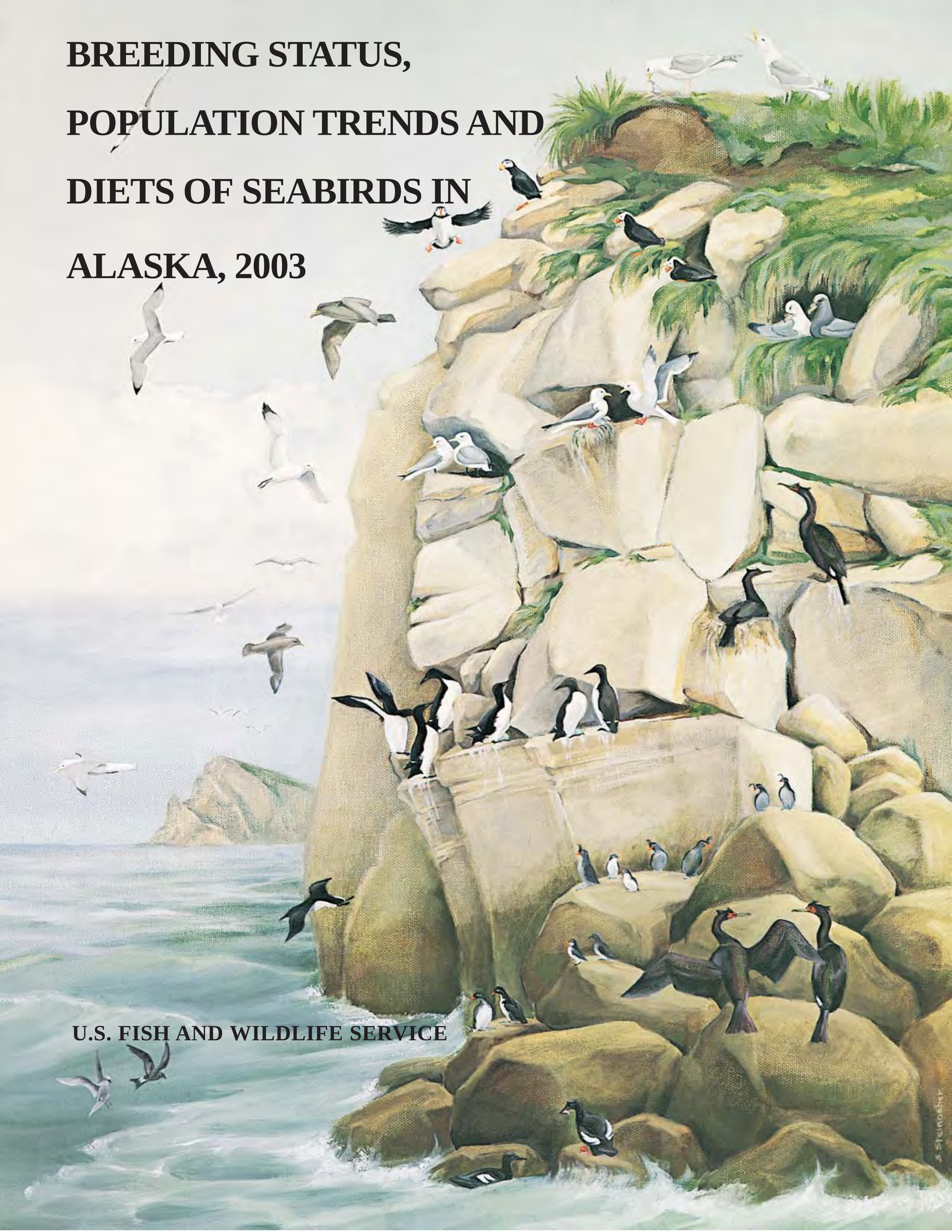
BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2003



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BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2003

Compiled By:

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EXECUTIVE SUMMARY

Data are being collected annually for selected species of marine birds at breeding colonies on the far-flung Alaska Maritime National Wildlife Refuge (NWR) and at other areas in Alaska to monitor the condition of the marine ecosystem and to evaluate the conservation status of species under the trust of the U. S. Fish and Wildlife Service. The strategy for colony monitoring includes estimating timing of nesting events, rates of reproductive success (e.g., chicks fledged per nest), population trends and diet composition of representative species of various foraging guilds (e.g., offshore diving fish-feeders, offshore surface-feeding fish-feeders, diving plankton-feeders) at geographically dispersed breeding sites. This information enables managers to better understand ecosystem processes and respond appropriately to resource issues. It also provides a basis for researchers to test hypotheses about ecosystem change. The value of the marine bird monitoring program is enhanced by having sufficiently long time-series to describe patterns for these long-lived species.

In summer 2003 data were gathered on storm-petrels, cormorants, glaucous-winged gulls, kittiwakes, murres, pigeon guillemots, auklets, and/or puffins at eight annual monitoring sites on the Alaska Maritime NWR, one annual monitoring site on the Togiak NWR and one site on the Becharof NWR. In addition, data were gathered at seven other locations which are visited intermittently or are currently part of a research or monitoring program off refuges.

In 2003, we recorded relatively few cases of later than normal hatching chronology. Most species were within normal bounds or were earlier than average. Timing of nesting of diving plankton feeders (auklets) was normal in all but two cases, the exceptions being the earlier than average hatching of crested auklets at St. Lawrence Island and later than normal hatching for this species at Buldir Island. Fish feeders (cormorants, gulls, kittiwakes, murres, puffins) were earlier than normal in 13 of 29 cases, late in five cases and about normal in 11 cases.

Plankton feeders (storm-petrels and auklets) had average or above average rates of reproductive success in all but two cases. Least and crested auklets exhibited below average success at Buldir Island in 2003. For surface fish feeders, glaucous-winged gulls had above average productivity at Buldir Island and below average rates of success at Puale Bay and St. Lazaria Island. At Chukchi and Bering Sea locations kittiwakes had above average success in six out of nine instances. In the Gulf of Alaska, black-legged kittiwake success was above average in two of three cases. Monitored species of diving fish feeders (cormorants, murres and puffins) had average or above average rates of productivity in the majority of instances in Alaska in 2003. Below average success was recorded in 12 of 31 cases (species x sites), spread throughout the species mix and geographic regions. Cormorant productivity was below average in 9 of 12 cases.

Storm-petrel populations were increasing at three colonies and stable at the remaining sites. Populations of fish feeders (fulmars, cormorants, gulls, kittiwakes, murres, guillemots, rhinoceros auklets, puffins) exhibited stable populations in 54 of 89 cases. We found significant upward trends in 15 cases and significant downward trends in 20 cases (species x site). No geographic patterns were apparent with regard to population trends of fish eating seabirds. Diving plankton feeders showed mixed results as well. Least auklet populations were down significantly at Kasatochi Island while crested auklets appeared to be increasing at that colony.

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INTRODUCTION

This report is the eighth in a series of annual reports summarizing the results of seabird monitoring surveys at breeding colonies on the Alaska Maritime National Wildlife Refuge (NWR) and elsewhere in Alaska (see Byrd and Dragoo 1997, Byrd et al. 1998 and 1999, Dragoo et al. 2000, 2001, 2003 and 2004 for compilations of previous years' data). This report series is patterned after the publications of the Joint Nature Conservation Committee in Britain (e.g., Mavor et al. 2004). Like in Britain, the seabird monitoring program in Alaska is designed to keep track of selected species of marine birds that indicate changes in the ocean environment. Furthermore, the U. S. Fish and Wildlife Service has the responsibility to conserve seabirds, and monitoring data are used to identify conservation problems. The objective is to provide long-term, time-series data from which biologically-significant changes may be detected and from which hypotheses about causes of changes may be tested.

The Alaska Maritime NWR was established specifically "To conserve marine bird populations and habitats in their natural diversity and the marine resources upon which they rely" and to "provide for an international program for research on marine resources" (Alaska National Interests Land Conservation Act of 1982). The monitoring program is an integral part of the management of this refuge, by providing data that can be used to define "normal" variability in demographic parameters and identify patterns that fall outside norms and thereby constitute conservation issues. Although approximately 80% of the seabird nesting colonies in Alaska occur on the Alaska Maritime NWR, marine bird nesting colonies occur on other public lands (national and state refuges) and on private lands as well.

The strategy for colony monitoring includes estimating timing of nesting events, reproductive success, population trends, and prey used by representative species of various foraging guilds (e.g., murres are offshore diving fish-feeders, kittiwakes are offshore surface-feeding fish-feeders, auklets are diving plankton-feeders, etc.) at geographically dispersed breeding sites along the entire coastline of Alaska (Fig. 1). A total of 10 sites on the Alaska Maritime NWR, located roughly 300-500 km apart, are scheduled for annual surveys, and at least some data were available from most of these in 2003. Furthermore, data are recorded annually or semiannually at other sites in Alaska (e.g., Cape Peirce, Togiak NWR). In addition, colonies near the annual sites are identified for less frequent surveys to "calibrate" the information at the annual sites. Data provided from other research projects (e.g., those associated with evaluating the impacts of oil spills on marine birds) also supplement the monitoring database.

In this report, we summarize information from 2003 for each species; i.e., tables with estimates of average hatch dates and reproductive success, and maps with symbols indicating the relative timing of hatching and success at various sites. In addition, historical patterns of hatching chronology and productivity are illustrated for many sites (those where we have adequate information). Population trend information is included for sites where at least four data points have been gathered. Seabird diet data from several locations are presented as well.

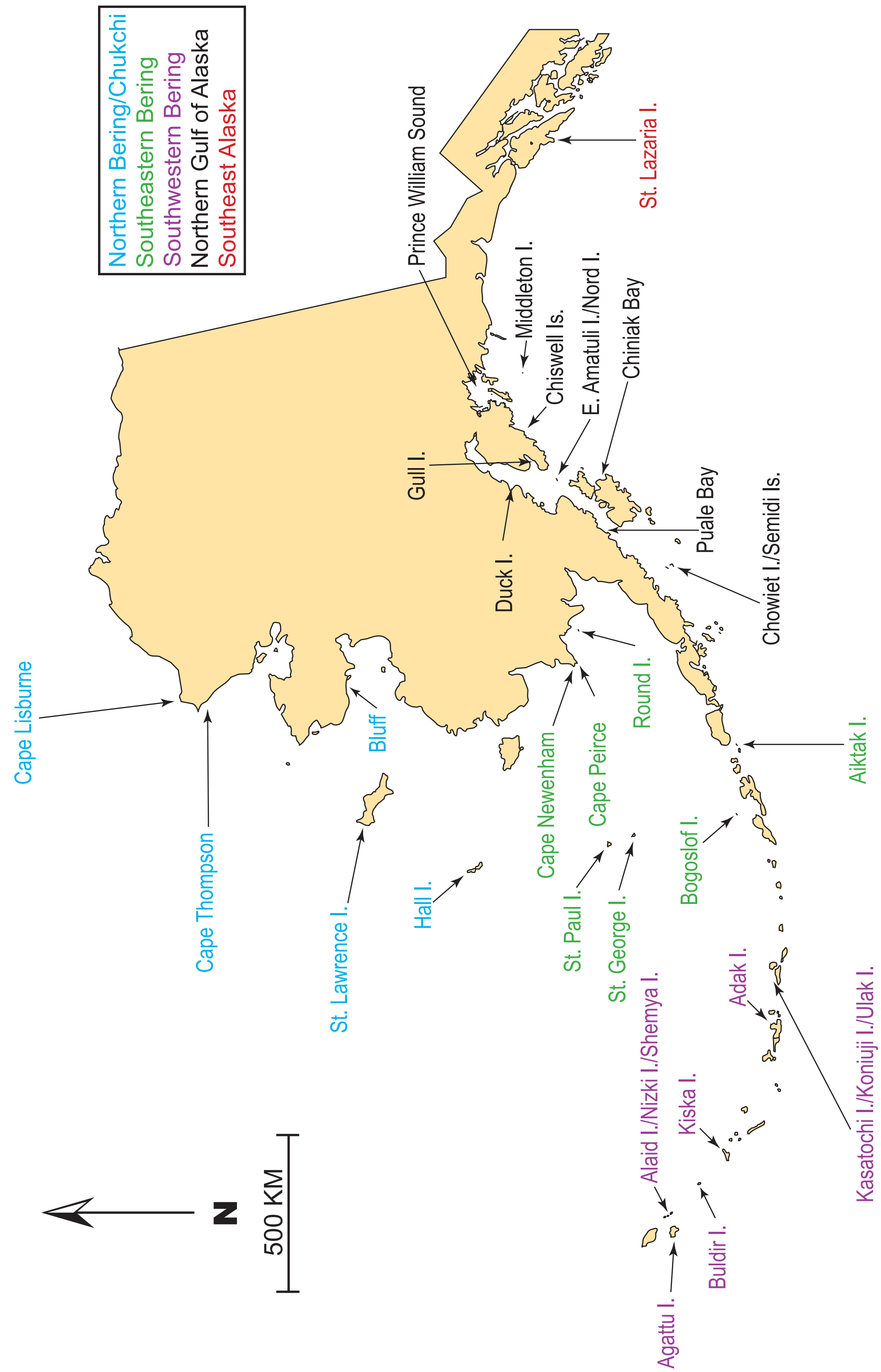


Figure 1. Map of Alaska showing the locations of seabird monitoring sites summarized in this report. Text colors indicate geographic regions.

METHODS

Data collection methods generally followed protocols specified in "Standard Operating Procedures for Population Inventories" (USFWS 2000*a, b, c*). Timing of nesting events and productivity usually were based on periodic checks of samples of nests (frequently in plots) throughout the breeding season, but a few estimates of productivity were based on single visits to colonies late in the breeding season (as noted in tables). Hatch dates commonly were used to describe nesting chronology. Productivity typically was expressed as chicks fledged per egg, but occasionally other variables were used (e.g., chicks hatched per egg, chicks fledged per nest site, etc., Table 1). Population surveys were conducted for ledge-nesting species at times of the day and breeding season when variability in attendance was reduced. Most burrow-nester counts were made early in the season before vegetation obscured burrow entrances. Deviations from standard methods are indicated in reports from individual sites which are appropriately referenced.

