/day)			
	Mean	SD	Range	*n*	Mean	SD	Range	*n*
1995	xx[a]	xx	xx-xx	xx	xx	xx	xx-xx	xx
1998	xx	xx	xx-xx	xx	xx	xx	xx-xx	xx
2002	6.9	0.6	xx-xx	23	-	-	-	-
2004	5.9	2.1	xx-xx	2	3.6	0.1	xx-xx	2

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

Table 32. Numbers of rhinoceros auklet burrows counted during censuses at Chowiet Island, Alaska. No counts were conducted in 1978, 1980-1992, 2004, 2008, or after 2012.

Colony	1976	1977	1979	1993	1998	2003	2005	2006	2007	2009	2010[a]	2011	2012
Spruce Cove													
Sub-colony A	57	xx[b]	xx	-	-	-	293	64	113	78	81	46	146
Sub-colony B	-	xx	xx	-	-	-	408	-	233	130	88	197	221
Sub-colony C	285	xx	xx	430	-	-	178	86	91	125	95	83	109
Total	342	xx	xx	430	782	997	879	150	437	333	264	326	476
Landing Cove	45	xx	xx	116	204	112	33	7	19	9	10	27	43
South Bay													
Sub-colony 1	-	xx	xx	-	-	-	-	89	68	58	110	72	133
Sub-colony 2	-	xx	xx	-	-	-	-	42	54	44	35	47	49
Sub-colony 3	-	xx	xx	-	-	-	-	73	39	67	61	80	113
Sub-colony 4	-	xx	xx	-	-	-	-	18	44	25	23	53	35
Sub-colony 5	-	xx	xx	-	-	-	-	45	100	81	57	29	78
Total	179	xx	xx	531	565	830	375	267	305	275	286	281	408
South East Colony	-	-	-	-	-	-	-	-	18	-	-	-	-
Island-wide total	566	xx	xx	>1077	1551	1939	1287	>424	779	617	560	634	927

[a]In 2010 the count was conducted in August, thus likely not directly comparable to other years when the protocol has been to conduct the count in late May to mid-June.

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

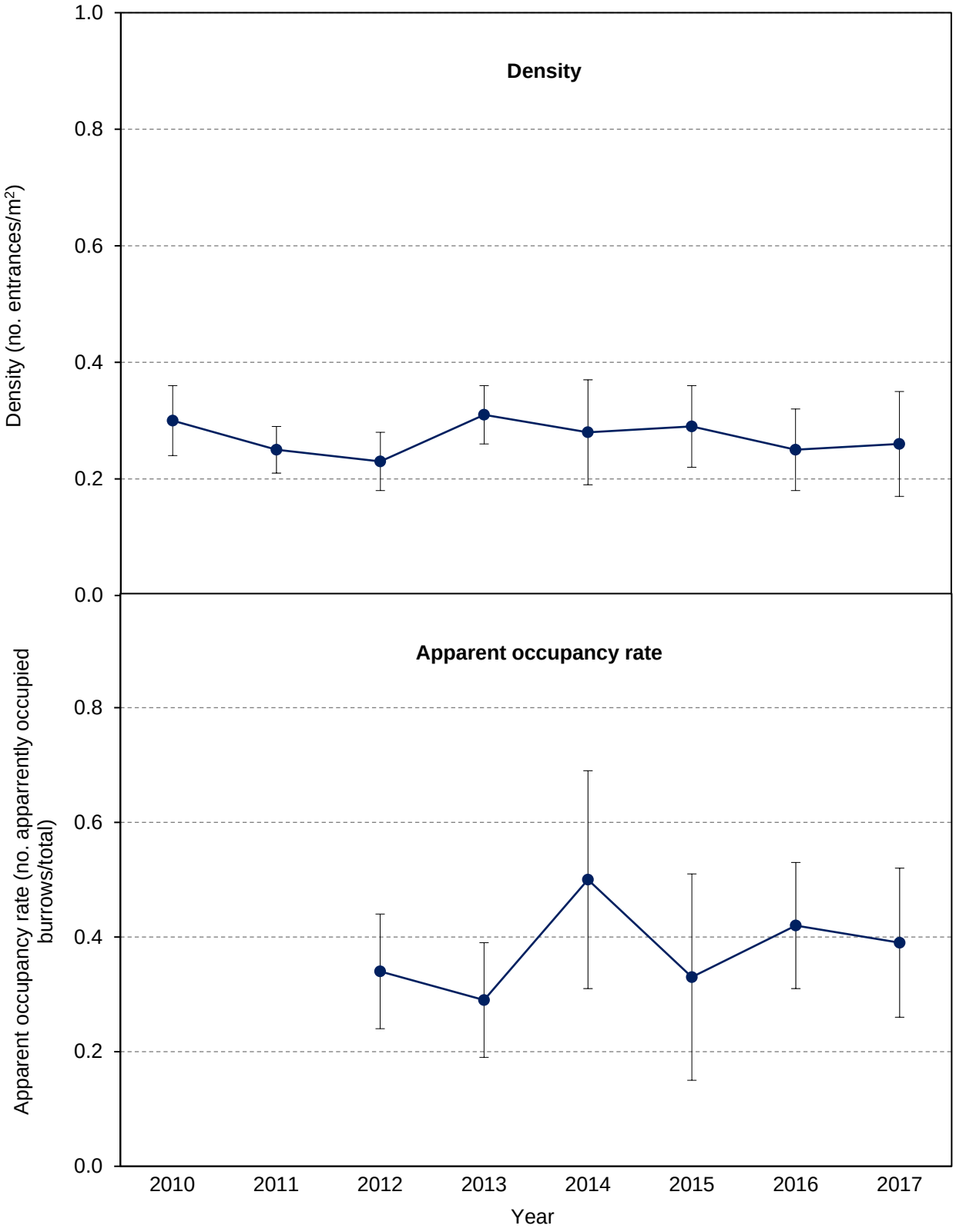

Figure 23. Burrow entrance densities and apparent occupancy rates of rhinoceros auklets on index plots at Chowiet Island, Alaska.

Table 33. Burrow entrance densities and apparent occupancy rates of rhinoceros auklets on index plots at Chowiet Island, Alaska. Density is expressed as the number of medium-large (≥ 9.5 cm) burrow entrances per m^2 and potentially includes burrows belonging to arctic ground squirrels. Apparent occupancy rate is expressed as the proportion of medium-large (≥ 9.5 cm) burrows with evidence of apparent occupancy late in the nesting period. Evidence of apparent occupancy includes observations of feathers, droppings, fresh vegetation, eggs, eggshell fragments, or chicks in the burrow. Density is assessed in late May or early June, before laying, whereas apparent occupancy rate is assessed in mid to late August, towards the end of the chick-rearing period. The number of burrows used to calculate apparent occupancy rate is not necessarily the same as those presented for density because not all nests counted during density surveys are refound later in the season, and some nests are excluded from apparent occupancy rate analysis (e.g., undetermined apparent occupancy statuses).

Year	South Bay Plots			Spruce Cove Plots			Total	Mean	SD
	1	2	3	4	5	6			
Density									
2010	0.35	0.32	0.23	-	-	-	-	0.30	0.06
2011	0.28	0.27	0.20	-	-	-	-	0.25	0.04
2012	0.32	0.19	0.19	0.18	0.27	0.22	0.23	0.23	0.05
2013	0.33	0.30	0.24	0.30	0.41	0.29	0.31	0.31	0.05
2014	0.39	0.24	0.15	0.22	0.37	0.32	0.28	0.28	0.09
2015	0.34	0.24	0.22	0.28	0.41	0.27	0.29	0.29	0.07
2016	0.32	0.22	0.15	0.29	0.32	0.18	0.25	0.25	0.07
2017	0.37	0.22	0.14	0.28	0.34	0.22	0.26	0.26	0.09
Plot area (m^2)	78.8	78.8	78.8	78.8	78.8	78.8	472.5	-	-
Apparent occupancy rate									
2010[a]	-	-	-	-	-	-	-	-	-
2011[a]	-	-	-	-	-	-	-	-	-
2012	0.35	0.31	0.33	0.50	0.20	0.35	0.33	0.34	0.10
2013	0.33	0.31	0.33	0.41	0.31	0.22	0.29	0.29	0.10
2014	0.48	0.44	0.46	0.87	0.38	0.36	0.48	0.50	0.19
2015	0.15	0.32	0.41	0.59	0.13	0.43	0.31	0.34	0.18
2016	0.52	0.47	0.25	0.50	0.36	0.36	0.42	0.42	0.11
2017	0.21	0.29	0.55	0.32	0.48	0.47	0.37	0.39	0.13

[a]Apparent occupancy rate methodology was standardized in 2012. Historical data (South Bay plots in 2010 and 2011) presented in previous reports has been removed given it is not comparable to current methods.

Table 34. Burrow entrance densities and apparent occupancy rates of rhinoceros auklets on index plots at Chowiet Island, Alaska in 2017. Density is expressed as the number of medium-large (≥ 9.5 cm) burrow entrances per m^2 and potentially includes burrows belonging to arctic ground squirrels. Apparent occupancy rate is expressed as the proportion of medium-large (≥ 9.5 cm) burrows with evidence of apparent occupancy late in the nesting period. Evidence of apparent occupancy includes observations of feathers, droppings, fresh vegetation, eggs, eggshell fragments, or chicks in the burrow. Density is assessed in late May or early June, before laying, whereas apparent occupancy rate is assessed in mid to late August, towards the end of the chick-rearing period. The number of burrows used to calculate apparent occupancy rate is not necessarily the same as those presented for density because not all nests counted during density surveys are refound later in the season, and some nests are excluded from apparent occupancy rate analysis (e.g., nests with storm-petrels and undetermined apparent occupancy statuses).

Parameter	South Bay Plots			Spruce Cove Plots			Total	Mean	SD
	1	2	3	4	5	6			
Density									
Number of medium-large (≥ 9.5 cm) burrow entrances	29	17	11	22	27	17	123	-	-
Plot area (m^2)	78.8	78.8	78.8	78.8	78.8	78.8	472.5	-	-
Density of medium-large burrows	0.37	0.22	0.14	0.28	0.34	0.22	0.26	0.26	0.09
Survey date	23 May	23 May	23 May	25 May	25 May	25 May		-	-
Apparent occupancy rate									
Medium-large (≥ 9.5 cm) burrows w/ apparent occupancy	6	5	6	7	13	8	45	-	-
Total medium-large (≥ 9.5 cm) burrows	29	17	11	22	27	17	123	-	-
Apparent occupancy rate of medium-large burrows	0.21	0.29	0.55	0.32	0.48	0.47	0.37	0.39	0.13
Survey date	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	-	-	-

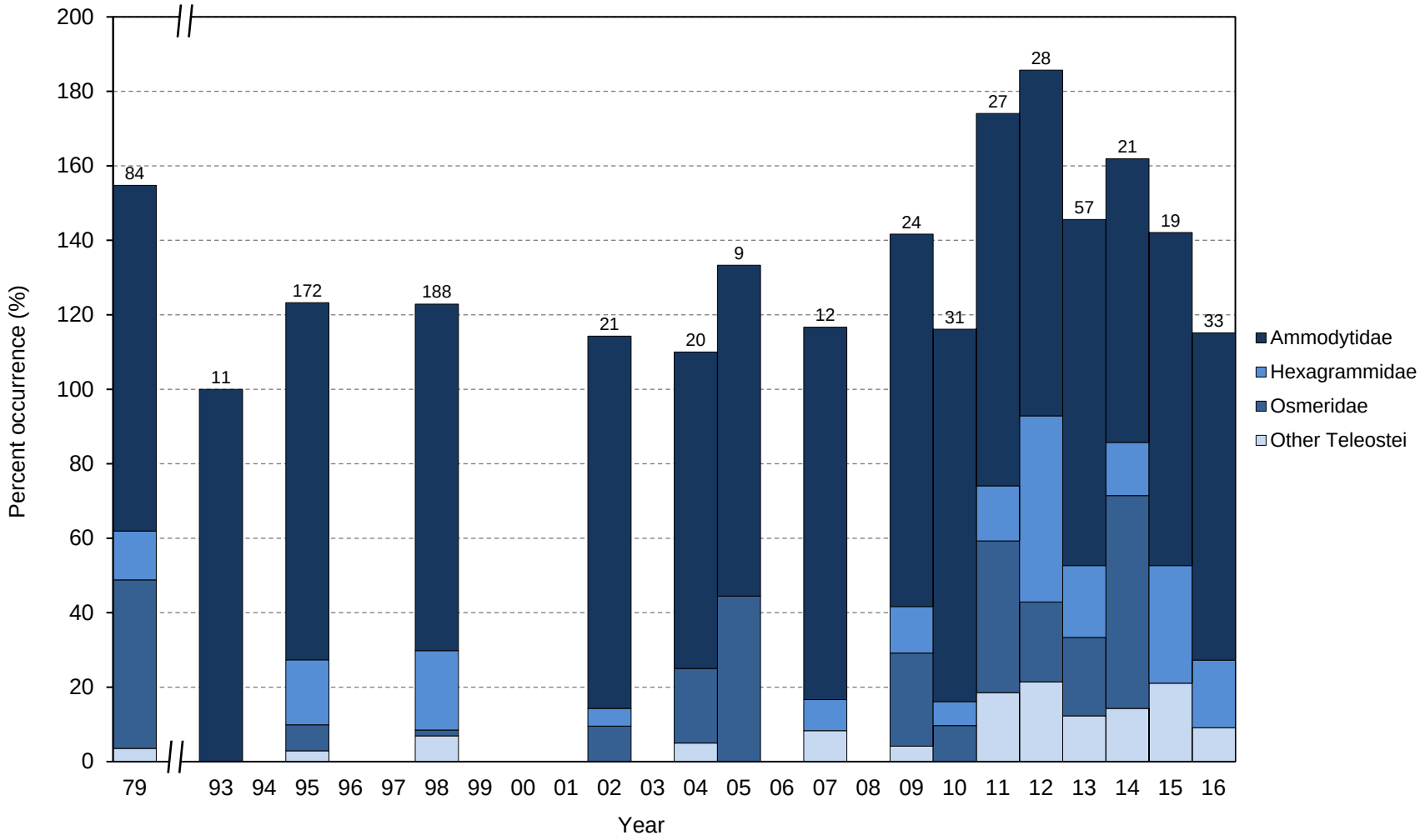

Figure 24. Frequency of occurrence of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks or from chicks themselves. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; samples were collected in 2017 but have not yet been analyzed

Table 35. Frequency of occurrence of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the field (1998, 2005, 2007), the laboratory (2002, 2004, 2009-2016) or a location unknown (1979, 1993, 1995) to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks or from chicks themselves. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; samples were collected in 2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1993	1995	1998	2002	2004	2005	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	84	11	172	188	21	20	9	12	24	31	27	28	57	21	19	33	21
Invertebrates	4.8	-	4.1	-	-	-	-	-	-	-	11.1	-	3.5	-	-	-	*pending*
Fish	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**-**
Teleostei	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**-**
Ammodytidae	**92.9**	**100.0**	**95.9**	**93.1**	**100.0**	**85.0**	**88.9**	**100.0**	**100.0**	**100.0**	**100.0**	**92.9**	**93.0**	**76.2**	**89.5**	**87.9**	**-**
Ammodytes spp.	92.9	100.0	95.9	93.1	100.0	85.0	88.9	100.0	100.0	100.0	100.0	92.9	93.0	76.2	89.5	87.9	-
Hexagrammidae	**13.1**	**-**	**17.4**	**21.3**	**4.8**	**-**	**-**	**8.3**	**12.5**	**6.5**	**14.8**	**50.0**	**19.3**	**14.3**	**31.6**	**18.2**	**-**
Pleurogrammus monopterygius	4.8	-	-	-	-	-	-	-	12.5	3.2	14.8	3.6	3.5	14.3	31.6	15.2	-
Other Hexagrammidae	9.5	-	17.4	21.3	4.8	-	-	8.3	-	3.2	-	50.0	19.3	-	-	9.1	-
Osmeridae	**45.2**	**-**	**7.0**	**1.6**	**9.5**	**20.0**	**44.4**	**-**	**25.0**	**9.7**	**40.7**	**21.4**	**21.1**	**57.1**	**-**	**-**	**-**
Mallotus villosus	45.2	-	7.0	1.6	9.5	20.0	-	-	25.0	9.7	40.7	21.4	21.1	57.1	-	-	-
Other Osmeridae	-	-	-	-	-	-	44.4	-	-	-	-	-	-	-	-	-	-
Other Teleostei	3.6	-	2.9	6.9	-	5.0	-	8.3	4.2	-	18.5	21.4	12.3	14.3	21.1	9.1	-

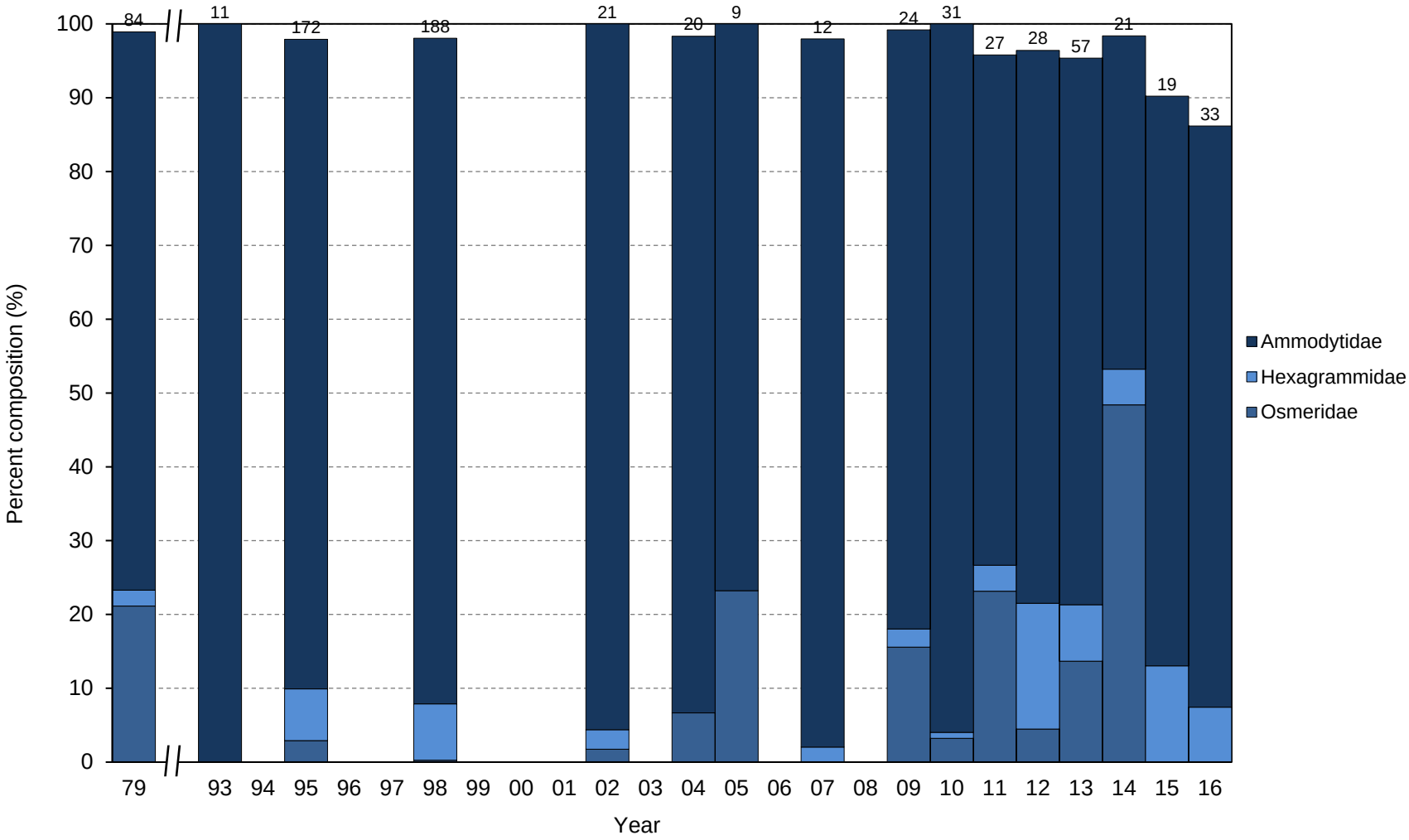

Figure 25. Percent composition of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; samples were collected in 2017 but have not yet been analyzed.

Table 36. Percent composition of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the field (1998, 2005, 2007), the laboratory (2002, 2004, 2009-2016) or a location unknown (1979, 1993, 1995) to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; samples were collected in 2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1993	1995	1998	2002	2004	2005	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	84	11	172	188	21	20	9	12	24	31	27	28	57	21	19	33	21
No. individuals	927	85	958	1129	114	60	56	49	122	248	285	223	366	186	92	188	*pending*
Invertebrates	0.5	-	1.3	-	-	-	-	-	-	-	1.1	-	0.5	-	-	-	-
Fish	**99.5**	**100.0**	**98.7**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**98.9**	**100.0**	**99.5**	**100.0**	**100.0**	**100.0**	**-**
Teleostei	**99.5**	**100.0**	**98.7**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**98.9**	**100.0**	**99.5**	**100.0**	**100.0**	**100.0**	**-**
Ammodytidae	**75.6**	**100.0**	**88.0**	**90.2**	**95.6**	**91.7**	**76.8**	**95.9**	**81.1**	**96.0**	**69.1**	**74.9**	**74.0**	**45.2**	**77.2**	**78.7**	**-**
Ammodytes spp.	75.6	100.0	88.0	90.2	95.6	91.7	76.8	95.9	81.1	96.0	69.1	74.9	74.0	45.2	77.2	78.7	-
Hexagrammidae	2.2	-	7.0	7.6	2.6	-	-	2.0	2.5	0.8	3.5	17.0	7.7	4.8	13.0	7.4	-
Osmeridae	**21.1**	**-**	**2.9**	**0.3**	**1.8**	**6.7**	**23.2**	**-**	**15.6**	**3.2**	**23.2**	**4.5**	**13.7**	**48.4**	**-**	**-**	**-**
Mallotus villosus	21.1	-	2.9	0.3	1.8	6.7	-	-	15.6	3.2	23.2	4.5	13.7	48.4	-	-	-
Other Osmeridae	-	-	-	-	-	-	23.2	-	-	-	-	-	-	-	-	-	-
Other Teleostei	0.5	-	0.8	1.9	-	1.7	-	2.0	0.8	-	3.2	3.6	4.1	1.6	9.8	13.8	-

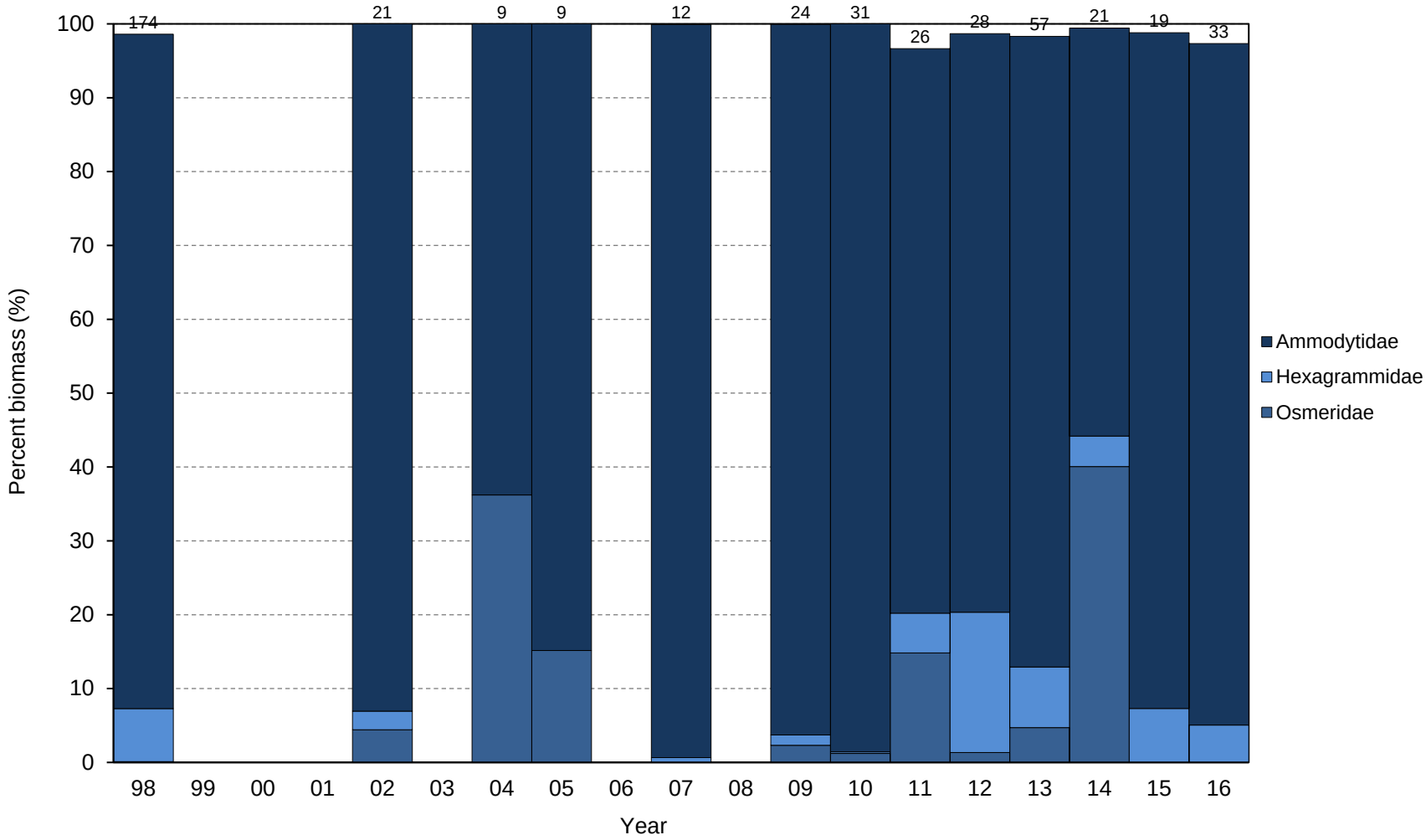

Figure 26. Relative biomass of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; no mass data exist in 1979, 1993, or 1995. Samples were collected in 2017 but have not yet been analyzed.

Table 37. Relative biomass of major prey items in diets of rhinoceros auklet chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the field (1998, 2005, 2007) or the laboratory (2002, 2004, 2009-2016) to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1992, 1994, 1996-1997, 1999-2001, 2003, 2006, or 2008; no mass data exist in 1979, 1993, or 1995. Samples were collected in 2017 but have not yet been analyzed. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1998	2002	2004	2005	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	174	21	9	9	12	24	31	26	28	57	21	19	33	21
Total mass (g)	3680	315	81	282	228	550	945	564	523	1236	602	92	732	*pending*
Invertebrates	-	-	-	-	-	-	-	1.2	-	0.6	-	-	-	-
Fish	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**98.8**	**100.0**	**99.4**	**100.0**	**100.0**	**100.0**	**-**
Teleostei	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**98.8**	**100.0**	**99.4**	**100.0**	**100.0**	**100.0**	**-**
Ammodytidae	**91.3**	**93.1**	**63.8**	**84.9**	**99.3**	**96.2**	**98.6**	**76.4**	**78.3**	**85.4**	**55.2**	**91.5**	**92.3**	**-**
Ammodytes spp.	91.3	93.1	63.8	84.9	99.3	96.2	98.6	76.4	78.3	85.4	55.2	91.5	92.3	-
Hexagrammidae	7.2	2.5	-	-	0.7	1.4	0.2	5.4	19.0	8.2	4.1	7.3	5.1	-
Osmeridae	**0.1**	**4.4**	**36.2**	**15.1**	**-**	**2.3**	**1.2**	**14.8**	**1.3**	**4.7**	**40.1**	**-**	**-**	**-**
Mallotus villosus	0.1	4.4	36.2	-	-	2.3	1.2	14.8	1.3	4.7	40.1	-	-	-
Other Osmeridae	-	-	-	15.1	-	-	-	-	-	-	-	-	-	-
Other Teleostei	1.4	-	-	-	0.1	0.1	-	2.1	1.3	1.1	0.6	1.2	2.7	-

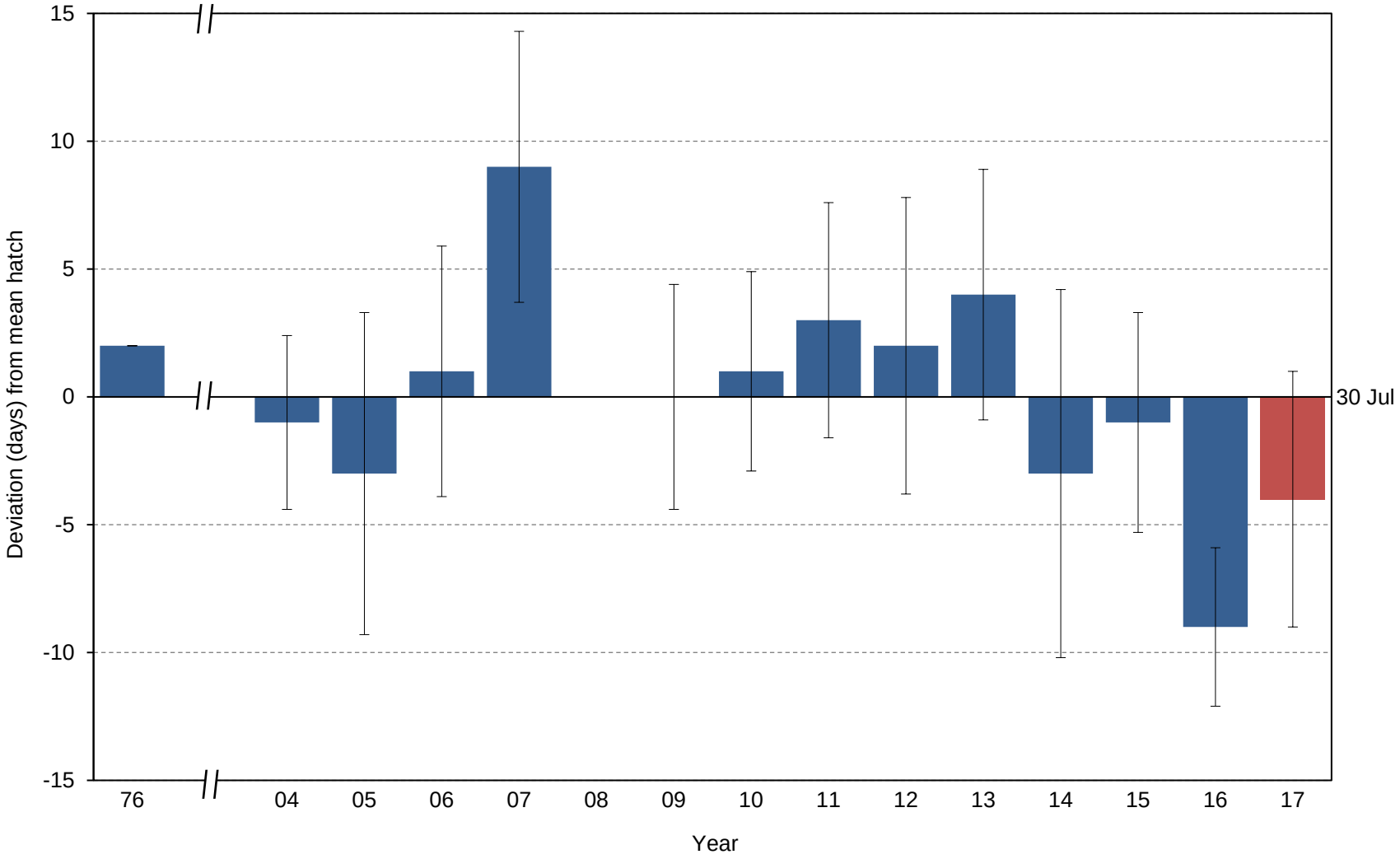

Figure 27. Yearly hatch date deviation (from the 1976-2016 average of 30 July) for horned puffins at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1977-2003 or 2008.

Table 38. Breeding chronology of horned puffins at Chowiet Island, Alaska. No data were collected in 1977-2003 or 2008.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1976	31 Jul	-	56	23 Jul	17 Aug	>4 Sep
2004	28 Jul	3.4	6	24 Jul	3 Aug	>15 Aug
2005	27 Jul	6.3	37	17 Jul	14 Aug	>2 Sep
2006	31 Jul	4.9	29	21 Jul	16 Aug	26 Aug
2007	8 Aug	5.3	14	27 Jul	15 Aug	>2 Sep
2009	30 Jul	4.4	13	21 Jul	10 Aug	>4 Sep
2010	31 Jul	3.9	16	25 Jul	10 Aug	1 Sep
2011	2 Aug	4.6	17	27 Jul	10 Aug	>6 Sep
2012	31 Jul	5.8	22	22 Jul	13 Aug	>2 Sep
2013	3 Aug	4.9	42	23 Jul	18 Aug	>30 Aug
2014	27 Jul	7.2	48	18 Jul	16 Aug	26 Aug
2015	29 Jul	4.3	17	23 Jul	5 Aug	>1 Sep
2016	20 Jul	3.1	51	13 Jul	26 Jul	20 Aug
2017	26 Jul	5.0	71	19 Jul	14 Aug	>1 Sep

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

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

Table 39. Frequency distribution of hatch dates for horned puffins at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1977-2003 or 2008; data from individual nests are not available in 1976.

Julian date[a]	No. nests hatching on Julian date												
	04	05	06	07	09	10	11	12	13	14	15	16	17
195	-	-	-	-	-	-	-	-	-	-	-	2	-
196	-	-	-	-	-	-	-	-	-	-	-	-	-
197	-	-	-	-	-	-	-	-	-	-	-	-	-
198	-	1	-	-	-	-	-	-	-	-	-	1	-
199	-	-	-	-	-	-	-	-	-	1	-	-	-
200	-	-	-	-	-	-	-	-	-	5	-	23	8
201	-	-	-	-	-	-	-	-	-	-	-	-	-
202	-	5	1	-	1	-	-	-	-	2	-	7	1
203	-	-	-	-	-	-	-	-	-	4	-	1	-
204	-	12	1	-	-	-	-	1	1	5	3	9	2
205	-	1	-	-	-	-	-	-	-	2	-	-	25
206	2	1	1	-	-	1	-	2	-	2	-	1	10
207	-	1	3	-	-	1	-	-	-	4	1	1	2
208	-	8	2	1	3	2	3	1	1	10	2	6	3
209	-	-	-	-	-	-	-	-	3	-	5	-	6
210	3	-	3	-	3	-	4	6	-	3	-	-	3
211	-	1	-	-	1	-	-	-	1	-	-	-	-
212	-	1	7	-	2	8	-	5	7	1	2	-	1
213	-	-	-	-	-	-	-	-	-	-	-	-	2
214	-	-	7	2	2	1	4	2	17	3	-	-	2
215	-	-	-	-	-	-	-	-	-	-	-	-	-
216	1	-	1	-	-	1	1	1	1	-	2	-	-
217	-	1	-	-	-	-	-	-	3	-	2	-	-
218	-	3	2	1	-	1	1	-	4	2	-	-	5
219	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	5	-	-	3	1	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-	-	-	-	-
222	-	-	-	-	1	1	1	1	1	-	-	-	-
223	-	-	-	-	-	-	-	-	-	-	-	-	-
224	-	1	-	2	-	-	-	-	1	-	-	-	-
225	-	-	-	-	-	-	-	-	-	1	-	-	-
226	-	1	-	-	-	-	-	2	-	-	-	-	1
227	-	-	-	3	-	-	-	-	-	-	-	-	-
228	-	-	1	-	-	-	-	-	-	3	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	2	-	-	-	-
n	6	37	29	14	13	16	17	22	42	48	17	51	71

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

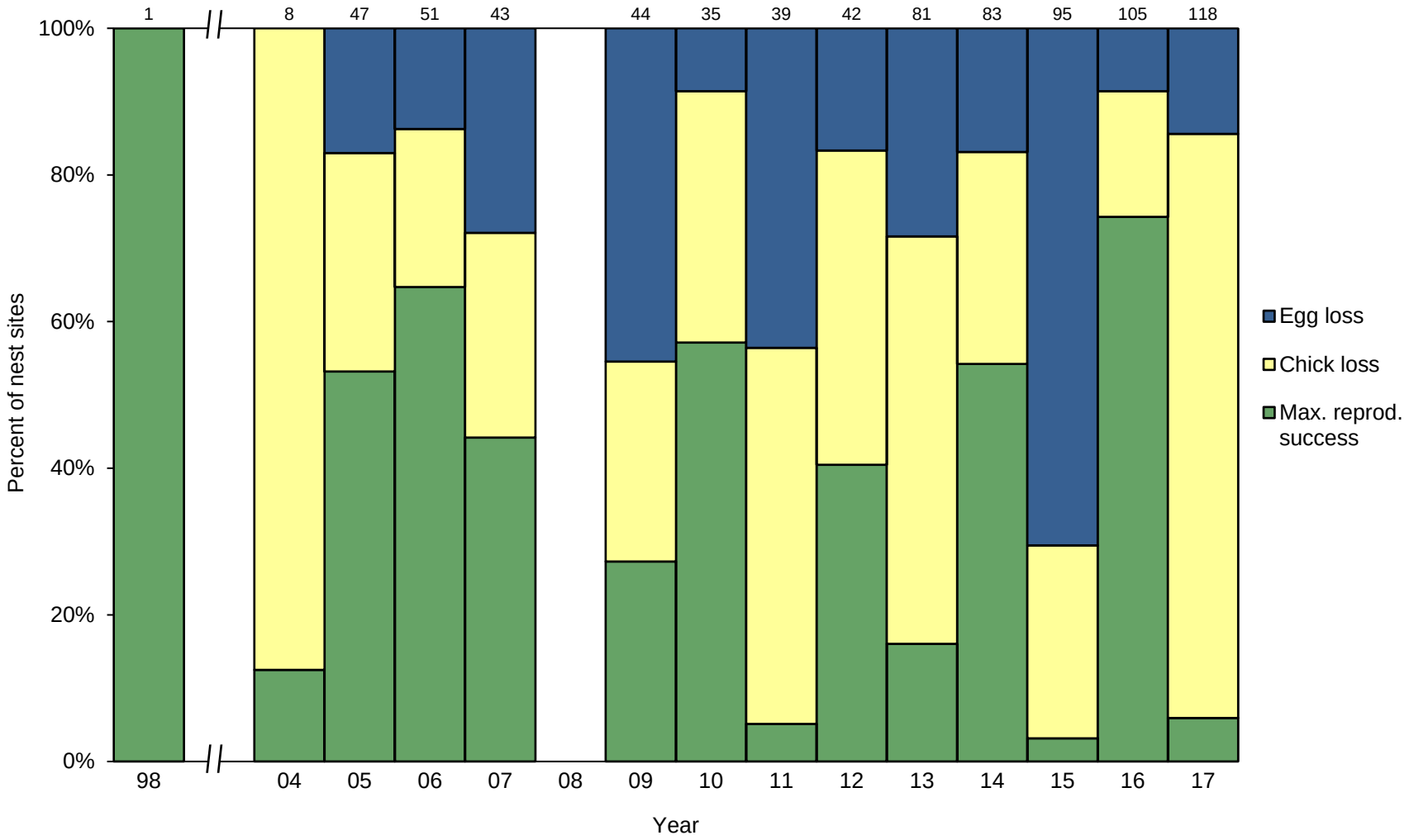

Figure 28. Maximum potential reproductive performance of horned puffins at Chowiet Island, Alaska. Values include nest sites with chicks still present but too young to consider fledged at the last check. Egg loss=[(B+H)-D+H]/(B+H); Chick loss=[(D+H)-F+H]/(B+H); Maximum potential reproductive success=[(F+H)/(B+H)], where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged; H=nest sites with young chicks still present. Numbers above columns indicate sample sizes (B+H). No data were collected in 1977-1997, 1999-2003, or 2008; maximum values are not available in 1976.

Table 40. Reproductive performance of horned puffins at Chowiet Island, Alaska. No data were collected in 1977-1997, 1999-2003, or 2008.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential nesting success[d] [(D+H)/(B+H)]	Max. potential fledging success[d] [(F+H)/(D+H)]	Max. potential reproductive success[d] [(F+H)/(B+H)]
1976	48	32	19	-	0.67	0.59	0.40	-	-	-
1998	0	0	0	1	-	-	-	1.00	1.00	1.00
2004	7	7	0	1	1.00	0.00	0.00	1.00	0.13	0.13
2005	44	36	22	3	0.82	0.61	0.50	0.83	0.64	0.53
2006	45	38	27	6	0.84	0.71	0.60	0.86	0.75	0.65
2007	26	14	2	17	0.54	0.14	0.08	0.72	0.61	0.44
2009	44	24	12	0	0.55	0.50	0.27	0.55	0.50	0.27
2010	30	27	15	5	0.90	0.56	0.50	0.91	0.63	0.57
2011	38	21	1	1	0.55	0.05	0.03	0.56	0.09	0.05
2012	36	29	11	6	0.81	0.38	0.31	0.83	0.49	0.40
2013	70	47	2	11	0.67	0.04	0.03	0.72	0.22	0.16
2014	74	60	36	9	0.81	0.60	0.49	0.83	0.65	0.54
2015	93	26	1	2	0.28	0.04	0.01	0.29	0.11	0.03
2016	105	96	78	0	0.91	0.81	0.74	0.91	0.81	0.74
2017	118	101	7	0	0.86	0.07	0.06	0.86	0.07	0.06

[a]Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present $\geq$30 d for horned puffins). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

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

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

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

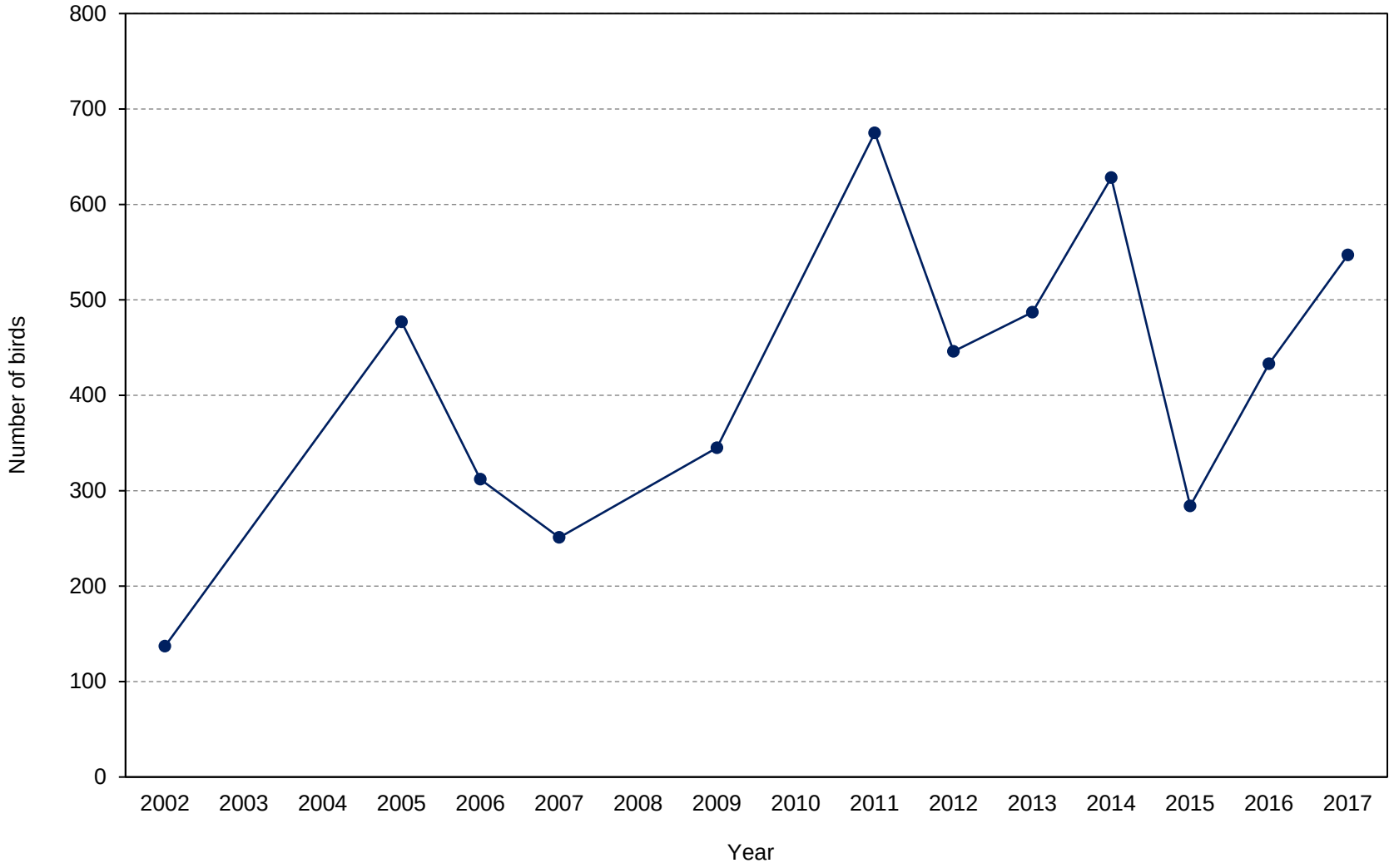

Figure 29. Maximum numbers of horned puffins counted on a water index plot at Chowiet Island, Alaska. Data include only counts conducted during last 30 days of incubation each year. No counts were conducted in 1978-1992, 1996-1997, 1999-2001, 2003-2004, 2008, or 2010; data potentially exist in 1977, 1993-1995, and 1998 but have not yet been summarized.