Table 1. Productivity parameters used in this report.

Species	Productivity Value
Storm-petrels	Chicks Fledged/Egg (Total chicks fledged/Total eggs laid)
Cormorants	Chicks Fledged/Nest (Total chicks fledged/Total nests)
Glaucous-winged Gull	Hatching Success (Total chicks/Total eggs)
Kittiwakes	Chicks Fledged/Nest (Total chicks fledged/Total nests)
Murres	Chicks Fledged/Nest Site (Total chicks fledged/Total sites where egg was laid)
Ancient Murrelet	Hatching Success (Total chicks/Total eggs)
Auklets (except RHAU)	Chicks Fledged/Nest Site (Total chicks fledged/Total sites where egg was laid)
Rhinoceros Auklet	Chicks Fledged/Egg (Total chicks fledged/Total eggs)
Puffins	Chicks Fledged/Egg (Total chicks fledged/Total eggs)

This report summarizes monitoring data for 2003, and compares 2003 results with previous years. For sites with at least two years of data prior to 2003, site averages were used for comparisons. Otherwise, prior estimates for nearby sites were utilized for comparisons. For chronology, we considered dates within 3 days of the long-term average to be "normal"; larger deviations represented relatively early or late dates. For productivity, we defined significant deviations from "normal" as any that differed by more than 20% from the site or regional average. Overall population trends were analyzed using linear regression models on log-transformed data (ln). Trends were considered to be significant at the $p<0.05$ level and are reported as percent per annum increase or decline.

Seabird diet information was collected from adult or nestling birds. Nestling diet data are generally from chick regurgitations or observations of bill loads of fish brought to the chicks and adult diet data are from regurgitations or stomach samples. Diets of piscivorous seabirds are reported as percent occurrence and data from planktivorous seabirds are reported as percent biomass of prey types. Data are reported in stacked bar graphs to facilitate viewing several years of data on one graph. The complete stacked bar indicates the cumulative percent occurrence of prey types in the samples and can add up to more than one hundred percent. The cumulative percent occurrence provides information on the average number of prey types per sample. For example, a cumulative percent occurrence of 200% for horned puffins indicates that on average each bird consumed two different prey types during one foraging trip and a cumulative percent occurrence of 100% for black-legged kittiwakes indicates that on average each bird consumed one prey type during one foraging trip.

RESULTS

Northern Fulmar (*Fulmarus glacialis*)

Breeding Chronology.–No data for 2003.

Productivity.–No data for 2003.

Populations.–We found no significant trends for northern fulmars at any monitored colony (Figure 2).

Diet.–No data.

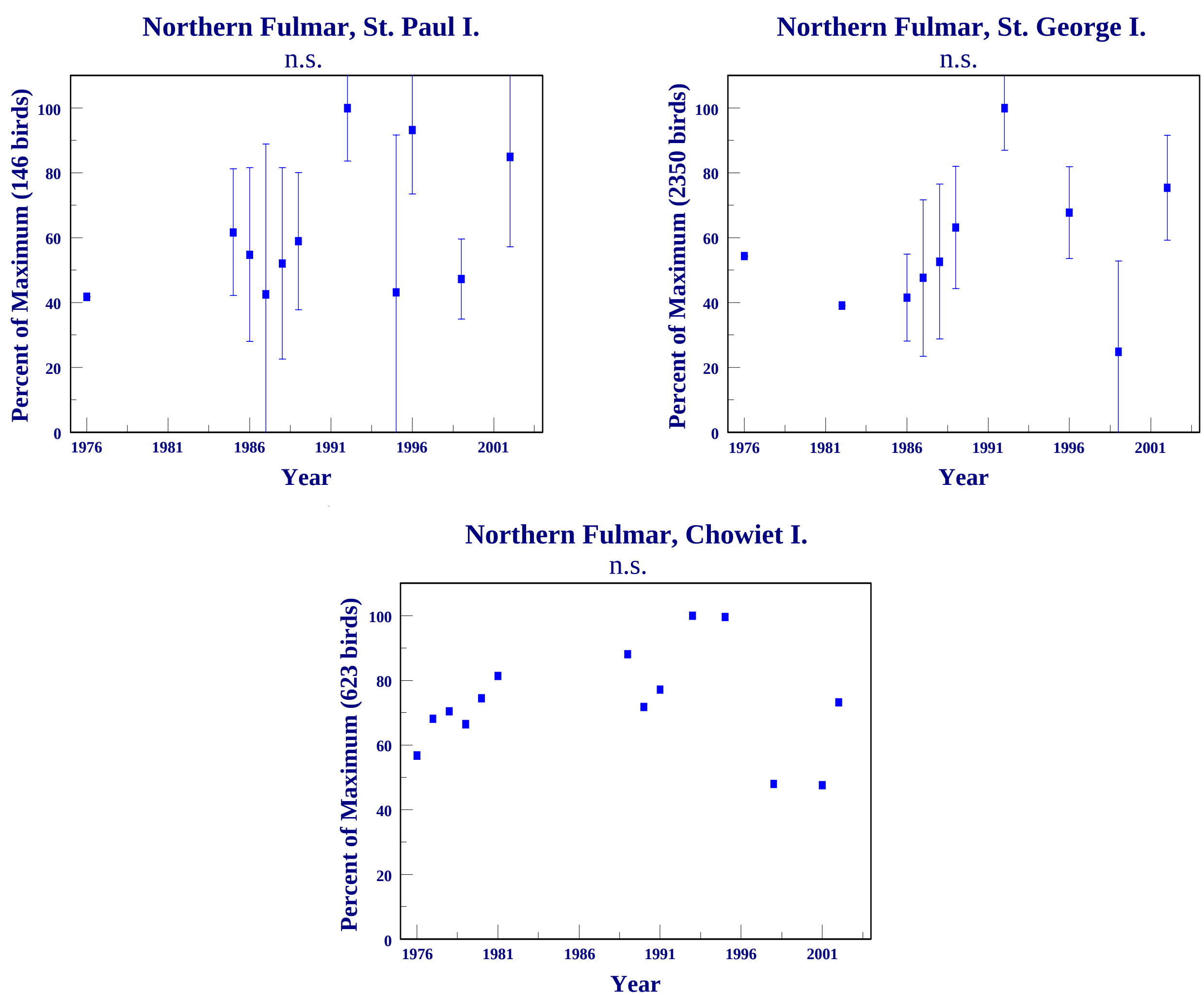


Figure 2. Trends in populations of northern fulmars at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

Fork-tailed Storm-Petrel (*Oceanodroma furcata)*

Breeding Chronology.–The mean hatch date for fork-tailed storm-petrels at St. Lazaria Island was earlier than average in 2003 (Table 2, Fig. 3).

Table 2. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lazaria I.	—	30 Jun (43)[a]	17 Jul[b] (8)[a]	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–In 2003, productivity of fork-tailed storm-petrels ranged from 97% at Buldir Island to 72% at Ulak Island (Table 3, Fig. 4). Compared to previous years, this species had above average success at all sites where it was monitored.

Table 3. Reproductive performance of fork-tailed storm-petrels at Alaskan sites monitored in 2003.

Site	Chicks Fledged[a]/egg	No. of Plots	No. of Eggs	Reference
Buldir I.	0.97	6	31	Jones et al. 2005
Ulak I.	0.72	1	60	Barton and Lindquist 2003
St. Lazaria I.	0.80	8	121	L. Slater Unpubl. Data

[a]Fledged chick defined as being still alive at last check in August or September.

Populations.–Fork-tailed and Leach's storm-petrel burrows were combined at most sites for population monitoring purposes. Storm-petrel populations increased by 3.9% per annum at Buldir Island, 9.3% per annum at Aiktak Island and by 4.1% per annum at St. Lazaria Island (Fig. 5). No other monitored colonies exhibited significant trends.

Diet.–Diets of fork-tailed storm petrels at Buldir and St. Lazaria islands consisted of a majority of myctophids and other larval fish. In a small sample from Aiktak Island, storm petrel diet consisted entirely of *Parathemisto* species (Fig. 6). Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Neocalanus plumchrus*, *Hyperoche medusarum*, *Parathemisto pacifica*, *Littorina sp.*, and *Nucella sp.*

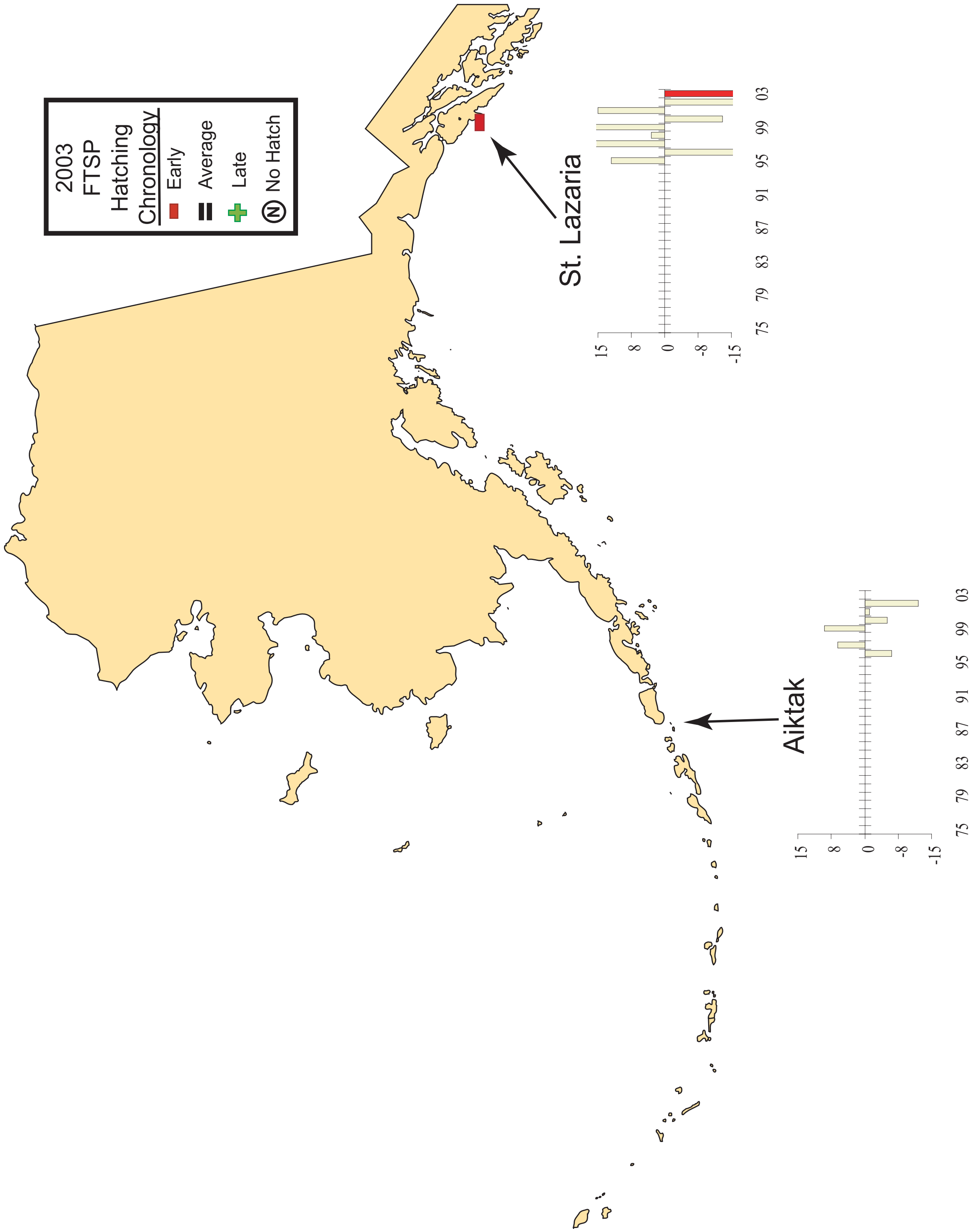


Figure 3. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

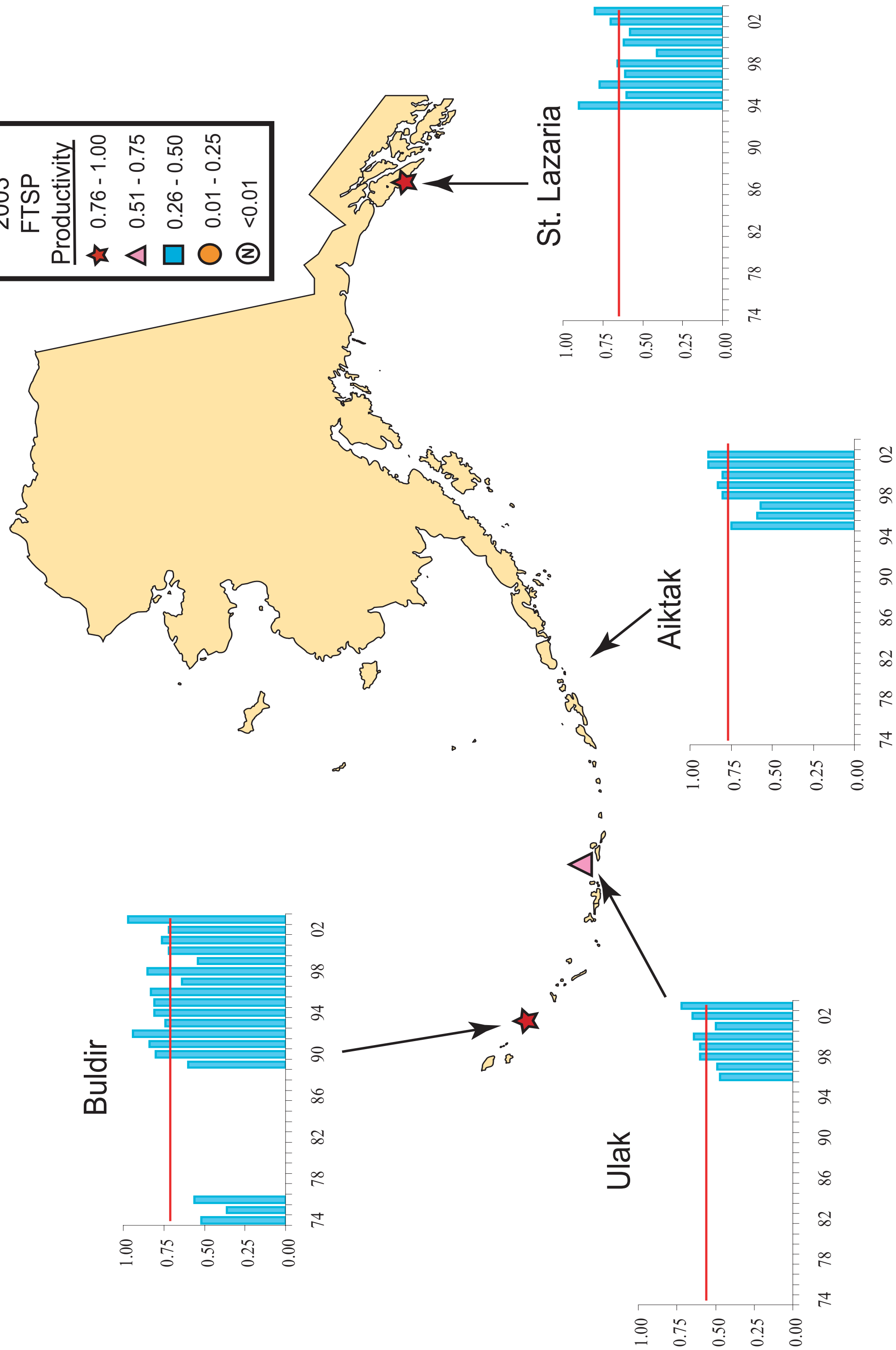


Figure 4. Productivity of fork-tailed storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

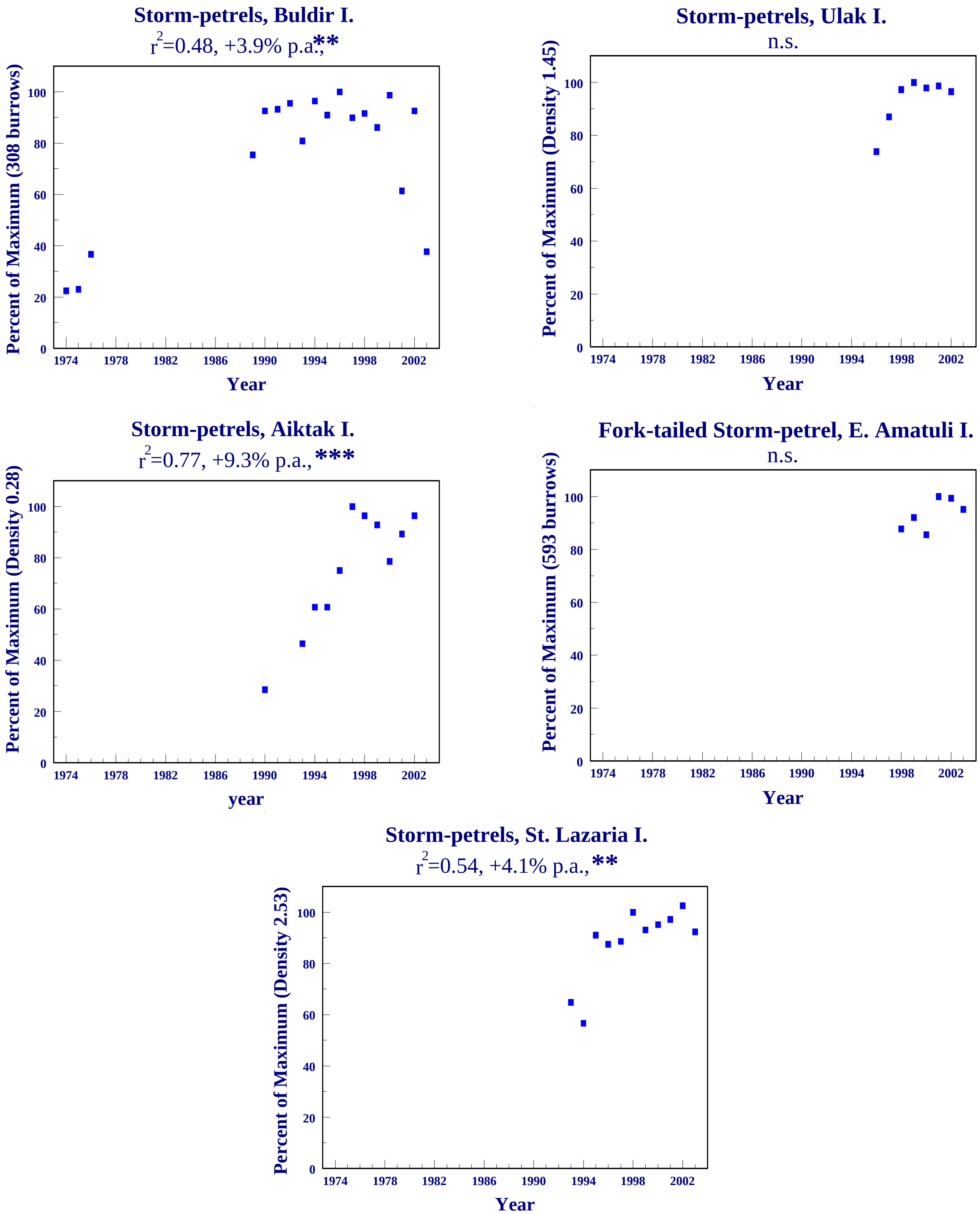


Figure 5. Trends in populations of storm-petrels at Alaskan sites. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

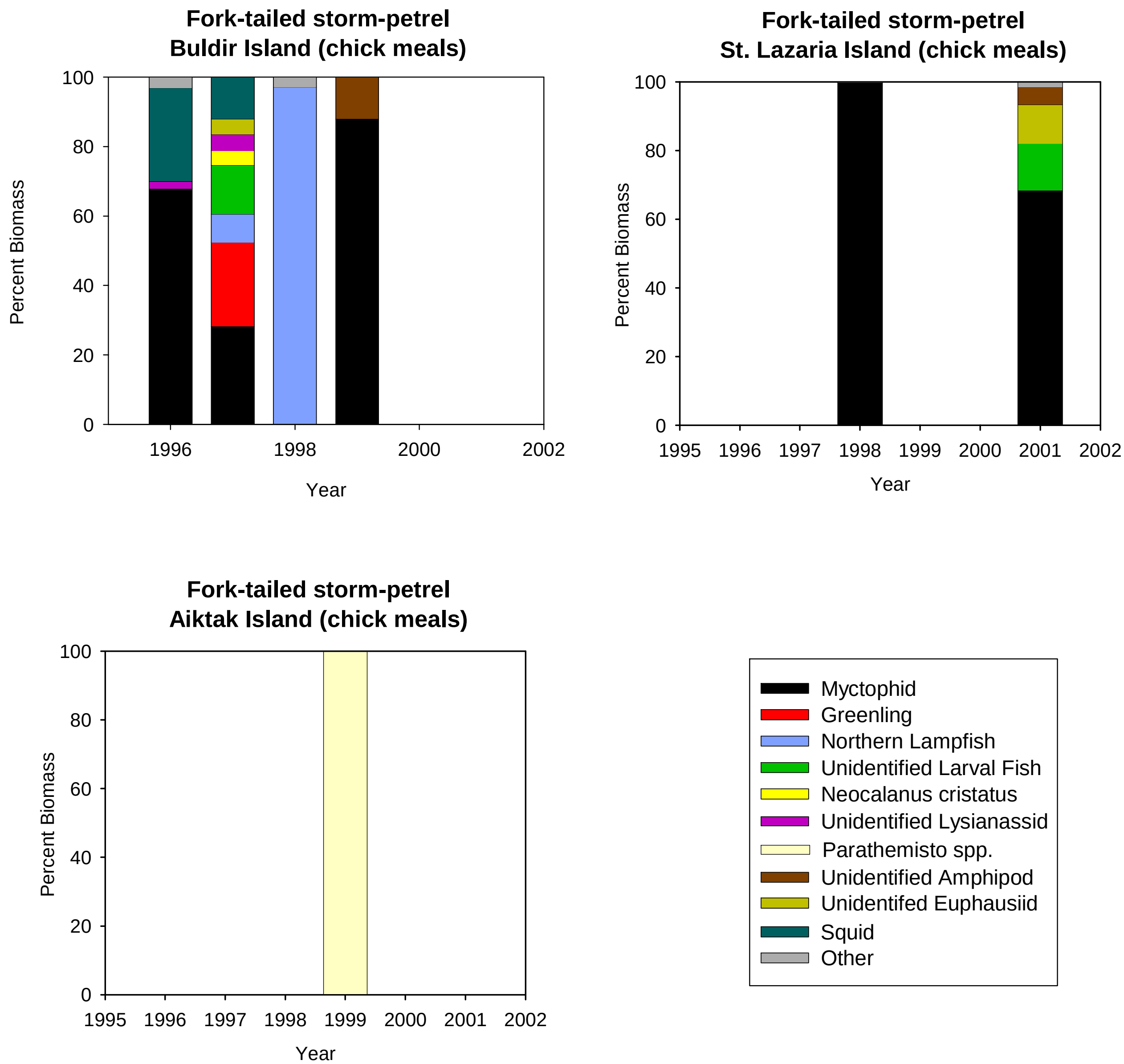


Figure 6. Diets of fork-tailed storm-petrels at Alaskan sites. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent biomass of prey type in the diet.

Leach's Storm-Petrel (*Oceanodroma leucorhoa*)

Breeding Chronology.–The mean hatch date for Leach's storm-petrels at St. Lazaria Island was earlier than average in 2003 (Table 4, Fig. 7).

Table 4. Hatching chronology of Leach's storm-petrels at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lazaria I.	—	27 Jul (34)[a]	3 Aug[b] (8)[a]	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–In 2003, productivity of Leach's storm-petrels was average at St. Lazaria Island and above average at Buldir Island (Table 5, Fig. 8).

Table 5. Reproductive performance of Leach's storm-petrels at Alaskan sites monitored in 2003.

Site	Chicks Fledged[a]/egg	No. of Plots	No. of Eggs	Reference
Buldir I.	0.90	6	40	Jones et al. 2005
St. Lazaria I.	0.66	8	88	L. Slater Unpubl. Data

[a]Fledged chick defined as being still alive at last check in August or September.

Populations.–Fork-tailed and Leach's storm-petrel burrows were combined at most sites for population monitoring purposes. Storm-petrel populations increased by 3.9% per annum at Buldir Island, 9.3% per annum at Aiktak Island and by 4.1% per annum at St. Lazaria Island (Fig. 5). No other monitored colonies exhibited significant trends.

Diet.–The Leach's storm-petrels from Buldir and St. Lazaria islands predominately ate myctophids and other larval fish (Fig. 9). At Buldir Island Leach's storm-petrels ate a more diverse diet secondarily relying on lysianassids and euphausiids. In a small sample from Aiktak Island, storm petrel diet consisted entirely of unidentified larval fish. Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Neocalanus cristatus*, *Hyperoche medusarum*, *Parathemisto pacifica*, Amphipod sp., *Thysanonessa sp.*, shrimp zoea, and crab zoea.

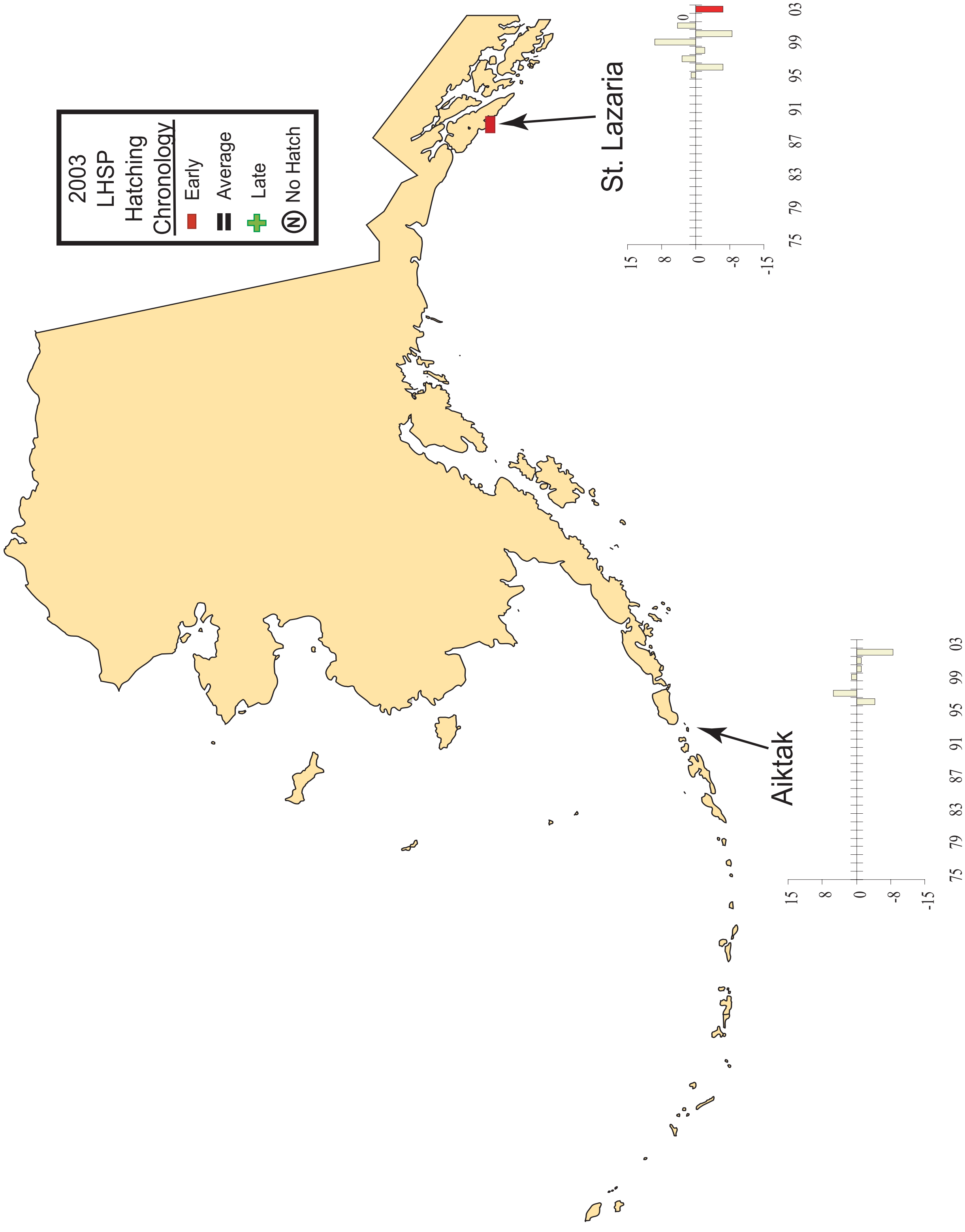


Figure 7. Hatching chronology of Leach's storm-petrels at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