Table 41. Numbers of horned puffins counted on a water index plot at Chowiet Island, Alaska. Data include only counts conducted during last 30 days of incubation each year (defined as 30 days before first hatch date; Table 38). No counts were conducted in 1978-1992, 1996-1997, 1999-2001, 2003-2004, 2008, or 2010.

Replicate	1977	1993	1994	1995	1998	2002	2005	2006	2007
1	xx[a]	xx	xx	xx	xx	90	469	82	251
2	xx	xx	xx	xx	xx	117	270	301	133
3	xx	xx	xx	xx	xx	81	244	299	136
4	xx	xx	xx	xx	xx	137	271	312	173
5	xx	xx	xx	xx	xx	61	398	157	148
6	xx	xx	xx	xx	xx	62	477	-	-
7	xx	xx	xx	xx	xx	67	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
Mean	xx	xx	xx	xx	xx	88	355	230	168
Max.	xx	xx	xx	xx	xx	137	477	312	251
n	xx	xx	xx	xx	xx	7	6	5	5
SD	xx	xx	xx	xx	xx	29	106	105	49
First hatch	20 Jul[b]	20 Jul[b]	20 Jul[b]	20 Jul[b]	xx	20 Jul[b]	17 Jul	21 Jul	23 Jul
First count	xx	xx	xx	xx	xx	19 Jun	19 Jun	20 Jun	22 Jun
Last count	xx	xx	xx	xx	xx	19 Jul	14 Jul	12 Jul	19 Jul
Count protocol[c]	A	A	A	A	xx	B	C	D	C

Table 41 (continued). Numbers of horned puffins counted on a water index plot at Chowiet Island, Alaska. Data include only counts conducted during last 30 days of incubation each year (defined as 30 days before first hatch date; Table 38). No counts were conducted in 1978-1992, 1996-1997, 1999-2001, 2003-2004, 2008, or 2010.

Replicate	2009	2011	2012	2013	2014	2015	2016	2017
1	76	248	378	496	282	194	270	218
2	161	485	414	162	264	96	237	151
3	345	175	446	193	458	177	394	404
4	300	418	254	234	410	284	426	85
5	127	556	251	487	514	85	371	547
6	321	389	339	467	322	108	426	291
7	-	675	327	120	369	124	334	402
8	-	79	353	388	151	250	383	397
9	-	-	-	-	230	201	433	327
10	-	-	-	-	416	-	345	233
11	-	-	-	-	181	-	-	-
12	-	-	-	-	628	-	-	-
13	-	-	-	-	221	-	-	-
Mean	221	378	345	318	342	169	362	306
Max.	345	675	446	496	628	284	433	547
n	6	8	8	8	13	9	10	10
SD	114	200	69	157	140	70	67	138
First hatch	19 Jul	23 Jul	22 Jul	23 Jul	18 Jul	23 Jul	13 Jul	19 Jul
First count	21 Jun	25 Jun	21 Jun	24 Jun	18 Jun	22 Jun	17 Jun	21 Jun
Last count	18 Jul	21 Jul	15 Jul	21 Jul	9 Jul	19 Jul	3 Jul	5 Jul
Count protocol[c]	C	E	E	E	E	E	E	E

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

[b]In years when date of first hatch is unknown, count period is determined by the average date of first hatch across other years (20 July).

[c]A=all replicates represent single count per day, all between 0700-0930h; B=all replicates represent single count per day, all between 0730h-0930h; C=all replicates represent the mean of two or more counts per day within 5%, all between 0730-0930h; D=some replicates represent single count per day, some represent the mean of two counts per day within 5%, all between 0730-0930h. E=all replicates represent the mean of two or more counts per day within 5%, all between 0700-0930h.

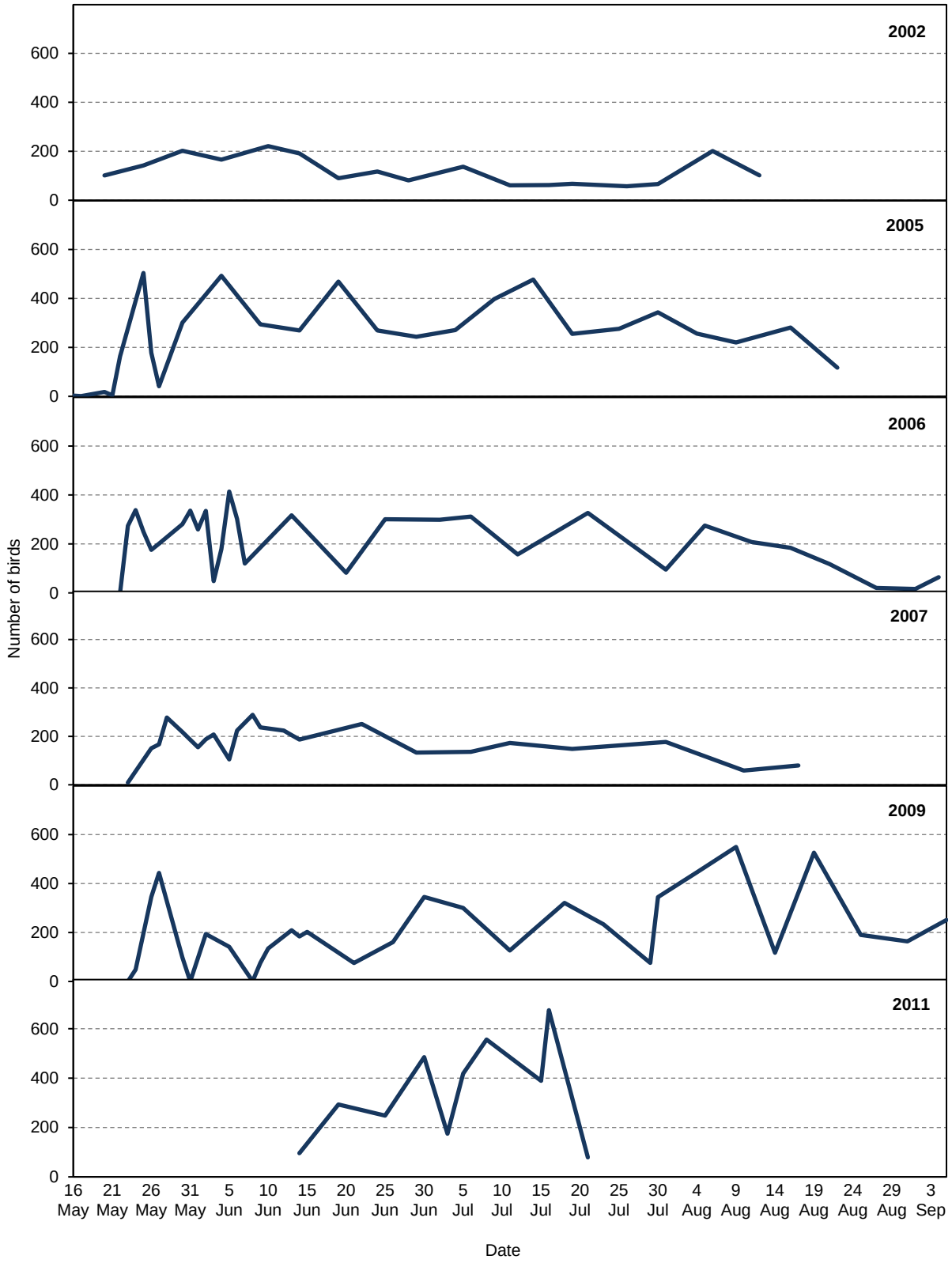

Figure 30. Number of horned puffins counted on a water index plot at Chowiet Island, Alaska. Starting in 2011, counts were conducted only during the period in the breeding season with lowest day-to-day variability; thus fewer counts during a smaller count window were conducted. No counts were conducted in 2003-2004, 2008, or 2010.

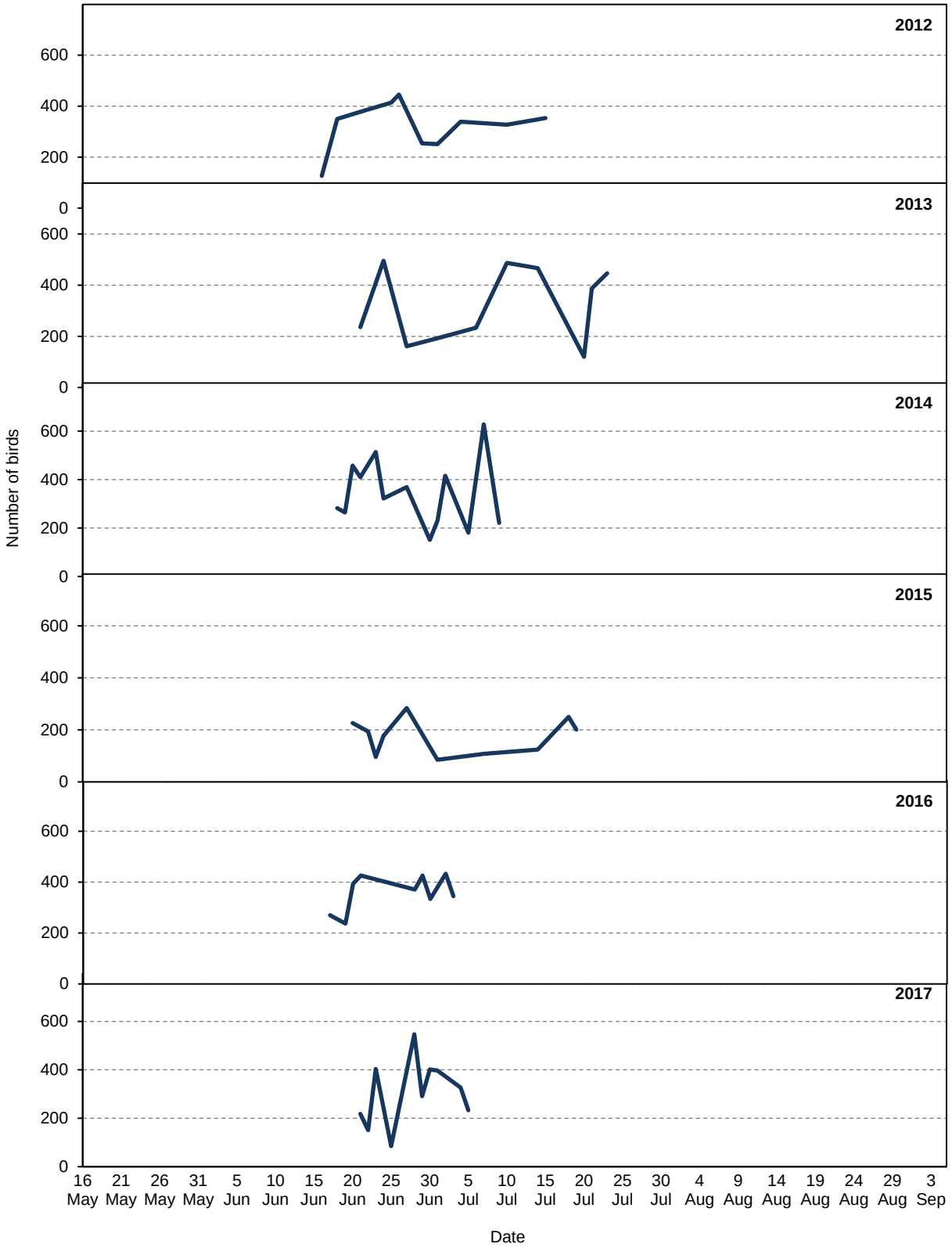

Figure 30 (continued). Number of horned puffins counted on a water index plot at Chowiet Island, Alaska. Starting in 2011, counts were conducted only during the period in the breeding season with lowest day-to-day variability; thus fewer counts during a smaller count window were conducted. No counts were conducted in 2003-2004, 2008, or 2010.

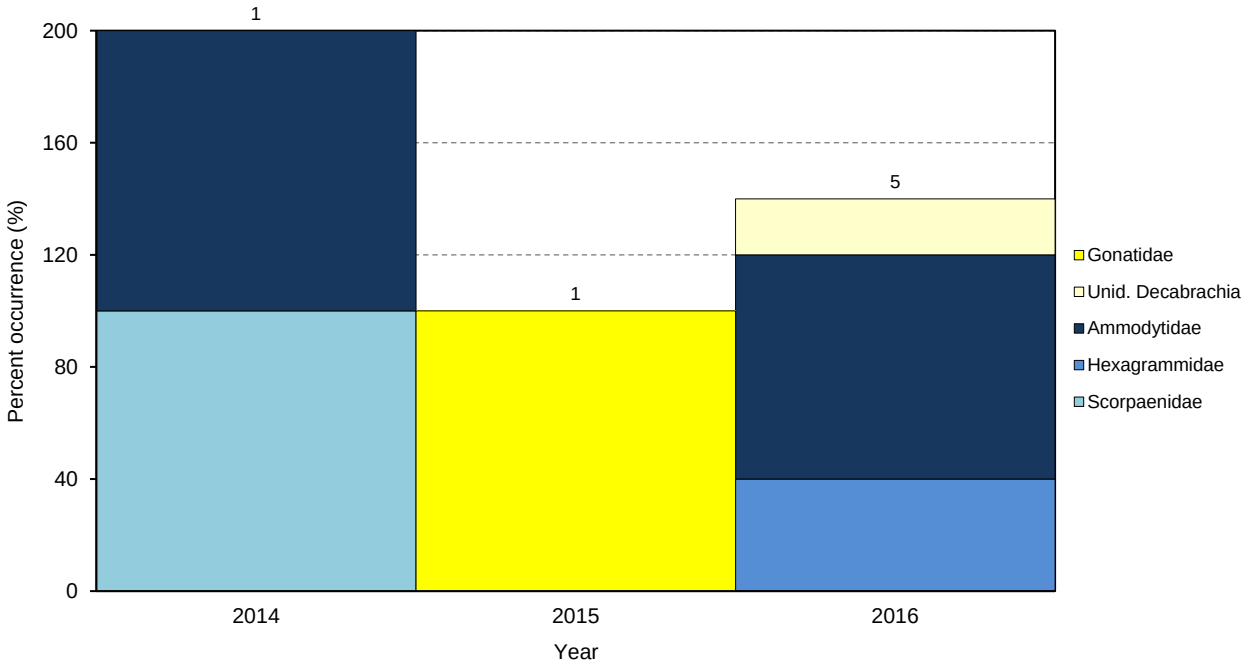

Figure 31. Frequency of occurrence of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2017.

Table 42. Frequency of occurrence of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015	2016
No. samples	1	1	5
Invertebrates	**-**	**100.0**	**20.0**
Cephalopoda	**-**	**100.0**	**20.0**
Gonatidae	**-**	**100.0**	**-**
Gonatus madokai	-	100.0	-
Unid. Decabrachia	-	-	20.0
Fish	**100.0**	**-**	**100.0**
Teleostei	**-**	**-**	**100.0**
Ammodytidae	**100.0**	**-**	**80.0**
Ammodytes spp.	100.0	-	80.0
Hexagrammidae	**-**	**-**	**40.0**
Pleurogrammus monopterygius	-	-	40.0
Scorpaenidae	**100.0**	**-**	**-**
Sebastes spp.	100.0	-	-

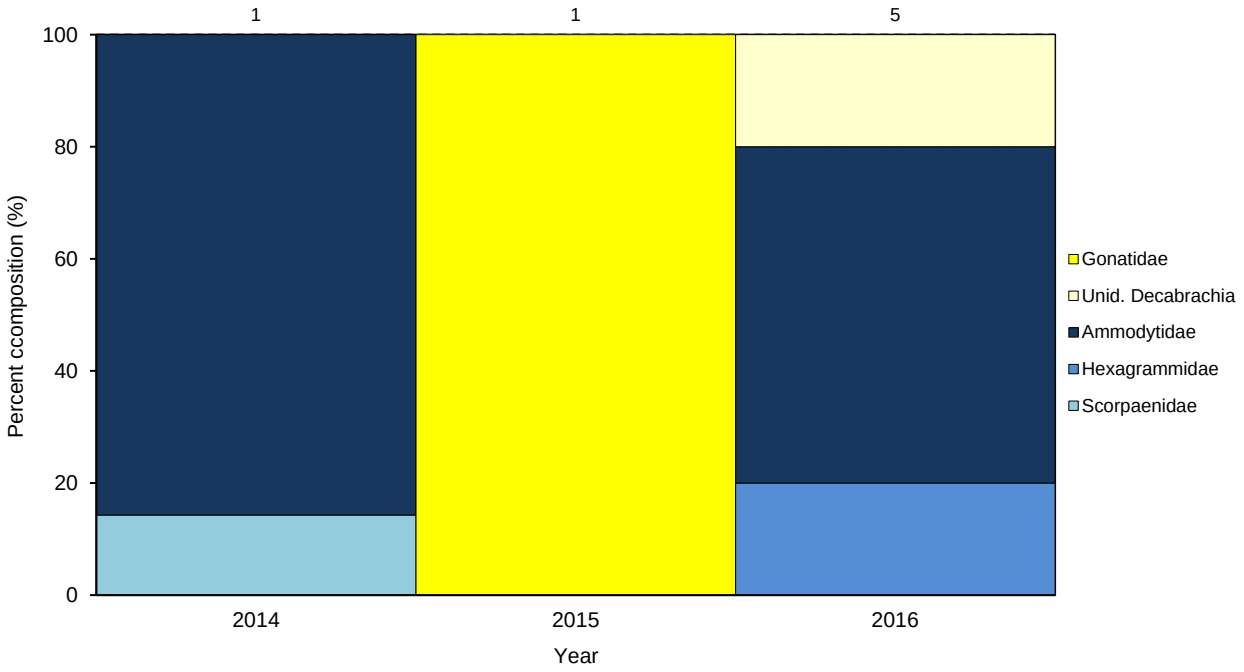

Figure 32. Percent composition of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2017.

Table 43. Percent composition of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015	2016
No. samples	1	1	5
No. individuals	7	1	10
Invertebrates	**-**	**100.0**	**20.0**
Cephalopoda	**-**	**100.0**	**20.0**
Gonatidae	**-**	**100.0**	**-**
Gonatus madokai	-	100.0	-
Unid. Decabrachia	-	-	20.0
Fish	**100.0**	**-**	**80.0**
Teleostei	**100.0**	**-**	**80.0**
Ammodytidae	**85.7**	**-**	**60.0**
Ammodytes spp.	85.7	-	60.0
Hexagrammidae	**-**	**-**	**20.0**
Pleurogrammus monopterygius	-	-	20.0
Scorpaenidae	**14.3**	**-**	**-**
Sebastes spp.	14.3	-	-

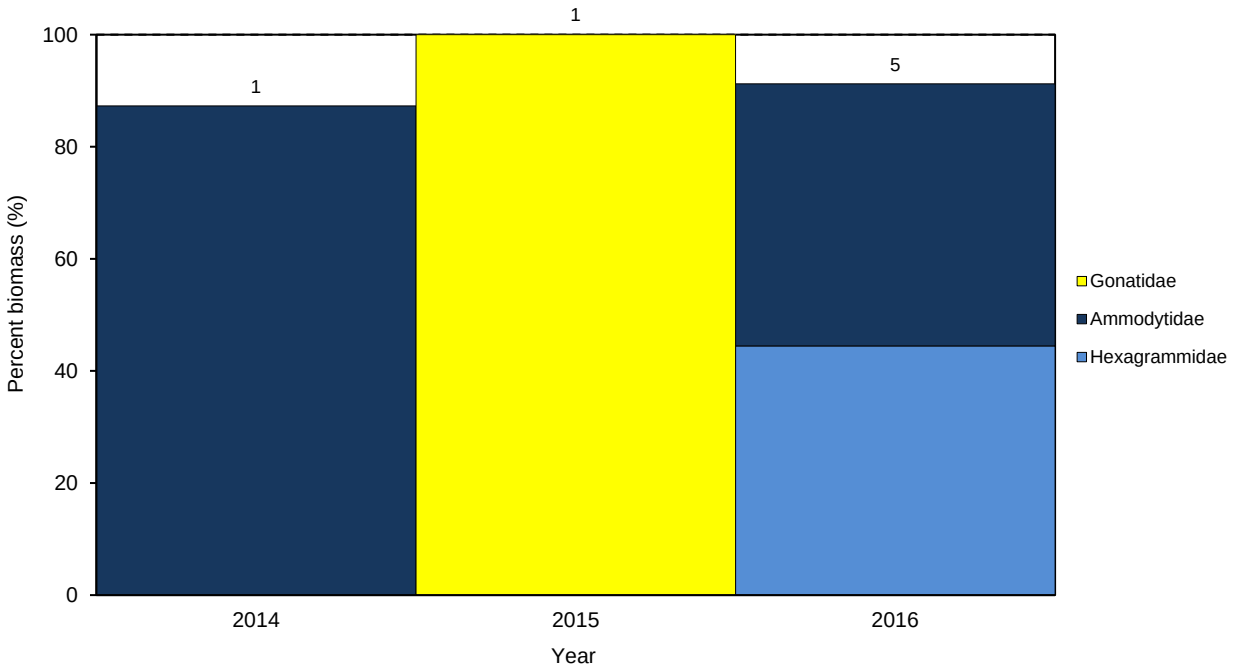

Figure 33. Relative biomass of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2017.

Table 44. Relative biomass of major prey items in diets of horned puffin chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015	2016
No. samples	1	1	5
Total mass (g)	8	1	14
Invertebrates	**-**	**100.0**	**8.8**
Cephalopoda	**-**	**100.0**	**8.8**
Gonatidae	**-**	**100.0**	**-**
Gonatus madokai	-	100.0	-
Unid. Decabrachia	-	-	8.8
Fish	**100.0**	**-**	**91.2**
Teleostei	**100.0**	**-**	**91.2**
Ammodytidae	**87.3**	**-**	**46.8**
Ammodytes spp.	87.3	-	46.8
Hexagrammidae	**-**	**-**	**44.5**
Pleurogrammus monopterygius	-	-	44.5
Other Teleostei	12.7	-	-

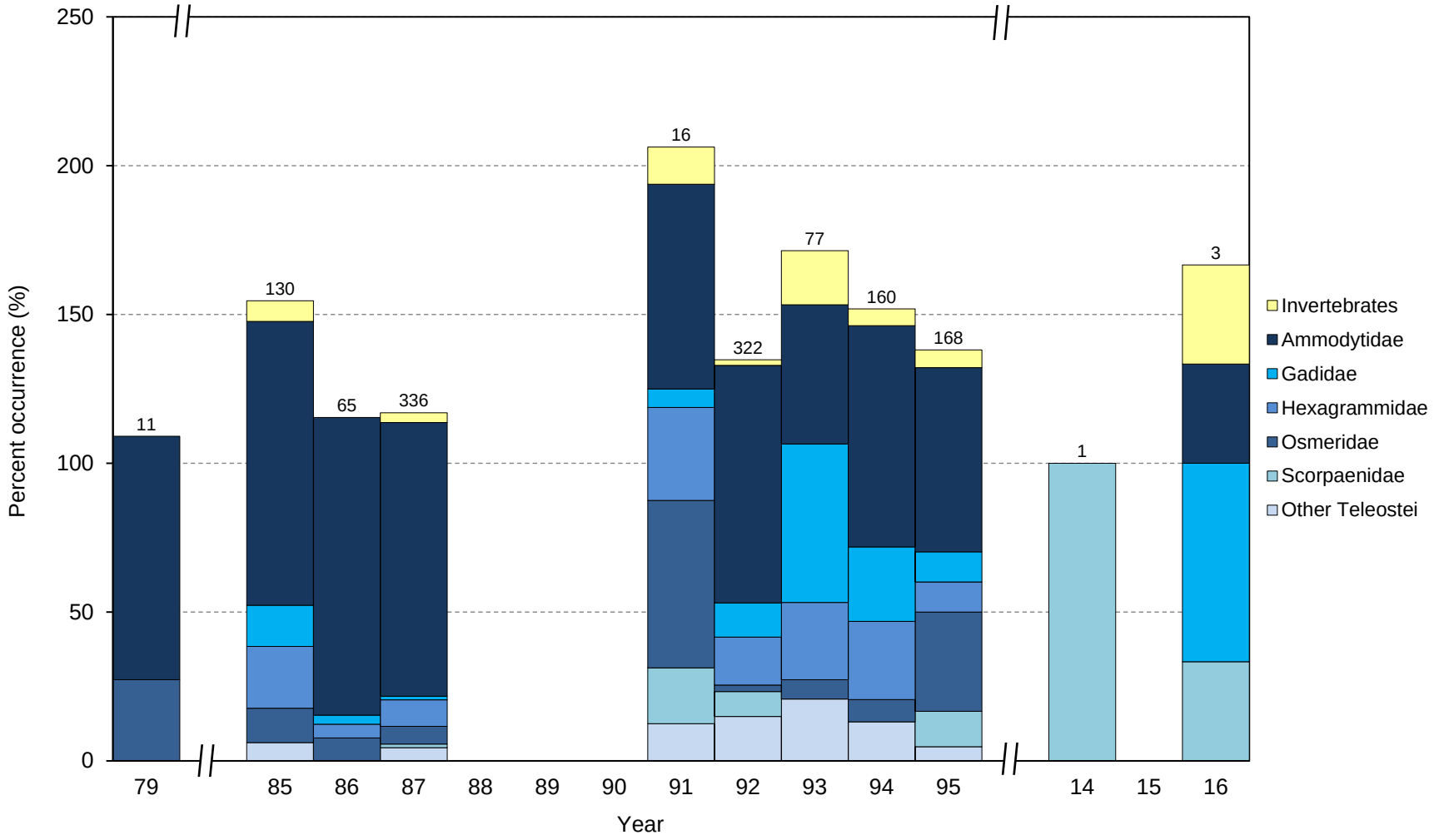

Figure 34. Frequency of occurrence of major prey items in diets of horned puffin chicks at Suklik Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017.

Table 45. Frequency of occurrence of prey items in diets of horned puffin chicks at Suklik Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1985	1986	1987	1991	1992	1993	1994	1995	2014	2016
No. samples	11	130	65	336	16	322	77	160	168	1	3
Invertebrates	-	6.9	-	3.3	12.5	1.9	18.2	5.6	6.0	-	33.3
Fish	**100.0**	**100.0**	**100.0**	**99.1**	**100.0**	**99.7**	**93.5**	**99.4**	**100.0**	**100.0**	**100.0**
Teleostei	**100.0**	**100.0**	**100.0**	**99.1**	**100.0**	**99.7**	**93.5**	**99.4**	**100.0**	**100.0**	**100.0**
Ammodytidae	**81.8**	**95.4**	**100.0**	**92.0**	**68.8**	**79.8**	**46.8**	**74.4**	**61.9**	**-**	**33.3**
Ammodytes spp.	81.8	95.4	100.0	92.0	68.8	79.8	46.8	74.4	61.9	-	33.3
Gadidae	**-**	**13.8**	**3.1**	**1.2**	**6.3**	**11.5**	**53.2**	**25.0**	**10.1**	**-**	**66.7**
Gadus chalcogrammus	-	13.8	3.1	1.2	6.3	10.9	51.9	18.8	9.5	-	66.7
Other Gadidae	-	-	-	-	6.3	2.8	2.6	13.1	0.6	-	-
Hexagrammidae	**-**	**20.8**	**4.6**	**8.9**	**31.3**	**16.1**	**26.0**	**26.3**	**10.1**	**-**	**-**
Hexagrammos decagrammus	-	-	-	-	-	-	22.1	23.8	-	-	-
Unid. Hexagrammidae	-	-	-	-	31.3	16.1	5.2	2.5	-	-	-
Other Hexagrammidae	-	20.8	4.6	8.9	-	-	-	1.9	10.1	-	-
Osmeridae	**27.3**	**11.5**	**7.7**	**6.0**	**56.3**	**2.2**	**6.5**	**7.5**	**33.3**	**-**	**-**
Mallotus villosus	27.3	11.5	7.7	6.0	56.3	2.2	6.5	7.5	33.3	-	-
Scorpaenidae	**-**	**-**	**-**	**1.2**	**18.8**	**8.4**	**-**	**-**	**11.9**	**100.0**	**33.3**
Unid. Scorpaenidae	-	-	-	-	18.8	8.4	-	-	-	100.0	-
Other Scorpaenidae	-	-	-	1.2	-	-	-	-	11.9	-	33.3
Other Teleostei	-	6.2	-	4.5	12.5	14.9	20.8	13.1	4.8	-	-

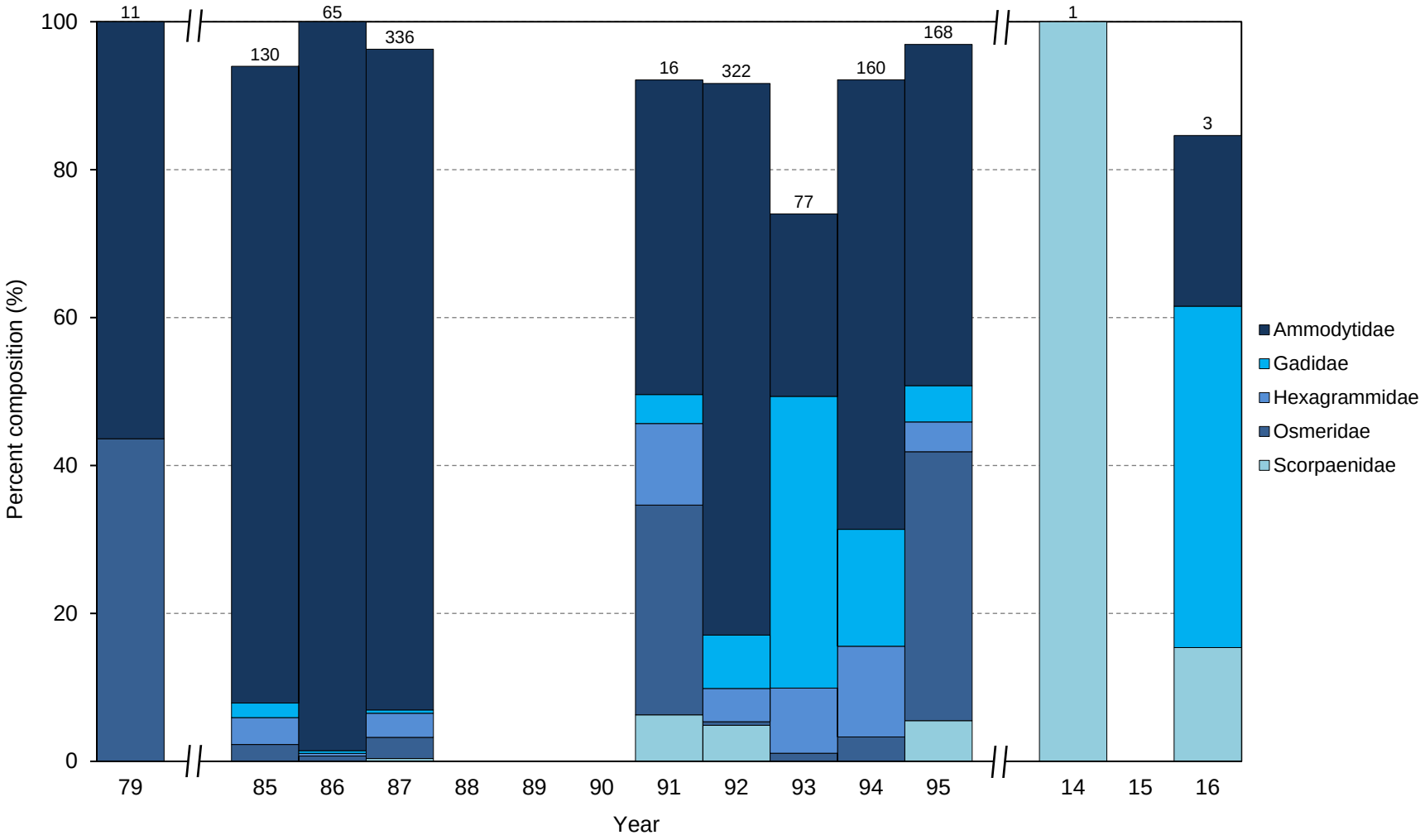

Figure 35. Percent composition of major prey items in diets of horned puffin chicks at Suklik Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017.

Table 46. Percent composition of prey items in diets of horned puffin chicks at Suklik Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1985	1986	1987	1991	1992	1993	1994	1995	2014	2016
No. samples	11	130	65	336	16	322	77	160	168	1	3
No. individuals	94	1928	833	1323	127	2050	454	816	817	2	13
Invertebrates	-	0.5	-	1.1	6.3	2.2	19.2	1.7	1.8	-	15.4
Fish	**100.0**	**99.5**	**100.0**	**98.9**	**93.7**	**97.8**	**80.8**	**98.3**	**98.2**	**100.0**	**84.6**
Teleostei	**100.0**	**99.5**	**100.0**	**98.9**	**93.7**	**97.8**	**80.8**	**98.3**	**98.2**	**100.0**	**84.6**
Ammodytidae	**56.4**	**86.1**	**98.6**	**89.3**	**42.5**	**74.6**	**24.7**	**60.8**	**46.1**	**-**	**23.1**
Ammodytes spp.	56.4	86.1	98.6	89.3	42.5	74.6	24.7	60.8	46.1	-	23.1
Gadidae	**-**	**2.0**	**0.4**	**0.5**	**3.9**	**7.2**	**39.4**	**15.8**	**4.9**	**-**	**46.2**
Gadus chalcogrammus	-	2.0	0.4	0.5	3.1	6.6	39.0	11.6	4.8	-	46.2
Other Gadidae	-	-	-	-	0.8	0.6	0.4	4.2	0.1	-	-
Hexagrammidae	-	3.6	0.4	3.3	11.0	4.5	8.8	12.3	4.0	-	-
Osmeridae	**43.6**	**2.3**	**0.7**	**2.9**	**28.3**	**0.5**	**1.1**	**3.3**	**36.4**	-	-
Mallotus villosus	43.6	2.3	0.7	2.9	28.3	0.5	1.1	3.3	36.4	-	-
Scorpaenidae	**-**	**-**	**-**	**0.4**	**6.3**	**4.9**	**-**	**-**	**5.5**	**100.0**	**15.4**
Unid. Scorpaenidae	-	-	-	-	6.3	4.9	-	-	-	100.0	-
Other Scorpaenidae	-	-	-	0.4	-	-	-	-	5.5	-	15.4
Other Teleostei	-	5.5	-	2.6	1.6	6.1	6.8	6.1	1.2	-	-

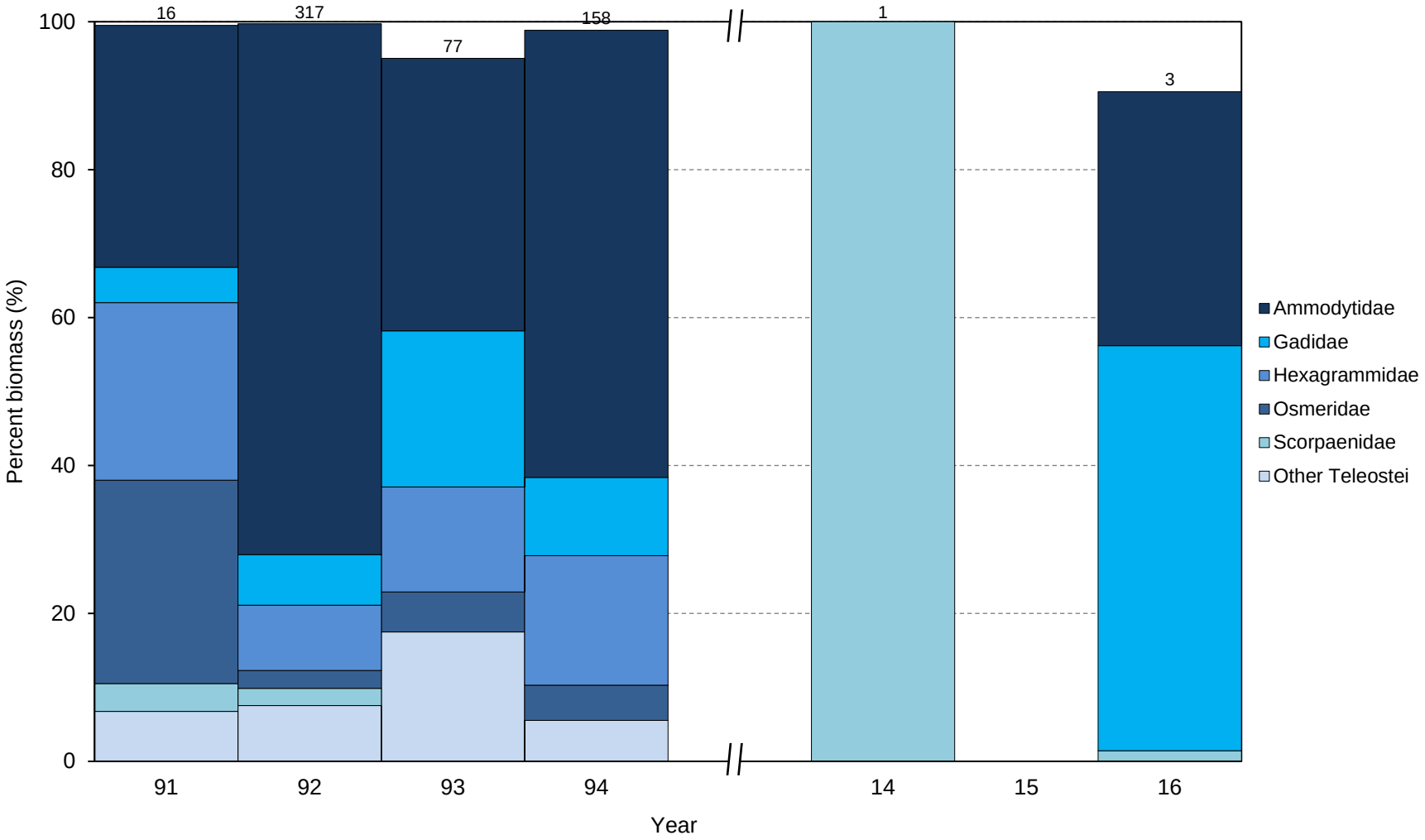

Figure 36. Relative biomass of major prey items in diets of horned puffin chicks at Suklik Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017; no mass data exist in 1979, 1985-1987, or 1995.

Table 47. Relative biomass of prey items in diets of horned puffin chicks at Suklik Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, 2015, or 2017; no mass data exist in 1979, 1985-1987, or 1995. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1991	1992	1993	1994	2014	2016
No. samples	16	317	77	158	1	3
Total mass (g)	201	2664	274	1117	3	22
Invertebrates	0.5	0.3	4.9	1.2	-	9.5
Fish	**99.5**	**99.7**	**95.1**	**98.8**	**100.0**	**90.5**
Teleostei	**99.5**	**99.7**	**95.1**	**98.8**	**100.0**	**90.5**
Ammodytidae	**32.7**	**71.8**	**36.9**	**60.5**	**-**	**34.3**
Ammodytes spp.	32.7	71.8	36.9	60.5	-	34.3
Gadidae	**4.8**	**6.8**	**21.1**	**10.6**	**-**	**54.8**
Gadus chalcogrammus	4.2	6.0	21.0	8.5	-	54.8
Other Gadidae	0.6	0.8	0.1	2.1	-	-
Hexagrammidae	**24.0**	**8.8**	**14.2**	**17.5**	**-**	**-**
Hexagrammos decagrammus	-	-	12.7	15.4	-	-
Unid. Hexagrammidae	24.0	8.8	1.5	0.5	-	-
Other Hexagrammidae	-	-	-	1.6	-	-
Osmeridae	**27.5**	**2.4**	**5.4**	**4.8**	**-**	**-**
Mallotus villosus	27.5	2.4	5.4	4.8	-	-
Scorpaenidae	**3.7**	**2.3**	**-**	**-**	**100.0**	**1.4**
Unid. Scorpaenidae	3.7	2.3	-	-	100.0	-
Other Scorpaenidae	-	-	-	-	-	1.4
Other Teleostei	6.8	7.5	17.5	5.5	-	-

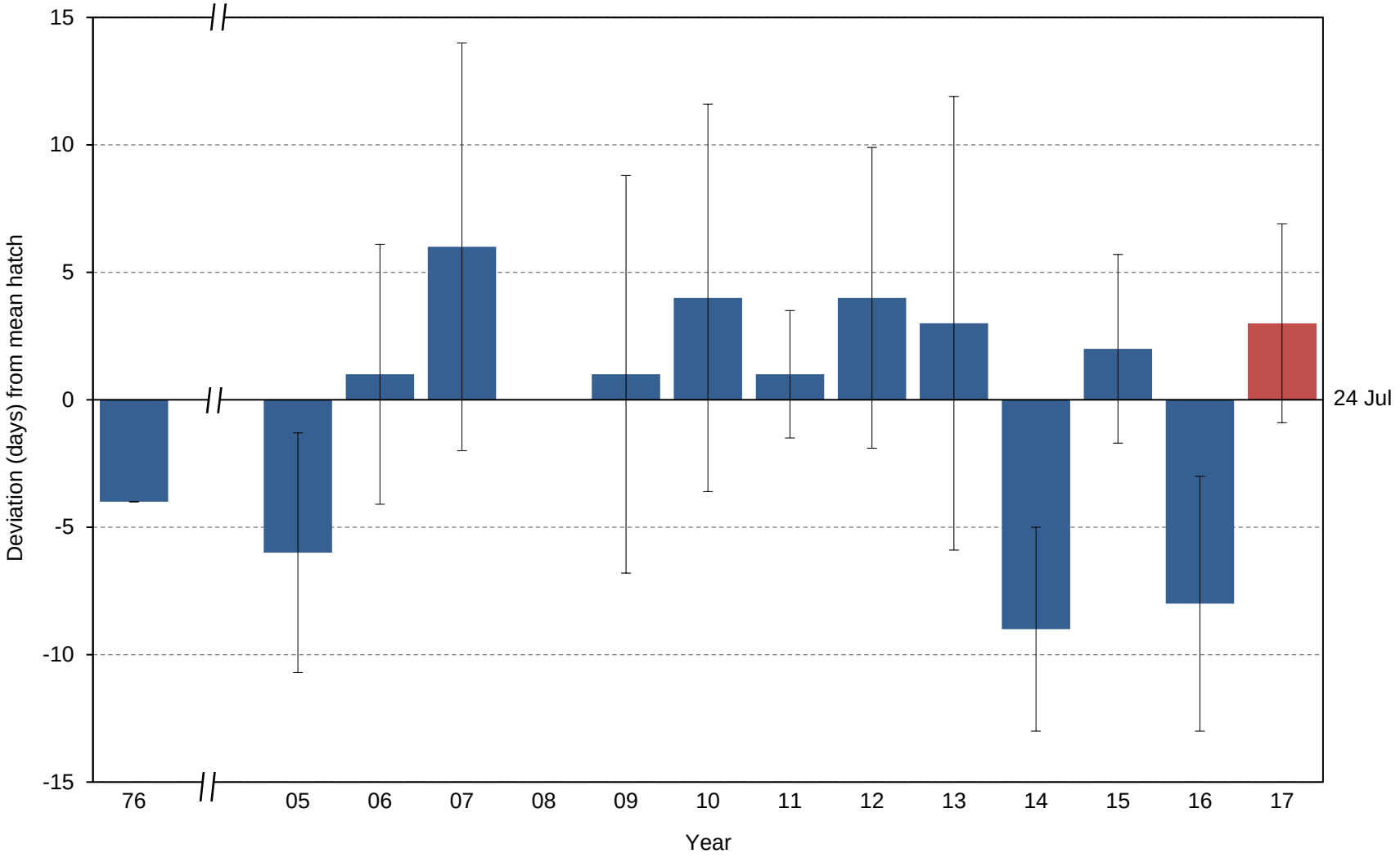

Figure 37. Yearly hatch date deviation (from the 1976-2016 average of 24 July) for tufted puffins at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1977-2004 or 2008.