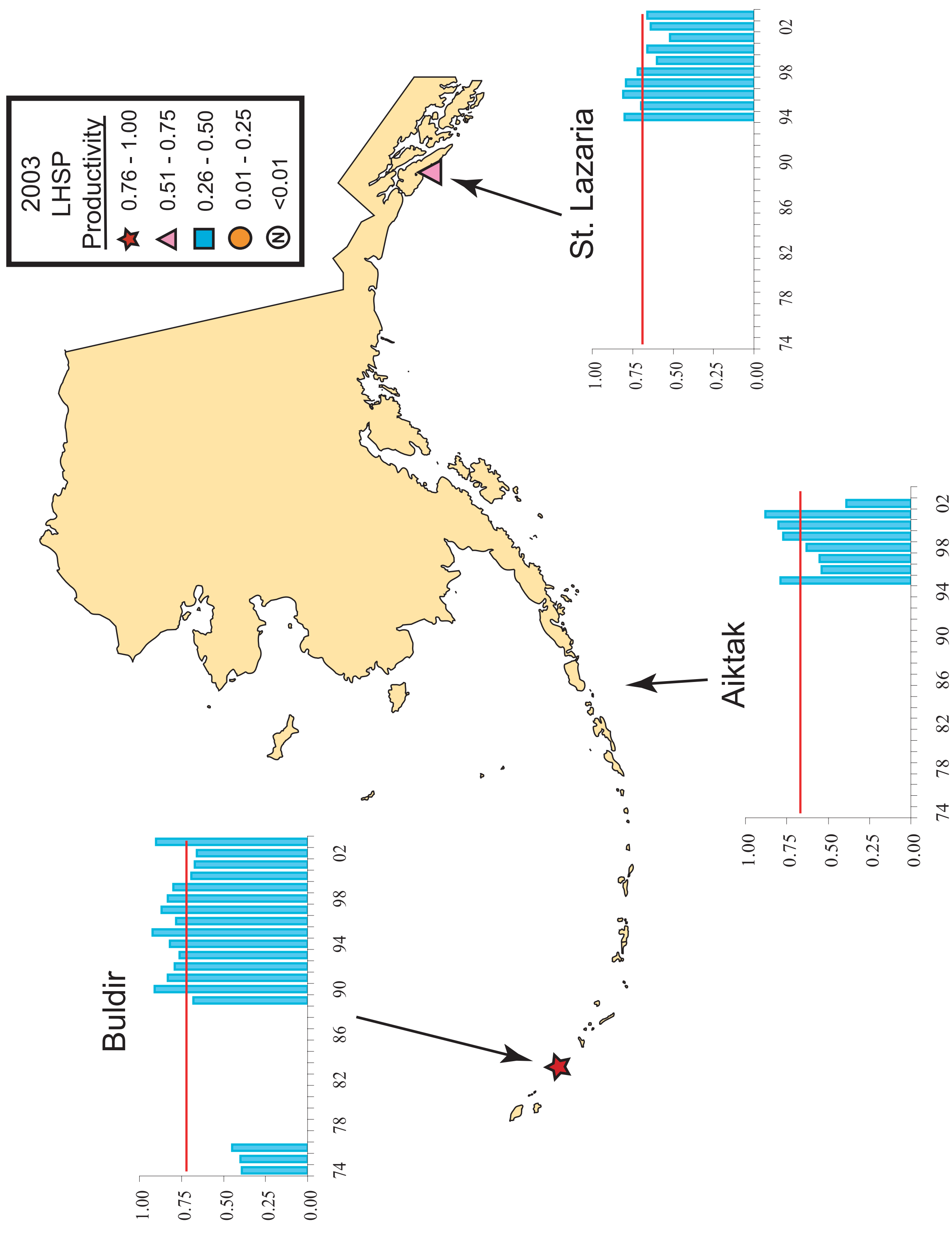


Figure 8. Productivity of Leach's storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

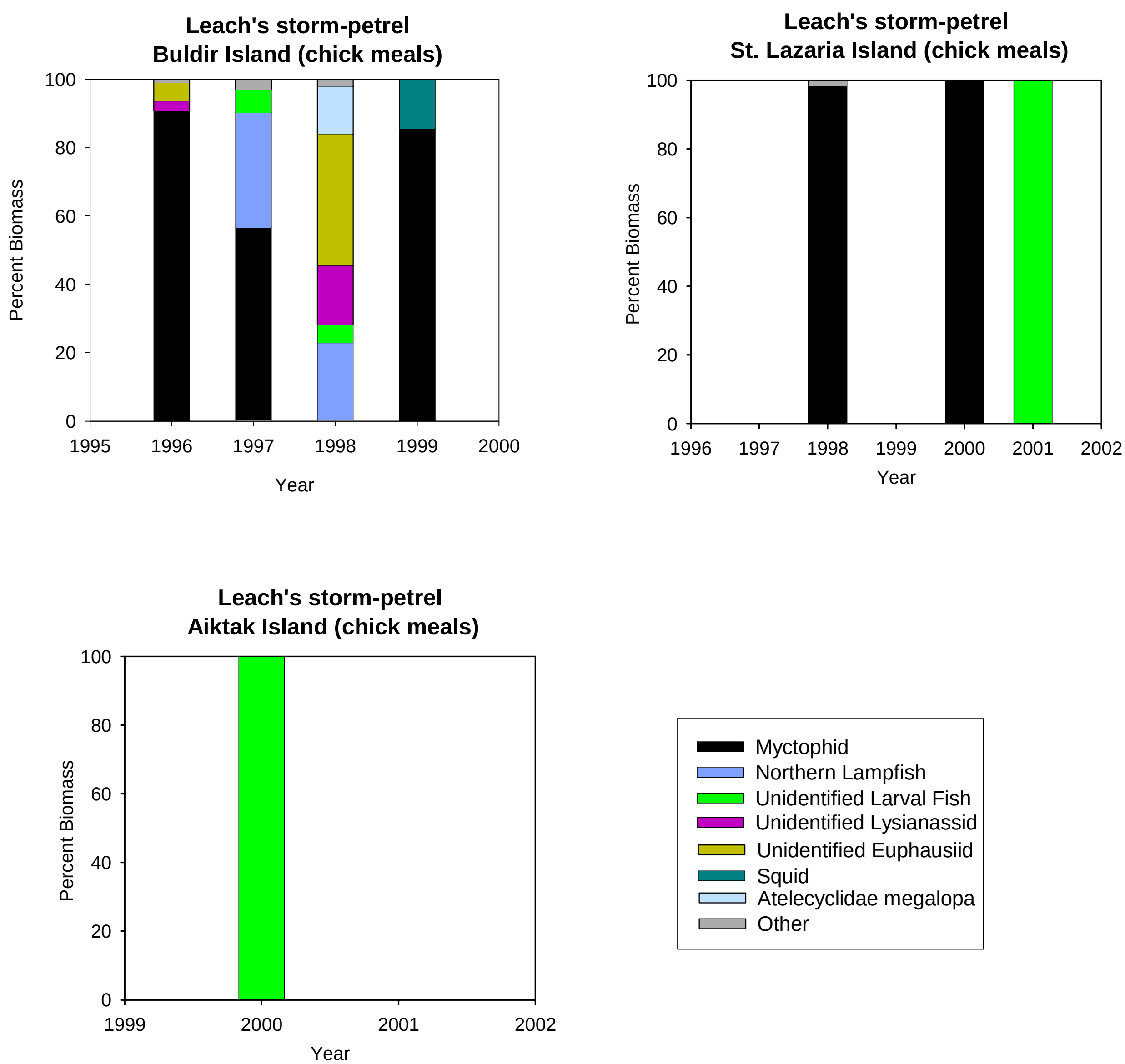


Figure 9. Diets of Leach's storm-petrels at Alaskan sites. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent biomass of prey type in the diet.

Double-crested Cormorant (*Phalacrocorax auritus)*

Breeding Chronology.–No data for 2003.

Productivity.–No data for 2003.

Populations.–No data.

Diet.–In a small sample from Aiktak Island, double-crested cormorant diet consisted entirely of kelp greenling in 2000 (Fig. 10).

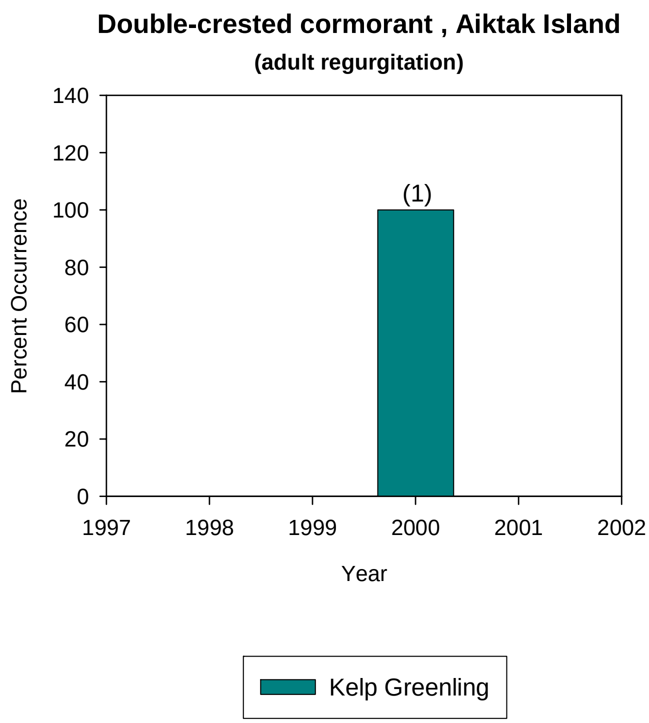


Figure 10. Diets of double-crested cormorants at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Red-faced Cormorant (*Phalacrocorax urile*)

Breeding Chronology .–No data for 2003.

Productivity .–In 2003, productivity of red-faced cormorants ranged from complete failure at Kasatochi Island and Chiniak Bay to 2.30 chicks fledged per nest at St. George Island (Table 6). Productivity in 2003 was higher than average at the Pribilof Islands and below average at Ulak and Kasatochi islands in the central Aleutians, and at Chiniak Bay; with complete failures at the latter two colonies (Fig. 11).

Table 6. Reproductive performance of red-faced cormorants at Alaskan sites monitored in 2003.

Site	Chicks Fledged/Nest	No. of Plots	No. of Nests	Reference
St. Paul I.	2.01	5	87	Polito and Drew 2003
St. George I.	2.30	3	68	McDonough and Erwin 2003
Ulak I.	1.00[a]	N/A[b]	150	Barton and Lindquist 2003
Kasatochi I.	0.00	N/A	16	Barton and Lindquist 2003
Chiniak B.	0.00[a]	N/A	22	Kildaw et al. 2003

[a]Value obtained from one time visit to colony.
[b]Not applicable or not reported.

Populations .–Red-faced cormorants were differentiated from other cormorants at only two colonies. We found a significant annual decline of -4.2% at the Semidi Islands and a -12.8% per annum decrease at Chiniak Bay (Fig. 12). See the section covering pelagic cormorants for a discussion of general cormorant population trends at colonies where the species are combined.

Diet .–No data.

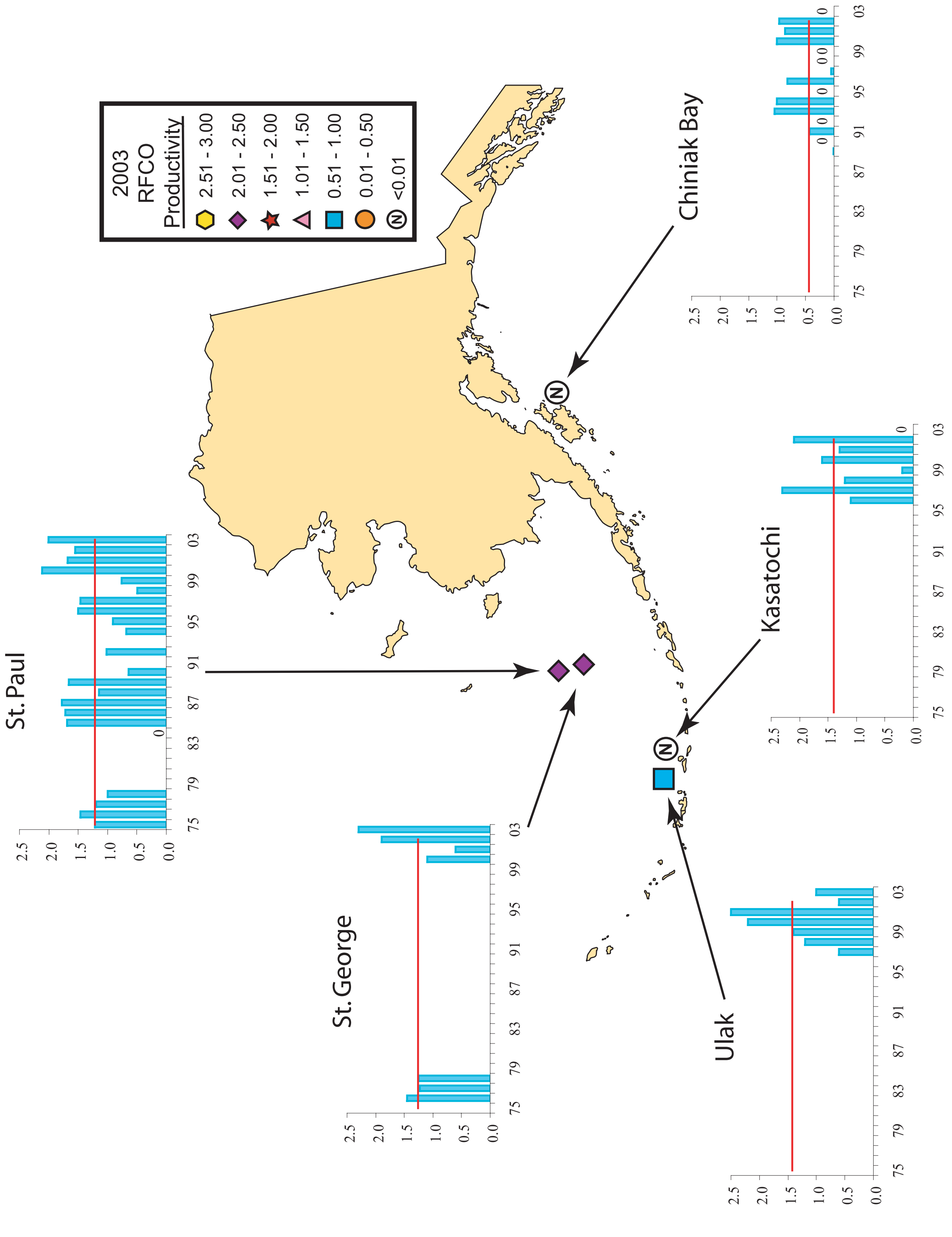


Figure 11. Productivity of red-faced cormorants (chicks fledged/nest) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

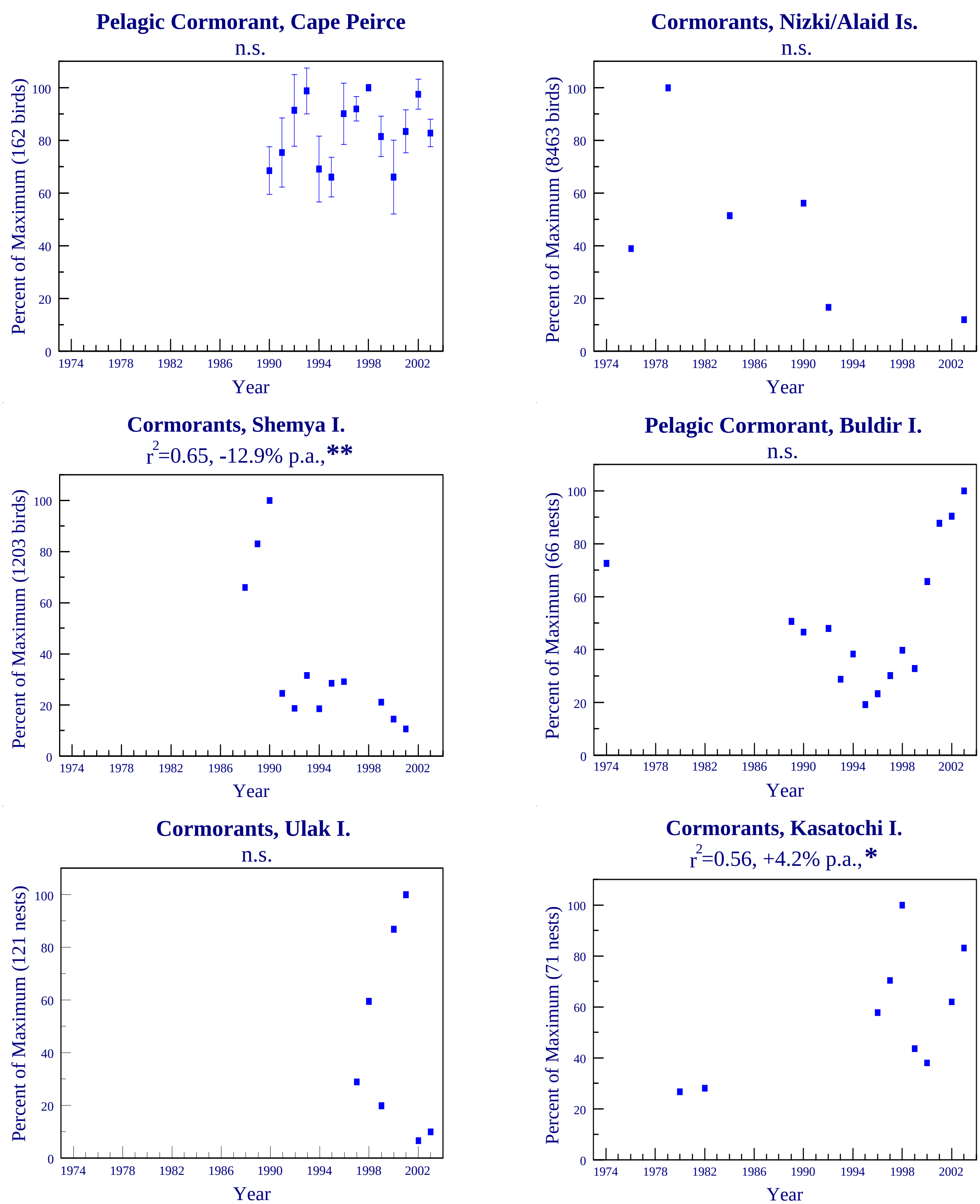


Figure 12. Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

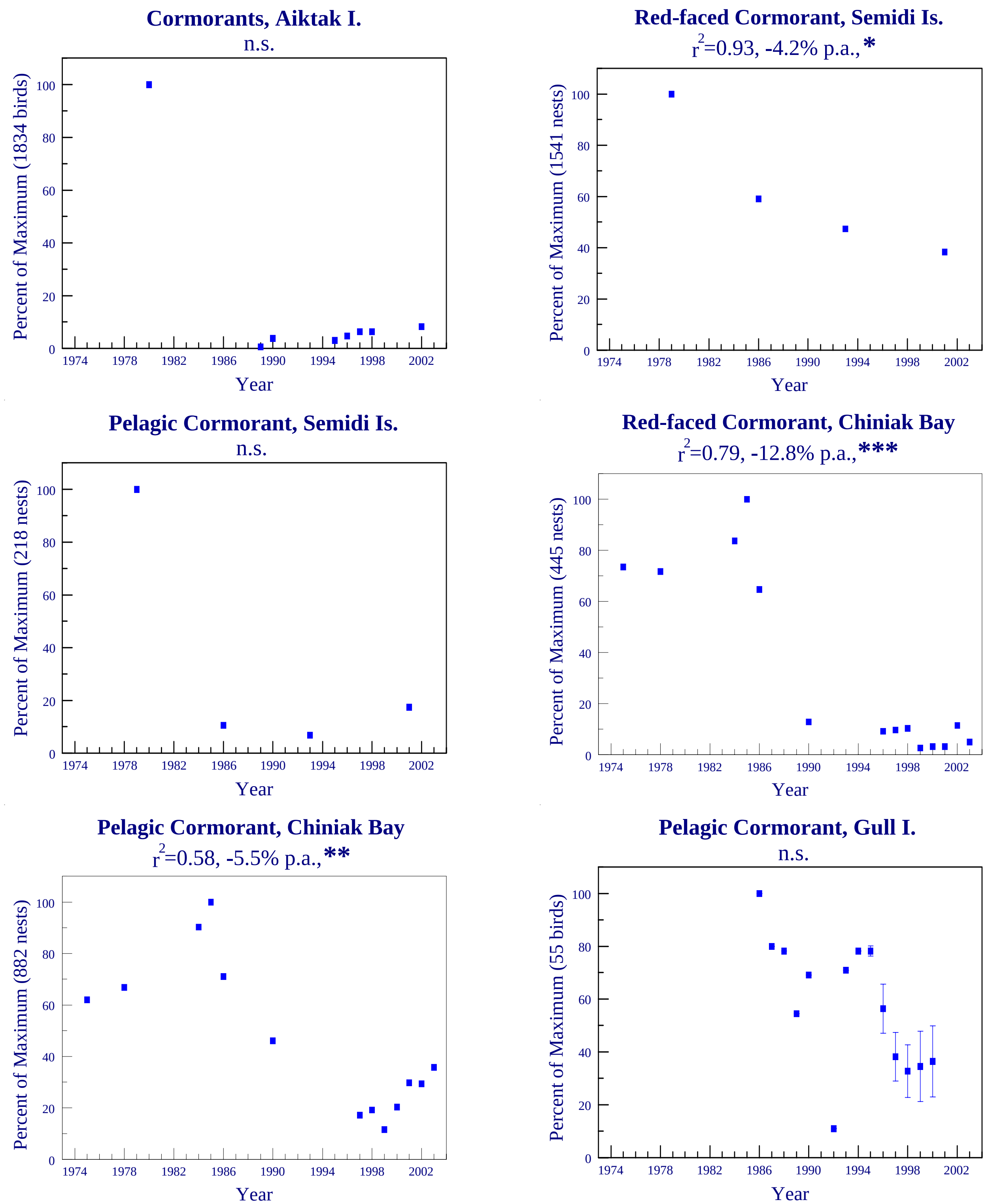
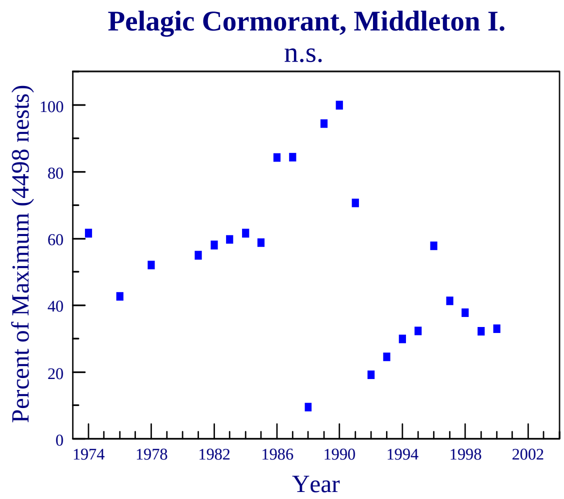


Figure 12 (continued). Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).



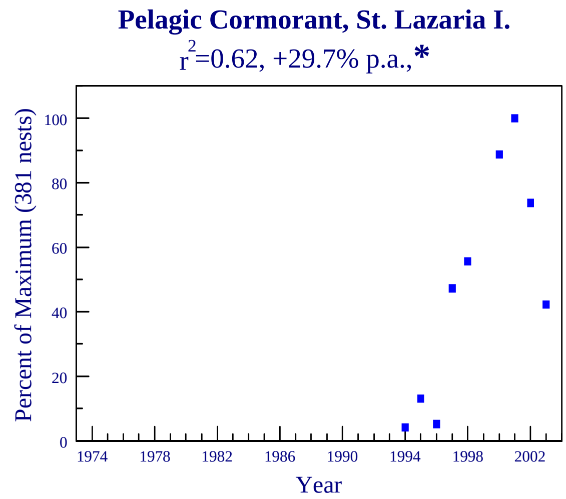


Figure 12 (continued). Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Breeding Chronology .–Hatching dates for pelagic cormorants were about average at Cape Peirce in 2003 (Table 7).

Table 7. Hatching chronology of pelagic cormorants at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Cape Peirce	—	17 Jun (26)[a]	20 Jun[b] (11)[a]	R. MacDonald Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity .–Pelagic cormorant productivity was below average at most sites monitored in 2003 (Table 8, Fig. 13). Success was above average at Cape Peirce.

Table 8. Reproductive performance of pelagic cormorants at Alaskan sites monitored in 2003.

Site	Chicks Fledged/Nest	No. of Plots	No. of Nests	Reference
Cape Peirce	1.61	8	33	R. MacDonald Unpubl. Data
Round I.	1.00	5	10	Cody 2003
Buldir I.	0.50	N/A[a]	73	Jones et al. 2005
Ulak I.	1.30[b]	N/A	10	Barton and Lindquist 2003
Kasatochi I.	0.06	N/A	27	Barton and Lindquist 2003
Chiniak B.	0.20[b]	N/A	322	Kildaw et al. 2003
St. Lazaria I.	0.90	N/A	161	L. Slater Unpubl. Data

[a]Not applicable or not reported.
[b]Value obtained from one time visit to colony.

Populations .–Cormorants are known to shift nesting locations between years, so it is difficult to confidently interpret changes in counts. Nevertheless, numbers of pelagic cormorants or nests (the index that has been used at some sites) have remained relatively stable at most monitored sites (Fig. 12). We found a significant negative trend for pelagic cormorants at Chiniak Bay (-5.5% per annum) and an increase in pelagic cormorants at St. Lazaria Island (+29.7% per annum). Cormorants (species combined) showed no trends at most sites but declined at Shemya Island (-12.9% per annum) and exhibited a positive trend of +4.2% per annum at Kasatochi Island (Fig. 12).