Table 48. Breeding chronology of tufted puffins at Chowiet Island, Alaska. No data were collected in 1977-2004 or 2008.

Year	Mean hatch	SD	*n*[a]	First hatch	Last hatch	First fledge[b]
1976	19 Jul	-	48	9 Jul	14 Aug	4 Sep
2005	18 Jul	4.7	28	9 Jul	27 Jul	26 Aug
2006	25 Jul	5.1	17	21 Jul	6 Aug	27 Aug
2007	30 Jul	8.0	15	23 Jul	24 Aug	>1 Sep
2009	25 Jul	7.8	12	13 Jul	6 Aug	2 Sep
2010	28 Jul	7.6	17	15 Jul	9 Aug	27 Aug
2011	25 Jul	2.5	4	23 Jul	29 Jul	>6 Sep
2012	27 Jul	5.9	12	14 Jul	9 Aug	31 Aug
2013	27 Jul	8.9	24	17 Jul	22 Aug	>30 Aug
2014	15 Jul	4.0	23	5 Jul	23 Jul	21 Aug
2015	26 Jul	3.7	26	23 Jul	5 Aug	>1 Sep
2016	15 Jul	5.0	40	8 Jul	2 Aug	20 Aug
2017	27 Jul	3.9	31	21 Jul	6 Aug	>1 Sep

[a]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[b]In years when no chicks fledged before the field crew left the island at the end of the season, date of first fledge is listed as > the date of last nest check.

Table 49. Frequency distribution of hatch dates for tufted puffins at Chowiet Island, Alaska. Data include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1977-2004 or 2008; data from individual nests are not available in 1976.

Julian date[a]	No. nests hatching on Julian date												
	05	06	07	08	09	10	11	12	13	14	15	16	17
186	-	-	-	-	-	-	-	-	-	1	-	-	-
187	-	-	-	-	-	-	-	-	-	-	-	-	-
188	-	-	-	-	-	-	-	-	-	-	-	-	-
189	-	-	-	-	-	-	-	-	-	-	-	-	-
190	3	-	-	-	-	-	-	-	-	1	-	4	-
191	-	-	-	-	-	-	-	-	-	3	-	-	-
192	-	-	-	-	-	-	-	-	-	-	-	-	-
193	-	-	-	-	-	-	-	-	-	1	-	1	-
194	1	-	-	-	1	-	-	-	-	3	-	11	-
195	1	-	-	-	-	-	-	-	-	-	-	11	-
196	7	-	-	-	2	1	-	1	-	7	-	-	-
197	1	-	-	-	-	-	-	-	-	-	-	-	-
198	3	-	-	-	-	3	-	-	3	2	-	3	-
199	1	-	-	-	1	-	-	-	1	-	-	-	-
200	-	-	-	-	-	-	-	-	-	4	-	4	-
201	-	-	-	-	-	-	-	-	2	-	-	-	-
202	7	9	-	-	1	-	-	-	2	-	-	2	3
203	-	-	-	-	-	-	-	-	-	-	-	-	-
204	1	-	4	-	-	1	2	1	1	1	9	1	-
205	-	-	-	-	-	-	1	-	-	-	5	-	4
206	2	-	-	-	-	-	-	3	1	-	-	-	10
207	-	1	-	-	-	-	-	-	4	-	-	2	-
208	1	3	1	-	-	3	-	-	-	-	2	-	-
209	-	-	-	-	-	1	-	-	2	-	5	-	6
210	-	-	6	-	4	-	1	3	1	-	-	-	4
211	-	-	-	-	-	1	-	-	1	-	-	-	-
212	-	2	-	-	1	2	-	3	2	-	1	-	-
213	-	-	-	-	-	-	-	-	-	-	3	-	1
214	-	1	-	-	-	-	-	-	1	-	-	-	1
215	-	-	1	-	1	-	-	-	-	-	-	1	-
216	-	-	-	-	-	2	-	-	1	-	-	-	-
217	-	-	-	-	-	-	-	-	-	-	1	-	-
218	-	1	2	-	1	2	-	-	-	-	-	-	2
219	-	-	-	-	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-	-	-	-	-
221	-	-	-	-	-	1	-	-	-	-	-	-	-
222	-	-	-	-	-	-	-	1	-	-	-	-	-
223	-	-	-	-	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	-	-	-	-	-	-
225	-	-	-	-	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	-	-	-	-	-	-	-	-
227	-	-	-	-	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	-	-	-	-	-	-
229	-	-	-	-	-	-	-	-	-	-	-	-	-
230	-	-	-	-	-	-	-	-	1	-	-	-	-
231	-	-	-	-	-	-	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-	-	-	-	-	-
234	-	-	-	-	-	-	-	-	1	-	-	-	-
235	-	-	-	-	-	-	-	-	-	-	-	-	-
236	-	-	1	-	-	-	-	-	-	-	-	-	-
n	28	17	15	-	12	17	4	12	24	23	26	40	31

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

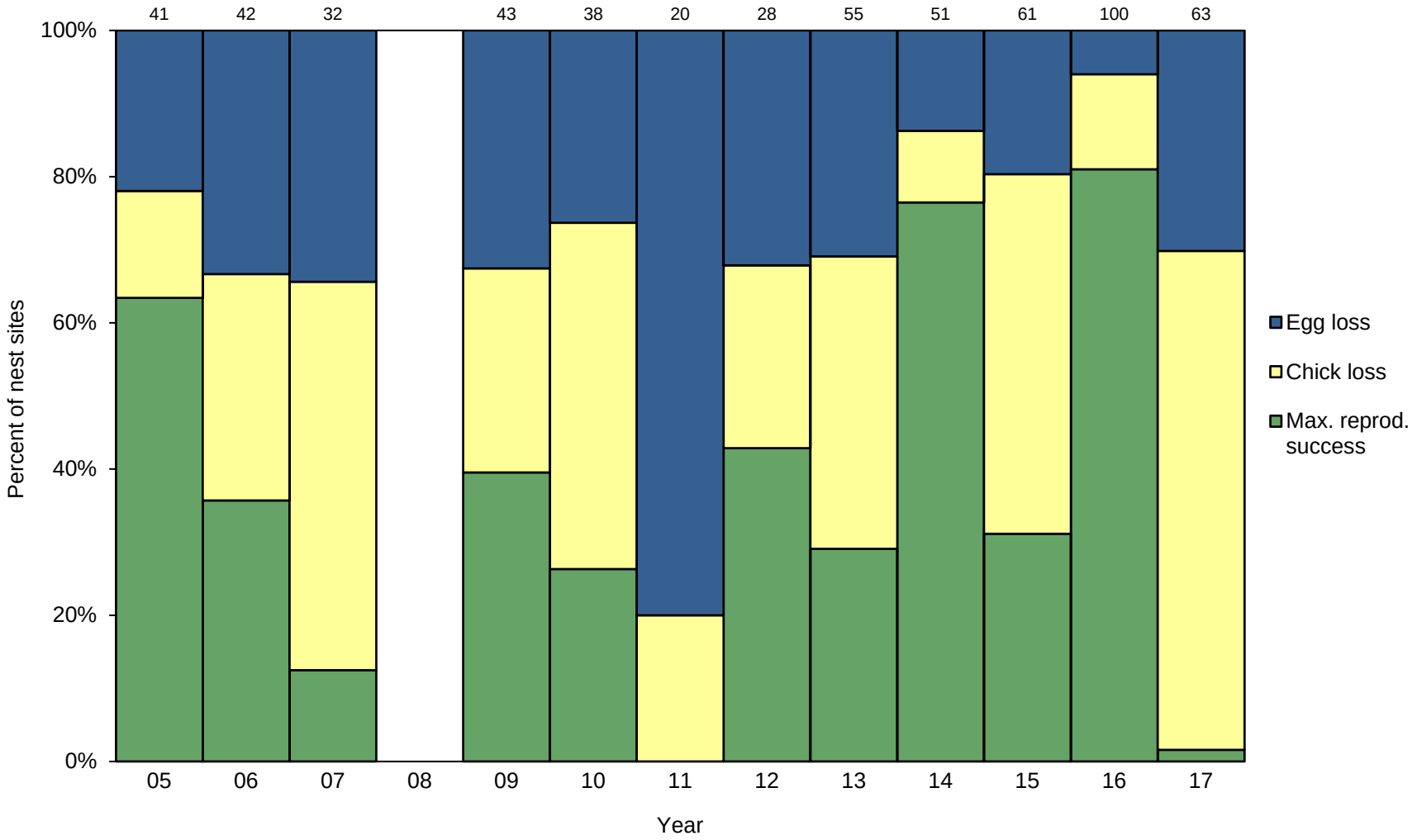

Figure 38. Maximum potential reproductive performance of tufted puffins at Chowiet Island, Alaska. Values include nest sites with chicks still present but too young to consider fledged at the last check. Egg loss=[(B+H)-D+H]/(B+H); Chick loss=[(D+H)-F+H]/(B+H); Maximum potential reproductive success=[(F+H)/(B+H)], where B=nest sites with eggs; D=nest sites with chicks; F=nest sites with chicks fledged; H=nest sites with young chicks still present. Numbers above columns indicate sample sizes (B+H). No data were collected in 1977-2004 or 2008; maximum values are not available in 1976.

Table 50. Reproductive performance of tufted puffins at Chowiet Island, Alaska. No data were collected in 1977-2004 or 2008.

Year	Nest sites w/ eggs (B)	Nest sites w/ chicks (D)	Nest sites w/ chicks fledged (F)	Nest sites w/ young chicks still present[a] (H)	Nesting success (D/B)[b]	Fledging success (F/D)[c]	Reproductive success (F/B)	Max. potential nesting success[d] [(D+H)/(B+H)]	Max. potential fledging success[d] [(F+H)/(D+H)]	Max. potential reproductive success[d] [(F+H)/(B+H)]
1976	38	16	9	-	0.42	0.56	0.24	-	-	-
2005	41	32	26	0	0.78	0.81	0.63	0.78	0.81	0.63
2006	38	24	11	4	0.63	0.46	0.29	0.67	0.54	0.36
2007	29	18	1	3	0.62	0.06	0.03	0.66	0.19	0.13
2009	40	26	14	3	0.65	0.54	0.35	0.67	0.59	0.40
2010	35	25	7	3	0.71	0.28	0.20	0.74	0.36	0.26
2011	20	4	0	0	0.20	0.00	0.00	0.20	0.00	0.00
2012	27	18	11	1	0.67	0.61	0.41	0.68	0.63	0.43
2013	49	32	10	6	0.65	0.31	0.20	0.69	0.42	0.29
2014	48	41	36	3	0.85	0.88	0.75	0.86	0.89	0.76
2015	54	42	12	7	0.78	0.29	0.22	0.80	0.39	0.31
2016	100	94	81	0	0.94	0.86	0.81	0.94	0.86	0.81
2017	63	44	1	0	0.70	0.02	0.02	0.70	0.02	0.02

[a]Chicks still present at last check but too young to consider successfully fledged by fledging age conventions (still present ≥33 d for tufted puffins). These nests are not included in the number of nest sites w/ eggs (B) or chicks (D) or estimates of success but are used only to calculate a value of maximum potential reproductive success.

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

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

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

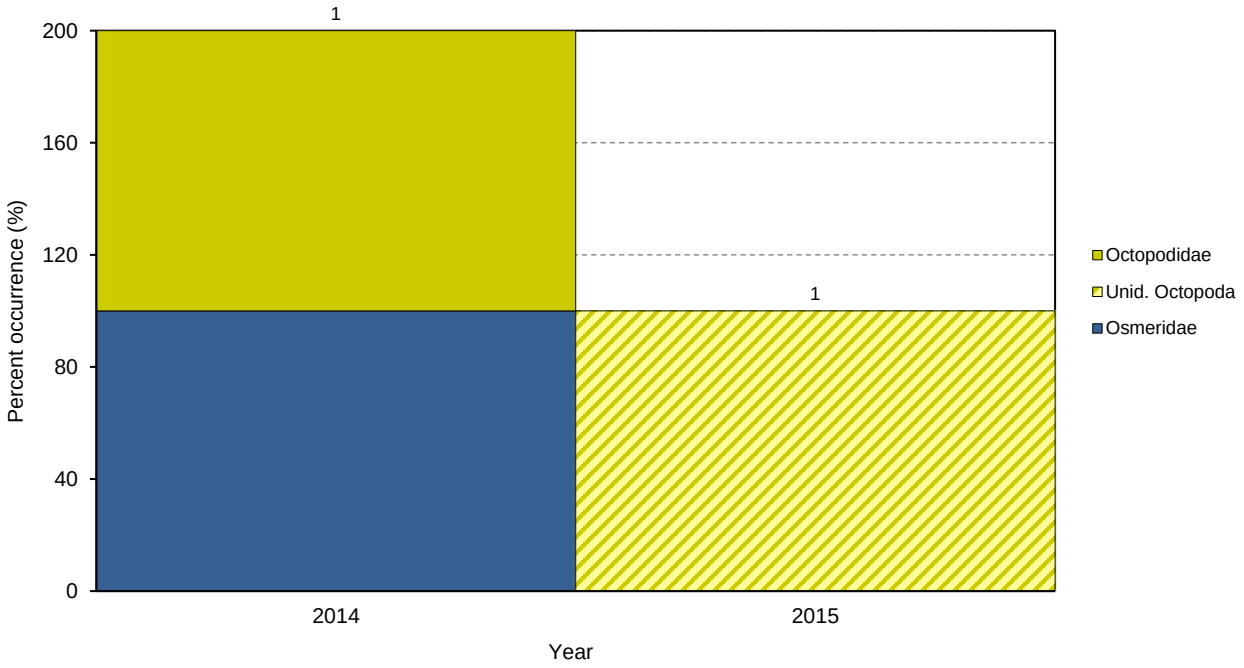

Figure 39. Frequency of occurrence of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2016-2017.

Table 51. Frequency of occurrence of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2016-2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015
No. samples	1	1
Invertebrates	**100.0**	**100.0**
Cephalopoda	**100.0**	**100.0**
Octopodidae	**100.0**	**-**
Enteroctopus dofleini	100.0	-
Unid. Octopoda	-	100.0
Fish	**100.0**	**-**
Teleostei	**100.0**	**-**
Osmeridae	**100.0**	**-**
Mallotus villosus	100.0	-

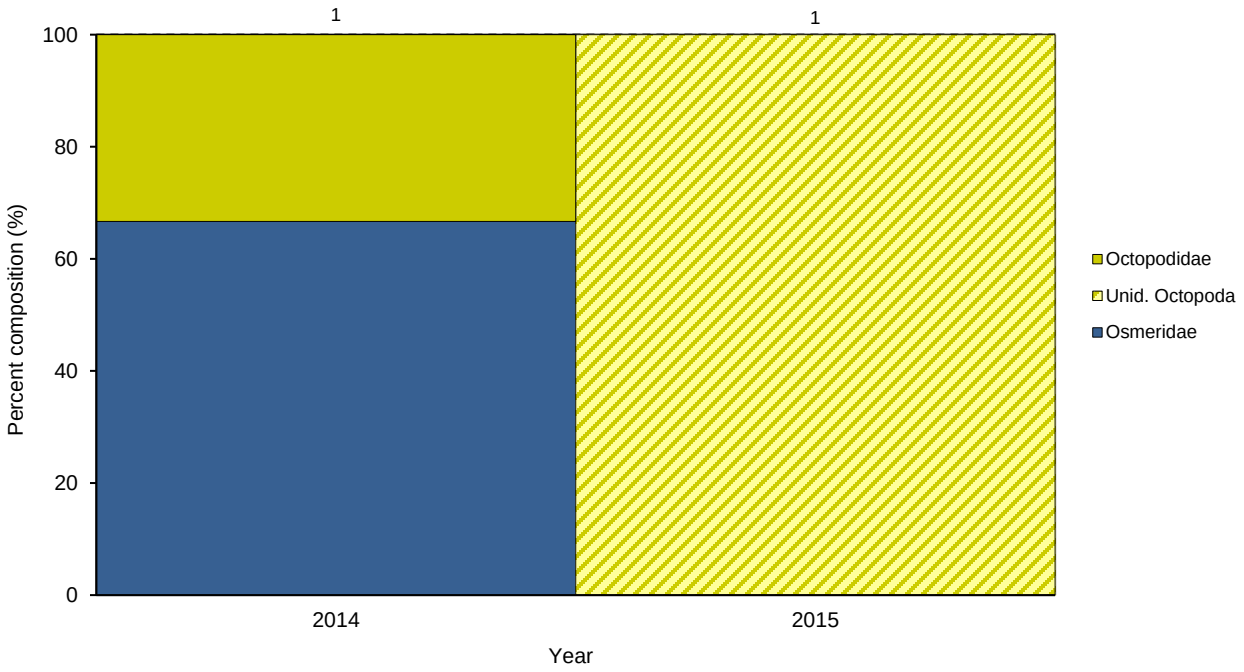

Figure 40. Percent composition of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2016-2017.

Table 52. Percent composition of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2016-2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015
No. samples	1	1
No. individuals	6	1
Invertebrates	**33.3**	**100.0**
Cephalopoda	**33.3**	**100.0**
Octopodidae	**33.3**	**-**
Enteroctopus dofleini	33.3	-
Unid. Octopoda	-	100.0
Fish	**66.7**	**-**
Teleostei	**66.7**	**-**
Osmeridae	**66.7**	**-**
Mallotus villosus	66.7	-

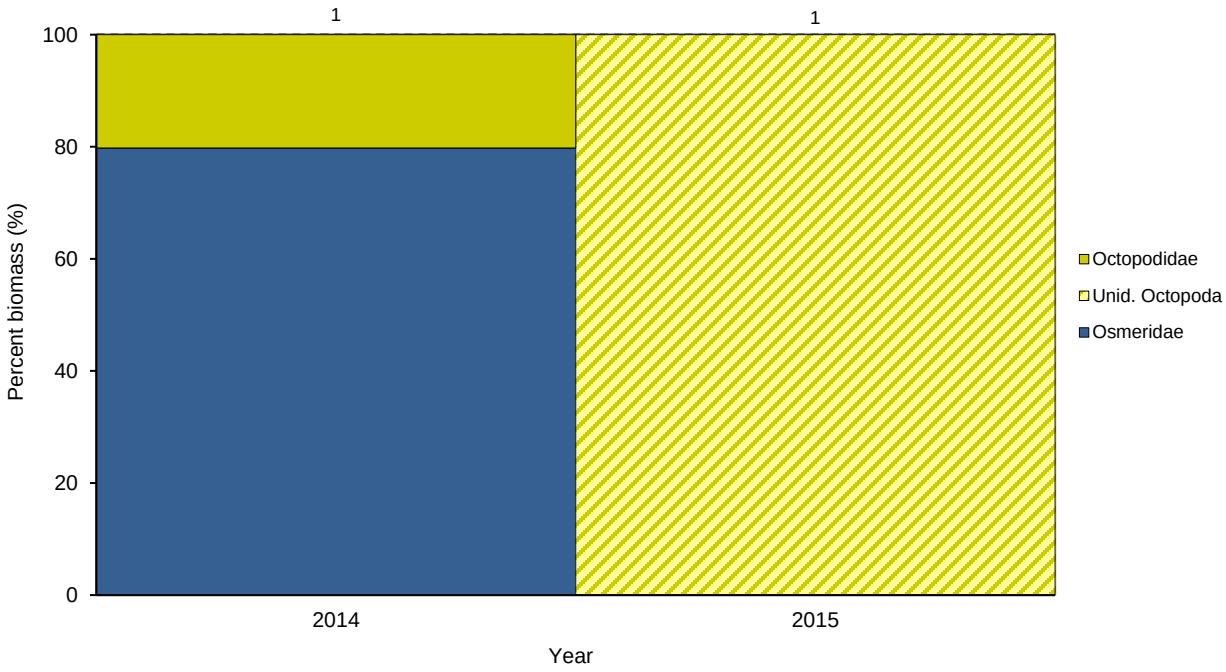

Figure 41. Relative biomass of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 2016-2017.

Table 53. Relative biomass of major prey items in diets of tufted puffin chicks at Chowiet Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 2016-2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2014	2015
No. samples	1	1
Total mass (g)	9	1
Invertebrates	**20.2**	**100.0**
Cephalopoda	**20.2**	**100.0**
Octopodidae	**20.2**	**-**
Enteroctopus dofleini	20.2	-
Unid. Octopoda	-	100.0
Fish	**79.8**	**-**
Teleostei	**79.8**	**-**
Osmeridae	**79.8**	**-**
Mallotus villosus	79.8	-

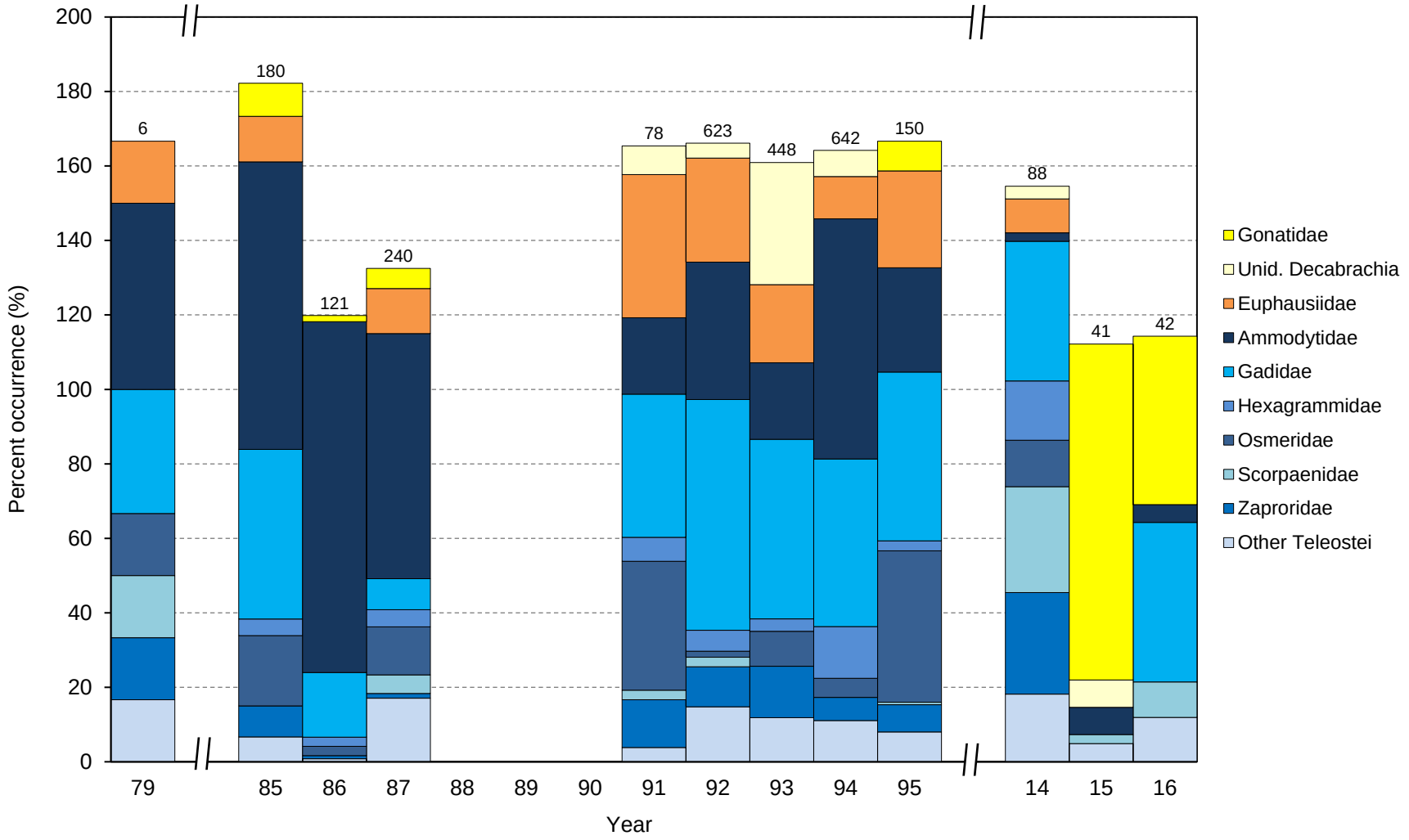

Figure 42. Frequency of occurrence of major prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017.

Table 54. Frequency of occurrence of prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average occurrence of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1985	1986	1987	1991	1992	1993	1994	1995	2014	2015	2016
No. samples	6	180	121	240	78	623	448	642	150	88	41	42
Invertebrates	**16.7**	**22.8**	**3.3**	**20.0**	**56.4**	**33.1**	**50.9**	**17.9**	**32.7**	**14.8**	**100.0**	**45.2**
Cephalopoda	**-**	**11.7**	**3.3**	**8.8**	**19.2**	**8.2**	**37.3**	**8.6**	**9.3**	**6.8**	**100.0**	**45.2**
Gonatidae	**-**	**8.9**	**1.7**	**5.4**	**-**	**-**	**-**	**-**	**8.0**	**-**	**90.2**	**45.2**
Unid. Gonatidae	-	8.9	1.7	5.4	-	-	-	-	8.0	-	85.4	42.9
Other Gonatidae	-	-	-	-	-	-	-	-	-	-	4.9	4.8
Unid. Decabrachia	-	-	-	-	7.7	4.0	32.8	7.0	-	3.4	7.3	-
Other Cephalopoda	-	3.3	1.7	4.2	11.5	4.5	6.0	1.7	2.0	4.5	2.4	-
Euphausiacea	**16.7**	**12.2**	**-**	**12.1**	**38.5**	**27.9**	**21.0**	**11.4**	**26.0**	**9.1**	**-**	**-**
Euphausiidae	**16.7**	**12.2**	**-**	**12.1**	**38.5**	**27.9**	**21.0**	**11.4**	**26.0**	**9.1**	**-**	**-**
Thysanoessa spp.	16.7	12.2	-	12.1	-	-	-	-	26.0	-	-	-
Unid. Euphausiidae	-	-	-	-	38.5	27.9	21.0	11.4	-	9.1	-	-
Other Invertebrates	-	-	-	0.4	2.6	1.3	1.3	-	-	-	-	-
Fish	**100.0**	**96.7**	**100.0**	**92.9**	**79.5**	**92.0**	**81.5**	**95.6**	**88.7**	**93.2**	**12.2**	**61.9**
Teleostei	**100.0**	**96.7**	**100.0**	**92.9**	**79.5**	**92.0**	**81.5**	**95.6**	**88.7**	**93.2**	**12.2**	**61.9**
Ammodytidae	**50.0**	**77.2**	**94.2**	**65.8**	**20.5**	**36.9**	**20.5**	**64.5**	**28.0**	**2.3**	**7.3**	**4.8**
Ammodytes spp.	50.0	77.2	94.2	65.8	20.5	36.9	20.5	64.5	28.0	2.3	7.3	4.8
Gadidae	**33.3**	**45.6**	**17.4**	**8.3**	**38.5**	**62.0**	**48.2**	**45.0**	**45.3**	**37.5**	**-**	**42.9**
Gadus chalcogrammus	33.3	45.6	12.4	8.3	30.8	56.2	45.8	38.6	42.7	27.3	-	40.5
Other Gadidae	-	-	10.7	-	12.8	19.3	8.3	15.6	5.3	17.0	-	2.4
Hexagrammidae	-	4.4	2.5	4.6	6.4	5.6	3.3	13.9	2.7	15.9	-	-
Osmeridae	**16.7**	**18.9**	**2.5**	**12.9**	**34.6**	**1.6**	**9.4**	**5.1**	**40.7**	**12.5**	**-**	**-**
Mallotus villosus	16.7	17.8	2.5	12.9	34.6	1.3	9.4	5.1	40.7	11.4	-	-
Other Osmeridae	-	1.7	-	-	-	0.5	-	-	-	1.1	-	-
Scorpaenidae	16.7	-	-	5.0	2.6	2.6	-	-	0.7	28.4	2.4	9.5
Zaproridae	**16.7**	**8.3**	**0.8**	**1.3**	**12.8**	**10.8**	**13.8**	**6.2**	**7.3**	**27.3**	**-**	**-**
Zaprora silenus	16.7	8.3	0.8	1.3	12.8	10.8	13.8	6.2	7.3	27.3	-	-
Other Teleostei	16.7	6.7	0.8	17.1	3.8	14.8	11.8	11.1	8.0	18.2	4.9	11.9
Other	-	-	-	-	2.6	0.2	-	-	-	-	-	-

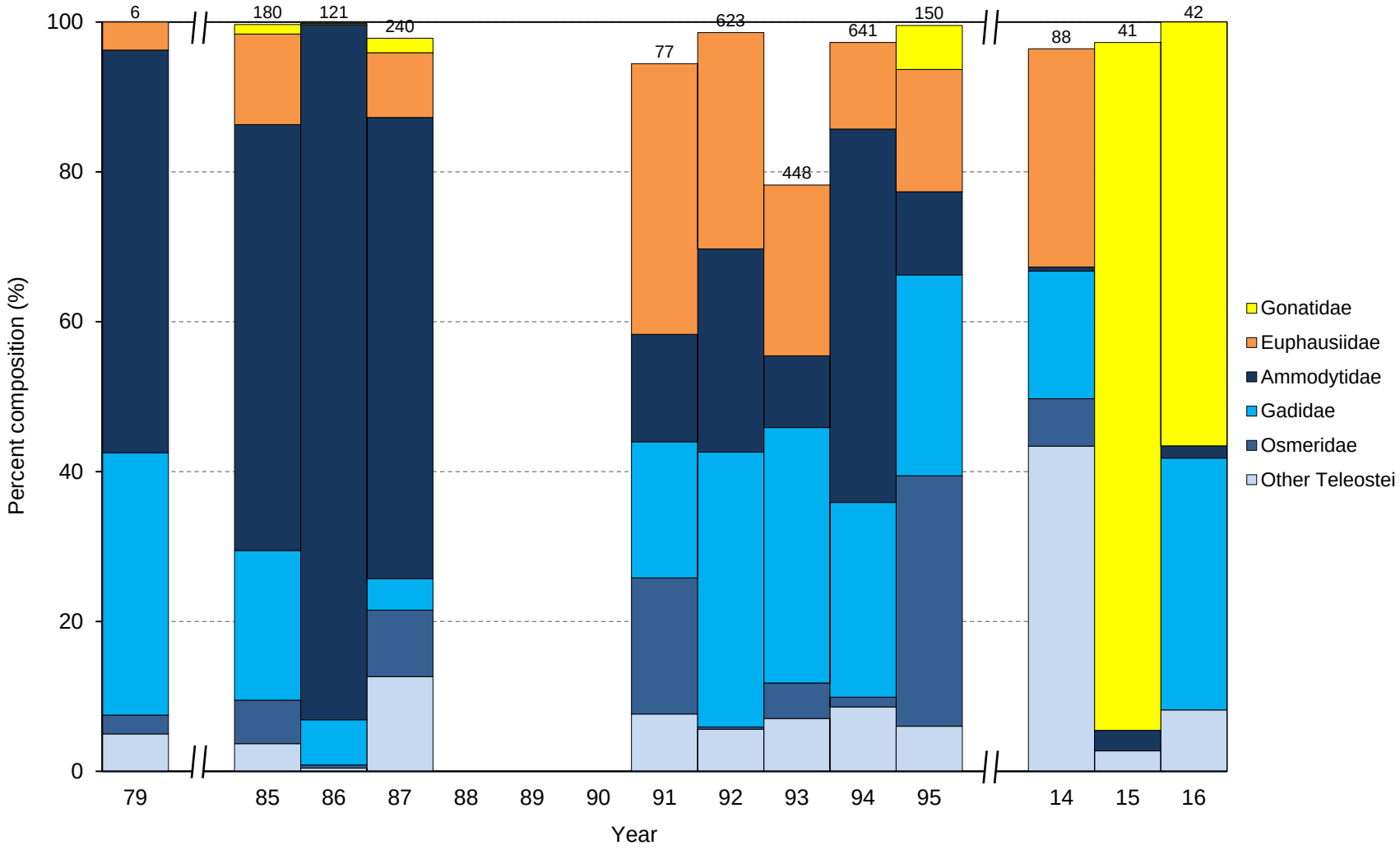

Figure 43. Percent composition of major prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017.

Table 55. Percent composition of prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1979	1985	1986	1987	1991	1992	1993	1994	1995	2014	2015	2016
No. samples	6	180	121	240	77	623	448	641	150	88	41	42
No. individuals	80	1812	1180	879	523	5869	2840	4328	649	364	183	122
Invertebrates	**3.8**	**13.7**	**0.3**	**12.7**	**41.3**	**30.3**	**44.5**	**14.3**	**22.7**	**32.7**	**94.5**	**56.6**
Cephalopoda	**-**	**1.6**	**0.3**	**4.0**	**4.8**	**1.2**	**21.5**	**2.7**	**6.3**	**3.6**	**94.5**	**56.6**
Gonatidae	**-**	**1.3**	**0.2**	**1.9**	**-**	**-**	**-**	**-**	**5.9**	**-**	**91.8**	**56.6**
Unid. Gonatidae	-	1.3	0.2	1.9	-	-	-	-	5.9	-	89.6	54.9
Other Gonatidae	-	-	-	-	-	-	-	-	-	-	2.2	1.6
Other Cephalopoda	-	0.3	0.2	2.0	-	-	21.5	2.7	0.5	3.6	2.7	-
Euphausiacea	**3.8**	**12.1**	**-**	**8.6**	**36.1**	**28.9**	**22.8**	**11.6**	**16.3**	**29.1**	**-**	**-**
Euphausiidae	**3.8**	**12.1**	**-**	**8.6**	**36.1**	**28.9**	**22.8**	**11.6**	**16.3**	**29.1**	**-**	**-**
Unid. Euphausiidae	-	-	-	-	36.1	28.9	22.8	11.6	-	29.1	-	-
Other Euphausiidae	3.8	12.1	-	8.6	-	-	-	-	16.3	-	-	-
Other Invertebrates	-	-	-	0.1	0.4	0.2	0.2	-	-	-	-	-
Fish	**96.3**	**86.3**	**99.7**	**87.3**	**58.3**	**69.7**	**55.5**	**85.7**	**77.3**	**67.3**	**5.5**	**43.4**
Teleostei	**96.3**	**86.3**	**99.7**	**87.3**	**58.3**	**69.7**	**55.5**	**85.7**	**77.3**	**67.3**	**5.5**	**43.4**
Ammodytidae	**53.8**	**56.8**	**92.8**	**61.5**	**14.3**	**27.1**	**9.6**	**49.8**	**11.1**	**0.5**	**2.7**	**1.6**
Ammodytes spp.	53.8	56.8	92.8	61.5	14.3	27.1	9.6	49.8	11.1	0.5	2.7	1.6
Gadidae	**35.0**	**20.0**	**6.0**	**4.2**	**18.2**	**36.7**	**34.1**	**26.0**	**26.8**	**17.0**	**-**	**33.6**
Gadus chalcogrammus	35.0	20.0	2.5	4.2	14.5	32.8	31.8	22.0	25.6	11.8	-	32.0
Other Gadidae	-	-	3.6	-	3.6	3.8	2.3	4.0	1.2	5.2	-	1.6
Osmeridae	**2.5**	**5.8**	**0.4**	**8.9**	**18.2**	**0.3**	**4.8**	**1.3**	**33.4**	**6.3**	**-**	**-**
Mallotus villosus	2.5	4.0	0.4	8.9	18.2	0.2	4.8	1.3	33.4	6.0	-	-
Other Osmeridae	-	1.8	-	-	-	0.1	-	-	-	0.3	-	-
Other Teleostei	5.0	3.7	0.4	12.6	7.6	5.6	7.0	8.6	6.0	43.4	2.7	8.2
Other	-	-	-	-	0.4	<0.1	-	-	-	-	-	-

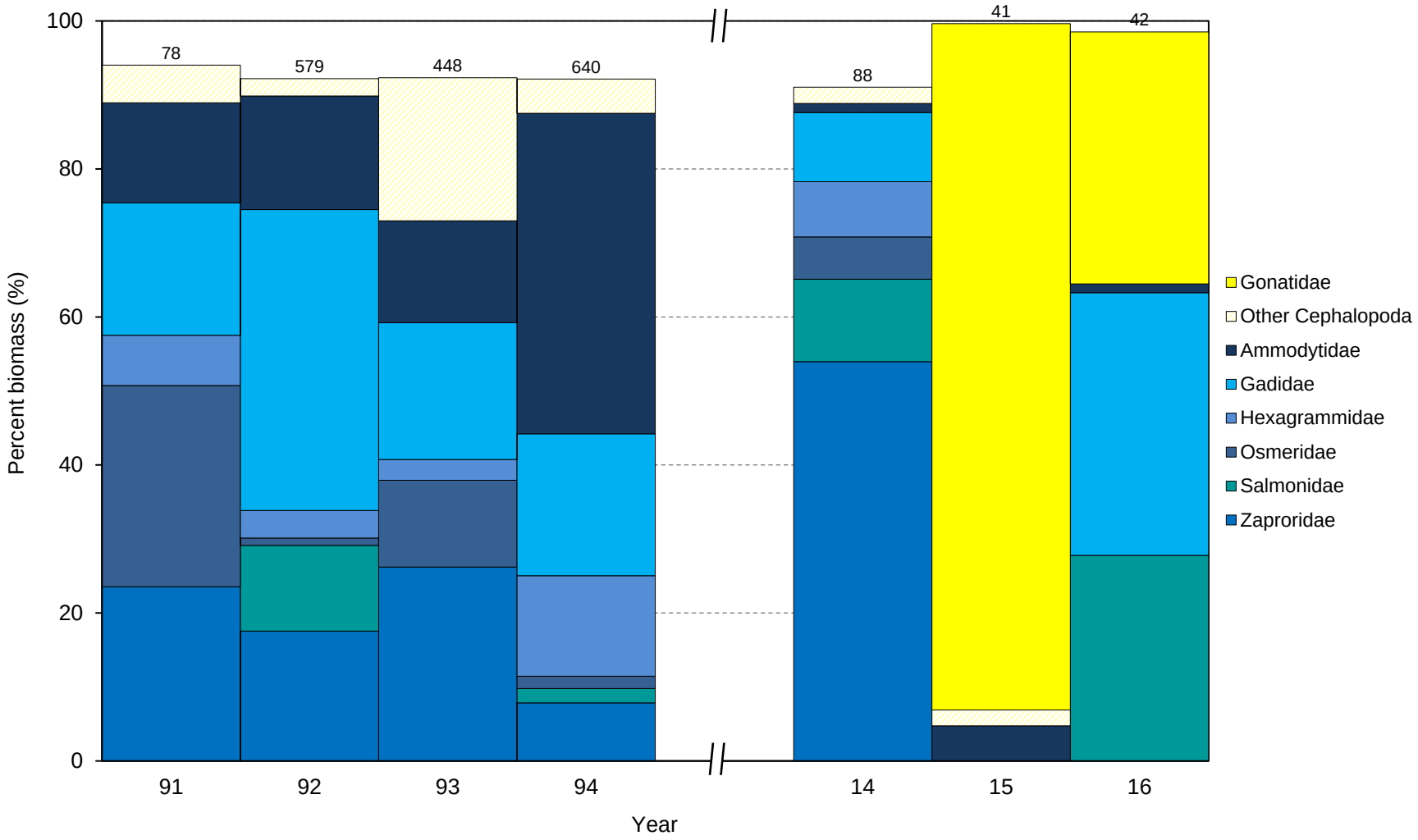

Figure 44. Relative biomass of major prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average biomass of at least 5% are shown. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. Numbers above columns indicate sample sizes. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017; no mass data exist in 1979, 1985-1987, or 1995.

Table 56. Relative biomass of prey items in diets of tufted puffin chicks at Suklik Island, Alaska. Numbers represent the percentage of the mass of combined food samples comprised by each prey item (sums to 100% each year). Prey was identified and measured in the laboratory to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average biomass of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of bill-loads collected from adults returning to the colony to feed chicks. No diet samples were collected in 1980-1984, 1988-1990, 1996-2013, or 2017; no mass data exist in 1979, 1985-1987, or 1995. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1991	1992	1993	1994	2014	2015	2016
No. samples	78	579	448	640	88	41	42
Total mass (g)	566	5199	2099	3250	738	195	313
Invertebrates	**10.2**	**5.8**	**22.1**	**6.3**	**3.3**	**94.9**	**34.1**
Cephalopoda	**5.1**	**2.3**	**19.3**	**4.6**	**2.2**	**94.9**	**34.1**
Gonatidae	**-**	**-**	**-**	**-**	**-**	**92.7**	**34.1**
Unid. Gonatidae	-	-	-	-	-	89.6	32.2
Other Gonatidae	-	-	-	-	-	3.1	1.9
Other Cephalopoda	5.1	2.3	19.3	4.6	2.2	2.2	-
Other Invertebrates	5.1	3.5	2.7	1.7	1.1	-	-
Fish	**89.7**	**94.1**	**77.9**	**93.7**	**96.7**	**5.1**	**65.9**
Teleostei	**89.7**	**94.1**	**77.9**	**93.7**	**96.7**	**5.1**	**65.9**
Ammodytidae	**13.5**	**15.4**	**13.8**	**43.3**	**1.2**	**4.7**	**1.2**
Ammodytes spp.	13.5	15.4	13.8	43.3	1.2	4.7	1.2
Gadidae	**17.9**	**40.6**	**18.5**	**19.2**	**9.3**	**-**	**35.5**
Gadus chalcogrammus	15.6	34.2	17.7	16.4	6.9	-	35.1
Other Gadidae	2.3	6.5	0.8	2.8	2.5	-	0.4
Hexagrammidae	6.8	3.7	2.8	13.6	7.5	-	-
Osmeridae	**27.2**	**1.0**	**11.7**	**1.7**	**5.7**	**-**	**-**
Mallotus villosus	27.2	0.7	11.7	1.7	5.5	-	-
Other Osmeridae	-	0.2	-	-	0.2	-	-
Salmonidae	-	11.6	-	1.9	11.1	-	27.8
Zaproridae	**23.6**	**17.6**	**26.2**	**7.9**	**54.0**	**-**	**-**
Zaprora silenus	23.6	17.6	26.2	7.9	54.0	-	-
Other Teleostei	0.8	4.3	5.0	6.2	7.9	0.3	1.5
Other	0.1	<0.1	-	-	-	-	-

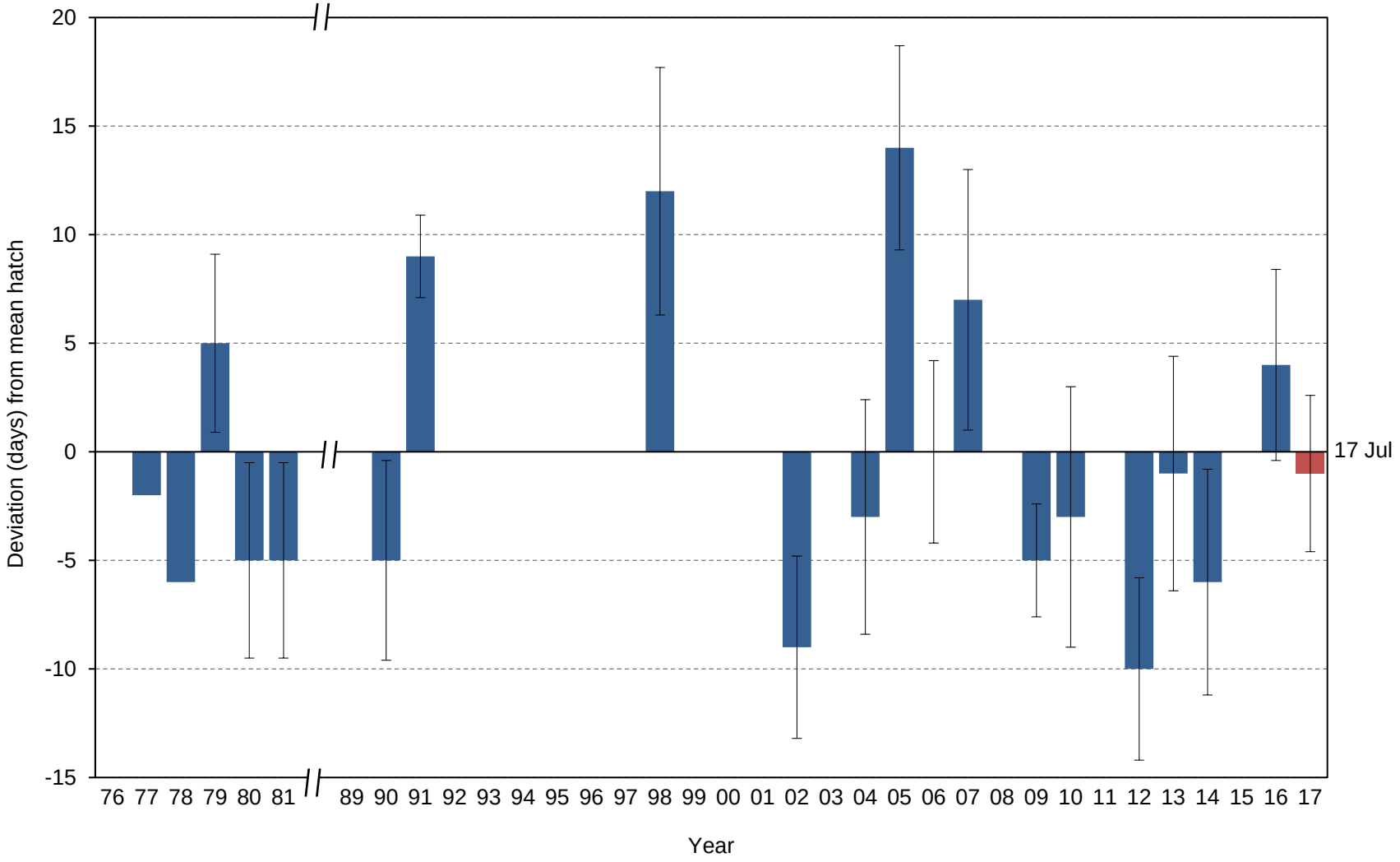

Figure 45. Yearly hatch date deviation (from the 1976-2016 average of 17 July) for black-legged kittiwakes at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date; red highlights the current year. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008 and no eggs hatched in plots in 1989, 2011, or 2015; data potentially exist in 1995 but have not yet been summarized.

Table 57. Breeding chronology of black-legged kittiwakes at Chowiet Island, Alaska. Data represent the dates of the first egg laid and the first chick hatched in each nest. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008; no eggs hatched in plots in 1989, 2011, or 2015.

Year	Mean lay	SD	*n*[a]	Mean hatch	SD	*n*[b]	First lay	First hatch	Last hatch	First fledge[c]
1976	20 Jun	-	40	16 Jul[d]	-	-	10 Jun	7 Jul	4 Aug	20 Aug
1977	19 Jun	-	54	15 Jul[d]	-	-	9 Jun	-	-	-
1978	15 Jun	-	46	11 Jul[d]	-	-	5 Jun	3 Jul	26 Jul	12 Aug
1979	25 Jun	4.3	99	22 Jul	4.1	70	19 Jun	15 Jul	4 Aug	>25 Aug
1980	14 Jun	5.1	120	11 Jul	4.5	46	6 Jun	2 Jul	20 Jul	19 Aug
1981	14 Jun	4.4	126	12 Jul	4.5	109	6 Jun	4 Jul	1 Aug	17 Aug
1989	1 Jul	2.8	23	-	-	-	27 Jun	-	-	-
1990	-	-	-	12 Jul	4.6	11	-	3 Jul	21 Jul	15 Aug
1991	28 Jun	3.5	14	26 Jul	1.9	3	23 Jun	25 Jul	29 Jul	-
1995	xx[e]	xx	xx	xx	xx	xx	17 Jun	xx	xx	xx
1998	1 Jul	7.0	57	29 Jul	5.7	30	19 Jun	19 Jul	10 Aug	28 Aug
2002	11 Jun	4.6	121	8 Jul	4.2	108	2 Jun	29 Jun	25 Jul	18 Aug
2004	15 Jun	4.2	121	13 Jul	5.4	41	10 Jun	4 Jul	24 Jul	>15 Aug
2005	4 Jul	6.9	32	31 Jul	4.7	23	16 Jun	25 Jul	12 Aug	30 Aug
2006	21 Jun	4.9	319	17 Jul	4.2	222	9 Jun	9 Jul	29 Jul	21 Aug
2007	29 Jun	5.1	99	24 Jul	6.0	71	19 Jun	13 Jul	6 Aug	25 Aug
2009	20 Jun	3.2	65	12 Jul	2.6	107	17 Jun	5 Jul	19 Jul	18 Aug
2010	20 Jun	4.7	75	14 Jul	6.0	85	15 Jun	1 Jul	3 Aug	15 Aug
2011	19 Jul	0.0	1	-	-	-	19 Jul	-	-	-
2012	11 Jun	4.2	135	6 Jul	5.2	90	<6 Jun	24 Jun	19 Jul	13 Aug
2013	18 Jun	4.3	143	16 Jul	5.4	96	9 Jun	6 Jul	1 Aug	18 Aug
2014	14 Jun	5.7	240	11 Jul	5.2	188	7 Jun	3 Jul	25 Jul	14 Aug
2015	2 Jul	2.5	27	-	-	-	25 Jun	-	-	-
2016	23 Jun	4.4	178	20 Jul	4.4	203	16 Jun	14 Jul	15 Aug	20 Aug
2017	20 Jun	4.3	101	16 Jul	3.6	101	13 Jun	7 Jul	27 Jul	19 Aug

[a]Sample sizes for mean lay dates are a sub-sample of total nests for which no egg to egg interval is ≤ 7 days.
[b]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[c]In years when no chicks fledged before the field crew left the island at the end of the season, date of first fledge is listed as > the date of last nest check.
[d]Extrapolated from lay dates using mean incubation period.
[e]xx indicate data potentially exist but have not yet been summarized.

Table 58. Frequency distribution of hatch dates for black-legged kittiwakes at Chowiet Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008 and no eggs hatched in plots in 1989, 2011, or 2015; data from individual nests are not available in 1976-1978.

Julian date[a]	No. nests hatching on Julian date									
	79	80	81	90	91	95	98	02	04	05
176	-	-	-	-	-	xx[b]	-	-	-	-
177	-	-	-	-	-	xx	-	-	-	-
178	-	-	-	-	-	xx	-	-	-	-
179	-	-	-	-	-	xx	-	-	-	-
180	-	-	-	-	-	xx	-	2	-	-
181	-	-	-	-	-	xx	-	-	-	-
182	-	-	-	-	-	xx	-	5	-	-
183	-	-	-	-	-	xx	-	-	-	-
184	-	2	-	1	-	xx	-	-	-	-
185	-	-	1	-	-	xx	-	-	-	-
186	-	2	-	-	-	xx	-	22	2	-
187	-	-	3	-	-	xx	-	-	-	-
188	-	4	-	-	-	xx	-	42	3	-
189	-	-	26	-	-	xx	-	-	1	-
190	-	7	-	1	-	xx	-	-	2	-
191	-	-	27	2	-	xx	-	-	2	-
192	-	11	-	2	-	xx	-	18	3	-
193	-	-	23	-	-	xx	-	-	-	-
194	-	6	-	2	-	xx	-	1	8	-
195	-	-	11	-	-	xx	-	13	4	-
196	1	3	-	-	-	xx	-	-	1	-
197	-	-	5	-	-	xx	-	-	-	-
198	5	5	-	2	-	xx	-	3	3	-
199	-	-	5	-	-	xx	-	-	-	-
200	17	5	-	-	-	xx	1	1	7	-
201	-	-	1	-	-	xx	-	-	-	-
202	18	1	-	1	-	xx	2	-	1	-
203	-	-	2	-	-	xx	-	-	-	-
204	16	-	-	-	-	xx	3	-	-	-
205	-	-	4	-	-	xx	2	-	-	-
206	5	-	-	-	2	xx	-	1	4	3
207	-	-	-	-	-	xx	1	-	-	-
208	2	-	-	-	-	xx	2	-	-	-
209	-	-	-	-	-	xx	1	-	-	1
210	-	-	-	-	1	xx	5	-	-	11
211	-	-	-	-	-	xx	1	-	-	-
212	3	-	-	-	-	xx	4	-	-	-
213	-	-	1	-	-	xx	-	-	-	-
214	1	-	-	-	-	xx	2	-	-	4
215	-	-	-	-	-	xx	-	-	-	-
216	2	-	-	-	-	xx	2	-	-	-
217	-	-	-	-	-	xx	-	-	-	-
218	-	-	-	-	-	xx	1	-	-	-
219	-	-	-	-	-	xx	-	-	-	-
220	-	-	-	-	-	xx	1	-	-	3
221	-	-	-	-	-	xx	-	-	-	-
222	-	-	-	-	-	xx	2	-	-	-
223	-	-	-	-	-	xx	-	-	-	-
224	-	-	-	-	-	xx	-	-	-	1
225	-	-	-	-	-	xx	-	-	-	-
226	-	-	-	-	-	xx	-	-	-	-
227	-	-	-	-	-	xx	-	-	-	-
228	-	-	-	-	-	xx	-	-	-	-
n	70	46	109	11	3	xx	30	108	41	23

Table 58 (continued). Frequency distribution of hatch dates for black-legged kittiwakes at Chowiet Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1982-1988, 1992-1994, 1996-1997, 1999-2001, 2003, or 2008 and no eggs hatched in plots in 1989, 2011, or 2015; data from individual nests are not available in 1976-1978.

Julian date[a]	No. nests hatching on Julian date								
	06	07	09	10	12	13	14	16	17
176	-	-	-	-	2	-	-	-	-
177	-	-	-	-	-	-	-	-	-
178	-	-	-	-	-	-	-	-	-
179	-	-	-	-	-	-	-	-	-
180	-	-	-	-	-	-	-	-	-
181	-	-	-	-	-	-	-	-	-
182	-	-	-	1	21	-	-	-	-
183	-	-	-	-	5	-	-	-	-
184	-	-	-	-	-	-	18	-	-
185	-	-	-	-	-	-	-	-	-
186	-	-	1	-	-	-	2	-	-
187	-	-	-	-	28	1	5	-	-
188	-	-	-	14	8	1	47	-	3
189	-	-	9	8	-	1	7	-	-
190	4	-	-	-	-	4	8	-	-
191	3	-	-	1	-	3	2	-	-
192	28	-	24	3	10	23	35	-	-
193	2	-	16	-	2	-	8	-	-
194	3	2	46	26	-	4	8	-	48
195	12	1	-	3	-	1	1	-	-
196	51	2	-	-	-	21	2	4	-
197	21	-	1	-	7	-	21	25	-
198	8	-	2	-	6	18	5	10	12
199	24	9	-	18	-	-	2	1	16
200	26	11	8	-	-	-	2	34	11
201	1	2	-	-	1	-	-	-	-
202	3	3	-	-	-	5	9	71	5
203	5	-	-	-	-	-	1	-	-
204	17	-	-	5	-	5	2	8	5
205	5	13	-	3	-	-	-	19	-
206	1	5	-	-	-	2	3	14	-
207	-	-	-	-	-	-	-	-	-
208	5	-	-	-	-	3	-	-	1
209	-	-	-	-	-	-	-	8	-
210	3	3	-	2	-	3	-	2	-
211	-	3	-	-	-	-	-	-	-
212	-	12	-	-	-	-	-	-	-
213	-	-	-	-	-	1	-	2	-
214	-	-	-	-	-	-	-	3	-
215	-	-	-	1	-	-	-	-	-
216	-	4	-	-	-	-	-	-	-
217	-	-	-	-	-	-	-	-	-
218	-	1	-	-	-	-	-	-	-
219	-	-	-	-	-	-	-	-	-
220	-	-	-	-	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-
222	-	-	-	-	-	-	-	-	-
223	-	-	-	-	-	-	-	-	-
224	-	-	-	-	-	-	-	1	-
225	-	-	-	-	-	-	-	-	-
226	-	-	-	-	-	-	-	-	-
227	-	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	-	1	-
n	222	71	107	85	90	96	188	203	101

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.
[b]xx indicates data potentially exist but have not yet been summarized.

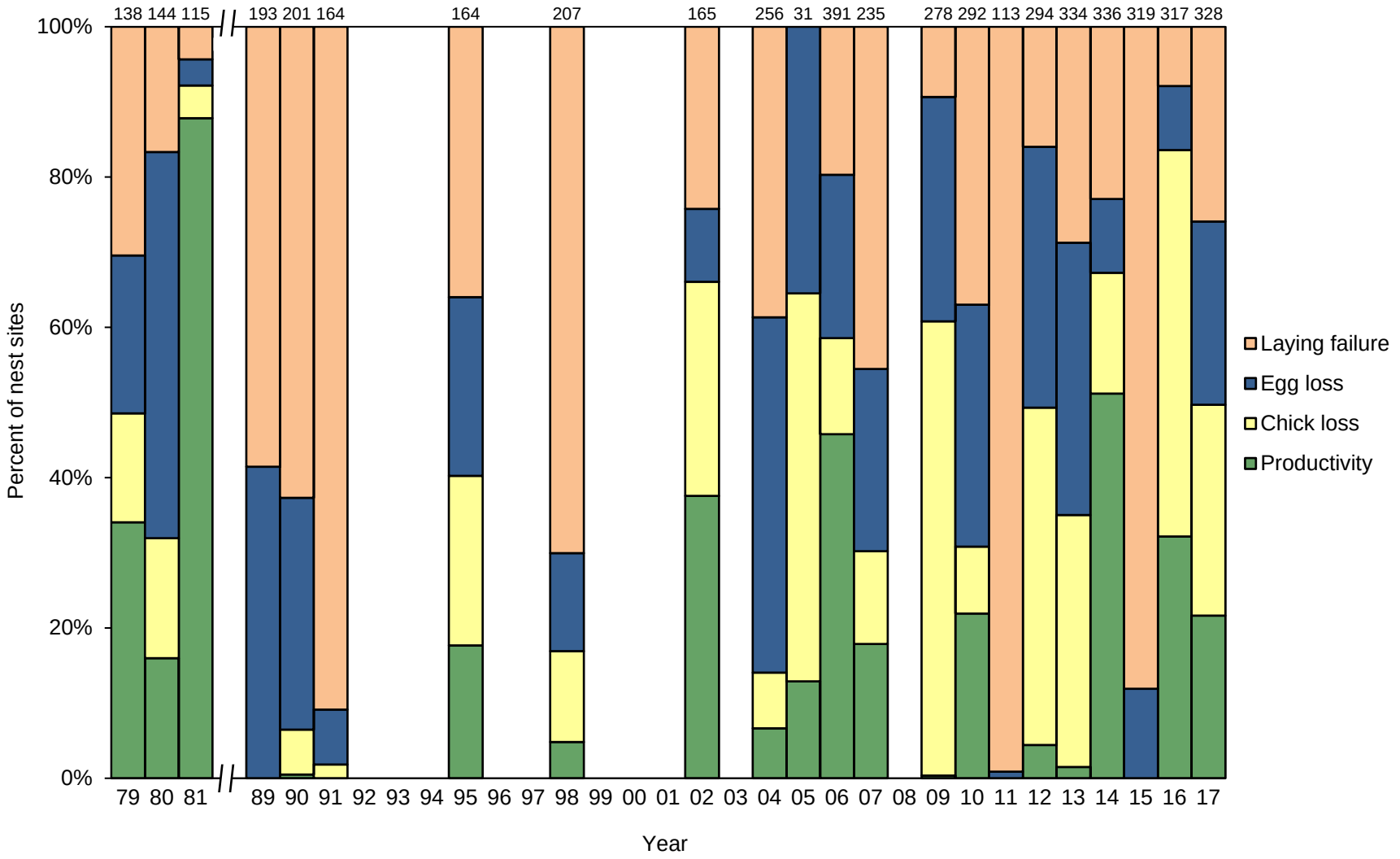

Figure 46. Reproductive performance of black-legged kittiwakes at Chowiet Island, Alaska. Laying failure=(A-B)/A; Egg loss=(B-D)/A; Chick loss=(D-F)/A; Productivity=F/A, where A=total nests; B=nests with eggs; D=nests with chicks; F=nests with chicks fledged. Numbers above columns indicate sample sizes (A). No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008; data potentially exist in 1976-1978 and 1993 but have not yet been summarized.

Table 59. Reproductive performance of black-legged kittiwakes at Chowiet Island, Alaska. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	Total nest starts (A)	Nests w/ eggs (B)	Total eggs (C)	Nests w/ chicks (D)	Total chicks (E)	Nests w/ chicks fledged (F)	Total chicks fledged (G)	Laying success (B/A)	Mean clutch size (C/B)	Nesting success (D/B)	Hatching success (E/C)	Chick success (G/E)	Egg success (G/C)	Fledging success (F/D)	Reprod. success (F/B)	Fledglings /nest start (G/A)	Prod. (F/A)
1976	65	27	xx[a]	xx	xx	xx	xx	0.42	1.8	xx	xx	xx	xx	xx	-[b]	xx	xx
1977	61	54	xx	xx	xx	xx	xx	0.89	1.6	xx	xx	xx	xx	xx	-[b]	xx	xx
1978	66	46	xx	xx	xx	xx	xx	0.70	1.7	xx	xx	xx	xx	xx	-[b]	xx	xx
1979	138	96	96	67	67	47	47	0.70	1.0	0.70	0.70	0.70	0.49	0.70	0.49	0.34	0.34
1980	144	120	120	46	46	23	23	0.83	1.0	0.38	0.38	0.50	0.19	0.50	0.19	0.16	0.16
1981	115	110	110	106	106	101	101	0.96	1.0	0.96	0.96	0.95	0.92	0.95	0.92	0.88	0.88
1989	193	80	100	0	0	0	0	0.41	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	201	75	106	13	16	1	1	0.37	1.4	0.17	0.15	0.06	0.01	0.08	0.01	<0.01	<0.01
1991	164	15	16	3	4	0	0	0.09	1.1	0.20	0.25	0.00	0.00	0.00	0.00	0.00	0.00
1993	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	-[b]	xx	xx
1995	164	105	125	66	74	20	20	0.64	1.2	0.63	0.59	0.27	0.16	0.30	0.19	0.12	0.12
1998	207	62	74	35	41	10	10	0.30	1.2	0.56	0.55	0.24	0.14	0.29	0.16	0.05	0.05
2002	165	125	236	109	171	62	64	0.76	1.9	0.87	0.72	0.37	0.27	0.57	0.50	0.39	0.38
2004	256	157	234	36	48	17	18	0.61	1.5	0.23	0.21	0.38	0.08	0.47	0.11	0.07	0.07
2005	31	31	34	20	21	4	4	1.00	1.1	0.65	0.62	0.19	0.12	0.20	0.13	0.13	0.13
2006	391	314	520	229	304	179	189	0.80	1.7	0.73	0.58	0.62	0.36	0.78	0.57	0.48	0.46
2007	235	128	148	71	75	42	44	0.54	1.2	0.55	0.51	0.59	0.30	0.59	0.33	0.19	0.18
2009	278	252	388	169	187	1	1	0.91	1.5	0.67	0.48	0.01	0.00	0.01	0.00	0.00	0.00
2010	292	184	243	90	108	64	66	0.63	1.3	0.49	0.44	0.61	0.27	0.71	0.35	0.23	0.22
2011	113	1	1	0	0	0	0	0.01	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	294	247	389	145	154	13	13	0.84	1.6	0.59	0.40	0.08	0.03	0.09	0.05	0.04	0.04
2013	334	238	334	117	138	5	5	0.71	1.4	0.49	0.41	0.04	0.01	0.04	0.02	0.01	0.01
2014	336	259	444	226	337	172	186	0.77	1.7	0.87	0.76	0.55	0.42	0.76	0.66	0.55	0.51
2015	319	38	44	0	0	0	0	0.12	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	317	292	492	265	383	102	102	0.92	1.7	0.91	0.78	0.27	0.21	0.38	0.35	0.32	0.32
2017	328	243	347	163	191	71	71	0.74	1.4	0.67	0.55	0.37	0.20	0.44	0.29	0.22	0.22

[a]xx indicates data potentially exist but have not yet been summarized.
[b]Productivity data exist in historical reports for total chicks fledged/nests with eggs (G/B): 1976: 0.18; 1977: 0.70; 1978: 0.00; 1993: 0.00.
[c]Productivity data exist in 1994 based on one visit method (not comparable to other years), nests with chicks/nests present at visit, and was 0.56.

Table 60. Standard deviation in reproductive performance parameters of black-legged kittiwakes at Chowiet Island, Alaska. Sampling for kittiwakes is clustered by plot except when sample sizes per plot are too small to allow for groupings or plot data are not available. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	No. plots[a]	Total nest starts	Sampling design[b]	Laying success	Mean clutch size	Nesting success	Hatching success	Chick success	Egg success	Fledging success	Reprod. success	Fledglings /nest start	Prod.
1976	xx[c]	65	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1977	xx	61	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1978	xx	66	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1979	2	138	Cluster by plot	0.08	0.00	0.05	0.05	0.11	0.11	0.11	0.11	0.12	0.12
1980	2	144	Cluster by plot	0.02	0.00	0.22	0.22	0.11	0.15	0.11	0.15	0.12	0.12
1981	2	115	Cluster by plot	0.02	0.00	0.02	0.02	0.03	0.04	0.03	0.04	0.06	0.06
1989	7	193	Cluster by plot	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	8	201	Cluster by plot	0.09	0.05	0.09	0.08	0.05	0.01	0.06	0.01	0.01	0.01
1991	8	164	Cluster by plot	0.02	0.07	0.12	0.15	0.00	0.00	0.00	0.00	0.00	0.00
1993	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1995	7	164	Cluster by plot	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	9	207	Cluster by plot	0.04	0.05	0.13	0.13	0.07	0.06	0.08	0.07	0.02	0.02
2002	7	165	Cluster by plot	0.11	0.03	0.04	0.09	0.05	0.04	0.06	0.07	0.09	0.09
2004	11	256	Cluster by plot	0.04	0.04	0.04	0.04	0.10	0.02	0.12	0.04	0.02	0.02
2005	9	31	Simple random	0.00	0.06	0.09	0.08	0.09	0.06	0.09	0.06	0.06	0.06
2006	14	391	Cluster by plot	0.02	0.03	0.05	0.05	0.03	0.03	0.03	0.05	0.05	0.04
2007	10	235	Cluster by plot	0.04	0.03	0.05	0.04	0.05	0.04	0.06	0.05	0.03	0.03
2009	10	278	Cluster by plot	0.02	0.05	0.05	0.04	0.01	<0.01	0.01	<0.01	<0.01	<0.01
2010	10	292	Cluster by plot	0.04	0.03	0.08	0.07	0.06	0.06	0.06	0.07	0.06	0.05
2011	6	113	Cluster by plot	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	10	294	Cluster by plot	0.04	0.05	0.04	0.02	0.03	0.01	0.03	0.02	0.02	0.02
2013	11	334	Cluster by plot	0.03	0.03	0.03	0.02	0.02	<0.01	0.02	0.01	<0.01	<0.01
2014	11	336	Cluster by plot	0.03	0.04	0.02	0.03	0.04	0.04	0.04	0.05	0.06	0.05
2015	11	319	Cluster by plot	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	11	317	Cluster by plot	0.02	0.04	0.02	0.04	0.03	0.02	0.04	0.04	0.04	0.04
2017	11	328	Cluster by plot	0.03	0.04	0.05	0.03	0.06	0.03	0.06	0.04	0.03	0.03

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

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

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

Table 61. Clutch sizes of black-legged kittiwakes at Chowiet Island, Alaska. Sample units consist of total nests, not plots. No data were collected in 1982-1988, 1992, 1994, 1996-1997, 1999-2001, 2003, or 2008.

Year	Total nest starts	Nest sites w/ x eggs:				Nest sites w/ eggs	Total eggs	Mean clutch size
	(A)	0	1	2	3	(B)	(C)	(C/B)
1976	65	xx[a]	xx	xx	xx	27	xx	1.8
1977	61	xx	xx	xx	xx	54	xx	1.6
1978	66	xx	xx	xx	xx	46	xx	1.7
1979	138	42	96	0	0	96	96	1.0
1980	144	24	120	0	0	120	120	1.0
1981	115	5	110	0	0	110	110	1.0
1989	193	113	60	20	0	80	100	1.3
1990	201	126	44	31	0	75	106	1.4
1991	164	149	14	1	0	15	16	1.1
1993	xx	xx	xx	xx	xx	xx	xx	xx
1995	164	xx	xx	xx	xx	105	xx	xx
1998	207	145	50	12	0	62	74	1.2
2002	165	40	16	107	2	125	236	1.9
2004	256	99	80	77	0	157	234	1.5
2005	31	0	28	3	0	31	34	1.1
2006	391	77	108	206	0	314	520	1.7
2007	235	107	108	20	0	128	148	1.2
2009	278	26	116	136	0	252	388	1.5
2010	292	108	125	59	0	184	243	1.3
2011	113	112	1	0	0	1	1	1.0
2012	294	47	106	140	1	247	389	1.6
2013	334	96	142	96	0	238	334	1.4
2014	336	77	74	185	0	259	444	1.7
2015	319	281	32	6	0	38	44	1.2
2016	317	25	92	200	0	292	492	1.7
2017	328	85	139	104	0	243	347	1.4

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

Table 62. Reproductive performance of black-legged kittiwakes at Chowiet Island, Alaska in 2017.

Parameter	Plot											Total	SD[a]
	P03 B02	P03 B03	P03 B04	P03 B05	P06 B01	P06 B02	P06 B03	P09 B01	P09 B02	P10 B02	P11 B01		
Total nest starts (A)	45	22	19	29	32	36	31	22	47	25	20	328	-
Nests w/ eggs (B)	38	15	9	21	24	29	21	13	37	21	15	243	-
Total eggs (C)	51	22	12	27	36	40	28	22	60	27	22	347	-
Nests w/ chicks (D)	25	5	8	8	19	18	14	10	31	13	12	163	-
Total chicks (E)	28	7	10	11	20	19	15	12	40	15	14	191	-
Nests w/ chicks fledged (F)	10	3	0	0	12	9	6	7	10	10	4	71	-
Total chicks fledged (G)	10	3	0	0	12	9	6	7	10	10	4	71	-
Laying success (B/A)	0.84	0.68	0.47	0.72	0.75	0.81	0.68	0.59	0.79	0.84	0.75	0.74	0.03
Mean clutch size (C/B)	1.3	1.5	1.3	1.3	1.5	1.4	1.3	1.7	1.6	1.3	1.5	1.4	0.04
Nesting success (D/B)	0.66	0.33	0.89	0.38	0.79	0.62	0.67	0.77	0.84	0.62	0.80	0.67	0.05
Hatching success (E/C)	0.55	0.32	0.83	0.41	0.56	0.48	0.54	0.55	0.67	0.56	0.64	0.55	0.03
Chick success (G/E)	0.36	0.43	0.00	0.00	0.60	0.47	0.40	0.58	0.25	0.67	0.29	0.37	0.06
Egg success (G/C)	0.20	0.14	0.00	0.00	0.33	0.23	0.21	0.32	0.17	0.37	0.18	0.20	0.03
Fledging success (F/D)	0.40	0.60	0.00	0.00	0.63	0.50	0.43	0.70	0.32	0.77	0.33	0.44	0.06
Reproductive success (F/B)	0.26	0.20	0.00	0.00	0.50	0.31	0.29	0.54	0.27	0.48	0.27	0.29	0.04
Fledglings/nest start (G/A)	0.22	0.14	0.00	0.00	0.38	0.25	0.19	0.32	0.21	0.40	0.20	0.22	0.03
Productivity (F/A)	0.22	0.14	0.00	0.00	0.38	0.25	0.19	0.32	0.21	0.40	0.20	0.22	0.03

[a]Standard deviations are calculated based on plot as a sample unit.

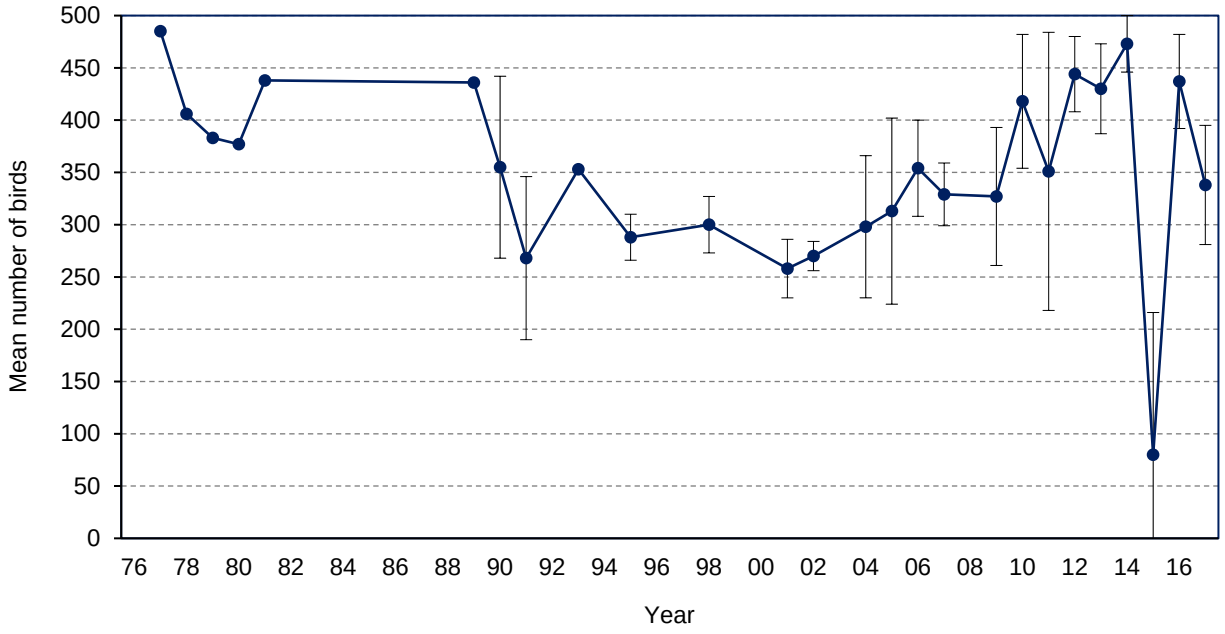

Figure 47. Mean numbers of black-legged kittiwakes counted on index plots at Chowiet Island, Alaska. Error bars represent standard deviation. No counts were conducted in 1982-1988, 1992, 1996-1997, 1999-2000, 2003, or 2008; data potentially exist in 1994 but have not yet been summarized.

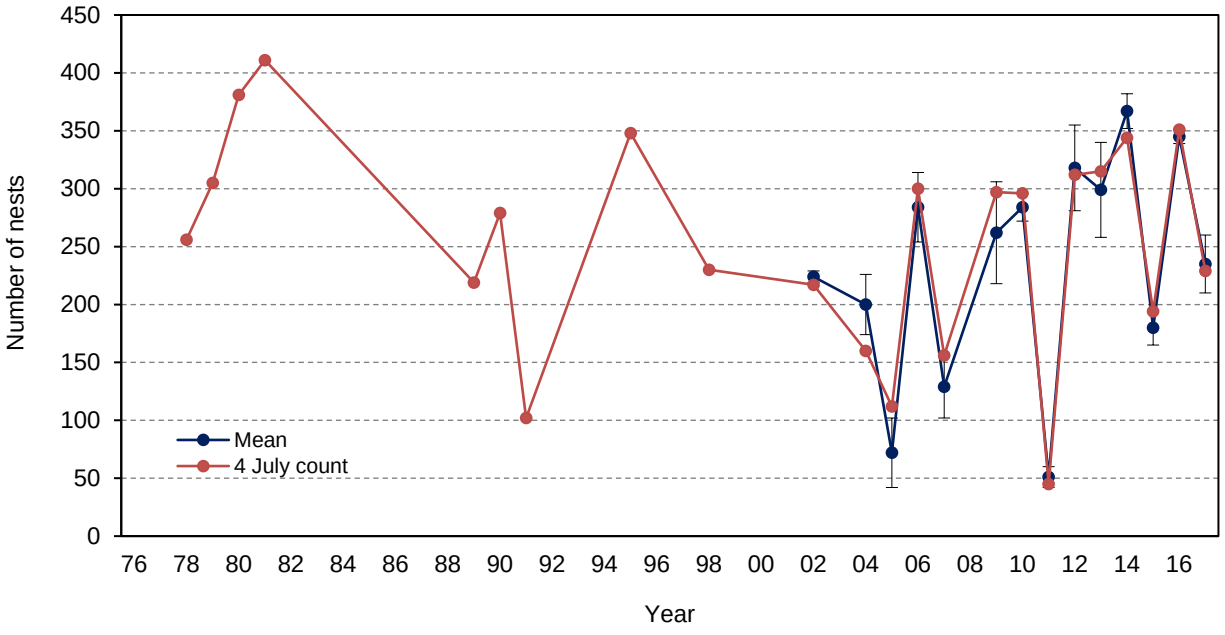

Figure 48. Numbers of black-legged kittiwake nests counted on index plots at Chowiet Island, Alaska. Data are presented as both mean numbers of nests and numbers of nests counted on 4 July (± 7 days). Error bars represent standard deviation around mean values. No counts were conducted in 1977, 1982-1988, 1992, 1996-1997, 1999-2001, 2003, or 2008; data potentially exist in 1993 and 1994 but have not yet been summarized.

Table 63. Numbers of black-legged kittiwakes counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	1977	1978	1979	1980	1981	1989[a]	1990[b]	1991	1993	1994	1995	1998	2001	2002
1	xx[c]	xx	xx	xx	xx	xx	470	321	xx	xx	264	258	279	304
2	xx	xx	xx	xx	xx	xx	493	285	xx	xx	292	330	269	283
3	xx	xx	xx	xx	xx	xx	406	220	xx	xx	308	298	226	264
4	xx	xx	xx	xx	xx	-	453	153	xx	xx	266	314	-	272
5	xx	xx	xx	xx	xx	-	365	184	xx	xx	323	299	-	269
6	xx	xx	xx	xx	xx	-	298	232	xx	xx	305	-	-	267
7	xx	xx	xx	xx	xx	-	341	231	xx	xx	271	-	-	247
8	xx	xx	xx	xx	xx	-	284	293	xx	xx	274	-	-	267
9	xx	xx	xx	xx	xx	-	224	388	xx	xx	-	-	-	272
10	xx	xx	xx	xx	xx	-	369	375	xx	xx	-	-	-	257
11	xx	xx	xx	xx	xx	-	280	-	xx	xx	-	-	-	273
12	xx	xx	xx	xx	xx	-	271	-	xx	xx	-	-	-	259
13	xx	xx	xx	xx	xx	-	-	-	xx	xx	-	-	-	281
Mean	485	406	383	377	438	436	355	268	353	xx	288	300	258	270
n	47	21	48	44	49	xx	12	10	xx	xx	8	5	3	13
SD	xx	xx	xx	xx	xx	xx	87	78	xx	xx	22	27	28	14
First count	10 Jun	6 Jun	18 Jun	6 Jun	6 Jun	xx	xx	22 Jun	xx	xx	22 Jun	1 Jul	19 Jul	12 Jun
Last count	29 Jul	28 Jun	6 Aug	25 Jul	25 Jul	xx	xx	18 Jul	xx	xx	16 Jul	21 Jul	23 Jul	19 Jul

Table 63 (continued). Numbers of black-legged kittiwakes counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015[d]	2016	2017
1	334	283	413	314	378	394	289	510	478	516	389	504	405
2	329	332	379	275	397	397	399	489	483	478	268	502	426
3	366	331	378	339	439	380	502	431	474	469	76	487	422
4	365	432	345	340	342	376	436	454	433	511	40	443	315
5	346	415	385	327	298	366	121	432	407	480	12	405	330
6	348	416	381	314	296	346	357	425	345	474	0	429	324
7	367	269	299	318	294	496	-	395	408	436	3	420	336
8	246	280	355	315	327	516	-	405	432	442	0	381	323
9	211	175	349	382	300	403	-	432	442	446	10	397	291
10	208	199	256	367	203	511	-	465	397	477	1	504	293
11	248	-	-	-	-	-	-	-	-	-	-	-	251
12	205	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	298	313	354	329	327	419	351	444	430	473	80	447	338
n	12	10	10	10	10	10	6	10	10	10	10	10	11
SD	68	89	46	30	66	64	133	36	43	27	136	48	57
First count	10 Jun	21 Jun	20 Jun	17 Jun	25 Jun	17 Jun	4 Jul	10 Jun	15 Jun	9 Jun	29 Jun	19 Jun	16 Jun
Last count	4 Jul	25 Jul	22 Jul	3 Aug	27 Jul	23 Jul	25 Jul	20 Jul	26 Jul	9 Jul	27 Jul	13 Jul	20 Jul

[a]For 1989, summary presented is from 3 replicates. A total of 13 replicates were completed; additional replicate values exist but not yet summarized.
[b]For 1990, a total of 12 replicates were completed. Prior to 2015 report, only first 4 replicates were presented and used in summary.
[c]xx indicates data potentially exist but have not yet been summarized.
[d]Low counts for most replicates in 2015 due to reproductive failure; black-legged kittiwakes abandoned the cliffs.

Table 64. Numbers of black-legged kittiwake nests counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1977, 1982-1988, 1992, 1996-1997, 1999-2001, 2003, or 2008.

Replicate	1978	1979	1980	1981	1989	1990	1991	1993	1994	1995	1998	2002	2004
1	xx[a]	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx[a]	222	208
2	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	225	207
3	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	228	210
4	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	224	211
5	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	231	230
6	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	230	233
7	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	223	233
8	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	217	194
9	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	216	180
10	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	216	174
11	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	223	163
12	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	225	160
13	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	229	-
Mean	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	224	200
4 Jul count[b]	256	305	381	411	219	279	102	xx	xx	348	230	217	160
n	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	13	12
SD	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	5	26
First count	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	12 Jun	10 Jun
Last count	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	19 Jul	4 Jul

Table 64 (continued). Numbers of black-legged kittiwake nests counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1977, 1982-1988, 1992, 1996-1997, 1999-2001, 2003, or 2008.

Replicate	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	20	328	83	305	293	45	361	353	383	213	344	263
2	47	321	91	294	288	60	349	353	368	194	334	273
3	50	311	121	314	295	52	350	341	384	172	339	266
4	86	300	159	297	298	40	349	315	386	175	343	243
5	95	287	156	273	296	60	326	294	368	188	346	229
6	112	279	161	267	291	-	331	293	371	181	351	230
7	109	253	136	259	276	-	312	280	361	170	353	219
8	84	255	126	215	267	-	279	267	350	169	352	209
9	60	252	131	217	270	-	269	249	344	179	342	210
10	54	253	122	181	270	-	260	243	352	158	348	205
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
Mean	72	284	129	262	284	51	319	299	367	180	345	235
4 Jul count[b]	112	300	156	297	296	45	312	315	344	194	351	229
n	10	10	10	10	10	5	10	10	10	10	10	10
SD	30	30	27	44	12	9	37	41	15	15	6	25
First count	21 Jun	20 Jun	17 Jun	25 Jun	17 Jun	4 Jul	10 Jun	15 Jun	9 Jun	29 Jun	19 Jun	20 Jun
Last count	25 Jul	23 Jul	3 Aug	27 Jul	23 Jul	25 Jul	20 Jul	26 Jul	9 Jul	27 Jul	13 Jul	20 Jul

[a]xx indicates data potentially exist but have not yet been summarized.
[b]Count closest to 4 July (±7 days).