Diet .–Pelagic cormorants from St. Lazaria Island predominately ate Pacific sand lance, Irish lord, and other sculpin, with lesser amounts of other fish species (Fig. 14).

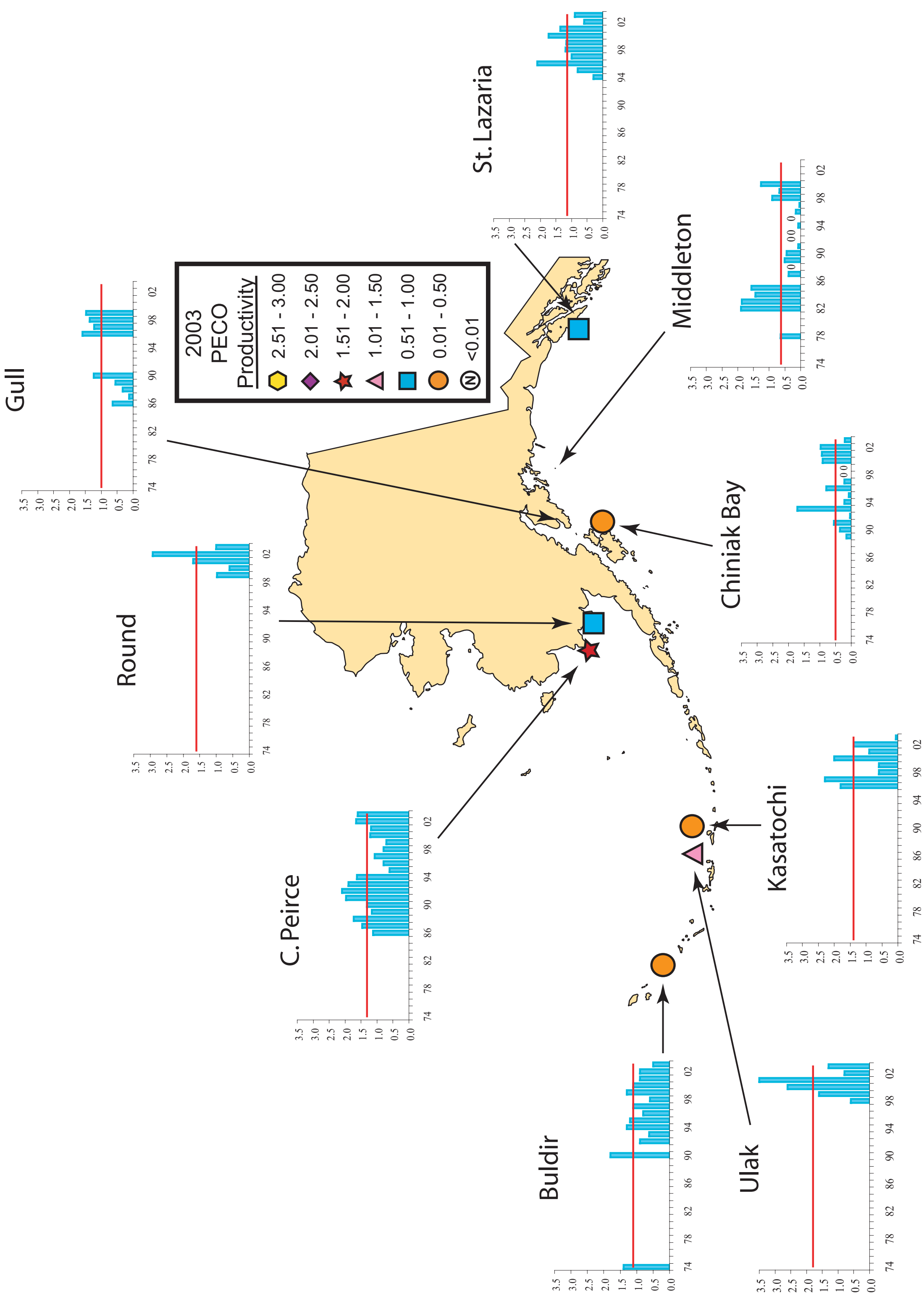


Figure 13. Productivity of pelagic cormorants (chicks fledged/nest) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

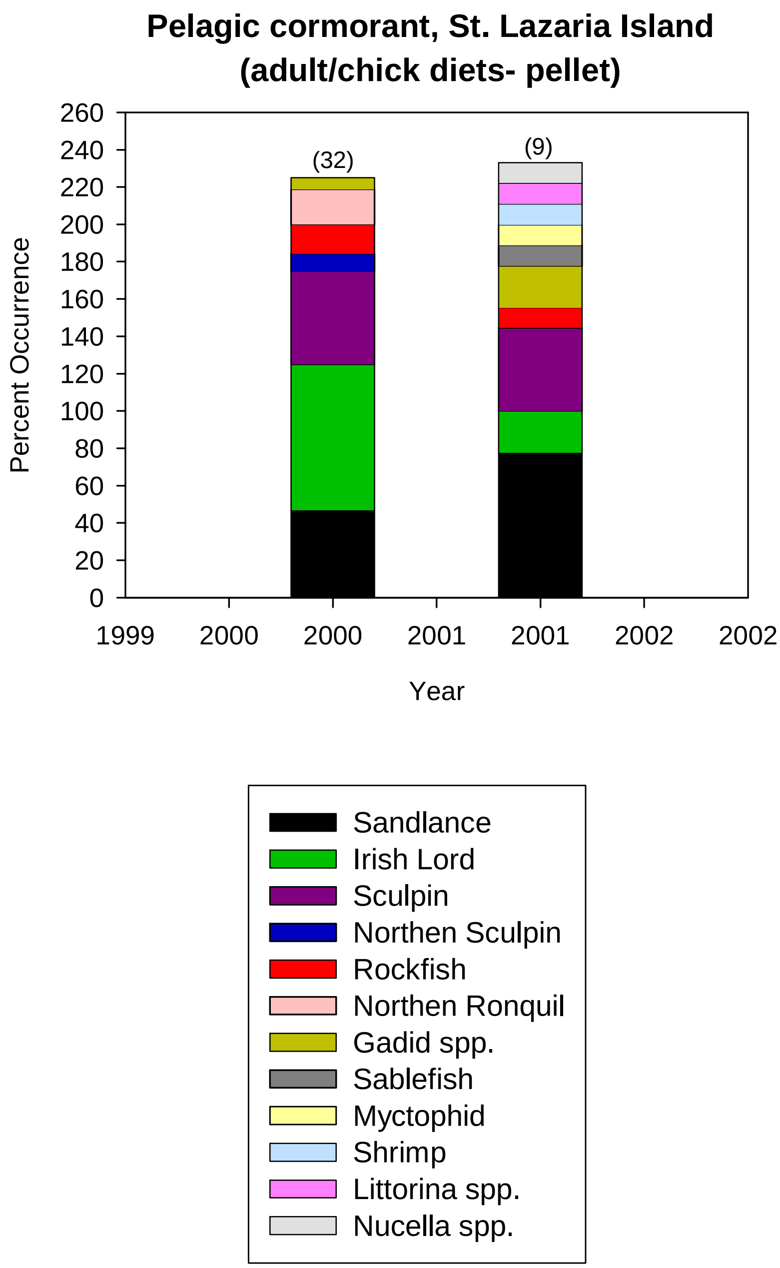


Figure 14. Diets of pelagic cormorants at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Glaucous-winged Gull *(Larus glaucescens)*

Breeding Chronology.–In 2003 the mean hatch date was later than average at Puale Bay and average at St. Lazaria Island (Table 9, Figure 15).

Table 9. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Puale Bay	—	11 Jul (16)[a]	5 Jul (2)[b]	Levandoski and Savage 2004
St. Lazaria I.	29 Jun (91)	30 Jun (91)	3 July (4)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Hatching success in 2003 ranged from 12 % at Puale Bay to 42% at Buldir Island (Table 10, Fig. 16). Success was above average at Buldir Island and below average at Puale Bay and St. Lazaria Island in 2003.

Table 10. Reproductive performance of glaucous-winged gulls at Alaskan sites monitored in 2003.

Site	Hatching Success[a]	No. of Plots	No. of Nests	Reference
Buldir I.	0.42	N/A[b]	23	Jones et al. 2005
Puale Bay	0.12	N/A	9	S. Savage Unpubl. Data
St. Lazaria I.	0.26	3	97	L. Slater Unpubl. Data

[a]Total chicks/Total eggs.
[b]Not applicable or not reported.

Populations.–We found a significant negative trend at Buldir Island (-21.3% per annum) and a significant increase (+13.6% per annum) at Middleton Island (Fig. 17). No trends were evident at other monitored colonies.

Diet.–Glaucous-winged gulls on Aiktak and Buldir islands ate a wide range of prey species consisting primarily of herring and sand lance with lesser amounts of avian prey, invertebrates, sea urchins, marine algae and unidentified fish (Fig. 18). Most of the unidentified fish were large and possibly Atka mackerel or Pacific cod.

The diets of glaucous-winged gulls in Prince William Sound varied by site (Figure 19). Glaucous-winged gulls at Shoup Bay ate predominately offal followed secondarily by salmon eggs and intertidal invertebrates. Eleanor Island glaucous-winged gulls almost exclusively fed their chicks salmonids and capelin while the adults ate a more diverse diet.