Table 65. Numbers of black-legged kittiwake adults counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date											Mean	SD
	16 Jun	20 Jul	21 Jun	25 Jun	29 Jun	4 Jul	5 Jul	10 Jul	11 Jul	16 Jul	20 Jul		
A02B01	49	51	48	38	37	41	38	39	37	35	36	-	-
A02B02	81	91	86	57	72	61	70	66	55	58	55	-	-
A03B01	35	34	42	23	26	27	29	23	24	24	19	-	-
A03B02	42	43	41	30	33	38	39	35	28	30	28	-	-
A03B03	3	0	1	2	1	2	1	1	0	3	0	-	-
A06B01	51	54	47	37	39	40	36	38	34	37	16	-	-
A06B02	36	43	39	25	21	28	28	28	34	25	18	-	-
A09B01	24	29	31	23	22	18	27	21	17	19	18	-	-
A09B02	84	81	87	80	79	69	68	72	62	62	61	-	-
Total	405	426	422	315	330	324	336	323	291	293	251	338	57

Table 66. Numbers of black-legged kittiwake nests counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date										Mean	SD	Max.[a]
	20 Jun	21 Jun	25 Jun	29 Jun	4 Jul	5 Jul	10 Jul	11 Jul	16 Jul	20 Jul			
A02B01	39	39	35	31	30	31	30	31	32	31	-	-	39
A02B02	61	59	55	46	44	44	42	34	34	34	-	-	61
A03B01	22	22	21	20	19	19	18	18	18	18	-	-	22
A03B02	25	28	26	26	25	24	25	22	23	23	-	-	28
A03B03	1	1	1	1	1	1	1	0	0	0	-	-	1
A06B01	24	22	23	24	22	22	21	21	20	18	-	-	24
A06B02	18	17	19	19	19	18	13	15	15	14	-	-	19
A09B01	21	23	23	19	17	54	17	15	15	15	-	-	54
A09B02	52	62	63	57	52	17	52	53	53	52	-	-	63
Total	263	273	266	243	229	230	219	209	210	205	235	25	311

[a]Maximum count represents the sum of the maximum counts for each plot, and may not correspond to the maximum count of a single replicate.

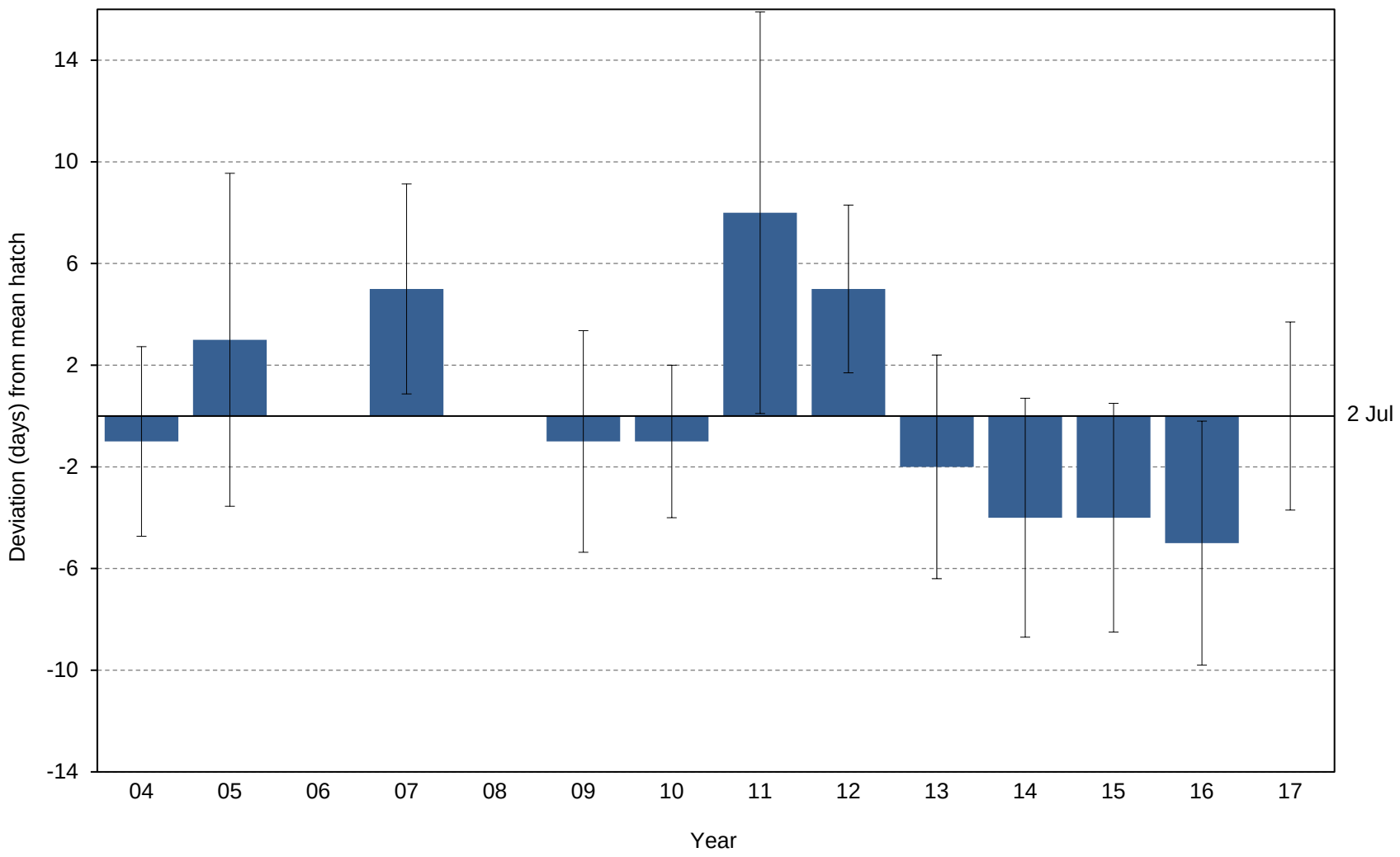

Figure 49. Yearly hatch date deviation (from the 1976-2016 average of 2 July) for glaucous-winged gulls at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 1977, 1980-1994, 1996-1997, 1999-2003, 2006, or 2008; data potentially exist in 1976, 1978-1979, 1995, and 1998 but have not yet been summarized.

Table 67. Breeding chronology of glaucous-winged gulls at Chowiet Island, Alaska. Data represent the dates of the first egg laid and the first chick hatched in each nest. No data were collected in 1977, 1980-1994, 1996-1997, 1999-2003, 2006, or 2008.

Year	Mean lay[a]	SD	*n*[b]	Mean hatch	SD	*n*[c]	First lay[a]	First hatch	Last hatch
1976	xx[d]	xx	xx	xx	xx	xx	xx	xx	xx
1978	xx	xx	xx	xx	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx	xx	xx	xx
1995	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx	xx	xx	xx
2004	xx	xx	xx	30 Jun	3.7	10	xx	22 Jun	3 Jul
2005	xx	xx	xx	5 Jul	6.6	18	xx	22 Jun	15 Jul
2007	xx	xx	xx	7 Jul	4.1	15	xx	1 Jul	11 Jul
2009	xx	xx	xx	1 Jul	4.4	36	xx	27 Jun	13 Jul
2010[e]	xx	xx	xx	1 Jul	3.0	35	xx	24 Jun	5 Jul
2011[e]	xx	xx	xx	9 Jul	7.9	24	xx	27 Jun	24 Jul
2012	-	-	-	6 Jul	3.3	15	< 3 Jun	3 Jul	14 Jul
2013	2 Jun	5.7	45	30 Jun	4.4	30	25 May	21 Jun	8 Jul
2014	-	-	-	28 Jun	4.7	29	< 22 May	20 Jun[f]	9 Jul
2015	-	-	-	28 Jun	4.5	60	< 23 May	19 Jun	7 Jul
2016	-	-	-	26 Jun	4.8	69	< 27 May	13 Jun	11 Jul
2017	-	-	-	2 Jul	3.7	32	< 27 May	24 Jun	11 Jul

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

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

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

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

[e]In 2010 and 2011, sample sizes were small and recorded hatch dates were late due to high rates of egg loss during the early egg-laying period.

[f]In 2014, date reflects first hatch within monitored nests. Actual first hatch on island occurred earlier.

Table 68. Frequency distribution of hatch dates for glaucous-winged gulls at Chowiet Island, Alaska. Data represent the date of the first chick hatched in each nest and include only nests in which observations of egg to chick ≤ 7 days. No data were collected in 1977, 1980-1994, 1996-1997, 1999-2003, 2006, or 2008.

Julian date[a]	No. nests hatching on Julian date																
	76	78	79	95	98	04	05	07	09	10	11	12	13	14	15	16	17
165	xx[b]	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	1	-
166	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
167	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
168	xx	Xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
169	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
170	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	1	2	-
171	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	1	-	4	-
172	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	1	-	1	1	-
173	xx	xx	xx	xx	xx	-	2	-	-	-	-	-	-	-	1	-	-
174	xx	xx	xx	xx	xx	1	-	-	4	-	-	-	-	3	20	6	-
175	xx	xx	xx	xx	xx	-	-	-	-	3	-	-	1	-	-	19	1
176	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	2	10	-	-	2
177	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	6	-	-	2	-
178	xx	xx	xx	xx	xx	-	-	-	2	-	1	-	-	-	5	2	-
179	xx	xx	xx	xx	xx	-	-	-	-	1	-	-	-	2	-	7	3
180	xx	xx	xx	xx	xx	4	1	-	11	-	5	-	5	6	15	7	4
181	xx	xx	xx	xx	xx	-	-	-	-	21	-	-	1	-	-	5	-
182	xx	xx	xx	xx	xx	-	-	3	1	-	-	-	-	2	3	2	6
183	xx	xx	xx	xx	xx	-	4	-	6	-	-	-	2	-	6	5	-
184	xx	xx	xx	xx	xx	-	2	1	-	-	-	-	6	-	-	-	2
185	xx	xx	xx	xx	xx	5	-	-	8	5	-	8	2	2	6	4	6
186	xx	xx	xx	xx	xx	-	-	4	-	5	-	-	-	1	-	-	7
187	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
188	xx	xx	xx	xx	xx	-	-	-	1	-	6	1	3	-	2	1	-
189	xx	xx	xx	xx	xx	-	-	-	2	-	-	-	1	-	-	-	-
190	xx	xx	xx	xx	xx	-	7	1	-	-	1	5	-	2	-	-	-
191	xx	xx	xx	xx	xx	-	-	-	-	-	2	-	-	-	-	-	-
192	xx	xx	xx	xx	xx	-	-	6	-	-	-	-	-	-	-	-	1
193	xx	xx	xx	xx	xx	-	-	-	1	-	-	-	-	-	-	1	-
194	xx	xx	xx	xx	xx	-	-	-	-	-	3	-	-	-	-	-	-
195	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
196	xx	xx	xx	xx	xx	-	2	-	-	-	-	1	-	-	-	-	-
197	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
198	xx	xx	xx	xx	xx	-	-	-	-	-	3	-	-	-	-	-	-
199	xx	xx	xx	xx	xx	-	-	-	-	-	1	-	-	-	-	-	-
200	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
201	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
202	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
203	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
204	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-	-	-	-	-
205	xx	xx	xx	xx	xx	-	-	-	-	-	2	-	-	-	-	-	-
n	xx	xx	xx	xx	xx	10	18	15	36	35	24	15	30	29	60	69	32

[a]In leap years, hatch dates are calculated using a leap year-specific Julian date calendar.
[b]xx indicates data potentially exist but have not yet been summarized.

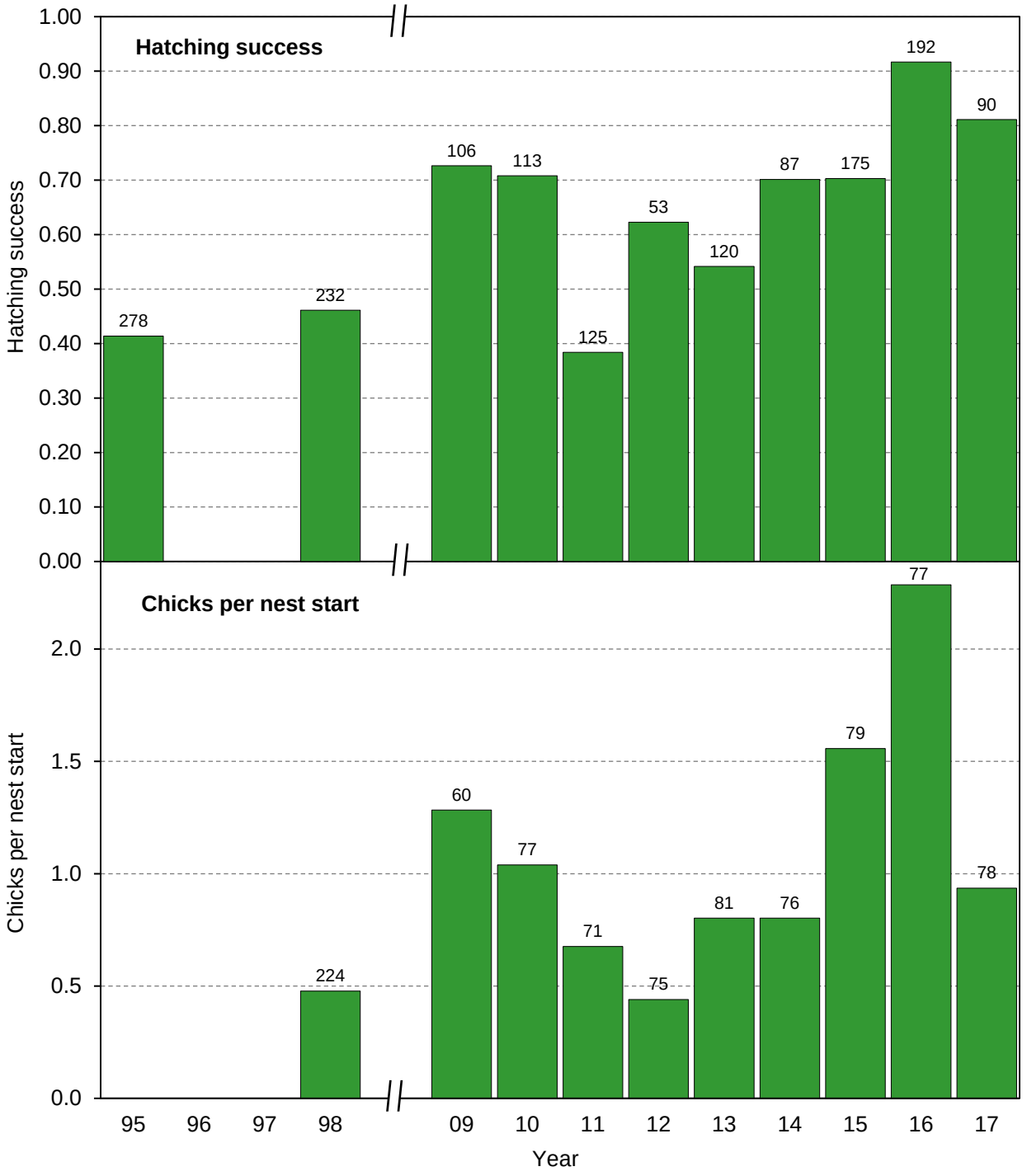

Figure 50. Reproductive performance of glaucous-winged gulls at Chowiet Island, Alaska. Hatching success=E/C; Chicks per nest start=E/A; where A=total nest starts, C=total eggs; E=total chicks. Numbers above columns indicate sample sizes ([C] for hatching success, [A] for chicks per nest start).No data were collected in 1980-1994, 1996-1997, 1999-2003, 2006, or 2008; data potentially exist in 1976-1979, 2004-2005, and 2007 but have not yet been summarized.

Table 69. Reproductive performance of glaucous-winged gulls at Chowiet Island, Alaska, as determined by a nest-monitoring methodology. Measures of success are based on frequent monitoring of individual nests (as opposed to count methodology presented in Table 72). No data were collected in 1980-1994, 1996-1997, 1999-2003, 2006, or 2008 (some reproductive performance data exist from the count methodology in 2002 and 2006; see Table 72).

Year	Total nest starts	Nest sites w/ x eggs:					Nest sites w/ eggs	Total eggs	Nest sites w/ x chicks:			Nest sites w/ chicks	Total chicks	Laying success	Mean clutch size	Mean brood size	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/ nest start
	(A)	0	1	2	3	4	(B)	(C)	1	2	3	(D)[a]	(E)[b]	(B/A)	(C/B)	(E/D)	(D/B)	(E/C)	(D/A)[c]	(E/A)[c]
1976	xx[d]	xx	6	30	54	0	90	228	xx	xx	xx	xx	xx	xx	2.53	xx	xx	xx	xx	xx
1977	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1978	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1995	-	xx	xx	xx	xx	xx	123	278	xx	xx	xx	xx	115	xx	2.3	xx	xx	0.41	xx	xx
1998	224	xx	xx	xx	xx	xx	106	232	xx	xx	xx	xx	107	0.47	2.2	xx	xx	0.46	xx	0.48
2004	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2005	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2007	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2009	60	17	3	17	23	0	43	106	7	17	12	36	77	0.72	2.5	2.1	0.84	0.73	0.60	1.28
2010	77	34	2	12	29	0	43	113	5	18	13	36	80	0.56	2.6	2.2	0.84	0.71	0.47	1.04
2011	71	18	5	24	24	0	53	125	7	10	7	24	48	0.75	2.4	2.0	0.45	0.38	0.34	0.68
2012	75	53	1	11	10	0	22	53	3	6	6	15	33	0.29	2.4	2.2	0.68	0.62	0.20	0.44
2013	81	36	4	7	34	0	45	120	7	11	12	30	65	0.56	2.7	2.2	0.67	0.54	0.37	0.80
2014	76	45	1	4	26	0	31	87	6	14	9	29	61	0.41	2.8	2.1	0.94	0.70	0.38	0.80
2015	79	14	4	12	49	0	65	175	14	29	17	60	123	0.82	2.7	2.1	0.92	0.70	0.76	1.56
2016	78	8	0	14	56	0	70	196	2	31	37	70	175	0.90	2.8	2.6	1.00	0.89	0.90	2.24
2017	78	41	4	13	20	0	37	90	2	19	11	32	73	0.47	2.4	2.3	0.86	0.81	0.41	0.94

[a]Nests with chicks include nests with hatched eggshells at which no chicks were found.

[b]Chick totals include dead chicks and hatched eggshells that had no associated chick found.

[c]Proportion of nests with chicks (D/A) and chicks/nest start (E/A) may be considered maximum potential values of productivity (F/A) and fledglings/nest start (G/A), respectively, based on the assumption that all chicks counted eventually fledge.

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

Table 70. Standard deviation in reproductive performance parameters of glaucous-winged gulls at Chowiet Island, Alaska. Sampling for gulls is clustered by plot except when sample sizes per plot are too small to allow for groupings or plot data are not available. No data were collected in 1980-1994, 1996-1997, 1999-2003, 2006, or 2008.

Year	No. plots[a]	Total nest starts	Sampling design[b]	Laying success	Mean clutch size	Mean brood size	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/ nest start
1976	xx[c]	xx	xx	xx	xx	xx	xx	xx	xx	xx
1977	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1978	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1995	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
2004	xx	xx	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2005	xx	xx	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2007	xx	xx	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2009	xx	xx	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2010	xx	xx	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2011	3	71	Cluster by plot	xx	xx	xx	xx	xx	xx	xx
2012	3	75	Cluster by plot	0.07	0.15	0.16	0.08	0.07	0.03	0.09
2013	3	81	Cluster by plot	0.07	0.07	0.24	0.03	0.02	0.03	0.15
2014	3	76	Cluster by plot	0.02	0.10	0.13	0.05	0.02	0.01	0.03
2015	3	79	Cluster by plot	0.05	0.07	0.10	0.02	0.03	0.05	0.17
2016	3	78	Cluster by plot	0.07	0.01	0.02	0.00	0.01	0.07	0.15
2017	3	78	Cluster by plot	0.02	0.06	0.06	0.06	0.05	0.01	0.03

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

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

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

Table 71. Reproductive performance of glaucous-winged gulls at Chowiet Island, Alaska in 2017, as determined by a nest-monitoring methodology. Data derived from frequent monitoring of individual nests.

Parameter		Plot			Total	SD[a]
		A	B	C		
Total nest starts (A)		6	53	19	78	-
Nests w/ x eggs:	0	3	27	11	41	-
	1	0	3	1	4	-
	2	1	8	4	13	-
	3	2	15	3	20	-
	4	0	0	0	0	-
Nests w/ eggs (B)		3	26	8	37	-
Total eggs (C)		8	64	18	90	-
Nests w/ x chicks:	1	0	1	1	2	-
	2	2	12	5	19	-
	3	1	8	2	11	-
Nests w/ chicks (D)[b]		3	21	8	32	-
Total chicks (E)[c]		7	49	17	73	-
Laying success (B/A)		0.50	0.49	0.42	0.47	0.02
Mean clutch size (C/B)		2.7	2.5	2.3	2.4	0.06
Mean brood size (E/D)		2.3	2.3	2.1	2.3	0.06
Nesting success (D/B)		1.00	0.81	1.00	0.86	0.06
Hatching success (E/C)		0.88	0.77	0.94	0.81	0.05
Prop. nests w/ chicks (D/A)[d]		0.50	0.40	0.42	0.41	0.01
Chicks/nest start (E/A)[d]		1.17	0.92	0.89	0.94	0.03

[a]Standard deviations are calculated from ratio estimator spreadsheets, based on plot as a sample unit.
[b]Nests with chicks include nests with hatched eggshells at which no chicks were found.
[c]Chick totals include dead chicks and hatched eggshells that had no associated chick found.
[d]Proportion of nests with chicks (D/A) and chicks/nest start (E/A) may be considered maximum potential values of productivity (F/A) and fledglings/nest start (G/A), respectively, based on the assumption that all chicks counted eventually fledge.

Table 72. Reproductive performance of glaucous-winged gulls at Chowiet Island, Alaska, as determined by a count methodology. Measures of success are based on count of nests, eggs, and chicks at varying intervals during the nesting period (as opposed to nest-monitoring methodology presented in Table 69); numbers of nests, eggs, and chicks represent maximum counts each year. Although monitoring individual nests (Table 69) is considered a better way to measure gull reproductive performance, data are collected and presented using count methodology to allow for comparisons with historic data. As of 2011, chicks were not counted following a protocol change so only laying success and mean clutch size can be calculated. No data were collected in 1976-1977, 1980-1997, 1999-2001, 2003, and 2008.

Year	Total nest starts	Nest sites w/ x eggs:				Nest sites w/ eggs	Total eggs	Nest sites w/ chicks	Total chicks	Laying success	Mean clutch size	Mean brood size	Nesting success	Hatching success	Prop. nest sites w/ chicks	Chicks/ nest start
	(A)[a]	1	2	3	4	(B)	(C)	(D)[b]	(E)[c]	(B/A)	(C/B)	(E/D)	(D/B)	(E/C)	(D/A)[d]	(E/A)[d]
1978	xx[e]	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1979	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
1998	224[f]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002[f]	138	1	6	92	0	99	289	-	153	0.72	2.9	-	-	0.53	-	1.11
2004	131	8	17	62	0	87	228	17	36	0.66	2.6	2.1	0.20	0.16	0.13	0.27
2005	130	9	23	18	0	50	109	20	44	0.38	2.2	2.2	0.40	0.40	0.15	0.34
2006[f]	157	6	31	42	0	79	194	38	71	0.50	2.5	1.9	0.48	0.37	0.24	0.45
2007	159	6	28	24	0	58	134	22	37	0.36	2.3	1.7	0.37	0.28	0.14	0.23
2009	172	9	37	62	0	108	269	66	116	0.63	2.5	1.8	0.61	0.43	0.38	0.67
2010	163	2	18	76	0	96	266	63	103	0.59	2.8	1.6	0.66	0.39	0.39	0.63
2011	79	8	21	15	0	44	95	-	-	0.56	2.2	-	-	-	-	-
2012	175	3	25	40	0	68	173	-	-	0.39	2.5	-	-	-	-	-
2013	225	5	19	75	0	99	268	-	-	0.44	2.7	-	-	-	-	-
2014	212	11	14	87	0	112	300	-	-	0.53	2.7	-	-	-	-	-
2015	155	5	23	74	0	102	273	-	-	0.66	2.7	-	-	-	-	-
2016	151	1	17	81	0	99	278	-	-	0.66	2.8	-	-	-	-	-
2017	126	7	24	30	0	61	145	-	-	0.48	2.4	-	-	-	-	-

[a]Productivity estimates based on only few visits (three in 2002, four in 2006) and represent a Boom-or-Bust estimate only; measures of success may not be comparable to other years when counts were conducted on a weekly basis throughout the season.

[b]Nests with chicks includes nests with hatched eggshells at which no chicks were found.

[c]Chick totals include dead chicks and hatched eggshells that had no associated chick found.

[d]Proportion of nests with chicks (D/A) and chicks/nest start (E/A) may be considered maximum potential values of productivity (F/A) and fledglings/nest start (G/A), respectively, based on the assumption that all chicks counted eventually fledge.

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

[f]Productivity in 1998 done using nest monitoring method, but all nests were included; data on total nests starts only included in this table and in Figure 51, all other data presented in Table 69.

Table 73. Reproductive performance of glaucous-winged gulls at Chowiet Island, Alaska in 2017, as determined by a count methodology. Data come from counts of nests, eggs, and chicks on plots throughout the nesting period. As of 2011, chicks were not counted following a protocol change.

Date	Total nest starts	Nests w/ x eggs:			Nests w/ eggs	Total eggs	Total chicks
	(A)	1	2	3	(B)	(C)	(D)
Plot A							
3 Jun	4	0	0	0	0	0	-
10 Jun	6	1	1	1	3	6	-
15 Jun	6	0	1	2	3	8	-
19 Jun	5	0	1	2	3	8	-
23 Jun	5	0	1	2	3	8	-
Plot B							
3 Jun	83	8	12	8	28	56	-
10 Jun	97	6	20	23	49	115	-
15 Jun	97	3	16	24	43	107	-
19 Jun	83	3	13	24	40	101	-
23 Jun	78	2	12	25	39	101	-
Plot C							
3 Jun	23	0	2	1	3	7	-
10 Jun	21	1	4	3	8	18	-
15 Jun	21	2	3	3	8	17	-
19 Jun	21	1	3	4	8	19	-
23 Jun	19	1	3	5	9	22	-

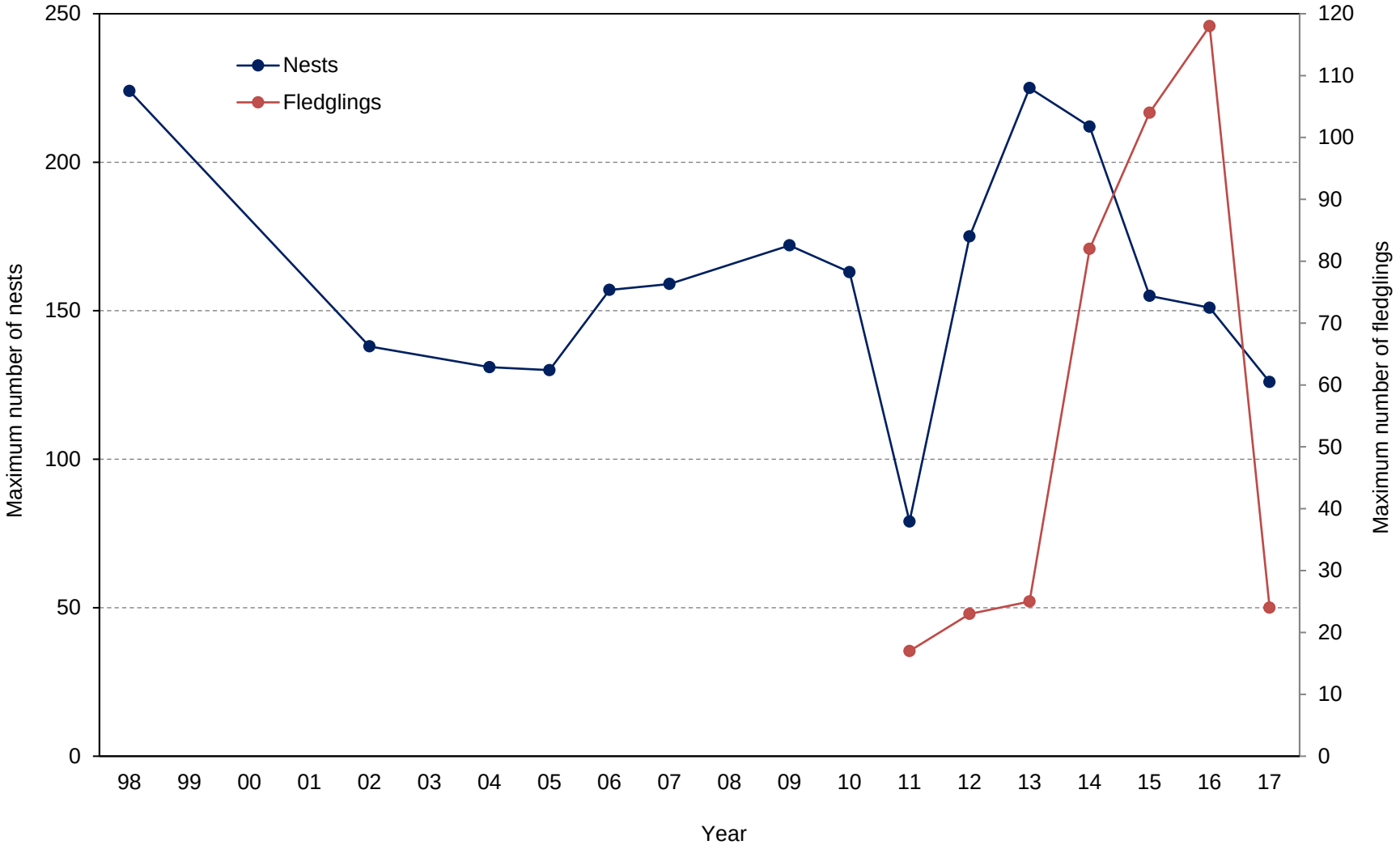

Figure 51. Maximum numbers of glaucous-winged gull nests and fledglings counted on sub-colonies A, B, and C at South Bay, Chowiet Island, Alaska. Nest data come from total nest starts (A) recorded during reproductive performance monitoring using a count methodology (Table 72); fledgling data come from replicate counts of fledglings conducted at the end of the breeding season.

Table 74. Numbers of glaucous-winged gull fledglings counted along South Bay sub-colony areas at Chowiet Island, Alaska.

Replicate	2011	2012	2013	2014	2015	2016	2017
1	3	11	11	76	6	48	14
2	10	22	25	81	23	108	18
3	17	23	22	82	64	118	23
4	15	16	16	64	66	78	24
5	16	9	-	68	104	48	9
6	6	-	-	-	-	16	-
7	3	-	-	-	-	-	-
Max.	17	23	25	82	104	118	24
n	7	5	4	5	5	6	5
SD	6	6	6	8	39	39	6
First count	13 Aug	11 Aug	9 Aug	5 Aug	6 Aug	5 Aug	6 Aug
Last count	5 Sep	2 Sep	24 Aug	25 Aug	28 Aug	31 Aug	31 Aug

Table 75. Numbers of glaucous-winged gull fledglings counted along South Bay sub-colony areas at Chowiet Island, Alaska in 2017.

Plot	Date					Max.
	6 Aug	12 Aug	19 Aug	25 Aug	31 Aug	
A	0	1	1	2	1	-
B	10	14	19	17	6	-
C	4	3	3	5	2	-
Total	14	18	23	24	9	24

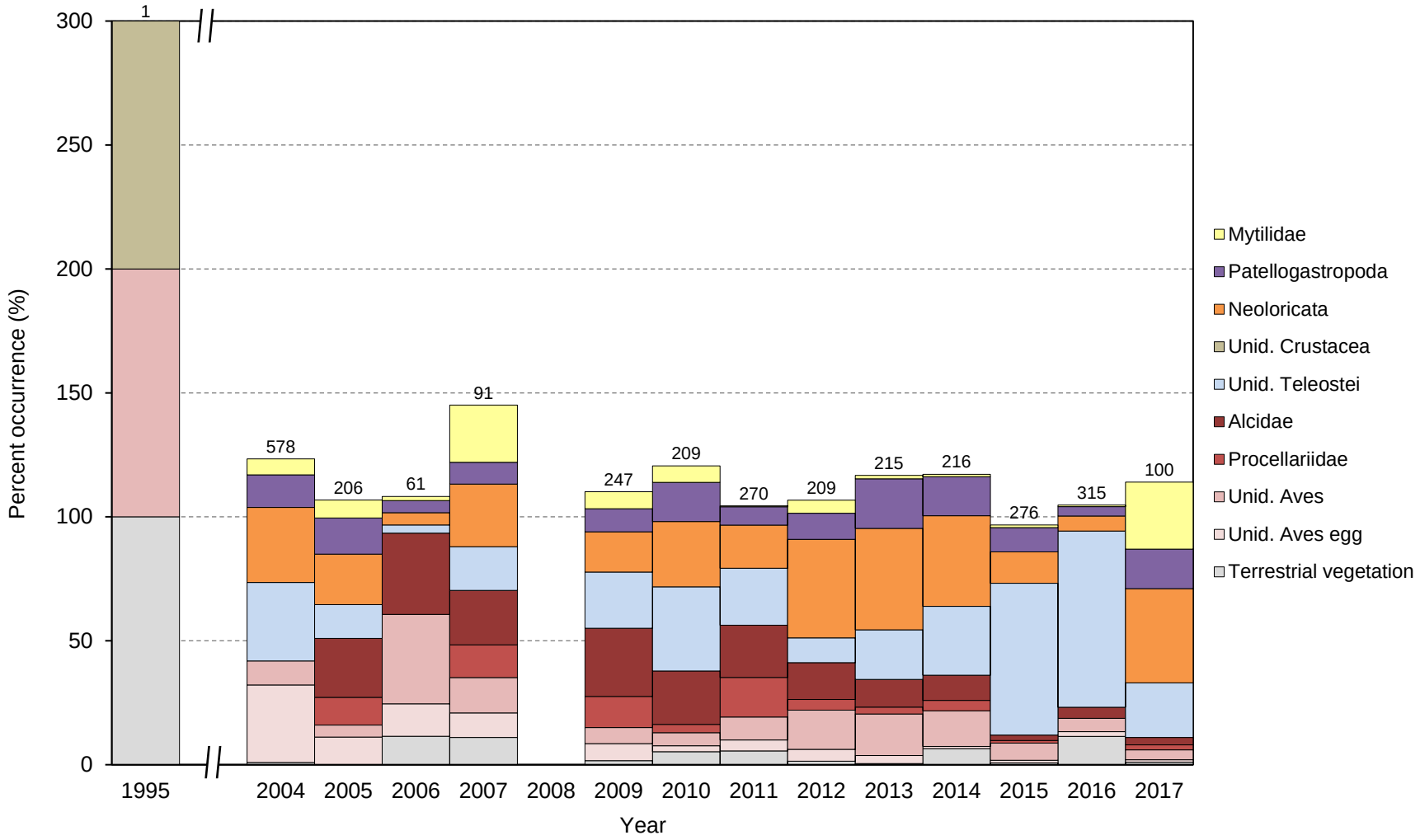

Figure 52. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey is grouped to family level or higher; only taxa with an among-year average occurrence of at least 5% are shown. Samples consist of stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2004-2007 and 2009-2017). Numbers above columns indicate sample sizes. No diet samples were collected in 1996-2003 or 2008.

Table 76. Frequency of occurrence of major prey items in diets of glaucous-winged gull adults at Chowiet Island, Alaska. Frequency is expressed as the percentage of food samples in which each prey item was present. Prey was identified in the laboratory (1995) or field (2004-2017) to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that occurred in at least 5% of diets on average across all years are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group, with values in bold showing totals for those taxa. Samples consist of stomach contents from adults collected at or near the colony (1995) and pellets regurgitated by adults at the colony (2004-2007 and 2009-2017). No diet samples were collected in 1996-2003 or 2008. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	1995	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	1	578	206	61	91	247	209	270	209	215	216	276	315	100
Invertebrates	**100.0**	**43.1**	**36.4**	**16.4**	**47.3**	**27.5**	**43.1**	**25.9**	**52.6**	**62.3**	**48.1**	**23.9**	**10.8**	**76.0**
Bivalvia	**-**	**6.4**	**7.3**	**1.6**	**23.1**	**6.9**	**6.7**	**0.4**	**5.3**	**1.4**	**0.9**	**1.1**	**0.6**	**27.0**
Mytilidae	**-**	**6.4**	**5.3**	**1.6**	**20.9**	**6.9**	**3.8**	**0.4**	**5.3**	**1.4**	**0.9**	**1.1**	**0.6**	**27.0**
Unid. Mytilidae	-	6.4	5.3	1.6	20.9	6.9	3.8	0.4	5.3	1.4	0.9	1.1	0.6	27.0
Other Bivalvia	-	-	1.9	-	2.2	-	2.9	-	-	-	-	-	-	-
Gastropoda	**-**	**13.3**	**14.6**	**4.9**	**8.8**	**9.3**	**16.3**	**7.4**	**11.5**	**28.8**	**15.7**	**9.8**	**3.8**	**16.0**
Patellogastropoda	-	13.1	14.6	4.9	8.8	9.3	15.8	7.4	10.5	20.0	15.7	9.8	3.8	16.0
Other Gastropoda	-	0.2	-	-	-	-	0.5	-	1.0	9.3	-	-	-	-
Polyplacophora	**-**	**30.3**	**20.4**	**4.9**	**25.3**	**16.2**	**26.3**	**17.4**	**39.7**	**40.9**	**36.6**	**12.7**	**6.0**	**38.0**
Neoloricata	-	30.3	20.4	4.9	25.3	16.2	26.3	17.4	39.7	40.9	36.6	12.7	6.0	38.0
Unid. Crustacea	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Invertebrates	-	3.8	1.9	8.2	8.8	4.0	4.8	5.9	1.9	4.7	4.6	1.8	0.3	11.0
Fish	**-**	**31.7**	**13.6**	**3.3**	**17.6**	**22.7**	**34.0**	**23.0**	**10.0**	**20.0**	**27.8**	**61.2**	**71.1**	**22.0**
Teleostei	**-**	**31.7**	**13.6**	**3.3**	**17.6**	**22.7**	**34.0**	**23.0**	**10.0**	**20.0**	**27.8**	**61.2**	**71.1**	**22.0**
Unid. Teleostei	-	31.7	13.6	3.3	17.6	22.7	34.0	23.0	10.0	20.0	27.8	61.2	71.1	22.0
Birds	**100.0**	**39.1**	**51.9**	**77.0**	**54.9**	**53.4**	**31.1**	**53.3**	**40.2**	**32.6**	**31.5**	**12.7**	**12.7**	**11.0**
Charadriiformes	**-**	**-**	**24.8**	**32.8**	**22.0**	**28.3**	**21.5**	**21.9**	**15.3**	**11.2**	**10.2**	**2.2**	**4.4**	**3.0**
Alcidae	**-**	**-**	**23.8**	**32.8**	**22.0**	**27.5**	**21.5**	**21.1**	**14.8**	**11.2**	**10.2**	**2.2**	**4.4**	**3.0**
Uria spp. egg	-	-	22.3	23.0	12.1	24.7	17.2	17.4	11.0	8.8	6.9	0.4	1.9	3.0
Other Alcidae	-	-	1.5	9.8	9.9	2.8	5.3	4.1	3.8	2.3	3.2	1.8	2.5	-
Other Charadriiformes	-	-	1.0	-	-	0.8	-	0.7	0.5	-	-	-	-	-
Procellariiformes	**-**	**-**	**11.2**	**-**	**13.2**	**12.6**	**3.3**	**16.3**	**4.3**	**2.8**	**6.9**	**1.8**	**1.3**	**3.0**
Procellariidae	**-**	**-**	**11.2**	**-**	**13.2**	**12.6**	**3.3**	**15.9**	**4.3**	**2.8**	**4.2**	**1.1**	**-**	**2.0**
Fulmarus glacialis egg	-	-	10.7	-	13.2	12.6	2.4	12.2	4.3	2.8	4.2	1.1	-	2.0
Other Procellariidae	-	-	0.5	-	-	-	1.0	3.7	-	-	-	-	-	-
Other Procellariiformes	-	-	-	-	-	-	-	0.4	-	-	3.2	0.7	1.3	1.0
Unid. Aves	100.0	9.7	4.9	36.1	14.3	6.5	5.3	9.3	15.8	16.7	14.4	6.9	5.4	4.0
Unid. Aves egg	-	31.3	11.2	13.1	9.9	6.9	2.4	4.4	4.8	3.3	0.9	1.1	1.9	1.0
Other Birds	-	-	-	1.6	-	-	-	1.9	-	-	-	0.7	-	-
Mammals	-	3.8	-	-	1.1	-	2.4	3.0	-	-	-	0.7	-	-
Other	**100.0**	**2.6**	**1.0**	**24.6**	**13.2**	**2.4**	**9.1**	**13.7**	**2.4**	**1.9**	**11.6**	**14.1**	**11.4**	**5.0**
Terrestrial vegetation	100.0	0.9	-	11.5	11.0	1.6	5.3	5.6	1.4	0.5	6.5	0.7	11.4	1.0
Other	-	2.1	1.0	13.1	3.3	0.8	4.8	10.0	1.0	1.9	5.1	13.4	-	4.0

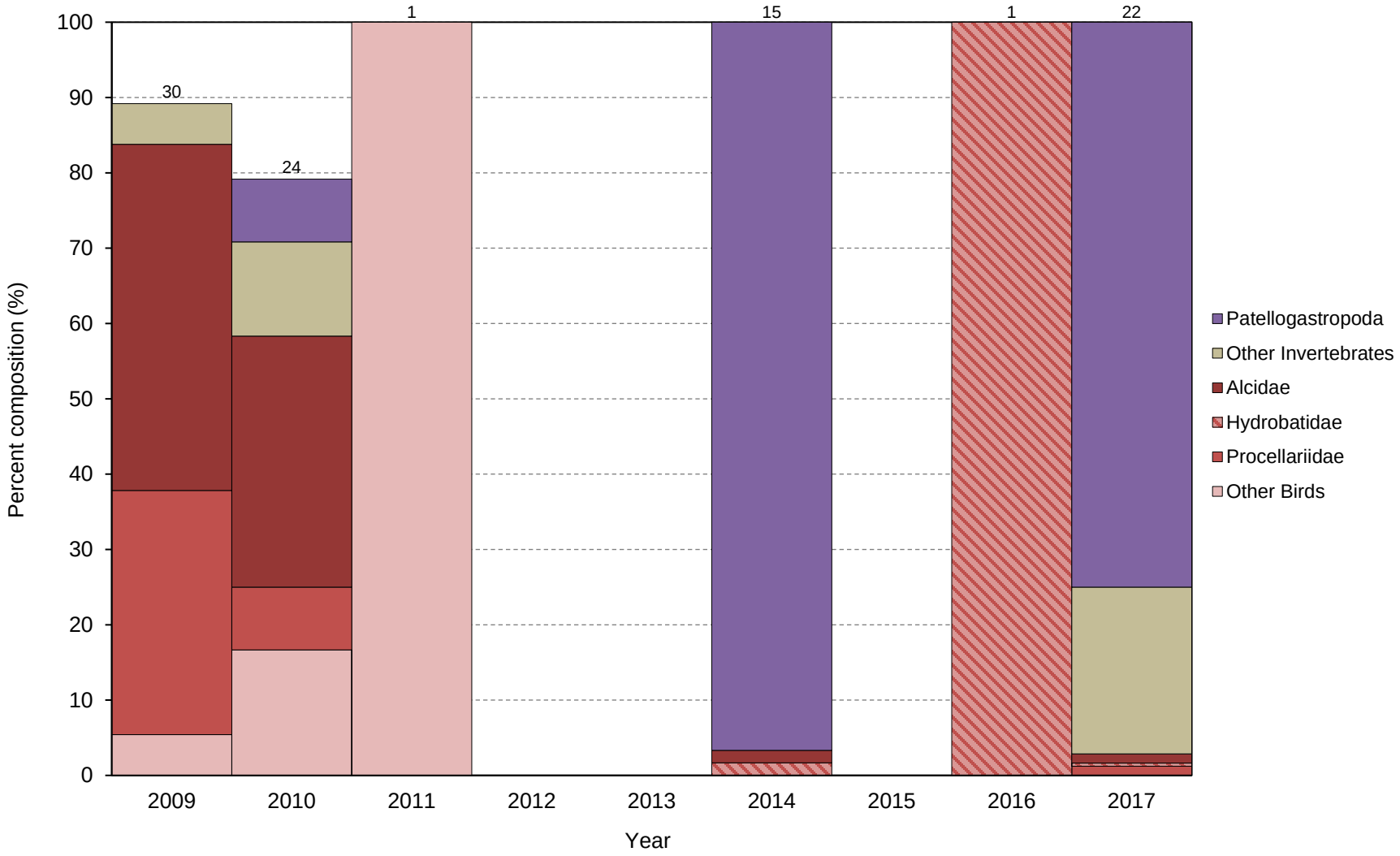

Figure 53. Percent composition of major prey items in diets of glaucous-winged gull adults at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item. Prey is grouped to family level or higher; only taxa with an among-year average composition of at least 5% are shown. Samples consist of pellets regurgitated by adults at the colony. Numbers above columns indicate sample sizes. No count data exist before 2009 or in 2012-2013 or 2015.

Table 77. Percent composition of major prey items in diets of glaucous-winged gull adults at Chowiet Island, Alaska. Values are expressed as the percentage of total individual prey items comprised by each prey item (sums to 100% each year). Prey was identified and measured in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey with an among-year average composition of at least 5% are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group with values in bold showing totals for those taxa. Samples consist of pellets regurgitated by adults at the colony. No count data exist before 2009 or in 2012-2013 or 2015. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2009	2010	2011	2014	2016	2017
No. samples	30	24	1	15	1	22
No. individuals	37	24	1	60	2	244
Invertebrates	**5.4**	**20.8**	**-**	**96.7**	**-**	**95.9**
Gastropoda	**-**	**8.3**	**-**	**96.7**	**-**	**75.0**
Patellogastropoda	-	8.3	-	96.7	-	75.0
Other Invertebrates	5.4	12.5	-	-	-	22.1
Fish	5.4	16.7	-	-	-	-
Birds	**89.2**	**58.3**	**100.0**	**3.3**	**100.0**	**4.1**
Charadriiformes	**51.4**	**33.3**	**-**	**1.7**	**-**	**1.2**
Alcidae	**45.9**	**33.3**	**-**	**1.7**	**-**	**1.2**
Aethia psittacula	10.8	12.5	-	-	-	-
Uria spp. egg	35.1	4.2	-	-	-	1.2
Other Alcidae	-	16.7	-	1.7	-	-
Other Charadriiformes	5.4	-	-	-	-	-
Procellariiformes	**32.4**	**8.3**	**-**	**1.7**	**100.0**	**1.6**
Hydrobatidae	**-**	**-**	**-**	**1.7**	**100.0**	**0.4**
Oceanodroma spp.	-	-	-	-	100.0	-
Other Hydrobatidae	-	-	-	1.7	-	0.4
Procellariidae	**32.4**	**8.3**	**-**	**-**	**-**	**1.2**
Fulmarus glacialis egg	32.4	4.2	-	-	-	1.2
Other Procellariidae	-	4.2	-	-	-	1.2
Unid. Aves	2.7	16.7	100.0	-	-	1.2
Other Birds	2.7	-	-	-	-	-
Other	-	4.2	-	-	-	-

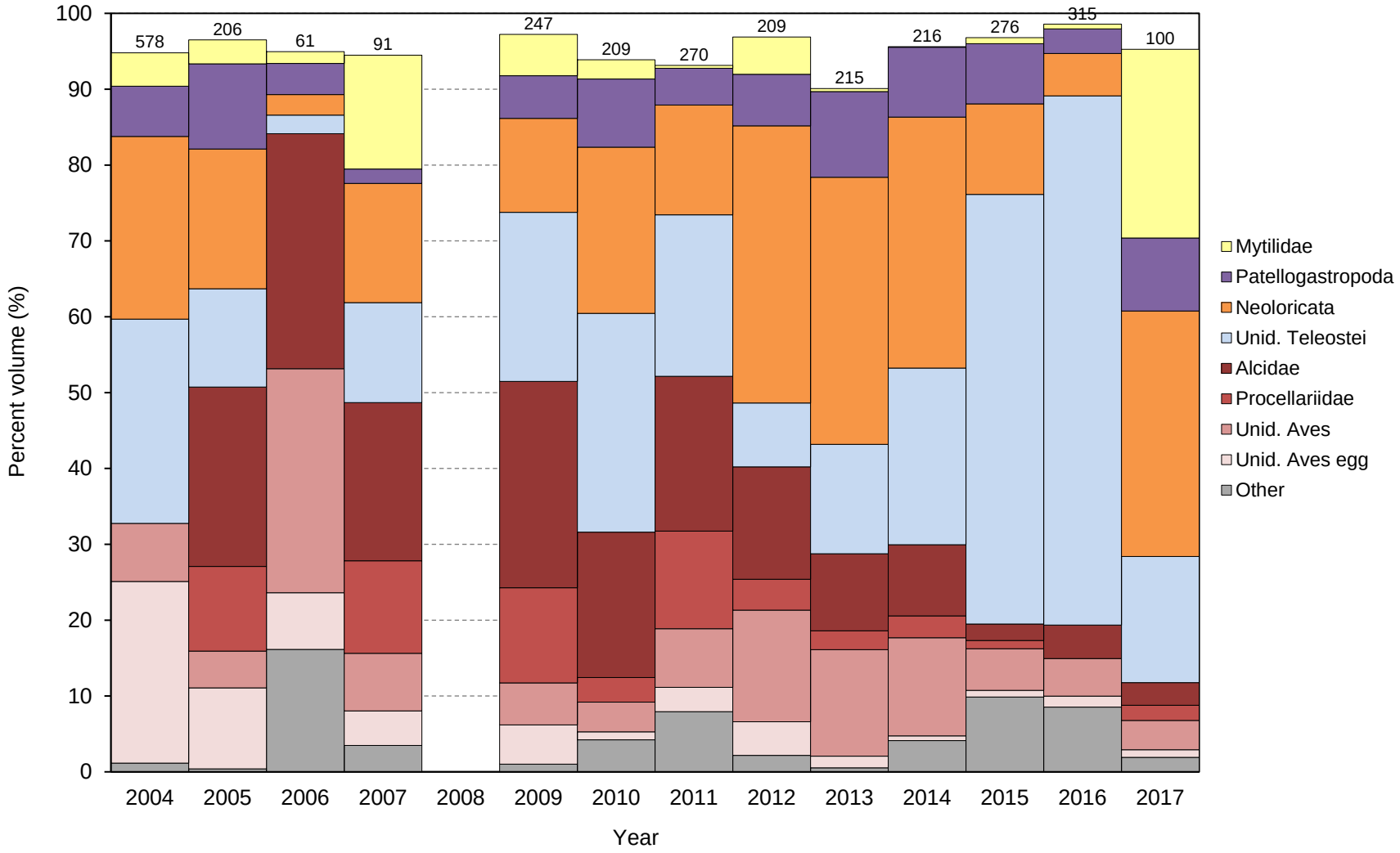

Figure 54. Percent volume of major prey items in diets of glaucous-winged gull adults at Chowiet Island, Alaska. Values represent the average percent volume of a prey item in all pellets. Prey is grouped to family level or higher; only taxa with an among-year average volume of at least 5% are shown. Samples consist of pellets regurgitated by adults at the colony. Numbers above columns indicate sample sizes. No diet samples were collected in 1996-2003; no volume data exist in 1995.

Table 78. Percent volume of prey in regurgitated pellets of glaucous-winged gull adults at Chowiet Island, Alaska. Values represent the average percent volume of a prey item in all pellets (sums to 100% each year). Prey was identified in the field to lowest taxon possible (some prey items were identified to species while others were only identified to genus, family, order, etc.). Any prey that made up at least 5% of diet volume on average across all years are shown to the lowest taxonomic level; others are lumped together as "others" in their respective taxonomic group, with values in bold showing totals for those taxa. No diet samples were collected in 1996-2003; no volume data exist in 1995. More detailed diet data and prey identifications are available, contact refuge biologists for details.

Prey	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
No. samples	578	206	61	91	247	209	270	209	215	216	276	315	100
Invertebrates	**37.1**	**35.3**	**12.8**	**37.0**	**25.4**	**38.0**	**22.0**	**50.9**	**56.8**	**43.8**	**21.7**	**9.8**	**70.8**
Bivalvia	**4.4**	**5.1**	**1.6**	**15.1**	**5.4**	**4.4**	**0.4**	**4.9**	**0.4**	**0.1**	**0.8**	**0.6**	**24.9**
Mytilidae	**4.4**	**3.2**	**1.6**	**15.0**	**5.4**	**2.5**	**0.4**	**4.9**	**0.4**	**0.1**	**0.8**	**0.6**	**24.9**
Unid. Mytilidae	4.4	3.2	1.6	15.0	5.4	2.5	0.4	4.9	0.4	0.1	0.8	0.6	24.9
Other Bivalvia	-	1.9	-	0.1	-	1.9	-	-	-	-	-	-	-
Gastropoda	**6.7**	**11.2**	**4.1**	**1.9**	**5.6**	**9.5**	**4.9**	**7.8**	**19.6**	**9.2**	**7.9**	**3.2**	**9.6**
Patellogastropoda	6.6	11.2	4.1	1.9	5.6	9.0	4.9	6.8	11.3	9.2	7.9	3.2	9.6
Other Gastropoda	<0.1	-	-	-	-	0.5	-	1.0	8.3	-	-	-	-
Polyplacophora	**24.1**	**18.4**	**2.7**	**15.7**	**12.4**	**21.9**	**14.5**	**36.5**	**35.2**	**33.1**	**11.9**	**5.6**	**32.4**
Neoloricata	24.1	18.4	2.7	15.7	12.4	21.9	14.5	36.5	35.2	33.1	11.9	5.6	32.4
Other Invertebrates	1.9	0.6	4.4	4.3	2.0	2.2	2.3	1.7	1.6	1.5	1.0	0.3	3.9
Fish	**27.0**	**13.0**	**2.5**	**13.2**	**22.3**	**28.8**	**21.3**	**8.4**	**14.4**	**23.3**	**56.6**	**69.8**	**16.6**
Teleostei	**27.0**	**13.0**	**2.5**	**13.2**	**22.3**	**28.8**	**21.3**	**8.4**	**14.4**	**23.3**	**56.6**	**69.8**	**16.6**
Unid. Teleostei	26.9	13.0	2.5	13.2	22.3	28.8	21.3	8.4	14.4	23.3	56.6	69.8	16.6
Birds	**31.7**	**51.3**	**68.5**	**45.2**	**51.3**	**27.4**	**47.2**	**38.5**	**28.2**	**28.8**	**11.1**	**11.9**	**10.7**
Charadriiformes	-	**24.6**	**31.0**	**20.9**	**28.0**	**19.2**	**21.1**	**15.3**	**10.2**	**9.4**	**2.2**	**4.4**	**3.0**
Alcidae	-	**23.6**	**31.0**	**20.9**	**27.2**	**19.2**	**20.4**	**14.8**	**10.2**	**9.4**	**2.2**	**4.4**	**3.0**
Uria spp. egg	-	22.2	21.4	11.2	24.4	15.0	16.6	11.0	8.3	6.2	0.4	1.9	3.0
Other Alcidae	-	1.5	6.3	9.6	2.8	4.2	3.9	3.8	1.8	3.2	1.8	2.5	-
Other Charadriiformes	-	1.0	-	-	0.8	-	0.7	0.5	-	-	-	-	-
Procellariiformes	-	**11.2**	-	**12.2**	**12.6**	**3.2**	**13.2**	**4.1**	**2.5**	**5.8**	**1.8**	**1.1**	**2.8**
Procellariidae	-	**11.2**	-	**12.2**	**12.6**	**3.2**	**12.9**	**4.1**	**2.5**	**2.9**	**1.1**	**-**	**2.0**
Fulmarus glacialis egg	-	10.7	-	12.2	12.6	2.3	9.2	4.1	2.5	2.9	1.1	-	2.0
Other Procellariidae	-	0.5	-	-	-	0.9	3.7	-	-	-	-	-	-
Other Procellariiformes	-	-	-	-	-	-	0.4	-	-	2.9	0.7	1.1	0.8
Unid. Aves	7.7	4.9	29.5	7.6	5.5	3.9	7.7	14.7	14.0	12.9	5.5	5.0	3.9
Unid. Aves egg	23.9	10.7	7.5	4.6	5.2	1.1	3.2	4.4	1.5	0.6	0.9	1.4	1.0
Other Birds	-	-	0.6	-	-	-	1.9	-	-	-	0.7	-	-
Mammals	3.3	-	-	1.1	-	1.6	1.6	-	-	-	0.7	-	-
Other	1.2	0.4	16.1	3.5	1.0	4.2	7.9	2.2	0.5	4.1	9.9	8.5	1.9

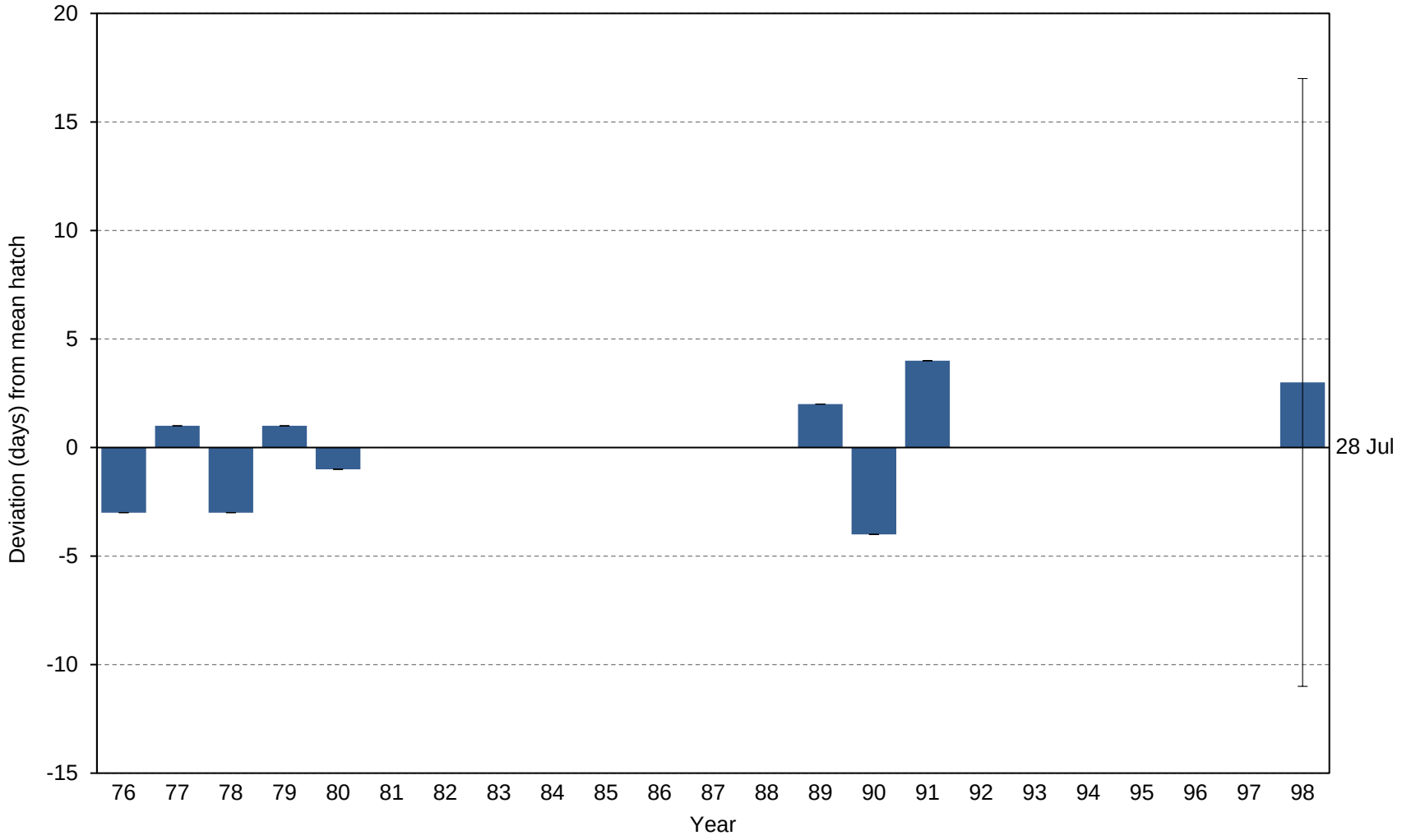

Figure 55. Yearly hatch date deviation (from the 1976-1998 average of 28 July) for northern fulmars at Chowiet Island, Alaska. Negative values indicate earlier than mean hatch date, positive values indicate later than mean hatch date. Error bars represent standard deviation around each year's mean hatch date. No data were collected in 1982-1988, 1992-1997, or after 1998.

Table 79. Breeding chronology of northern fulmars at Chowiet Island, Alaska. No data were collected in 1982-1988, 1992-1997, 1999-2001, 2003, or 2008. Data after 1998 are based on incidental observations because no nests were monitored.

Year	Mean lay	SD	*n*[a]	Mean hatch	SD	*n*[b]	First lay	First hatch	Last hatch
1976	6 Jun	xx[c]	208	24 Jul	xx	xx	29 May	xx	xx
1977	11 Jun	xx	386	29 Jul	xx	xx	2 Jun	xx	xx
1978	7 Jun	xx	397	25 Jul	xx	xx	26 May	xx	xx
1979	11 Jun	xx	400	29 Jul	xx	xx	2 Jun	xx	xx
1980	8 Jun	xx	389	26 Jul	xx	xx	27 May	xx	xx
1981	10 Jun	xx	395	28 Jul	xx	xx	31 May	xx	xx
1989	15 Jun	xx	31	30 Jul	xx	26	6 Jun	24 Jul	xx
1990	6 Jun	xx	68	24 Jul	xx	29	31 May	19 Jul	xx
1991	15 Jun	xx	91	1 Aug	xx	25	5 Jun	xx	xx
1998	15 Jun	5.0	80	31 Jul	14.0	11	8 Jun	26 Jul	xx
2002	-	-	-	-	-	-	1 Jun	16 Jul	-
2004	-	-	-	-	-	-	5 Jun	17 Jul	-
2005	-	-	-	-	-	-	24 May	23 Jul	-
2006	-	-	-	-	-	-	1 Jun	-	-
2007	-	-	-	-	-	-	8 Jun	-	-
2009	-	-	-	-	-	-	10 Jun	24 Jul	-
2010	-	-	-	-	-	-	4 Jun	-	-
2011	-	-	-	-	-	-	4 Jun	-	-
2012	-	-	-	-	-	-	30 May	-	-
2013	-	-	-	-	-	-	31 May	-	-
2014	-	-	-	-	-	-	27 May	17 Jul	-
2015	-	-	-	-	-	-	6 Jun	7 Aug	-
2016	-	-	-	-	-	-	6 Jun	30 Jul	-
2017	-	-	-	-	-	-	7 Jun	29 Jul	-

[a]Sample sizes for mean lay dates are a sub-sample of total nests for which no egg to egg interval is ≤ 7 days.
[b]Sample sizes for mean hatch dates are a sub-sample of total nests for which egg to chick interval is ≤ 7 days.
[c]xx indicates data potentially exist but have not yet been summarized.

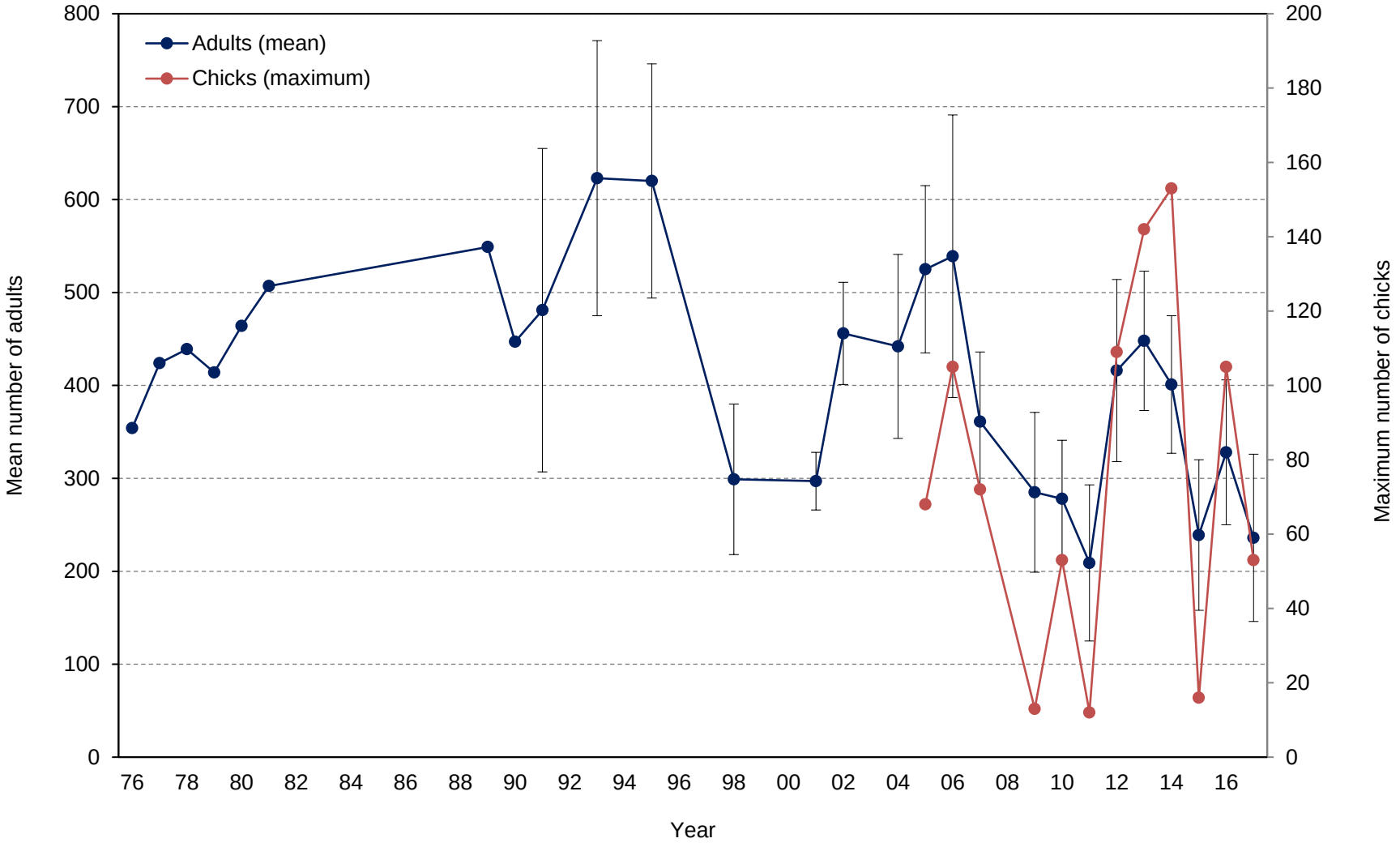

Figure 56. Mean numbers of northern fulmar adults and maximum numbers of chicks counted on index plots at Chowiet Island, Alaska. Error bars represent standard deviation. No adult counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008; no chick counts were conducted before 2005 or in 2008.

Table 80. Numbers of northern fulmar adults counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	1976	1977	1978	1979	1980	1981	1989	1990	1991	1993	1995	1998	2001	2002
1	xx[a]	xx	xx	xx	xx	xx	xx	xx	xx	xx	598	327	xx[a]	552
2	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	668	363	xx	477
3	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	740	208	xx	505
4	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	491	-	-	494
5	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	602	-	-	466
6	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	797	-	-	485
7	xx	xx	xx	xx	xx	xx	-	xx	xx	xx	446	-	-	486
8	xx	xx	xx	xx	xx	xx	-	xx	-	-	-	-	-	399
9	xx	xx	xx	xx	xx	xx	-	xx	-	-	-	-	-	441
10	xx	xx	xx	xx	xx	xx	-	xx	-	-	-	-	-	380
11	xx	xx	xx	xx	xx	xx	-	xx	-	-	-	-	-	402
12	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	382
13	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
14	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
15	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
16	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
17	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
18	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
19	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
20	xx	xx	xx	xx	xx	xx	-	-	-	-	-	-	-	-
21	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-
22	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-
23	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-
24	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-
25	xx	xx	-	xx	xx	xx	-	-	-	-	-	-	-	-
26	xx	xx	-	xx	xx	xx	-	-	-	-	-	-		
27	xx	xx	-	xx	xx	xx	-	-	-	-	-	-		
28	xx	xx	-	xx	xx	xx	-	-	-	-	-	-		
29	xx	xx	-	-	xx	xx	-	-	-	-	-	-		
30	xx	-	-	-	xx	xx	-	-	-	-	-	-		
Mean	354	424	439	414	464	507	549	447	481	623	620	299	297	456
n	xx	29	20	28	30	30	6	11	7	7	7	3	3	12
SD	xx	xx	xx	xx	xx	xx	xx	96	174	148	126	81	31	55
First count	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	20 Jun	1 Jul	xx	12 Jun
Last count	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	14 Jul	21 Jul	xx	16 Jul

Table 80 (continued). Numbers of northern fulmar adults counted on index plots at Chowiet Island, Alaska. No counts were conducted in 1982-1988, 1992, 1994, 1996-1997, 1999-2000, 2003, or 2008.

Replicate	2004	2005	2006	2007	2009[b]	2010	2011	2012	2013	2014	2015	2016	2017
1	571	589	644	400	331	362	355	473	489	474	204	339	227
2	613	536	830	413	353	339	256	566	551	544	227	418	228
3	360	499	508	387	353	319	210	340	446	395	216	496	461
4	321	548	556	416	314	305	151	525	512	417	163	329	273
5	354	600	585	451	211	290	267	459	476	449	261	328	242
6	404	626	441	308	145	293	206	401	410	364	190	314	250
7	417	443	371	274	-	212	126	412	371	286	290	296	206
8	521	318	379	322	-	215	97	275	325	373	382	260	183
9	482	537	-	418	-	161	-	306	-	327	339	281	152
10	379	562	-	221	-	287	-	-	-	378	117	224	134
11	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean	442	526	539	361	285	278	209	417	448	401	239	329	236
n	10	10	8	10	6	10	8	9	8	10	10	10	10
SD	99	90	152	75	86	63	84	98	75	74	81	78	90
First count	16 Jun	21 Jun	15 Jun	17 Jun	24 Jun	17 Jun	15 Jun	10 Jun	11 Jun	9 Jun	17 Jun	17 Jun	20 Jun
Last count	7 Jul	12 Jul	13 Jul	10 Jul	19 Jul	11 Jul	14 Jul	9 Jul	9 Jul	10 Jul	14 Jul	12 Jul	10 Jul

[a]xx indicates data potentially exist but have not yet been summarized.
[b]Four counts were excluded from data summary in 2009 because they occurred outside the standardized count window.

Table 81. Numbers of northern fulmar chicks counted on index plots at Chowiet Island, Alaska. No chick counts were conducted on index plots before 2005 (data from 2002 and 2004 are excluded because counts were conducted on a different set of productivity plots) or in 2008.

Replicate	2005[a]	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	62	69	58	13	42	7	78	109	135	16	66	42
2	62	75	66	-	44	12	74	130	139	12	69	35
3	-	95	68	-	50	6	108	131	138	13	82	42
4	-	105	72	-	46	6	-	136	152	10	99	50
5	-	-	-	-	-	8	-	136	147	11	98	49
6	-	-	-	-	-	-	-	-	-	-	96	-
Mean	62	86	66	13	46	8	87	128	142	12	85	44
Max.[b]	68	105	72	13	53	13	109	142	153	16	105	53
n	2	4	4	1	4	5	3	5	5	5	6	5
SD	0	17	6	-	3	2	19	11	7	2	15	6
First count	28 Aug	31 Aug	28 Aug	3 Sep	30 Aug	27 Aug	27 Aug	21 Aug	25 Aug	24 Aug	26 Aug	24 Aug
Last count	2 Sep	3 Sep	2 Sep	-	5 Sep	4 Sep	1 Sep	30 Aug	31 Aug	1 Sep	1 Sep	31 Aug

[a]Incomplete replicates (in which not all plots were counted) in 2005 are excluded from analysis.
[b]Maximum count represents the sum of the maximum counts for each plot, and may not correspond to the maximum count of a single replicate.

Table 82. Numbers of northern fulmar adults counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date										Mean	SD
	20 Jun	21 Jun	25 Jun	29 Jun	1 Jul	4 Jul	5 Jul	8 Jul	9 Jul	10 Jul		
A03N01	57	56	126	65	39	44	46	51	40	46	-	-
A04N01	11	12	23	10	9	18	12	11	7	6	-	-
A07N01	84	83	159	134	102	91	97	78	77	54	-	-
A10N01	28	29	47	25	25	16	13	14	10	8	-	-
A10N02	18	18	24	19	20	16	12	12	10	10	-	-
A12N01	19	20	47	14	25	31	17	12	6	9	-	-
A12N02	10	10	35	6	22	34	9	5	2	1	-	-
Total	227	228	461	273	242	250	206	183	152	134	236	90

Table 83. Numbers of northern fulmar chicks counted on index plots at Chowiet Island, Alaska in 2017.

Plot	Date					Mean	SD	Max.
	24 Aug	25 Aug	27 Aug	28 Aug	31 Aug			
A03N01	17	14	19	19	18	-	-	19
A04N01	0	0	0	0	0	-	-	0
A07N01	17	13	16	18	21	-	-	21
A10N01	6	6	5	10	7	-	-	10
A10N02	2	2	2	3	3	-	-	3
A12N01	0	0	0	0	0	-	-	0
A12N02	0	0	0	0	0	-	-	0
Total	42	35	42	50	49	44	6	53[a]

[a]Maximum count represents the sum of the maximum counts for each plot, and may not correspond to the maximum count of a single replicate.

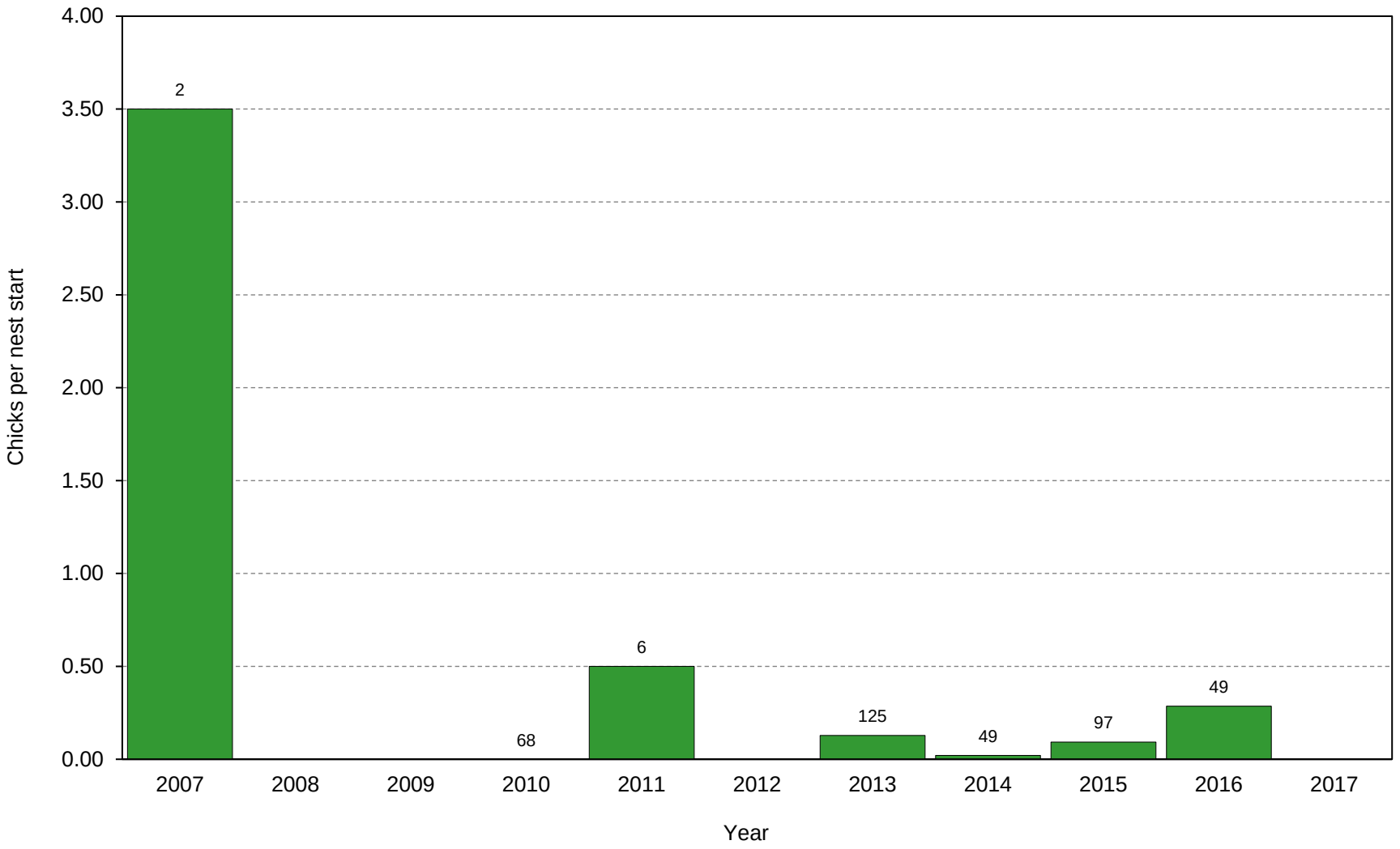

Figure 57. Reproductive performance of red-faced cormorants at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). No data were collected in 2002-2006, 2008-2009, 2012, or 2017.

Table 84. Reproductive performance of red-faced cormorants at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Measures of success are based on a count of nests (or maximum of several counts) conducted early in the nesting period and a count of large chicks (or maximum of several counts) conducted late in the nesting period. No data were collected in 2002-2006, 2008-2009, 2012, or 2017; historical data collected during the 1970s may potentially exist but have not yet been summarized.

Year	Total nest starts	Nests w/ x chicks[a]:				Nests w/ chicks	Total chicks	Mean brood size	Prop. nests w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
2007	2	0	0	1	1	2	7	3.5	1.00	3.50	7 Jun	3 Aug
2010	68	0	0	0	0	0	0	-	0.00	0.00	19 Jun	6+11 Aug
2011	6	1	1	0	0	2	3	1.5	0.33	0.50	13 Jun	29 Jul
2013	125	12	2	0	0	14	16	1.1	0.11	0.13	8+14 Jun	7 Aug
2014	49	1	0	0	0	1	1	1.0	0.02	0.02	8 Jun	31 Jul+12 Aug
2015	97	7	1	0	0	8	9	1.1	0.08	0.09	6+10+13 Jun	8+9 Aug
2016	49	4	5	0	0	9	14	1.6	0.18	0.29	4 Jun	2 Aug

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

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

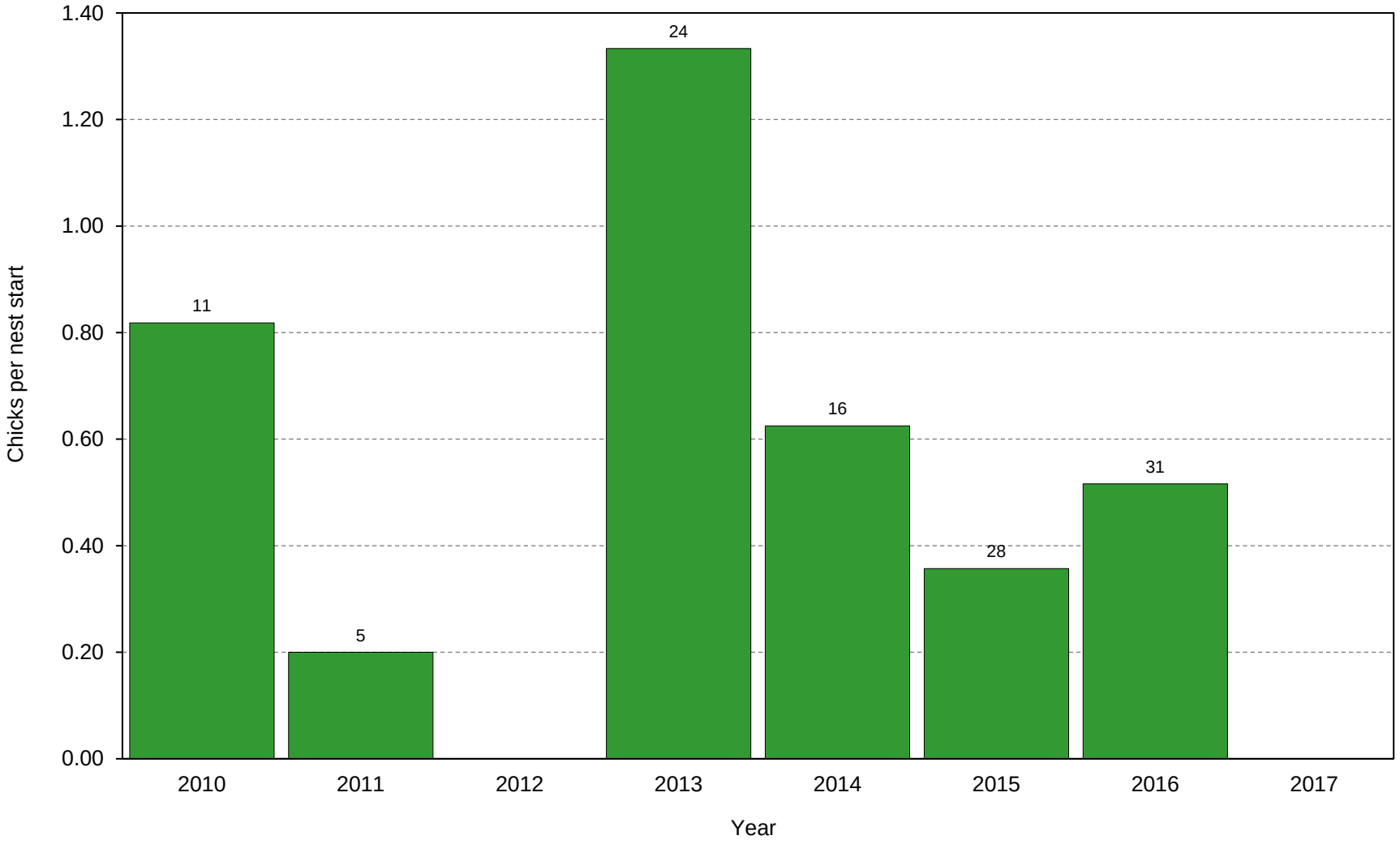

Figure 58. Reproductive performance of pelagic cormorants at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). No data were collected in 2002-2009, 2012, or 2017.

Table 85. Reproductive performance of pelagic cormorants at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Measures of success are based on a count of nests (or maximum of several counts) conducted early in the nesting period and a count of large chicks (or maximum of several counts) conducted late in the nesting period. No data were collected in 2002-2009, 2012, or 2017; historical data collected during the 1970s may potentially exist but have not yet been summarized.

Year	Total nest starts	Nests w/ x chicks[a]:				Nests w/ chicks	Total chicks	Mean brood size	Prop. nests w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
2010	11	3	0	2	0	5	9	1.8	0.45	0.82	19 Jun	6+11 Aug
2011	5	1	0	0	0	1	1	1.0	0.20	0.20	13 Jul	29 Jul
2013	24	3	10	3	0	16	32	2.0	0.67	1.33	6+8 Jun	4+7 Aug
2014	16	0	3	0	1	4	10	2.5	0.25	0.63	9+21 Jun	30 Jul
2015	28	5	1	1	0	7	10	1.4	0.25	0.36	10+13 Jun	8+9 Aug
2016	31	5	4	1	0	10	16	1.6	0.32	0.52	4 Jun	2 Aug

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

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

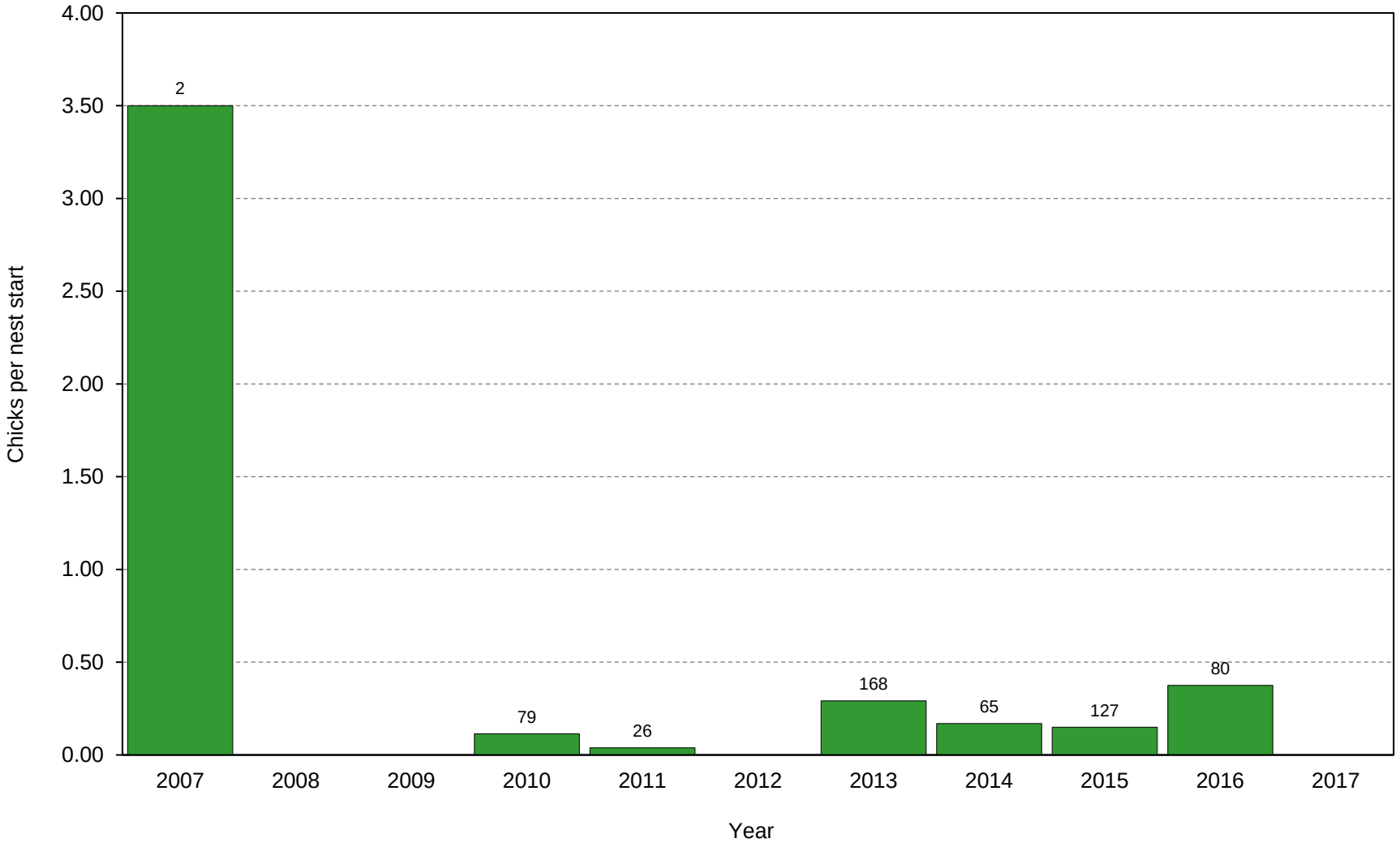

Figure 59. Reproductive performance of all cormorants (red-faced, pelagic, and unknown cormorant species) at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Success is measured by the number of chicks per nest start (E/A), where E=total chicks and A=total nest starts (including those without chicks). Numbers above columns indicate sample sizes (A). No data were collected in 2002-2006, 2008-2009, 2012, or 2017.