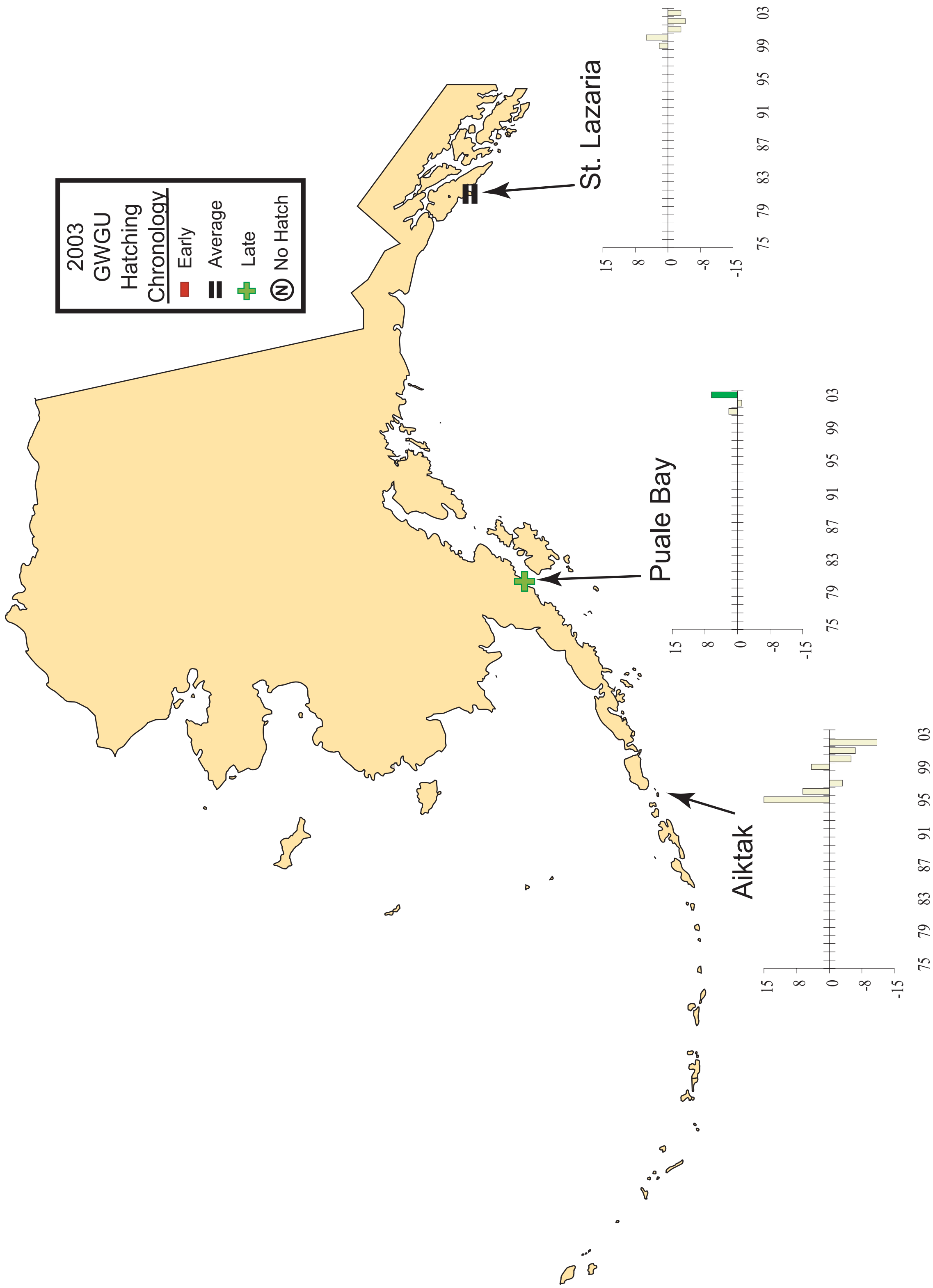


Figure 15. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

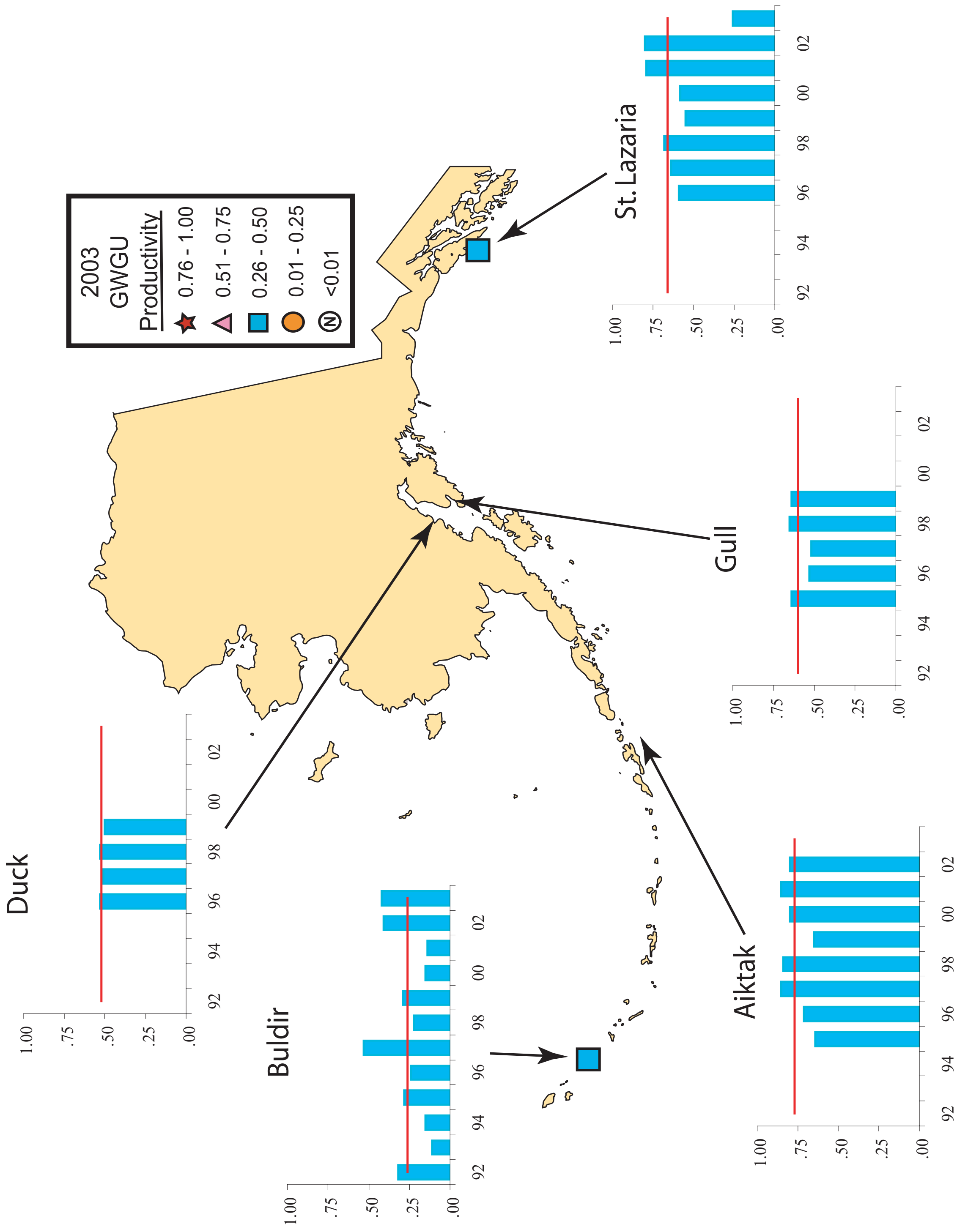


Figure 16. Productivity of glaucous-winged gulls (hatching success) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

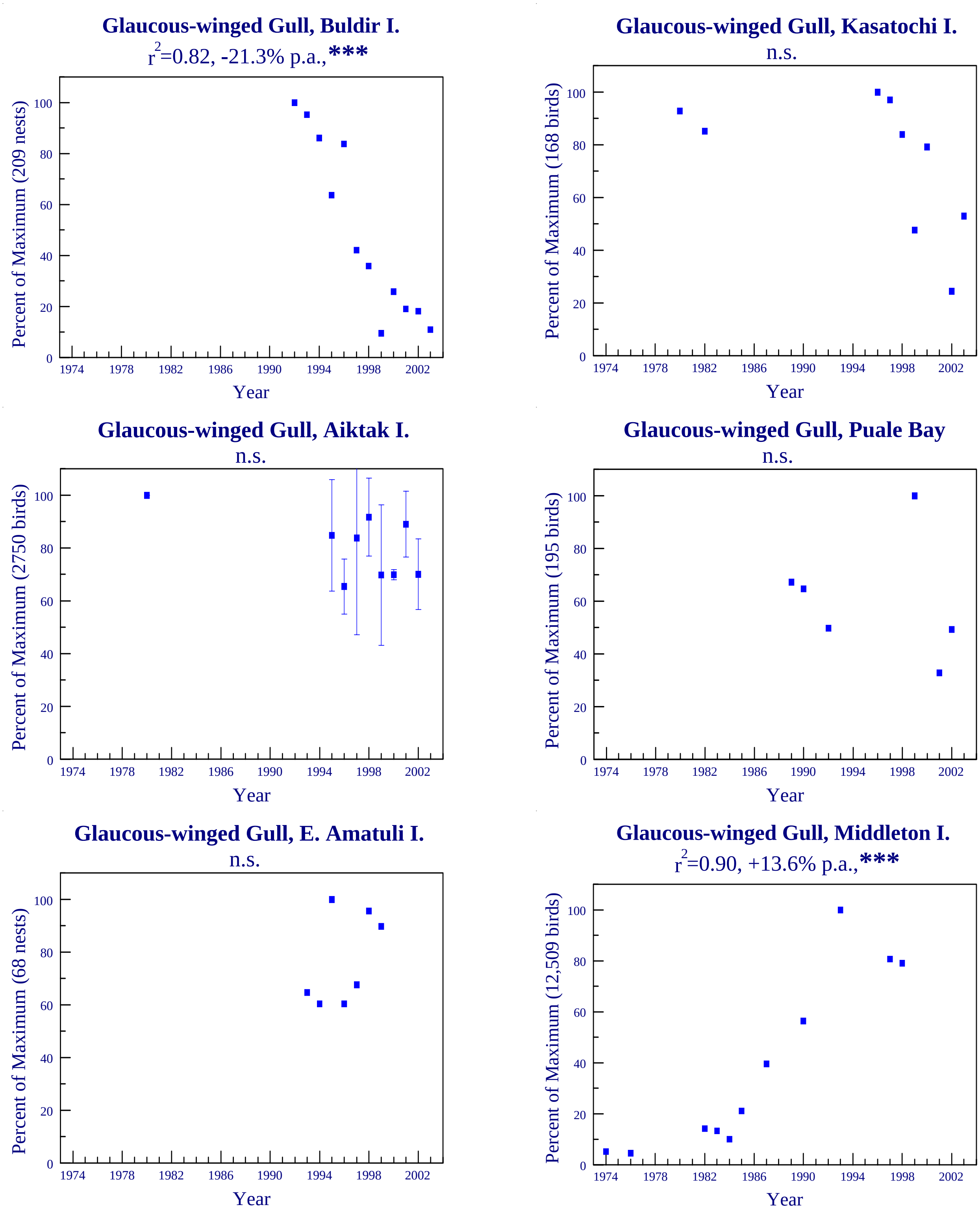


Figure 17. Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

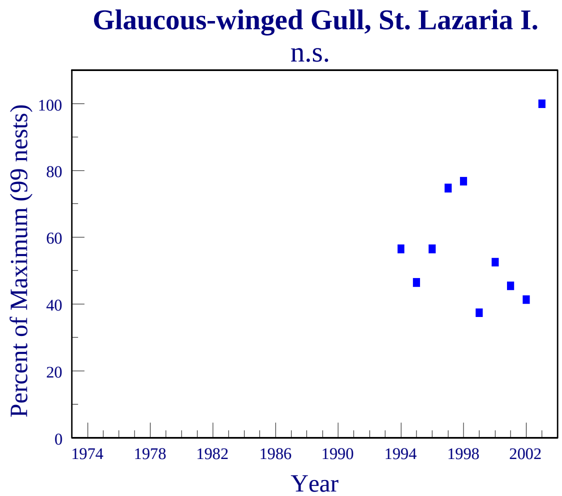


Figure 17 (continued). Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

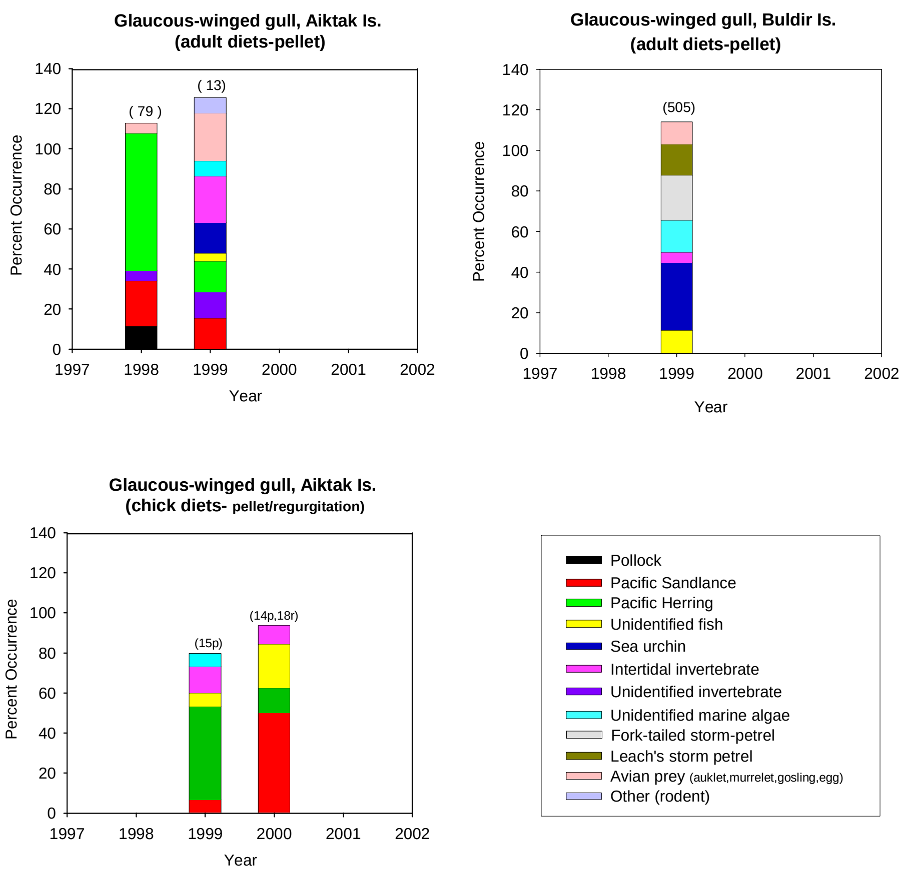


Figure 18. Diets of glaucous-winged gulls at Bering Sea sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

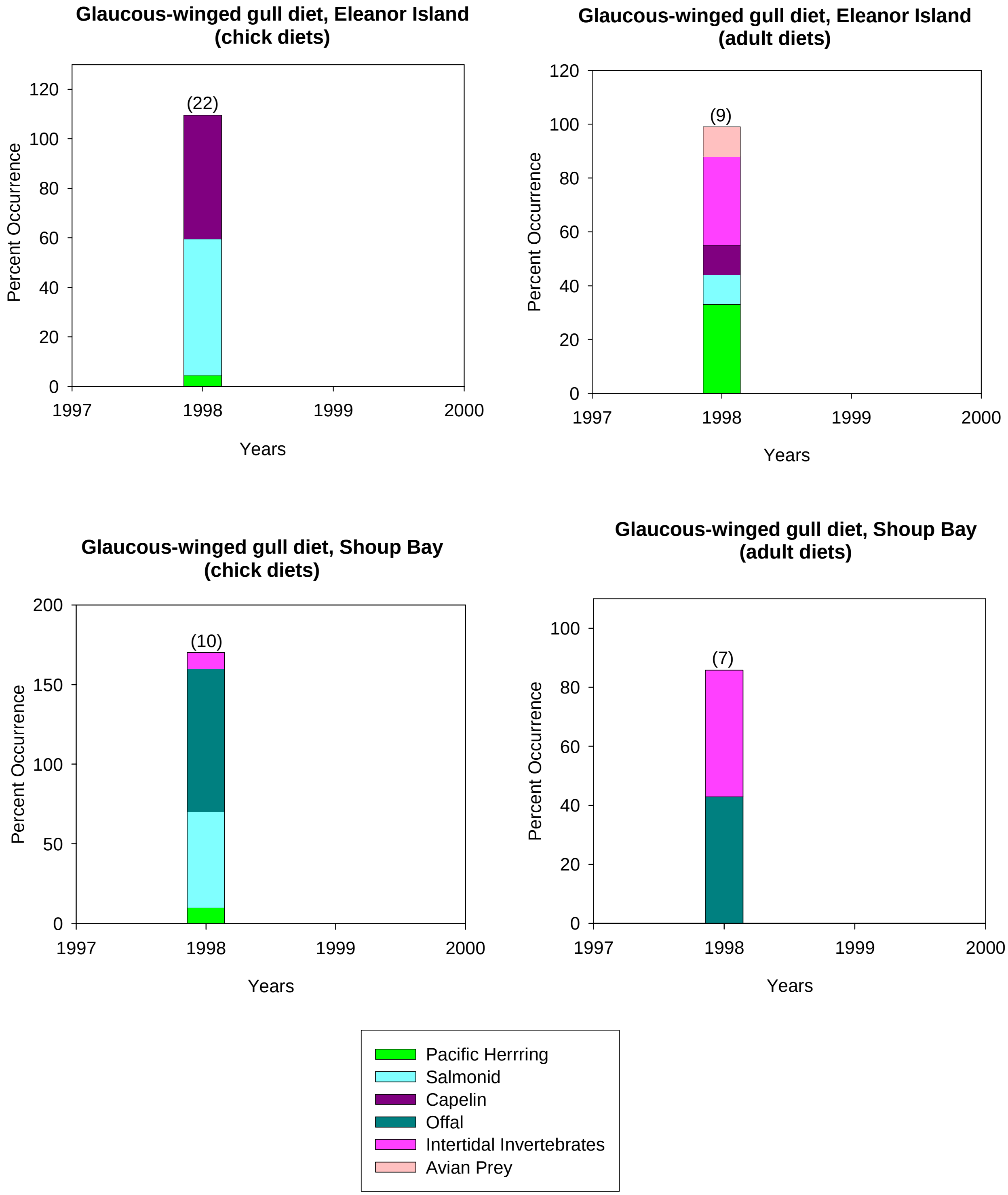


Figure 19. Diets of glaucous-winged gulls at Gulf of Alaska sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Black-legged Kittiwake (*Rissa tridactyla*)

Breeding Chronology .–In 2003, hatching was either early or average at most monitored sites but was late at Buldir Island (Table 11, Fig. 20).