Table 86. Reproductive performance of all cormorants (red-faced, pelagic, and unknown cormorant species) at Chowiet Island, Alaska, as determined by a Boom-or-Bust methodology. Measures of success are based on a count of nests (or maximum of several counts) conducted early in the nesting period and a count of large chicks (or maximum of several counts) conducted late in the nesting period. No data were collected in 2002-2006, 2008-2009, 2012, or 2017; historical data collected during the 1970s may potentially exist but have not yet been summarized.

Year	Total nest starts	Nests w/ x chicks[a]:				Nests w/ chicks	Total chicks	Mean brood size	Prop. nests w/ chicks	Chicks/ nest start	Date(s) of max. nest count	Date(s) of max. chick count
	(A)	1	2	3	4	(D)	(E)	(E/D)	(D/A)[b]	(E/A)[b]		
2007	2	0	0	1	1	2	7	3.5	1.00	3.50	7 Jun	3 Aug
2010	79	3	0	2	0	5	9	1.8	0.06	0.11	19 Jun	6+11 Aug
2011	26	2	1	0	0	3	4	1.3	0.12	0.15	13 Jul	29 Jul
2013	168	16	12	3	0	31	49	1.6	0.18	0.29	29 May+8 Jun	4+7 Aug
2014	65	1	3	0	1	5	11	2.2	0.08	0.17	8+9+21 Jun	30+31Jul+12 Aug
2015	127	12	2	1	0	15	19	1.3	0.12	0.15	6+10+13 Jun	8+9 Aug
2016	80	9	9	1	0	19	30	1.6	0.24	0.38	4 Jun	2 Aug

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

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

Table 87. Numbers of birds detected during off-road point count survey (route 362) at Chowiet Island, Alaska. Data represent only individuals observed from survey points (≤ 50m) and do not include birds flying over census area. Counts were conducted for five minutes at each survey point. No counts were conducted in years not listed.

Species	2002	2007	2011
Black oystercatcher	1	0	0
Parasitic jaeger	2	0	0
Parakeet auklet	1	0	1
Glaucous-winged gull	0	0	8
Tree swallow	0	0	4
Pacific wren	4	3	8
Hermit thrush	0	0	3
American pipit	2	1	0
Gray-crowned rosy-finch	8	1	3
Lapland longspur	1	0	2
Snow bunting	1	0	0
Savannah sparrow	11	11	11
Fox sparrow	5	5	0
Song sparrow	2	1	21
Golden-crowned sparrow	2	6	12
Date	5 Jun	9 Jun	8 Jun

Table 88. Mean numbers of birds detected on beach transect surveys along South Bay Beach, Chowiet Island, Alaska. Data represent species' presence but not necessarily absence in all years. No counts were conducted before 2002 or in 2003 or 2008.

Species	2002	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Harlequin duck	0	0	0	0	1	4	<1	0	<1	4	0	2	<1	0
Black oystercatcher	4	0	0	5	4	3	2	2	2	2	3	3	1	3
Least sandpiper	0	0	0	0	0	0	0	0	0	0	0	<1	0	0
Wandering tattler	0	0	0	0	<1	0	0	0	0	0	0	0	0	<1
Pigeon guillemot	0	0	0	<1	1	0	0	0	0	0	0	0	0	3
Bald eagle	0	0	0	<1	1	<1	<1	0	<1	0	<1	<1	0	1
Common raven	0	0	0	<1	0	0	0	<1	0	<1	0	0	0	<1
Bank swallow	<1	0	0	<1	<1	0	0	0	0	0	0	0	0	<1
Pacific wren	1	1	3	3	2	2	2	2	1	2	2	2	2	1
Hermit thrush	0	0	0	0	0	0	<1	<1	0	0	0	0	0	0
Gray-crowned rosy-finch	0	0	<1	1	1	<1	<1	0	1	<1	0	0	0	1
Yellow warbler	0	0	0	<1	0	0	0	0	0	0	0	0	0	0
Wilson's warbler	0	<1	<1	<1	0	0	<1	0	<1	<1	<1	0	0	0
Savannah sparrow	1	2	1	2	2	<1	<1	<1	2	1	2	1	<1	1
Fox sparrow	1	<1	<1	0	1	1	<1	<1	1	2	<1	<1	0	1
Song sparrow	3	4	6	5	3	2	4	5	2	5	3	4	3	3
Golden-crowned sparrow	<1	<1	0	2	1	<1	<1	1	<1	<1	<1	<1	0	1
n	6	5	5	5	5	5	5	5	5	5	5	5	5	5
First survey	2 Jun	6 Jun	7 Jun	3 Jun	1 Jun	3 Jun	2 Jun	5 Jun	3 Jun	4 Jun	2 Jun	2 Jun	2 Jun	2 Jun
Last survey	17 Jun	12 Jun	15 Jun	15 Jun	14 Jun	16 Jun	13 Jun	13 Jun	14 Jun	12 Jun	13 Jun	14 Jun	12 Jun	11 Jun

Table 89. Numbers of birds detected on beach transect surveys along South Beach, Chowiet Island, Alaska in 2017.

Species	Date					Mean	SD
	2 Jun	3 Jun	5 Jun	6 Jun	11 Jun		
Harlequin duck	0	0	0	0	0	0	0
Black oystercatcher	4	2	2	3	4	3	1
Least sandpiper	0	0	0	0	0	0	0
Wandering tattler	0	1	0	0	0	<1	<1
Pigeon guillemot	3	0	2	6	2	3	2
Bald eagle	0	2	0	1	2	1	1
Common raven	1	0	0	1	0	<1	1
Bank swallow	0	0	0	2	0	<1	1
Pacific wren	1	1	2	2	1	1	1
Hermit thrush	0	0	0	0	0	0	0
Gray-crowned rosy-finch	0	0	0	3	0	1	1
Yellow warbler	0	0	0	0	0	0	0
Wilson’s warbler	0	0	0	0	0	0	0
Savannah sparrow	2	1	0	1	1	1	1
Fox sparrow	0	0	1	2	2	1	1
Song sparrow	3	3	3	3	2	3	<1
Golden-crowned sparrow	2	2	1	1	1	1	1
Start time (AKST)	0845	0924	0935	0845	0846	-	-
End time (AKST)	0900	0943	0951	0902	0859	-	-

Table 90. Mean numbers of individuals found and encounter rates during COASST surveys along Landing Cove, Chowiet Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.1 km for Landing Cove) divided by the number of surveys. No data were collected in 2008.

Species	2006		2007		2009		2010		2011		2012	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Common murre	-	-	-	-	-	-	0.1	1.3	-	-	-	-
Unidentified murre	-	-	-	-	-	-	-	-	-	-	-	-
Parakeet auklet	-	-	-	-	-	-	-	-	-	-	-	-
Glaucous-winged gull	-	-	-	-	-	-	-	-	-	-	-	-
Northern fulmar	-	-	-	-	0.3	7.1	-	-	-	-	-	-
Sooty shearwater	0.1	1.3	0.3	5.7	-	-	-	-	-	-	-	-
Pelagic cormorant	-	-	-	-	-	-	-	-	-	-	0.1	2.9
Unidentified bird	0.3	2.5	-	-	-	-	-	-	-	-	0.1	1.4
All species	0.4	3.8	0.3	5.7	0.3	7.1	0.1	1.3	0.0	0.0	0.3	4.3
n	8		7		7		8		10		7	
First survey	3 Jul		28 May		24 May		25 May		2 Jun		25 May	
Last survey	29 Aug		23 Aug		25 Aug		31 Aug		24 Aug		25 Aug	

Table 90 (continued). Mean numbers of individuals found and encounter rates during COASST surveys along Landing Cove, Chowiet Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.1 km for Landing Cove) divided by the number of surveys. No data were collected in 2008.

Species	2013		2014		2015		2016		2017	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Common murre	-	-	0.2	1.7	1.3	43.3	0.1	10.0	-	-
Unidentified murre	-	-	-	-	0.2	1.7	-	-	-	-
Parakeet auklet	-	-	-	-	-	-	0.1	2.9	-	-
Glaucous-winged gull	-	-	0.2	1.7	0.2	6.7	-	-	-	-
Northern fulmar	-	-	-	-	-	-	-	-	-	-
Sooty shearwater	-	-	-	-	-	-	-	-	-	-
Pelagic cormorant	-	-	-	-	-	-	0.1	8.6	-	-
Unidentified bird	-	-	-	-	0.2	1.7	-	-	-	-
All species	0.0	0.0	0.3	3.3	1.8	53.3	0.4	21.4	0.0	0.0
n	6		6		6		7		8	
First survey	28 May		28 May		28 May		22 May		21 May	
Last survey	26 Aug		31 Aug		20 Aug		20 Aug		29 Aug	

Table 91. Mean numbers of individuals found and encounter rates during COASST surveys along South Bay Beach, Chowiet Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.2 km for South Bay Beach) divided by the number of surveys. No data were collected in 2008.

Species	2006		2007		2009		2010		2011		2012	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Black oystercatcher	-	-	-	-	-	-	-	-	-	-	-	-
Common murre	-	-	-	-	-	-	-	-	-	-	-	-
Ancient murrelet	0.1	0.5	-	-	-	-	-	-	-	-	0.2	4.2
Rhinoceros auklet	0.1	0.5	-	-	-	-	-	-	-	-	-	-
Black-legged kittiwake	-	-	-	-	-	-	-	-	-	-	-	-
Glaucous-winged gull	0.1	0.5	-	-	-	-	-	-	0.1	2.1	-	-
Northern fulmar	0.1	0.5	-	-	-	-	-	-	0.1	2.9	-	-
Short-tailed shearwater	-	-	-	-	-	-	-	-	-	-	-	-
Bald eagle	-	-	-	-	0.1	1.4	-	-	0.1	5.0	-	-
All species	0.4	1.8	0.0	0.0	0.1	1.4	0.0	0.0	0.3	10.0	0.2	4.2
n	11		8		7		8		12		6	
First survey	24 May		25 May		26 May		24 May		2 Jun		31 May	
Last survey	13 Aug		27 Aug		26 Aug		31 Aug		24 Aug		23 Aug	

Table 91 (continued). Mean numbers of individuals found and encounter rates during COASST surveys along South Bay Beach, Chowiet Island, Alaska. Mean number of individuals comprises the average number of new birds found per survey and does not include birds still present and re-encountered from previous surveys. Encounter rate is defined as the number of all birds (including both new individuals and re-encountered birds) found per km beach surveyed (0.2 km for South Bay Beach) divided by the number of surveys. No data were collected in 2008.

Species	2013		2014		2015		2016		2017	
	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate	Mean # ind.	Enc. rate
Black oystercatcher	0.2	5.0	-	-	-	-	-	-	-	-
Common murre	-	-	-	-	0.2	2.5	-	-	-	-
Ancient murrelet	-	-	-	-	-	-	-	-	-	-
Rhinoceros auklet	-	-	-	-	-	-	0.1	1.4	-	-
Black-legged kittiwake	0.2	0.8	-	-	-	-	-	-	-	-
Glaucous-winged gull	0.5	2.5	-	-	-	-	-	-	0.1	0.6
Northern fulmar	-	-	-	-	-	-	0.1	0.7	0.1	0.6
Short-tailed shearwater	-	-	-	-	0.2	0.8	-	-	-	-
Bald eagle	-	-	-	-	-	-	-	-	-	-
All species	0.8	8.3	0.0	0.0	0.3	3.3	0.3	2.1	0.3	1.3
n	6		6		6		7		8	
First survey	31 May		27 May		30 May		27 May		20 May	
Last survey	24 Aug		30 Aug		22 Aug		26 Aug		26 Aug	

Table 92. Numbers of birds encountered on COASST surveys along Landing Cove, Chowiet Island, Alaska in 2017. Data represent numbers of new individual birds found each survey; numbers of birds still present and re-encountered on each survey are shown parentheses.

Species	Date								Individuals[a]			Encounters[b]	
	21 May	5 Jun	18 Jun	1 Jul	17 Jul	30 Jul	15 Aug	29 Aug	Total	Mean	SD	Total	Enc. rate[c]
Total new individuals	0	0	0	0	0	0	0	0	0	0.0	0.0	-	-
Total encounters	0	0	0	0	0	0	0	0	-	-	-	0	0.0

[a]Individuals represent new birds seen on surveys only and do not include birds still present and re-encountered on surveys.
[b]Encounters represent all birds seen on surveys, including both new individuals and all instances of re-encountered birds.
[c]Encounter rate = number of birds encountered / km beach surveyed (0.1 km for Landing Cove) / number of surveys.

Table 93. Numbers of birds encountered on COASST surveys along South Bay Beach, Chowiet Island, Alaska in 2017. Data represent numbers of new individual birds found each survey; numbers of birds still present and re-encountered on each survey are shown parentheses.

Species	Date								Individuals[a]			Encounters[b]	
	20 May	3 Jun	15 Jun	3 Jul	18 Jul	31 Jul	12 Aug	26 Aug	Total	Mean	SD	Total	Enc. rate[c]
Glaucous-winged gull	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1	0.1	0.4	1	0.6
Northern fulmar	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1	0.1	0.4	1	0.6
Total new individuals	0	0	0	2	0	0	0	0	2	0.3	0.7	-	-
Total encounters	0	0	0	2	0	0	0	0	-	-	-	2	1.3

[a]Individuals represent new birds seen on surveys only and do not include birds still present and re-encountered on surveys.
[b]Encounters represent all birds seen on surveys, including both new individuals and all instances of re-encountered birds.
[c]Encounter rate = number of birds encountered / km beach surveyed (0.2 km for South Bay Beach) / number of surveys.

Annotated list of wildlife species observed at Chowiet Island, Alaska in 2017 (15 May to 3 September).

Abundance categories were defined as follows:

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

Status categories are defined as follows:

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

BIRDS

Aleutian cackling goose (*Branta hutchensii leucopareia*). Uncommon breeder. Aleutian cackling geese were detected on a total of 18 days from mid May until mid June. Later, a high count of 50 geese was seen on 17 August flying over South Bay. Most geese exhibiting nesting behavior were found near glaucous-winged gull colonies. Cow parsnip or "putchki" *(Heracleum lanatum*) was the dominant vegetation in these areas, however, nests were discovered in dense clumps of tall grass within the cow parsnip. Three nests were discovered on 29 May; two at North Point and one at Otter Point (first documented nest at Otter Point). Clutch sizes were only determined if hens were inadvertently flushed from the nest and care was taken to avoid drawing avian predators to the site.

Aleutian cackling goose Nest 1
- Location: southern glaucous-winged gull colony on North Point (see map)
- Coordinates: N 56.06071, W 156.71063
- Distance from nearest glaucous-winged gull nest: 10 m
- Dominant vegetation: 100% tall grass within putchki patch
- Slope/aspect: gradual/northeast
- Amount of down: abundant
- Clutch size: 6 eggs
- Status: unknown (active as of 13 June)

Aleutian cackling goose Nest 2
- Location: southern glaucous-winged gull colony on North Point (see map)
- Coordinates: N 56.05980, W 156.71133
- Distance from nearest glaucous-winged gull nest: 15 m
- Dominant vegetation: 100% tall grass within putchki patch
- Slope/aspect: gradual/north
- Amount of down: medium
- Clutch size: 3 eggs
- Status: unknown (active as of 13 June)

Aleutian cackling goose Nest 3

Location: below glaucous-winged gull colony on Otter Point (see map)
Coordinates: N 56.04394, W 156.72180
Distance from nearest glaucous-winged gull nest: 20 m
Dominant vegetation: 90% tall grass, 5% putchki, 5% fern
Slope/aspect: steep/north
Amount of down: medium
Clutch size: 5 eggs
Status: abandoned
Notes: A motion sensor camera was placed 5 m away from the nest on 29 May. The batteries were replaced on 13 June. Footage does not show the hen returning to the nest after 13 June. It is unknown whether human disturbance caused abandonment of the nest, but caution is strongly advised when approaching nests in the future.

The presence of feces and behavior of multiple pairs of geese suggest the existence of additional nests at both North Point and Otter Point. Six pairs were observed at North Point and two at Otter Point on 29 May. On 5 June Puffin Point was searched for nests where they have been located in previous years but none were found.

Common eider (*Somateria mollissima*). Uncommon breeder. Common eiders were observed 22 days from 29 May to 26 August. The highest daily count occurred on 8 June when a group of 12 adults was seen from West Rough. Three hens with two chicks were seen 23 July; chicks were not observed at any other time. Molting males were observed early in the season on 18 May and later from 23 July through the end of the season.

Harlequin duck (*Histrionicus histrionicus*). Common resident non-breeder. Harlequin ducks were encountered on 18 days throughout the season, reflecting when observers were working near the shoreline. No more than three were seen at any one time, although larger groups were observed in previous years. Harlequin ducks, which summer in the Semidi Islands, appear to be non-breeders.

Sandhill crane (*Antigone canadensis*). Irregular migrant. A single individual was heard and later seen at North Point on 19 and 20 May.

Black oystercatcher (*Haematopus bachmani*). Common breeder. The only shorebird known to regularly breed on Chowiet Island, black oystercatchers were seen or heard every day in 2017. Six nests were found in 2017; four in South Bay, and two in West Rough. Two nests in South Bay contained two eggs and the other two contained three eggs, and a total of seven chicks were observed, hatching between 10 June and 18 June. One nest in West Rough contained three eggs and three membranes were later found indicating that all three hatched. Although no date was noted some fledglings were seen at South Bay and at West Rough in August. Additional nests likely exist on Chowiet, however, observations were limited to areas that observers frequented. Pairs of black oystercatchers exhibiting territorial behavior were also observed at Rough Cove, Spruce Cove, Clay Lick, Constant Colony, Otter Point and North Point.

Bristle-thighed curlew (*Numenius tahitiensis*). Accidental vagrant. An individual was heard and seen near the cabin on 23 August. Photos were not taken due to fog, but observers had the opportunity to notice the curved bill and the contrast between the breast and the belly. The distinguishing call was a sure way to differentiate the curlew from a whimbrel in low light.

Ruddy turnstone (*Arenaria interpres*). Casual vagrant. Individuals were observed in South Bay on five occasions throughout the season. A maximum of two individuals were seen on 19 June. They were seen in intertidal areas on all occasions.

Black turnstone (*Arenaria melanocephala*). Accidental migrant. Individuals were observed in South Bay on three occasions throughout the season. Two were seen in intertidal areas and one was seen flying above the grassy berm near the beach. This is the second year that sightings of black turnstones have occurred on Chowiet.

Aleutian rock sandpiper (*Calidris ptilocnemis couesi*). Irregular migrant. Rock sandpipers were the most numerous non-breeding shorebird found in 2017. Sightings occurred on four days between 6 and 22 August, with a flock of 15 birds recorded on 19 August. Sightings occurred in Constant Colony and Landing Cove.

Least sandpiper (*Calidris minutilla*). Irregular probable breeder. Least sandpipers were detected on two days in early June and on five days from late July to mid August. A flock of eight birds was observed foraging in the intertidal zone in South Bay on 27 July. An individual was observed making breeding calls near the cabin 21 May 2016, but breeding has yet to be definitively confirmed for Chowiet Island.

Wilson's snipe (*Gallinago delicate*). Casual vagrant. Individuals were seen on 4 and 22 August. One sighting was near camp and the other was near the waterfall in Clay Lick. This is the fifth year that sightings of Wilson's snipe have occurred on Chowiet.

Wandering tattler (*Tringa incana*). Uncommon migrant. Wandering tattlers have been recorded annually in small numbers on Chowiet Island since the instigation of regular seabird monitoring in 2002. In 2017, they were observed five times from late July to late August. All sightings were of solitary individuals.

Parasitic jaeger (*Stercorarius parasiticus*). Common breeder. Parasitic jaegers were observed most days during the 2017 season. A high count of six individuals occurred on 29 May. The species was most commonly encountered in upland areas, but could be seen, or heard, throughout the island.

Common murre (*Uria aalge*). Abundant breeder. Common murre is the most abundant avian species on Chowiet Island. Population counts of common murres in 2017 were about half the number counted in most years but higher than in 2015 and 2016. Despite low numbers, nest sites observed on Chowiet had a reproductive success rate of 66%. This is the highest rate reported on Chowiet since monitoring began in 1979; however, low populations should be considered in the overall reproductive success of common murres on Chowiet Island. Photos of common murre nesting ledges were taken during a tour of South Island when the R/V *Tiĝlax̂* visited Chowiet for resupply on 14 July. Similar photos taken at South Island in August 2014 show a much higher abundance of common murres in the same locations. Murres are typically more abundant on nesting ledges in July, before chicks have fledged, so the absence of murres in the 2017 photos is especially significant.

Thick-billed murre (*Uria lomvia*). Abundant breeder. On Chowiet Island, common murres outnumber thick-billed murres by a ratio of approximately 10:1. Compared to the common murres, thick-billed murres typically nest in smaller clusters and on narrower cliff ledges. Population counts of thick-billed murres were about 2/3 the number counted in most years, but a reproductive success rate of 53% was higher than the mean recorded reproductive performance of 40%.

Pigeon guillemot (*Cepphus columba*). Common breeder. Hatch and Hatch (1983a) estimated a pigeon guillemot population of 500 individuals on Chowiet Island in the late 1970s. In 2017, individuals were most commonly observed in Landing Cove and South Bay. Because time spent in other locations was limited, estimates of populations and reproductive success are lacking for the season. Typically, one to four birds were seen on 60 days throughout the 2017 season. The highest count of pigeon guillemots was recorded when 46 birds were seen near North Point on 29 May. No fledglings were observed.

Ancient murrelet (*Synthliboramphus antiquus*). Uncommon breeder. Ancient murrelets are rarely encountered on Chowiet; however, they are known to breed in small numbers. Though auditory detections were common at South Bay beach at night during the peak of the fledging period in late June, no chick departures were confirmed. One burrow containing an ancient murrelet was found in West Rough in 2017. The adult was observed on four occasions before the nest was abandoned. No eggs were seen in the nest, although it is possible that eggs were present but not visible. Ancient murrelets were detected seven times during the season.

Parakeet auklet (*Aethia psittacula*). Abundant breeder. Parakeet auklets were seen daily until mid August when numbers significantly declined as chicks began to fledge. Raft counts in 2017 yielded the same maximum count as 2016; the highest single count since counts began in 1998. Parakeet auklet productivity appears highly variable on Chowiet Island; in 2017, a reproductive success rate of 46% was slightly higher than the mean recorded reproductive performance. On Chowiet Island, arctic ground squirrels may be a significant cause of parakeet auklet breeding failure due to depredation of eggs, chicks, and adults.

Rhinoceros auklet (*Cerorhinca monocerata*). Common breeder. Chowiet Island likely contains the only breeding population of rhinoceros auklets in the Semidi Islands; relatively large scattered colonies occur at South Bay and Spruce Cove, and a smaller colony occurs at Landing Cove. Rhinoceros auklets were rarely observed outside of diet sampling efforts at night. The first adult carrying fish was captured on 13 July, indicating the presence of chicks at this time. Activity during diet sampling significantly diminished by 1 August, although one sample was collected from a rhinoceros auklet captured on 9 August.

Horned puffin (*Fratercula corniculata*). Abundant breeder. Hatch and Hatch (1983a) estimated that between a quarter and a third of the world population of horned puffins breeds in the Semidi Islands, and that 10% of the Semidi population nests on Chowiet Island. Searchable horned puffin crevices were concentrated in low coastal areas, but the species also nested throughout talus slopes at some of the highest elevations on the island. One potentially significant limiting factor to horned puffin nesting success on Chowiet is the presence of arctic ground squirrels. One horned puffin chick was confirmed to be depredated by arctic ground squirrels in Landing Cove in 2016 with the aid of a motion-activated trail camera. Cameras were placed in two nests in 2017, but no arctic ground squirrels were observed. Although primarily a crevice-nester in Alaska, horned puffins nest exclusively in burrows on neighboring Suklik and Aghik Islands; these two islands contain 80% of the Semidi Island breeding population and are (along with smaller South Island) the only islands in the group that are not inhabited by arctic ground squirrels (Hatch and Hatch 1983a). While raft counts yielded a relatively high maximum count of horned puffins in 2017, the reproductive success rate of observed nest sites was extremely low. Only seven chicks remained at the end of the season out of 118 active nests. These were considered old enough to obtain a fledged status and contributed to a 6% reproductive success rate for the season. Chicks in failed nests appeared lethargic and underweight and were often found dead on subsequent checks. No diet samples were obtained in 2017, probably due to the infrequency of horned puffins with bill loads.

Tufted puffin (*Fratercula cirrhata*). Abundant breeder. In 2017, the reproductive success rate of observed nest sites for tufted puffins was the second lowest recorded on Chowiet. Only one chick remained at the end of the season out of 63 active nests. This chick was considered old enough to obtain a fledged status and produced a 2% reproductive success rate for the season. Similar to horned puffins, chicks in failed nests appeared lethargic and underweight and were often found dead on subsequent checks. No diet samples were obtained in 2017, probably due to the infrequency of tufted puffins with bill loads; however, one tufted puffin with a small bill load was observed from the R/V *Tiĝlax̂* on 3 September. Three tufted puffins with small bill loads were observed from the R/V *Tiĝlax̂* near Suklik Island on 4 September. Due to rough seas, crews were not able to offload on Suklik Island to collect puffin diet samples in 2017.

Black-legged kittiwake (*Rissa tridactyla*). Abundant breeder. In 2017, the reproductive success for observed nest sites was 22%; about average for black-legged kittiwakes on Chowiet. Laying failure, egg loss, and chick loss contributed nearly equally to overall failure of observed nest sites this year. Throughout the season, large flocks of kittiwakes were occasionally seen feeding on fish ~0.5 km offshore in Chowiet Bay and on the west side of Chowiet. These feeding events were not observed in 2015, which may have contributed to the poor nesting success of the kittiwakes in that year.

Glaucous-winged gull (*Larus glaucescens*). Abundant breeder. Glaucous-winged gulls bred across the island in approximately ten colonies. In 2017, the maximum number of nests counted at South Bay was 126; lower than the mean of 162 for previous years monitored. Fledgling counts yielded a significant decline in numbers after high counts in 2014, 2015, and 2016. Eggs were noted during the first hike to North Point on 19 May. Eggs were first observed in productivity and chronology plots on 27 May. The first chick was observed on 24 June.

Northern fulmar (*Fulmaris glacialis*). Abundant breeder. Hatch and Hatch (1983a) estimated that 90,000 fulmars bred on Chowiet Island in the late 1970s with over 440,000 breeding in the Semidi Islands as a whole; this constitutes virtually the entire population in the Gulf of Alaska and 1/3 of the entire Alaskan population. Fulmar productivity appeared to be somewhat lower than average with a maximum chick count of 53 on plots. The earliest egg was observed on 7 June near Stake 6 and first hatch was observed on 29 July near Stake 3.

Fork-tailed storm-petrel (*Oceanodroma furcata*). Rare probable breeder. The occurrence of fork-tailed storm-petrels on the island is not well documented. Although present in similar numbers to Leach's storm-petrels on other Semidi Islands, fork-tailed storm-petrels have been recorded on Chowiet Island by monitoring crews on only six years since 2002. They were detected in 2017 when an individual was heard in South Bay during rhinoceros auklet mist netting on 22 July.

Leach's storm-petrel (*Oceanodroma leucorhoa*). Uncommon probable breeder. Hatch and Hatch (1983a) estimated that 114,000 Leach's and 123,000 fork-tailed storm-petrels breed in the Semidi Islands; however, >80% of the population occurs on islands where ground squirrels are absent (Suklik, South, and Aghik islands). Their findings indicate that neither species was present on Chowiet Island in the late 1970s. Although no burrows have been documented, Leach's storm-petrel has been recorded on Chowiet Island by all annual monitoring crews since 2002, and it seems likely that small numbers breed on Chowiet Island. In 2017, Leach's storm-petrels were heard or seen on 22 nights between 24 May and 1 September (nearly all nights when observers were awake during complete darkness). The species was detected at South Bay as well as Cabin Valley. All detections in 2017 occurred at low and mid-elevations dominated by dense herbaceous vegetation. Multiple call types were heard including the churr call which

is normally made while birds are in burrows (possible indication of breeding on Chowiet), but sometimes by birds (probably prebreeders) on the ground under vegetation.

Red-faced cormorant (*Phalacrocorax urile).* Common breeder. Red-faced cormorants regularly breed on Chowiet Island, but numbers appear to fluctuate widely among survey years. All accessible shorelines, including historical colony locations, were searched in late May through mid June of 2017, however no nests were discovered. Red-faced cormorants were seen 53 times throughout the season and in late August fledglings were observed perched on rocks east of the glaucous-winged gull colonies in South Bay. After some exploration, empty nests were discovered in a rocky crag that was not visible from any convenient vantage point. It is very likely that red-faced cormorants nested in this area in 2017, but were not documented by observers.

Pelagic cormorant (*Phalacrocorax pelagicus).* Common breeder. Pelagic cormorants were seen 71 days throughout the season in 2017. Fledglings and empty nests were discovered in the same area where red-faced cormorants were observed in late August. It is very likely that pelagic cormorants nested in this area in 2017, but were not documented by observers.

Bald eagle (*Haliaeetus leucocephalus*). Common breeder. A nearly complete survey of the island was conducted in mid May to mid June and four active aeries were identified (see map). Three eaglets were observed in a nest at North Point on 29 May and 13 June. Two eaglets were observed in a nest at Eider Cove on 13 June. One eaglet was frequently observed in the Frog Rock nest until it was seen flying near the nest on 24 August. A pair of eagles exhibited territorial behavior in South Bay, but no other evidence of nesting was observed in that area. One fledgling was seen near Eider Cove on 30 August.

Rough-legged hawk (*Buteo lagopus*). Irregular resident non-breeder. One individual was seen on 12 and 23 June. Both times the bird was seen circling silently overhead.

Gyrfalcon (*Falco rusticolus*). Irregular migrant. An adult pair and two juvenile gyrfalcons were observed near Stonehenge and Windy Pass on 12 occasions from 27 July to 26 August. All were frequently seen perched on low rocks, on the ground, or circling low above observers.

Peregrine falcon (*Falco peregrinus*). Common breeder. Peregrine falcons were seen almost daily in 2017 with sightings occurring throughout the season and island. No aeries were visually confirmed but four territories were located (see map). A pair of adults with two begging fledglings was seen often near the ledge nester cliffs starting in mid July.

Common raven (*Corvus corax*). Common breeder. Ravens were seen daily throughout the season and five nesting territories were identified in 2017 (see map). While nests were not located in all of these territories, adults were seen with fledglings inhabiting these areas on a regular basis. The first fledgling was seen on 18 June and over 20 ravens were seen flying above Windy Pass on 31 July.

Bank swallow (*Riparia riparia*). Uncommon probable breeder. Bank swallows were detected on a total of 43 days in 2017, with the majority seen within Cabin Valley. Observations were made from late May to late August. A small colony of bank swallows was discovered in a dirt bank on the west side of North Point in 2005, and although the species has been noted in all monitoring years, breeding has not been confirmed since that time.

Pacific wren (*Troglodytes pacificus*). Common breeder. Numerous Pacific wrens were detected daily throughout the 2017 season. This species is most abundant in areas of thick vegetation or rocky slopes,

while the fledglings particularly enjoy the small woodpiles at the cabin. Fledglings were first observed on 16 June.

Golden-crowned kinglet (*Regulus satrapa*). Casual migrant. Small flocks of golden-crowned kinglets were seen near the cabin four times from 27 August to 1 September.

Hermit thrush (*Catharus guttatus*). Rare breeder. Hermit thrushes were detected on 39 days from 21 May to 22 June. Individuals were most commonly heard in Cabin Valley or in the hillside behind Constant Colony at dawn and dusk. A high count of three occurred on 28 and 29 May.

American pipit (*Anthus rubescens*). Uncommon breeder. American pipits were observed on 21 days throughout the season in 2017. High counts of four occurred at Windy Pass on 9 and 22 August. These larger groups contained adults and fledglings, presumably raised on Chowiet.

Gray-crowned rosy-finch (*Leucosticte tephrocotis*). Common breeder. Gray-crowned rosy-finches were observed almost daily throughout the season and in all habitat types. Fledglings were first noted on 20 July.

Common redpoll (*Acanthis flammea*). Casual breeder. Common redpolls were observed on 23 days throughout the island. A high count of at least five individuals was recorded near the cabin on 23 June. A fledgling was observed begging for food near Stake 9 on 16 July. This is the first evidence of breeding documented on Chowiet for this species.

Lapland longspur (*Calcarius lapponicus*). Uncommon breeder. Lapland longspurs were encountered on 17 days in 2017 from 19 May to 1 July. Fledglings were not observed this season; however, relatively little time was spent in the upland areas where all observations occurred.

Yellow warbler (*Setophaga petechial*). Uncommon breeder. Individuals were first seen near the cabin on 13 June. No yellow warblers were seen from late July to mid August, but they reappeared in Cabin Valley for the later part of the season. Individuals were seen on 31 days this season and fledglings were first observed on 1 July.

Wilson's warbler (*Cardellina pusilla*). Uncommon breeder. Wilson's warblers were first seen on Chowiet Island on 2 June. Wilson's warblers were seen on island 49 days in 2017. The first fledglings were seen in mid August.

Savannah sparrow (*Passerculus sandwichensis*). Common breeder. Savannah sparrows were present throughout the season and could be found in all vegetated areas. Fledglings were first seen on 10 June.

Fox sparrow (*Passerella iliaca*). Common breeder. Fox sparrows were present throughout the season and were most numerous in lowland areas. The first fledglings were seen in early June.

Song sparrow (*Melospiza melodia*). Common breeder. Song sparrows were observed daily throughout the season. This species is most numerous along the coast and in lower meadows. The first, of an abundance of fledglings, were seen in early June.

Golden-crowned sparrow (*Zonotrichia atricapilla*). Common breeder. Although slightly less numerous than the other sparrow species, golden-crowned sparrows were still observed daily throughout 2017 from the lowland areas and up into the higher meadows. Around mid August golden-crowned sparrows were

seen less frequently, although an individual was heard on 2 September. The first fledglings were observed in mid July.

MAMMALS

Arctic ground squirrel (*Urocitellus parryii*). Common breeder. Arctic ground squirrels, the only terrestrial mammal on Chowiet Island, were found throughout the island in any habitat type where the substrate permitted burrowing. It is unclear whether this species is native to the Semidi Islands or was introduced by humans (Cook et al. 2010). Primarily herbivorous, the consumption of seabirds by arctic ground squirrels has been documented on Chowiet Island by most monitoring crews, but estimating the extent of reproductive failure attributable to squirrels is difficult, and the ability to recognize squirrel kills may vary among observers. Further, without witnessing a predation event, it is impossible for field crews to determine whether a fed-upon carcass represents a kill or scavenging of a bird killed by other causes. We suspect that most carcasses that show signs of having been fed upon by squirrels are the result of kills, for simplicity we refer to these events as depredations but acknowledge that the possibility of scavenging cannot be excluded.

Of the 252 active auklet and puffin crevices monitored in 2017, a minimum of seven likely failed due to squirrel depredation. Most eggs that were consumed by squirrels may not be detectable, and kills where the carcass was left out of sight or removed from the crevice also would go undetected. Of the seven possible predation events, five were horned puffin chicks, and two were tufted puffin chicks. Motion-activated trail cameras were placed in three puffin burrows in 2016. One camera clearly documented a squirrel entering a horned puffin burrow and attacking and killing a large chick. Cameras were also placed in 2017, but no depredation events were recorded. Based on the results of crevice-nester monitoring, the following instances of squirrel depredation were documented in the past nine years:

Year	Adults			Chicks				Total Sites
	ANMU	PAAU	HOPU	ANMU	PAAU	HOPU	TUPU	
2009	0	2	0	0	1	3	4	10
2010	0	1	0	0	0	4	10	15
2011	0	0	0	0	0	1	1	2
2012	0	1	0	0	2	7	4	14
2013	0	5	0	0	5	8	3	22[a]
2014	1	3	1	2	3[a]	9	9[a]	24
2015	0	0	0	0	3	1[a]	1	5
2016	0	0	0	0	3	2[a]	0	5
2017	0	0	0	0	0	5	2	7
Total	1	12	1	2	17	40	34	104

[a]Total includes eggs addled or abandoned due to squirrel depredation event in the crevice.

The extent of squirrel depredation on rhinoceros auklets is more difficult to gauge because burrows are not monitored for productivity due to difficulties in ascertaining site contents. Arctic ground squirrels are common within rhinoceros auklet colonies at South Bay and Spruce Cove, and squirrel sign is regularly encountered in or near burrows deemed occupied by auklets. No carcasses were found in 2017 to indicate predation on rhinoceros auklet chicks by ground squirrels.

Ground squirrels are present on all of the Semidi Islands except South, Suklik, and Aghik islands, and based on the population estimates of Hatch and Hatch (1983a), these islands contain the bulk of the burrow-nesting seabirds in the group (i.e., >80% of the storm-petrels, Cassin's auklets, and horned puffins—which use burrows on squirrel-free islands in the Semidi Islands). Burrow-nesting seabirds are uncommon on Chowiet Island, and it seems likely that the presence of arctic ground squirrels is the limiting factor in this exclusion.

Sea otter (*Enhydra lutris*). Uncommon breeder. Sea otters were seen on 25 days in 2017; most sightings were of only one or two individuals. A high count of 11 individuals occurred during a hike to North Point on 29 May. Females with small pups were first observed on 29 May and pups were observed several more times throughout the season. Sightings of sea otters became very infrequent after early July.

Steller sea lion (*Eumetopias jubatus*). Common breeder. Sea lions were observed throughout the 2017 field season. A count of adults and pups on Jaba Rock and nearby islets was conducted on 5 June from a vantage point on Pupping Point. Numbers of adults and pups counted at these times were as follows (note that these counts could be lower than the actual due to the constraints of the steep landscape and the distance; no branded individuals were observed).

Site	5 June	
	Adults	Pups
Jaba Rock and nearby islets	293	22

Counts of sea lions at other beaches and pupping areas of the island were not conducted, thus our count of Jaba Rock and nearby islets represent only a portion of the sea lions present at Chowiet on 5 June. Sea lion sightings occurred regularly throughout the season, increasing in mid August when individuals began to congregate near Frog Rock—an annual occurrence. Numbers at Frog Rock regularly reached around 30 individuals.

Harbor seal (*Phoca vitulina*). Uncommon breeder. Harbor seals were seen on 42 days in 2017; most sightings outside of regular haul-out areas were of lone individuals or females with pups. A high count of 10 individuals occurred on 20 May at a haul-out area in South Bay. Pups were observed throughout the season in South Bay and near Constant Colony.

Fin whale (*Balaenoptera physalus*). Uncommon non-breeder. Fin whales were only seen once in 2017. A group of 12 were observed ~1 km off shore from Stake 6 on 4 July.

Humpback whale (*Megaptera novaeangliae*). Uncommon non-breeder. Humpbacks were seen only once in 2017. A large individual was observed near shore in Landing Cove while crews off loaded the Chowiet field camp on 3 September.

Table 94. Observations and breeding status of birds, selected mammals, and fish at Chowiet Island, Alaska. Information comes from annotated lists, which were not included in all reports, although incidental observations of wildlife were undoubtedly made in all years. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). No data were collected in 2003 or 2008.

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

Species	2002	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Greater white-fronted goose	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Emperor goose	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Brant	-	-	X	-	X	-	-	X	-	-	-	-	-	-
Aleutian cackling goose	X	-	-	X	X	X	X	X	X	B	B	B	P	B
Tundra swan	-	-	-	-	X	X	-	-	-	-	-	-	-	-
Gadwall	-	-	-	-	X	-	-	-	-	-	-	-	-	-
American widgeon	-	-	-	-	X	-	-	-	X	X	-	-	-	-
Mallard	-	-	X	-	X	X	-	-	-	X	-	-	-	-
Northern shoveler	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Northern pintail	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Green-winged teal (unspecified ssp.)	X	-	X	X	-	X	-	X	-	X	-	-	-	-
Greater scaup	X	-	X	X	X	X	X	-	-	X	-	-	-	-
Common eider	B	B	B	P	B	B	B	B	B	B	B	B	B	B
Harlequin duck	X	X	X	X	X	X	X	P	X	X	X	X	X	X
White-winged scoter	-	-	-	-	-	-	-	-	X	-	-	-	-	-
American (formerly black) scoter	-	-	-	X	-	-	-	-	X	-	-	-	-	-
Bufflehead	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Red-breasted merganser	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Horned grebe	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Red-necked grebe	-	-	-	-	-	X	X	-	X	-	-	-	-	-
Rufous hummingbird	-	-	X	-	-	-	-	-	X	-	X	X	-	-
Sandhill crane	-	-	X	-	X	X	X	-	X	-	-	X	-	X
Black oystercatcher	B	B	B	B	B	B	B	B	B	B	B	B	B	B
American golden-plover	-	-	-	-	-	X	-	-	X	-	-	X	-	-
Pacific golden-plover	-	-	-	X	-	-	X	-	-	-	-	-	-	-
Semipalmated plover	-	X	X	-	X	X	X	X	X	X	X	-	X	-
Whimbrel	-	X	-	-	-	X	-	X	X	-	X	-	-	-
Bristle-thighed curlew	-	-	-	-	-	X	-	-	-	-	-	-	-	X
Ruddy turnstone	-	-	-	-	-	-	-	-	X	X	-	-	X	X
Black turnstone	-	-	-	-	-	-	-	-	-	-	-	X	-	X
Dunlin	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Aleutian rock sandpiper (*C. p. couesi*)	X	X	X	X	X	X	-	-	X	X	X	X	X	X
Least sandpiper	X	X	-	-	X	X	P	P	P	P	P	P	P	P
Western sandpiper	-	X	-	-	-	X	-	-	X	-	-	-	-	-
Short-billed dowitcher	-	-	-	-	-	-	-	-	X	-	-	-	-	-

Table 94 (continued). Observations and breeding status of birds, selected mammals and fish at Chowiet Island, Alaska. Information comes from annotated lists, which were not included in all reports, although incidental observations of wildlife were undoubtedly made in all years. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). No data were collected in 2003 or 2008.

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

Species	2002	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Wilson's (formerly common) snipe	X	-	-	-	-	X	X	-	-	-	-	-	X	X
Spotted sandpiper	-	-	X	-	X	-	X	-	-	-	X	-	-	-
Solitary sandpiper	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Wandering tattler	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Greater yellowlegs	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Lesser yellowlegs	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Red phalarope		-	-	-	-	-	X	-	-	-	-	-	-	-
Parasitic jaeger	B	B	B	B	B	B	P	B	P	B	B	X/B?	B	B
Common murre	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Thick-billed murre	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Pigeon guillemot	B	B	B	P	B	B	B	B	B	B	B	B	B	B
Marbled murrelet	-	-	-	-	-	X	X	X	X	-	-	-	-	-
Ancient murrelet	B	X	B	-	B	B	P	B	B	B	B	B	B	B
Cassin's auklet	X	X	X	-	-	-	X	X	-	-	X	-	-	-
Parakeet auklet	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Least auklet	X	-	-	-	-	-	-	-	X	X	X	X	-	-
Crested auklet	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Rhinoceros auklet	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Horned puffin	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Tufted puffin	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Black-legged kittiwake	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Sabine's gull	-	-	-	-	-	-	-	X	-	-	-	-	-	-
Franklin's gull	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Mew gull	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Herring gull	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Glaucous-winged gull	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Red-throated loon	-	-	-	-	-	-	X	-	X	-	X	-	X	-
Common loon	-	-	-	-	-	X	X	-	-	-	-	-	-	-
Black-footed albatross	-	X	-	-	-	-	X	-	-	-	-	-	-	-
Northern fulmar	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Short-tailed shearwater	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Sooty shearwater	-	X	-	-	-	-	-	-	-	-	-	-	-	-
Fork-tailed storm-petrel	-	X	-	-	X	X	-	-	-	X	-	-	X	X
Leach's storm-petrel	X	X	X	-	X	P	P	P	P	P	P	P	P	P
Double-crested cormorant	-	-	-	-	-	-	X	-	X	X	-	-	-	-
Red-faced cormorant	B	B	P	B	B	B	B	B	B	B	B	B	B	B
Pelagic cormorant	X	X	B	B	B	B	B	B	B	B	B	B	B	B
Bald eagle	B	B	B	B	B	B	B	B	B	B	B	B	B	B

Table 94 (continued). Observations and breeding status of birds, selected mammals, and fish at Chowiet Island, Alaska. Information comes from annotated lists, which were not included in all reports, although incidental observations of wildlife were undoubtedly made in all years. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). No data were collected in 2003 or 2008.

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

Species	2002	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Northern harrier	-	-	-	-	-	X	-	-	-	-	X	-	-	-
Rough-legged hawk	-	B	B	B	B	B	P	-	-	X	-	X	X	X
Golden eagle	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Short-eared owl	-	X	-	-	-	X	-	-	-	X	-	-	-	-
Belted kingfisher	-	-	X	-	-	X	-	-	-	-	-	-	X	-
Downy woodpecker	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Merlin	-	-	-	-	-	X	X	-	-	X	X	-	-	-
Gyrfalcon	-	X	-	X	-	-	-	X	X	-	X	X	-	X
Peregrine falcon	-	P	B	B	B	B	B	B	B	B	B	B	B	B
Alder flycatcher	-	-	-	-	-	X	-	-	X	X	X	X	-	-
Black-billed magpie	-	-	-	-	-	X	B	X/B?	X	X	X	-	-	-
Common raven	B	B	B	B	X	B	B	B	B	B	B	B	B	B
Horned lark	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Tree swallow	-	-	-	X	-	-	-	X	-	-	-	-	-	-
Violet-green swallow	-	-	-	-	-	X	X	-	-	-	-	-	-	-
Bank swallow	P	B	B	X	X	P	P	X/B?	P	P	P	P	P	P
Cliff swallow	-	-	-	-	-	-	X	-	-	-	-	-	-	-
Barn swallow	-	-	X	-	-	-	X	-	X	X	-	X	-	-
Pacific (formerly winter) wren	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Golden-crowned kinglet	-	-	-	-	-	-	X	-	-	-	-	X	-	X
Ruby-crowned kinglet	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Gray-cheeked thrush	-	-	-	-	-	X	X	-	-	-	-	X	-	-
Hermit thrush	-	-	P	X	-	P	B	B	B	P	B	P	P	P
American robin	-	-	-	-	-	X	-	-	X	-	-	X	-	-
Varied thrush	-	X	-	-	X	X	X	-	X	-	-	-	-	-
Cedar waxwing	-	-	X	-	-	-	-	-	-	-	-	-	-	-
Eastern yellow wagtail	X	X	-	-		-	-	-	-	-	-	-	-	-
American pipit	-	B	B	X	X	B	B	X/B?	B	B	B	P	B	B
Gray-crowned rosy-finch	B	B	B	B	B	B	B	B	B	B	B	B	B	B
White-winged crossbill	-	-	-	-	-	-	-	-	-	X	-	-	-	-
Common redpoll	-	-	-	-	-	X	-	-	X	-	P	X	X	B
Pine siskin	-	-	-	-	-	X	-	-	X	X	X	-	-	-
Lapland longspur	X	X	P	X	X	B	P	P	P	B	P	B	B	B
Snow bunting	X	B	X	-	X	-	X	-	-	X	-	-	-	-
Orange-crowned warbler	-	-	-	-	-	X	X	-	X	X	X	-	-	-
Yellow warbler	X	P	P	B	-	B	B	P	B	B	B	-	X	B
Yellow-rumped warbler	-	-	-	-	-	-	-	-	X	X	-	-	X	-
Townsend's warbler	-	-	-	-	-	-	-	-	-	-	X	-	X	-
Wilson's warbler	X	P	P	P	-	B	B	P	B	B	P	B	B	B
American tree sparrow	-	-	-	-	-	-	-	-	-	-	-	X	X	-

Table 94 (continued). Observations and breeding status of birds, selected mammals and fish at Chowiet Island, Alaska. Information comes from annotated lists, which were not included in all reports, although incidental observations of wildlife were undoubtedly made in all years. Dashes indicate species not recorded that year but may not necessarily indicate absence from the island during the time period (e.g., species not observed although present, or species not recorded although observed). No data were collected in 2003 or 2008.

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

Species	2002	2004	2005	2006	2007	2009	2010	2011	2012	2013	2014	2015	2016	2017
Savannah sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Fox sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Song sparrow	B	B	B	B	B	B	B	B	B	B	B	B	B	B
White-crowned sparrow	-	-	-	-	-	-	X	-	-	X	-	X	X	-
Golden-crowned sparrow		B	B	P	B	B	B	B	B	B	B	B	B	B
Dark-eyed junco	-	-	-	-	-		X	X	-	X	-	-	X	-
Red-winged blackbird	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Rusty blackbird	-	-	-	-	-	X	-	-	-	-	-	-	-	-
Arctic ground squirrel	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Sea otter	B	B	B	-	B	B	B	B	B	P	B	B	B	B
Northern fur seal	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Steller sea lion	B	B	B	-	B	B	B	B	B	B	B	B	B	B
Northern elephant seal	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Harbor seal	X	X	B	X	B	B	B	B	B	B	B	B	B	B
Fin whale	X	X	X	-	X	X	X	X	X	X	X	X	X	X
Humpback whale	X	-	-	X	-	-	X	-	X	X	X	-	X	X
Orca	-	X	-	-	-	X	X	-	-	-	X	X	X	-
Dolly varden	-	-	-	-	-	-	-	P	P	B	B	B	-	-
Observation dates	6 May-12 Sep	8 May-16 Aug	13 May-2 Sep	14 May-5 Sep	20 May-3 Sep	17 May-5 Sep	19 May-7 Sep	20 May-7 Sep	19 May-4 Sep	20 May-31 Aug	20 May-1 Sep	21 May-2 Sep	21 May-3 Sep	15-May-3 Sep

Table 95. First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2004	2005	2009	2010	2011	2012
Apiaceae	***Angelica lucida***	**angelica**	21 Jun	13 Jun	8 Jul	1 Jul	<4 Jul	24 Jun
	Conioselinum chinense	hemlock parsley	late Jul	-	26 Jul	-	X	X
	Heracleum lanatum	**putchki, cow parsnip**	20 Jun	8 Jun	2 Jul	28 Jun	24 Jun	25 Jun
	Ligusticum lanatum	**petruski, beach lovage**	5 Jul	26 Jun	29 Jun	8Jul	X	6 Jul
Asteraceae	***Achillia borealis***	**yarrow**	5 Jul	27 Jun	26 Jun	22 Jun	10 Jul	14 Jun
	Antennaria monocephala	**pussytoes**	-	9 Jun	9 Jun	29 Jun	15 Jun	7 Jun
	Artemisia arctica	mountain sage	-	1 Jul	X	-	20 Jul	X
	Artemisia tilesii	**wormwood**	14 Jul	1 Jul	21 Jul	10 Aug	14 Jul	21 Jul
	Chrysanthemum arcticum	**Arctic daisy**	-	16 Jun	21 Jun	2 Jul	29 Jun	25 Jun
	Petasites frigidus	**coltsfoot**	20 Jun	13 May	7 Jun	X	29 May	22 Jun
	Prenanthes alata	rattlesnake root	-	-	5 Aug	17 Aug	X	X
	Senecio pseudo-arnica	**seashore sunflower**	9 Jul	1 Jul	12 Jul	14 Jul	10 Jul	6 Jul
	Senecio resedifolius	ragwort	-	26 Jun	2 Jul	3 Jul	14 Jul	25 Jun
	Solidago mutiradiata	**northern goldenrod**	5 Jul	26 Jun	12 Jul	7 Jul	3 Jul	29 Jun
	Taraxacum sp.	dandelion	-	-	14 Jun	-	-	X
Brassicaceae	*Barbarea orthoceras*	winter cress	8 Jun	22 May	10 Jun	-	X	26 Jun
	Cardamine umbellata	bitter cress	-	14 May	8 Jun	-	15 Jun	30 May
	Draba borealis	northern rock cress	-	30 May	3 Jun	X	19 May	31 May
	Draba hyperborea	cliff hanger	-	-	7 Jun	X	1 Jun	2 Jun
Campanulaceae	***Campanula lasiocarpa***	**bluebell, harebell**	18 Jul	1 Jul	12 Jul	22 Jul	29 Jul	11 Jul
Caryophyllaceae	*Cerastium beeringianum*	mouse-eared chickweed	-	-	X	-	X	14 Jun
	Honckenya peploides	beach greens	23 Jul	27 Jun	14 Jun	8 Jul	2 Jun	25 Jun
	Minuartia macrocarpa	sandwort	-	16 Jun	-	-	-	29 Jun
	Moehringia lateriflora	grove sandwort	24 Jun	6 Jun	17 Jul	-	-	11 Jun
	Sagina saginoides	pearlwort	-	-	late Jun	-	-	X
	Silene acaulis	moss campion	5 Jun	10 Jun	1 Jul	19 Jul	21 Jun	<29 Jun
	Stellaria crispa	chickweed	-	-	<26 Jul	-	-	<29 Jun
Cornaceae	***Cornus suecica***	**dwarf dogwood**	<5 Jun	22 May	3 Jun	23 May	29 May	3 Jun
Crassulaceae	***Sedum rosea***	**roseroot**	<5 Jun	22 May	29 May	27 May	<26 May	30 May
Cruciferae	*Cochlearia officinalis*	scurvy grass	-	-	-	-	-	-
Ericaceae	*Arctostaphylos alpina*	bearberry	-	30 May	X	29 May	8 Jun	27 May
	Empetrum nigrum	crowberry	X	X	X	X	X	X
	Ledum palustre	**Labrador tea**	20 Jun	2 Jun	20 Jun	20 Jun	X	20 Jun
	Loiseleuria procumbens	alpine azalea	-	18 May	23 May	23 May	27 May	26 May
	Rhododendron camtschaticum	**Kamchatka rhododendron**	1 Jul	16 Jun	1 Jul	3 Jul	10 Jul	29 Jun
	Vaccinium uliginosum	alpine blueberry	-	16 Jun	7 Jul	29 Jul	-	25 Jun
	Vaccinium vitis-idaea	cranberry	-	24-May	8 Jun	X	-	7 Jun
Fabaceae	*Lupinus nootkatensis*	lupine	4 Jul	7 Jun	20 Jun	15 Jun	-	29 Jun

Table 95 (continued). First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2013	2014	2015	2016	2017
Apiaceae	***Angelica lucida***	**angelica**	24 Jun	6 Jun	13 Jun	23 May	13 Jun
	Conioselinum chinense	hemlock parsley	21 Jul	2 Jul	<14 Jul	-	-
	Heracleum lanatum	**putchki, cow parsnip**	28 Jun	6 Jun	8 Jun	22 May	21 Jun
	Ligusticum lanatum	**petruski, beach lovage**	24 Jun	7 Jun	19 Jun	6 Jun	19 Jun
Asteraceae	***Achillia borealis***	**yarrow**	18 Jun	7 Jun	22 Jun	19 Jun	19 Jun
	Antennaria monocephala	**pussytoes**	8 Jun	<22 May	12 Jun	23 May	27 May
	Artemisia arctica	mountain sage	24 Jul	18 Jun	24 Jul	11 Jun	10 Jul
	Artemisia tilesii	**wormwood**	19 Jul	22 Jun	15 Jul	X	1 Jul
	Chrysanthemum arcticum	**Arctic daisy**	2 Jul	2 Jun	27 Jun	6 Jun	10 Jun
	Petasites frigidus	**coltsfoot**	30 May	25 May	-	-	-
	Prenanthes alata	rattlesnake root	15 Aug	-	-	-	-
	Senecio pseudo-arnica	**seashore sunflower**	28 Jun	22 Jun	7 Jul	X	3 Jul
	Senecio resedifolius	ragwort	28 Jun	30 May	16 Jun	25 Jun	13 Jun
	Solidago mutiradiata	**northern goldenrod**	10 Jul	27 May	1 Jul	12 Jun	13 Jun
	Taraxacum sp.	dandelion	< 2 Jul	<2 Jun	-	-	-
Brassicaceae	*Barbarea orthoceras*	winter cress	15 Jun	<23 May	16 Jun	26 May	29 May
	Cardamine umbellata	bitter cress	30 May	21 May	30 May	29 May	29 May
	Draba borealis	northern rock cress	31 May	22 May	-	23 May	29 May
	Draba hyperborea	cliff hanger	-	-	-	12 Jun	2 Jul
Campanulaceae	***Campanula lasiocarpa***	**bluebell, harebell**	19 Jul	28 Jun	24 Jul	30 Jun	16 Jul
Caryophyllaceae	*Cerastium Beeringianum*	mouse-eared chickweed	-	-	-	-	3 Jun
	Honckenya peploides	beach greens	28 Jun	8 Jul	16 Jun	12 Jun	3 Jun
	Minuartia macrocarpa	sandwort	2 Jul	8 Jun	-	6 Jun	-
	Moehringia lateriflora	grove sandwort	12 Jun	22 Jun	-	-	-
	Sagina saginoides	pearlwort	18 Jun	13 Jun	4 Jun	-	-
	Silene acaulis	moss campion	8 Jun	<23 May	6 Jun	26 May	5 Jun
	Stellaria crispa	chickweed	12 Jun	13 Jun	<19 Jul	X	3 Jun
Cornaceae	***Cornus suecica***	**dwarf dogwood**	31 May	<22 May	30 May	23 May	25 May
Crassulaceae	***Sedum rosea***	**roseroot**	22 May	<22 May	22 May	<21 May	<15 May
Cruciferae	*Cochlearia officinalis*	scurvy grass	29 May	30 May	<16 Jun	24 May	25 May
Ericaceae	*Arctostaphylos alpina*	bearberry	X	X	25 May	-	29 May
	Empetrum nigrum	crowberry	X	X	25 May	<21 May	27 May
	Ledum palustre	**Labrador tea**	14 Jun	22 May	1 Jun	26 May	25 May
	Loiseleuria procumbens	alpine azalea	24 May	<22 May	<23May	26 May	19 May
	Rhododendron camtschaticum	**Kamchatka rhododendron**	29 Jun	<18 Jun	25 Jun	11 Jun	3 Jun
	Vaccinium uliginosum	alpine blueberry	2 Jul	30 May	1 Jun	X	1 Jul
	Vaccinium vitis-idaea	cranberry	29 May	<22 May	4 Jun	26 May	X
Fabaceae	*Lupinus nootkatensis*	lupine	-	1 Jun	16 Jun	27 May	27 May

Table 95 (continued). First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2004	2005	2009	2010	2011	2012
Gentianaceae	*Gentiana algida*	Arctic gentian	mid Aug	early Aug	-	25 Aug	-	-
	Gentiana amarella	northern gentian	18 Jul	late Jun	30 Jul	9 Aug	29 Jul	6 Aug
Geraniaceae	***Geranium erianthum***	**wild geranium**	9 Jun	28 May	3 Jun	11 Jun	1 Jun	7 Jun
Iridaceae	*Iris setosa*	wild iris	5 Jul	20 Jun	18 Jul	14 Jul	17 Jul	<6 Jul
Liliaceae	***Frittalaria camschatsensis***	**chocolate lily**	12 Jun	3 Jun	15 Jun	18 Jun	10 Jun	17 Jun
Onagraceae	***Epilobium angustifolium***	**fireweed**	25 Jul	10 Jul	26 Jul	2 Aug	21 Jul	X
	Epilobium behringianum	willow herb	5 Jul	6 Jun	early Jul	X	14 Jul	X
	Epilobium glandulosum	willow herb	6 Jul	-	early Jul	10 Jul	X	21 Jun
	*Epilobium sertulatum**	willow herb	-	25 Jun	-	-	-	-
	Epilobium palustre	willow herb	-	-	-	-	-	-
Ophiogloglossace	*Botrychium lunaria*	moonwort	-	-	-	-	-	-
Orchidaceae	*Coeloglossum viride*	frog orchid	-	16 Jun	16 Jul	-	-	13 Jul
	*Cypripedium guttatum**	lady's slipper	-	-	26 Jun	27 Jun	10 Jul	-
	*Dactylorhiza aristata**	purple orchid	12 Jun	6 Jun	10 Jun	21 Jun	13 Jun	<11 Jul
	Malaxis monophylla	white adder's tongue	-	-	24 Jul	-	-	<24 Jul
	Platanthera dilatata	**bog orchid**	20 Jun	11 Jun	20 Jun	17 Jun	26 Jun	24 Jun
Orobanchaceae	*Orobanche fasciculata*	broomrape	early Aug	mid Jul	X	-	-	-
Plantaginaceae	*Plantago maritima*	seashore plantain	-	26 Jun	18 Jul	X	X	20 Jun
Polemoniaceae	*Polemonium acutiflorum*	Jacob's ladder	1 Aug	-	X	29 Jul	10 Jul	-
Polygonaceae	*Polygonum viviparum*	buckwheat	10 Jul	8 Jul	15 Jul	-	1 Aug	2 Jul
	Rumex arctica/transitorius	dock	-	19 Jun	~1 Jul	7 Jul	X	X
	Rumex fenestratus	**wild rhubarb, dock**	15 Jun	6 Jun	1 Jul	1 Jul	13 Jun	20 Jun
Portulacaceae	***Claytonia sibirica***	**spring beauty**	12 Jun	14 May	22 May	30 May	<27 May	30 May
	Montia fontana	water blinks	-	-	-	-	-	-
Primulaceae	*Androsace chamaejasme*	rockjasmine	-	18 May	29 May	24 May	27 May	<26 May
	Dodecatheon pulchellum	**shooting star**	8 Jun	22 May	26 May	29 May	29 May	<24 May
	Primula cuneifolia	wedge-leaved primrose	-	-	9 Jun	8 Jun	15 Jun	<5 Jun
	Trientalis europaea	**Arctic starflower**	15 Jun	6 Jun	8 Jun	10 Jun	29 May	7 Jun
Ranunculaceae	***Acontium delphinium***	**monkshood**	23 Jul	12 Jul	23 Jul	25 Jul	21 Jul	18 Jul
	Anemone narcissiflora	anemone	-	16 Jun	-	<19 Jun	29 Jun	<29 Jun
	Caltha palustris	**marsh marigold**	4 Jun	19 May	26 May	29 May	28 May	31 May
	Ranunculus occidentalis	**buttercup**	<5 Jun	13 May	<17 May	<19 May	<23 May	<20 May
Rosaceae	*Geum macrophyllum*	large-leaved avens	20 Jun	6 Jun	late Jun	22 Jun	X	22 Jun
	Potentilla egedii	**Pacific silverweed**	21 Jun	6 Jun	26 Jun	22 Jun	9 Jul	25 Jun
	Potentilla palustrus	marsh five-fingers	-	9 Jul	18 Jul	22Jun	-	22 Jul
	Potentilla villosa	**cinquefoil**	-	22 May	26 May	4 Jun	29 May	<24 May
	Rubus arcticus	**nagoon berry**	9 Jun	22 May	26 May	23 May	5 Jun	<24 May
	Rubus chamaemorus	cloudberry	-	2 Jun	7 Jun	9 Jun	6 Jun	3 Jun
	Rubus spectabilis	salmonberry	-	-	-	-	-	-

Table 95 (continued). First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2013	2014	2015	2016	2017
Gentianaceae	*Gentiana algida*	Arctic gentian	17 Aug	<20 Aug	11 Aug	-	-
	Gentiana amarella	northern gentian	3 Aug	17 Jul	26 Jul	10 Jul	25 Jul
Geraniaceae	***Geranium erianthum***	**wild geranium**	7 Jun	<22 May	31 May	23 May	25 May
Iridaceae	*Iris setosa*	wild iris	< 28 Jul	17 Jun	26 Jun	16 Jun	19 Jun
Liliaceae	***Frittalaria camschatsensis***	**chocolate lily**	12 Jun	27 May	10 Jun	30 May	7 Jun
Onagraceae	***Epilobium angustifolium***	**fireweed**	28 Jul	3 Jul	28 Jun	26 Jun	28 Jun
	Epilobium behringianum	willow herb	24 Jun	22 Jun	17 Jun	18 Jun	18 Jun
	Epilobium glandulosum	willow herb	2 Jul	13 Jun	<17 Jul	X	X
	*Epilobium sertulatum**	willow herb	-	-	-	-	-
	Epilobium palustre	willow herb	<3 Aug	3 Jul	<14 Jul	X	X
Ophiogloglossace	*Botrychium lunaria*	moonwort	-	-	20 Jul	-	-
Orchidaceae	*Coeloglossum viride*	frog orchid	-	26 Jun	-	-	30 Jun
	*Cypripedium guttatum**	lady's slipper	24 Jun	-	26 Jun	16 Jun	23 Jun
	*Dactylorhiza aristata**	purple orchid	24 Jun	-	-	-	-
	Malaxis monophylla	white adder's tongue	-	-	-	-	-
	Platanthera dilatata	**bog orchid**	12 Jun	2 Jun	12 Jun	9 Jun	19 Jun
Orobanchaceae	*Orobanche fasciculata*	broomrape	28 Jul	-	-	-	23 Jul
Plantaginaceae	*Plantago maritima*	seashore plantain	28 Jun	1 Jun	22 Jun	10 Jun	12 Jun
Polemoniaceae	*Polemonium acutiflorum*	Jacob's ladder	28 Jul	28 Jun	1 Aug	14 Jul	23 Jul
Polygonaceae	*Polygonum viviparum*	buckwheat	14 Jul	22 Jun	<14 Jul	X	16 Jul
	Rumex arctica/transitorius	dock	18 Jun	27 May	<26 Jun	<30 Jun	X
	Rumex fenestratus	**wild rhubarb, dock**	18 Jun	4 Jun	13 Jun	3 Jun	<15 May
Portulacaceae	***Claytonia sibirica***	**spring beauty**	28 May	<20 May	<22 May	<21 May	22 May
	Montia fontana	water blinks	14 Jun	29 May	-	24 May	29 May
Primulaceae	*Androsace chamaejasme*	rockjasmine	22 May	<22 May	<23 May	23 May	25 May
	Dodecatheon pulchellum	**shooting star**	24 May	<22 May	<23 May	27 May	17 May
	Primula cuneifolia	wedge-leaved primrose	11 Jun	25 May	7 Jun	29 May	28 May
	Trientalis europaea	**Arctic starflower**	8 Jun	<22 May	11 Jun	27 May	3 Jun
Ranunculaceae	***Acontium delphinium***	**monkshood**	15 Jul	8 Jul	14 Jul	12 Jul	23 Jul
	Anemone narcissiflora	anemone	14 Jun	<23 May	13 Jun	-	-
	Caltha palustris	**marsh marigold**	24 May	<20 May	22 May	<21 May	21 May
	Ranunculus occidentalis	**buttercup**	<20 May	<20 May	<21 May	<21 May	<15 May
Rosaceae	*Geum macrophyllum*	large-leaved avens	15 Jun	24 May	<24 Jun	7 Jun	10 Jun
	Potentilla egedii	**Pacific silverweed**	24 Jun	13 Jun	26 Jun	10 Jun	23 Jun
	Potentilla palustrus	marsh five-fingers	< 28 Jul	22 Jun	X	27 May	18 Jul
	Potentilla villosa	**cinquefoil**	24 May	<22 May	30 May	X	20 May
	Rubus arcticus	**nagoon berry**	31 May	<22 May	30 May	24 May	17 May
	Rubus chamaemorus	cloudberry	31 May	24 May	4 Jun	26 May	3 Jun
	Rubus spectabilis	salmonberry	-	-	<4 Aug	11 Jun	X

Table 95 (continued). First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2004	2005	2009	2010	2011	2012
Rosaceae	***Sanguisorba stipulata***	**Sitka burnet**	6 Jun	1 Jul	15 Jul	22 Jul	14 Jul	13 Jul
Rubiaceae	*Galium trifidum*	bedstraw	17 Jul	16 Jul	X	-	X	29 Jun
	Galium triflorum	bedstraw	-	-	16 Jul	-	X	30 Jun
Salicaceae	*Salix arctica*	dwarf willow	-	18 May	-	-	X	-
	Salix pulchra	diamondleaf willow	-	26 May	-	-	X	-
	Salix rotundifolia	dwarf willow	-	30 May	-	-	X	-
	*Salix stolonifera**	dwarf willow	-	30 May	-	-	X	-
Saxifragaceae	*Parnassia palustris*	grass-of-Parnassus	18 Jul	1 Jul	12 Jul	19 Jul	17 Jul	18 Jul
	Saxifraga bracteata	bracted saxifrage	mid Jul	25 May	3 Jun	4 Jun	3 Jun	31 May
Scrophulariaceae	***Castilleja unalaschcensis***	**coastal paintbrush**	12 Jun	6 Jun	12 Jun	10 Jun	19 Jun	20 Jun
	Pedicularis verticillata	**lousewort**	20 Jun	22 May	14 Jun	17 Jun	2 Jun	20 Jun
	Veronica america	brooklime	11 Jul	25 Jun	24 Jun	7 Jul	X	16 Jul
	Mimulus guttatus	**monkeyflower**						
Urtticaceae	*Urtica lyallii*	nettle	5 Aug	25 Jun	X	X	X	X
Violaceae	***Viola langsdorffi***	**Alaska violet**	late May	14 May	24 May	23 May	<22 May	<24 May

Table 95 (continued). First flowering dates of plants identified on Chowiet island, Alaska. Data represent the day a fully-opened flower was first observed on the island each year. Dates may be poor indicators of actual phenology because observations of initial flowering events for uncommon or inconspicuous plants may be missed or depend on timing of field crew activities. Species in bold are considered conspicuous, easy to identify, and fairly widespread and flowering dates of these species are probably recorded within a few days. Species found, but for which no flowering data are available, are denoted by an "X". Families and species are presented alphabetically. Identifications are made by field personnel on-island and have not been confirmed by other authorities. Asterisks denote species not found by (Hatch 1978), who conducted vegetative surveys on Chowiet and collected plants that were later identified by staff at the University of Alaska Herbarium, Fairbanks, Alaska. For further information on plants in specific years, see table comments in previous reports. No data collected before 2004 or in 2006-2008.

Family	Species	Common name	2013	2014	2015	2016	2017
Rosaceae	***Sanguisorba stipulata***	**Sitka burnet**	6 Jul	28 Jun	<8 Jul	30 Jun	1 Jul
Rubiaceae	*Galium trifidum*	bedstraw	28 Jul	X	-	-	-
	Galium triflorum	bedstraw	-	20 Jul	-	-	-
Salicaceae	*Salix arctica*	dwarf willow	23 May	X	X	X	X
	Salix pulchra	diamondleaf willow	< 8 Jun	X	X	X	X
	Salix rotundifolia	dwarf willow	X	X	X	X	X
	*Salix stolonifera**	dwarf willow	X	X	X	X	X
Saxifragaceae	*Parnassia palustris*	grass-of-Parnassus	19 Jul	8 Jul	16 Jul	28 Jun	8 Jul
	Saxifraga bracteata	bracted saxifrage	3 Jun	<24 May	30 May	31 May	30 May
Scrophulariaceae	***Castilleja unalaschcensis***	**coastal paintbrush**	18 Jun	27 May	4 Jun	3 Jun	10 Jun
	Pedicularis verticillata	**lousewort**	9 Jun	27 May	30 May	27 May	10 Jun
	Veronica america	brooklime	9 Jul	22 Jun	18 Jun	30 Jun	19 Jun
	Mimulus guttatus	**monkeyflower**	-	20 Jul	-	-	-
Urtticaceae	*Urtica lyallii*	nettle	X	<16 Jul	20 Jul	X	10 Jun
Violaceae	***Viola langsdorffi***	**Alaska violet**	24 May	<20 May	22 May	<21 May	<15 May

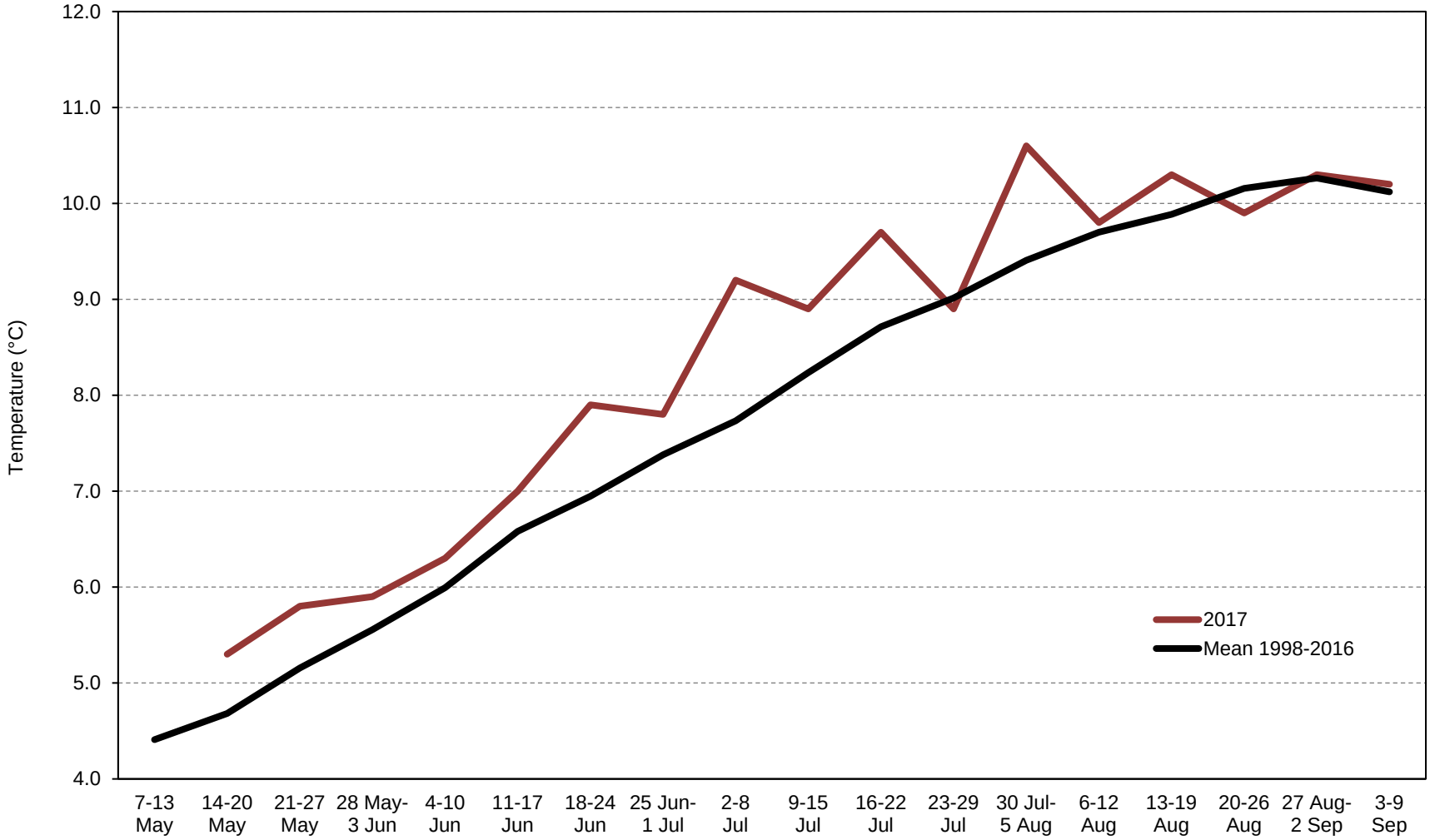

Figure 60. Mean weekly sea surface temperatures (°C) in Chowiet Bay, Chowiet Island, Alaska. No data were collected in 1999-2001 or 2003.

Table 96. Mean weekly sea surface temperatures (°C)[a] in Chowiet Bay, Chowiet Island, Alaska. No data were collected in 1999-2001 or 2003.

Week	1998	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1 - 7 Jan	-	-	-	-	-	-	4.2	-	-	-	-	-	-	-	-	-
8 - 14 Jan	-	-	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-
15 - 21 Jan	-	-	-	-	-	-	3.4	-	-	-	-	-	-	-	-	-
22 - 28 Jan	-	-	-	-	-	-	3.4	-	-	-	-	-	-	-	-	-
29 Jan - 4 Feb	-	-	-	-	-	-	3.2	-	-	-	-	-	-	-	-	-
5 - 11 Feb	-	-	-	-	-	-	3.0	-	-	-	-	-	-	-	-	-
12 - 18 Feb	-	-	-	-	-	-	2.9	-	-	-	-	-	-	-	-	-
19 - 25 Feb	-	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-
26 Feb - 4 Mar	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-
5 - 11 Mar	-	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-
12 - 18 Mar	-	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-
19 - 25 Mar	-	-	-	-	-	-	2.2	-	-	-	-	-	-	-	-	-
26 Mar - 1 Apr	-	-	-	-	-	-	2.6	-	-	-	-	-	-	-	-	-
2 - 8 Apr	-	-	-	-	-	-	2.7	-	-	-	-	-	-	-	-	-
9 - 15 Apr	-	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-
16 - 22 Apr	-	-	-	-	-	-	2.9	-	-	-	-	-	-	-	-	-
23 - 29 Apr	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-
30 Apr - 6 May	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-
7 - 13 May	-	4.4	4.7	5.1	-	-	3.4	-	-	-	-	-	-	-	-	-
14 - 20 May	6.0	4.8	5.0	5.4	4.6	3.9	3.8	4.2	4.8	4.7	4.0	4.0	5.7	-	-	5.3
21 - 27 May	6.0	5.1	5.3	5.8	5.0	4.0	4.0	4.2	5.1	4.7	4.4	4.2	6.0	6.2	7.3	5.8
28 May - 3 Jun	6.3	5.5	5.7	6.0	5.4	4.7	4.5	4.2	5.5	5.5	5.0	4.4	6.1	6.8	7.7	5.9
4 - 10 Jun	6.6	6.0	6.2	6.9	6.1	5.1	4.8	4.5	5.9	5.6	5.4	4.8	6.7	7.5	7.8	6.3
11 - 17 Jun	6.9	6.9	6.7	8.3	6.2	5.6	5.6	4.8	6.3	5.9	6.5	5.4	6.9	7.7	9.0	7.0
18 - 24 Jun	7.3	7.2	7.0	8.4	6.4	6.0	6.1	5.6	6.8	6.3	7.0	5.8	7.2	8.0	9.1	7.9
25 Jun - 1 Jul	7.3	7.8	7.5	8.0	7.5	6.7	6.4	6.1	7.4	7.0	7.2	5.9	7.6	8.8	9.5	7.8
2 - 8 Jul	8.4	9.3	7.8	8.1	8.3	6.4	6.2	6.9	7.5	6.6	7.0	6.3	8.7	8.6	9.9	9.2
9 - 15 Jul	8.1	8.6	8.6	8.4	8.1	7.4	7.3	7.8	7.7	7.2	8.3	7.0	8.6	9.4	11.0	8.9
16 - 22 Jul	8.8	9.6	8.6	9.2	8.2	7.4	-	8.5	8.4	7.2	8.2	7.9	8.8	9.8	11.4	9.7
23 - 29 Jul	8.9	9.7	8.7	9.0	8.9	8.4	-	6.9	8.6	8.7	8.3	7.5	9.8	11.6	11.2	8.9
30 Jul - 5 Aug	9.7	10.7	8.5	10.1	10.1	8.5	-	8.3	9.2	7.9	8.4	8.5	10.2	10.2	11.4	10.6
6 - 12 Aug	9.9	10.4	9.4	10.3	10.2	9.1	-	8.5	8.9	8.7	9.0	8.7	10.7	11.0	11.0	9.8
13 - 19 Aug	10.2	10.3	9.9	11.5	10.1	9.1	-	9.3	8.6	8.6	9.4	9.0	9.7	11.1	11.6	10.3
20 - 26 Aug	10.2	10.2	9.9	11.2	10.3	10.6	-	8.9	9.5	10.0	9.1	8.7	11.3	11.5	10.8	9.9
27 Aug - 2 Sep	10.3	10.5	10.1	11.9	10.5	9.8	-	9.5	10.1	8.3	9.4	10.0	10.7	10.8	11.8	10.3
3 - 9 Sep	9.6	11.0	10.8	-	10.9	10.3	-	9.2	10.3	8.7	9.6	-	-	-	10.8	10.2
10 - 16 Sep	-	9.1	-	-	-	10.1	-	-	-	-	-	-	-	-	-	-
17 - 23 Sep	-	-	-	-	-	10.4	-	-	-	-	-	-	-	-	-	-

Table 96 (continued). Mean weekly sea surface temperatures (°C)[a] in Chowiet Bay, Chowiet Island, Alaska. No data were collected in 1999-2001 or 2003.

Week	1998	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
24 - 30 Sep	-	-	-	-	-	9.5	-	-	-	-	-	-	-	-	-	-
1 - 7 Oct	-	-	-	-	-	9.2	-	-	-	-	-	-	-	-	-	-
8 - 14 Oct	-	-	-	-	-	8.7	-	-	-	-	-	-	-	-	-	-
15 - 21 Oct	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-	-	-
22 -2 8 Oct	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-	-
29 Oct - 4 Nov	-	-	-	-	-	7.5	-	-	-	-	-	-	-	-	-	-
5 - 11 Nov	-	-	-	-	-	7.2	-	-	-	-	-	-	-	-	-	-
12 -1 8 Nov	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-	-
19 - 25 Nov	-	-	-	-	-	6.5	-	-	-	-	-	-	-	-	-	-
26 Nov - 2 Dec	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	-
3 - 9 Dec	-	-	-	-	-	6.2	-	-	-	-	-	-	-	-	-	-
10 - 16 Dec	-	-	-	-	-	5.9	-	-	-	-	-	-	-	-	-	-
17 - 23 Dec	-	-	-	-	-	5.4	-	-	-	-	-	-	-	-	-	-
24 - 30 Dec	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	-

[a]Data loggers are anchored in 6-10 meters of water.

Table 97. Weather observations at Chowiet Island, Alaska in 2017.

Dates	Daily High Temperature ºC		Daily Low Temperature ºC		Total Precipitation (cm)
	Mean	Max.	Mean	Min.	
22-31 May	-	-	4.9	4.0	1.5
June	-	-	7.4	4.3	3.8
July	-	-	10.2	6.9	3.3
August	-	-	10.4	6.3	7.2
1-3 September	-	-	6.7	6.7	1.3
All (22 May - 3 Sep)	-	-	7.9	4.0	17.1

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

Species	Recipient	Diet type	Years	In 2017 annual report
Black oystercatcher	Adult	Stomach	1995	N
Common murre	Adult	Stomach	1995, 1998	N
Common murre	Chick	Bill-load	1998, 2002, 2004-2006	Y
Thick-billed murre	Chick	Bill-load	1998, 2002, 2004	Y
Pigeon guillemot	Adult	Stomach	1995	N
Parakeet auklet	Adult	Stomach	1995	N
Parakeet auklet	Chick	Regurgitation	2015-2017	Y
Rhinoceros auklet	Adult	Stomach	1998	N
Rhinoceros auklet	Chick	Bill-load	1979, 1993, 1995, 1998, 2002, 2004-2005, 2007, 2009-2016, (2017)	Y
Horned puffin	Adult	Stomach	1995	N
Horned puffin	Chick	Bill-load	2014-2016	Y
Tufted puffin	Adult	Stomach	1995	N
Tufted puffin	Chick	Bill-load	2014-2015	Y
Black-legged kittiwake	Adult	Stomach	1995, 1998	N
Glaucous-winged gull	Adult	Stomach	1995	Y
Glaucous-winged gull	Adult	Pellet	2004-2007, 2009-2017	Y
Glaucous-winged gull	Chick	Regurgitation	2002, 2004	N
Northern fulmar	Adult	Stomach	1995	N
Northern fulmar	Chick	Regurgitation	2002	N
Leach’s storm-petrel	Chick	Regurgitation	2014	N

Appendix B. Diet datasets in the AMNWR diet database from other sites in the Semidis Islands, Alaska.

Species	Recipient	Diet type	Years	In 2017 annual report
Kateekuk				
Common murre	Adult	Stomach	1995	N
Black-legged kittiwake	Chick	Stomach	1998	N
Suklik				
Black oystercatcher	Adult	Stomach	1994	N
Common murre	Adult	Stomach	1993-1994	N
Pigeon guillemot	Adult	Stomach	1994	N
Parakeet auklet	Adult	Stomach	1994	N
Horned puffin	Adult	Stomach	1993-1994	N
Horned puffin	Chick	Bill-load	1979, 1985-1987, 1991-1995, 2014, 2016	Y
Tufted puffin	Adult	Stomach	1993-1994	N
Tufted puffin	Chick	Bill-load	1979, 1985-1987, 1991-1995, 2014-2016	Y
Black-legged kittiwake	Adult	Stomach	1993-1994	N
Northern fulmar	Adult	Stomach	1994	N
Red-faced cormorant	Adult	Stomach	1994	N
Pelagic cormorant	Adult	Stomach	1994	N
Semidis (unspecified)				
Harlequin duck	Adult	Stomach	1992	N
Black oystercatcher	Adult	Stomach	1992	N
Common murre	Adult	Stomach	1992, 1995	N
Thick-billed murre	Adult	Stomach	1990	N
Pigeon guillemot	Adult	Stomach	1990, 1992	N
Cassin's auklet	Adult	Stomach	1992	N
Parakeet auklet	Adult	Stomach	1990, 1992	N
Horned puffin	Adult	Stomach	1992	N
Tufted puffin	Adult	Stomach	1990, 1992	N
Black-legged kittiwake	Adult	Stomach	1990, 1992	N
Glaucous-winged gull	Adult	Stomach	1990, 1992	N
Northern fulmar	Adult	Stomach	1990, 1992	N
Short-tailed shearwater	Adult	Stomach	1990	N
Leach's storm-petrel	Adult	Stomach	1990	N
Red-faced cormorant	Adult	Stomach	1992	N