Table 11. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	19 Jul (162)[a]	—	19 Jul[b] (3)[a]	Sheffield et al. 2005
Bluff	—	22 Jul (N/A[c])	24 Jul[b] (24)	Murphy 2003
St. Paul I.	—	12 Jul (201)	21 Jul[b] (19)	Polito and Drew 2003
St. George I.	—	16 Jul (48)	20 Jul[b] (19)	McDonough and Erwin 2003
Cape Peirce	—	26 Jun (171)	10 Jul[b] (14)	R. MacDonald Unpubl. Data
Buldir I.	—	10 Jul (21)	5 Jul[b] (15)	Jones et al. 2005
E. Amatuli I.	11 Jul (246)	10 Jul (246)	11 Jul[b] (9)	A. Kettle, Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity .–Productivity of black-legged kittiwakes in 2003 ranged from 0.08 chicks fledged per nest at Buldir Island to 0.80 chicks fledged per nest at Bluff (Table 12). Productivity was average or above average at all but one monitored Alaskan colony in 2003. The exception was Buldir Island where this species exhibited below average success this year (Fig. 21).

Table 12. Reproductive performance of black-legged kittiwakes at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest[a]	No. of Plots	No. of Nests	Reference
C. Lisburne	0.75[b]	N/A[c]	264	D. Roseneau Unpubl. Data
St. Lawrence I.	0.71	12	140	Sheffield et al. 2005
Bluff	0.80[b]	6	192	Murphy 2003
St. Paul I.	0.48	15	349	Polito and Drew 2003
St. George I.	0.32	5	121	McDonough and Erwin 2003
Cape Peirce	0.56	9	223	R. MacDonald Unpubl. Data
Round I.	0.48	5	50	Cody 2003
Buldir I.	0.08	7	213	Jones et al. 2005
Koniuji I.	0.60[b]	6	150	Barton and Lindquist 2003
Chiniak B.	0.31[b]	12	606	Kildaw et al. 2003
E. Amatuli I.	0.59	11	490	A. Kettle Unpubl. Data
Pr. Will. Snd.	0.34[b]	N/A	22,778	D. Irons Unpubl. Data

[a]Total chicks fledged/Total nests.
[b]Short visit.
[c]Not applicable or not reported.

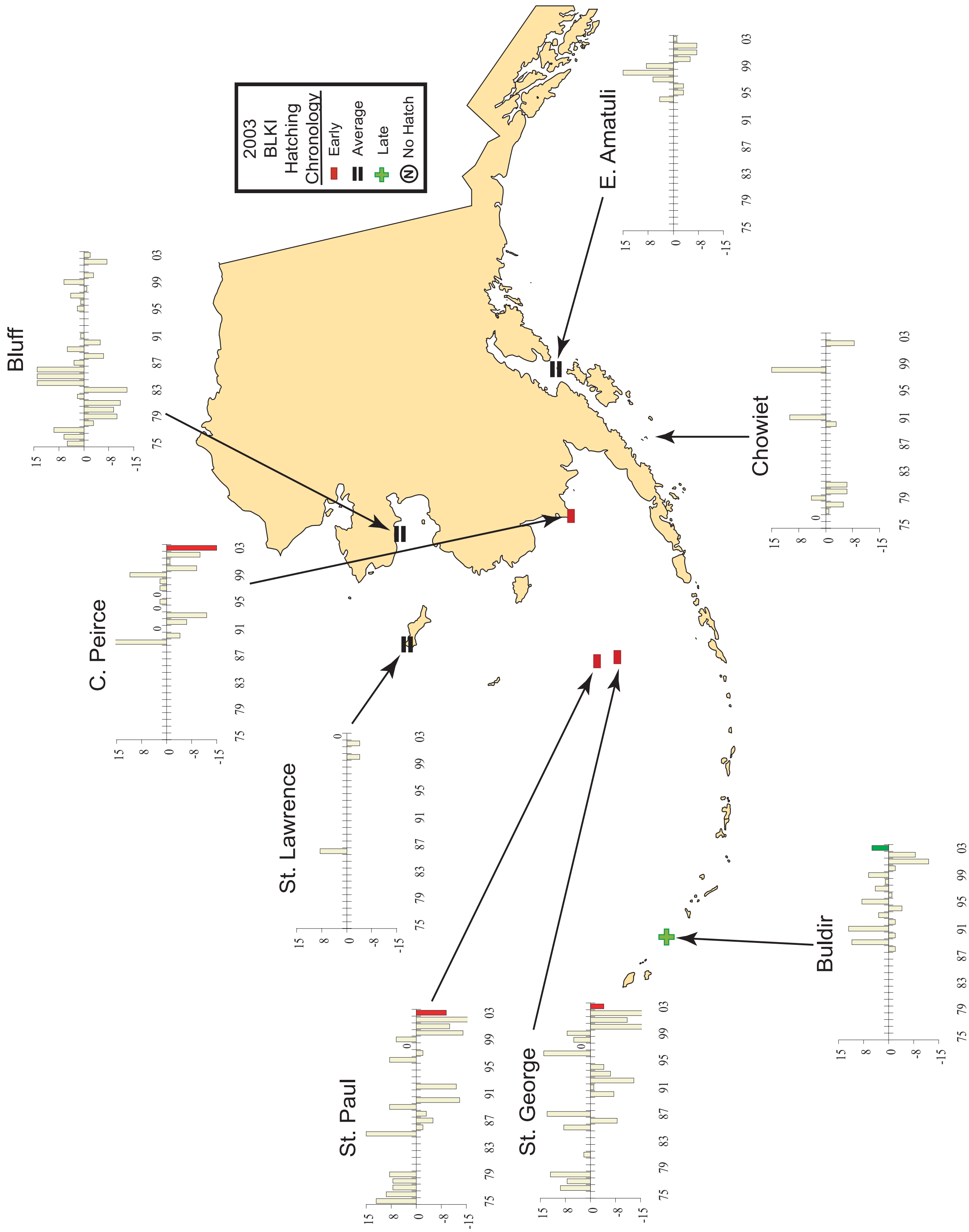


Figure 20. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

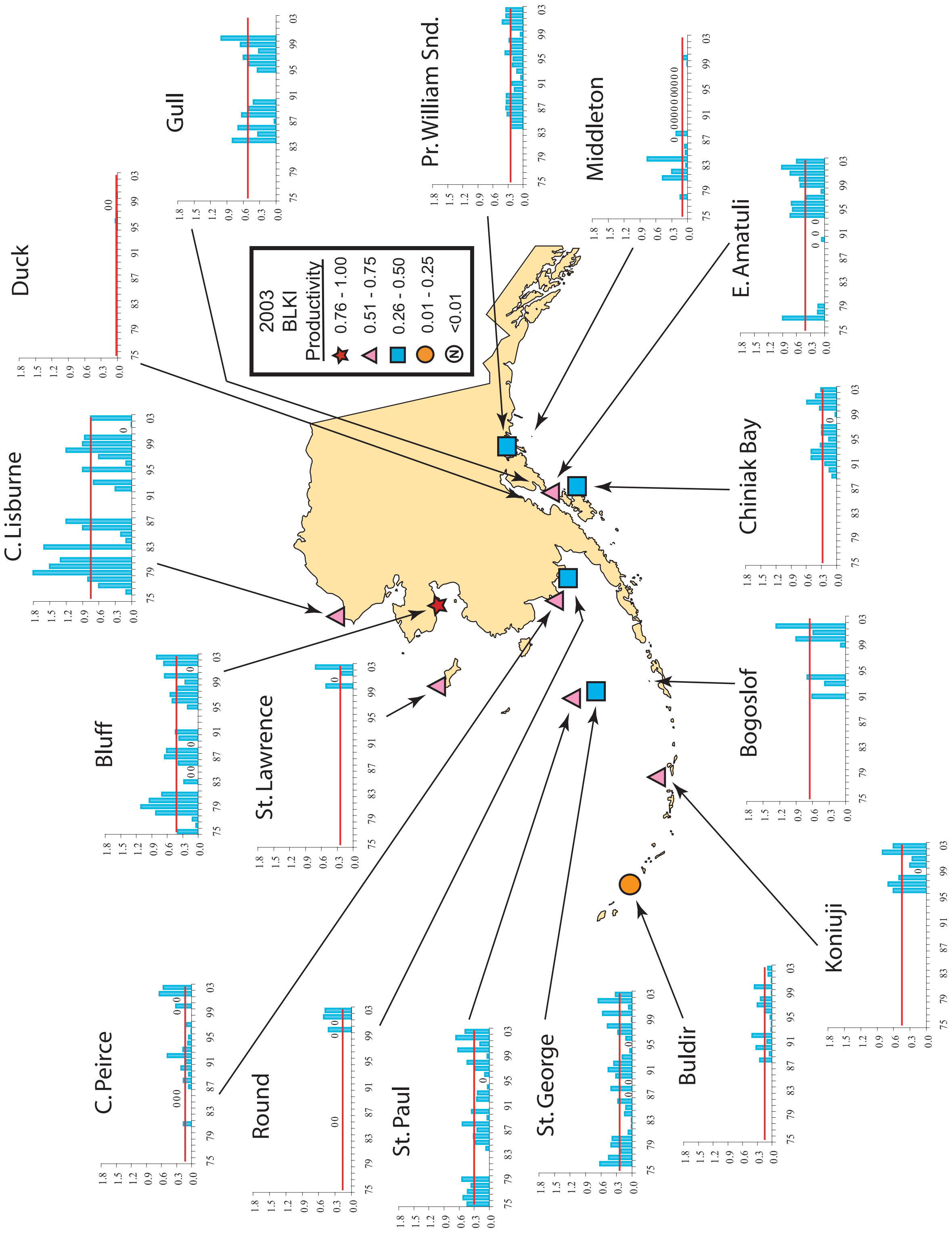


Figure 21. Productivity of black-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

<u>Populations</u>.–Significantly negative population trends occurred at St. Paul (-4.0% per annum), Chowiet (-1.9%), and Middleton (-7.5%) islands and at Cape Peirce (-6.4%, Fig. 22). Significant increases have occurred at Buldir Island (+6.6% per annum) and Prince William Sound (+1.6%). No other monitored colonies exhibited significant population changes.

<u>Diet</u>.–Diets of black-legged kittiwakes of the Aleutian Islands, Bering Sea and Chukchi Sea lacked the capelin and herring seen in the Gulf of Alaska diets (note that legends contain different prey types for the two areas.) Instead, there was a greater occurrence of walleye pollock, greenling, myctophids and euphausiids (Fig. 23). Pollock and Pacific sandlance occurred in significant amounts in the diets of Pribilof Island black-legged kittiwakes but did not occur in the diets of western Aleutian black-legged kittiwakes.

Gulf of Alaska black-legged kittiwakes relied most heavily upon Pacific sandlance and capelin. Black-legged kittiwakes in northern Prince William Sound (Shoup Bay) fed mostly on Pacific herring and sandlance (Fig. 24).

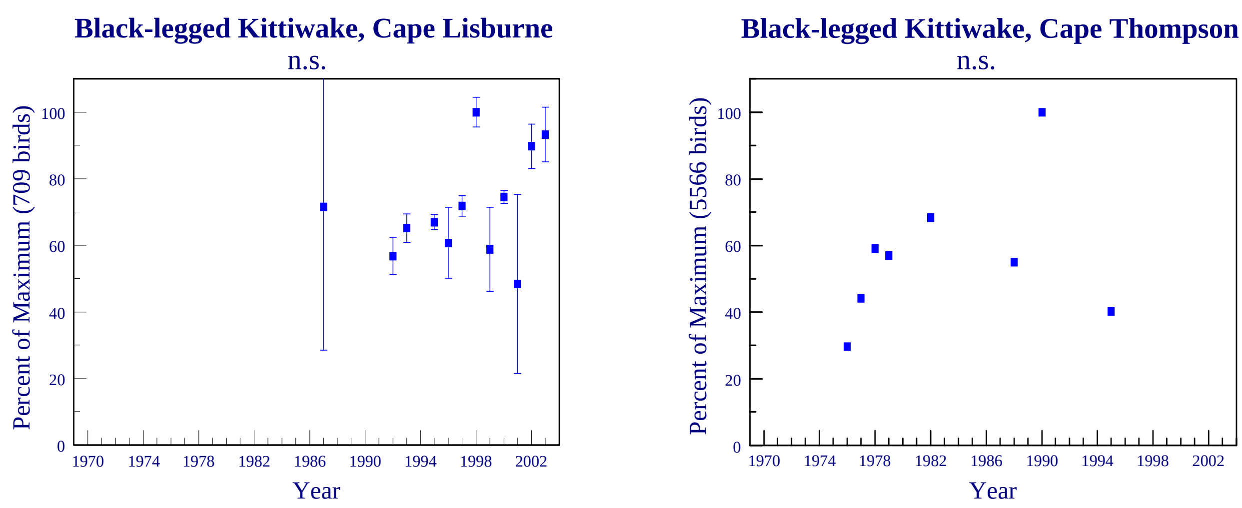


Figure 22. Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

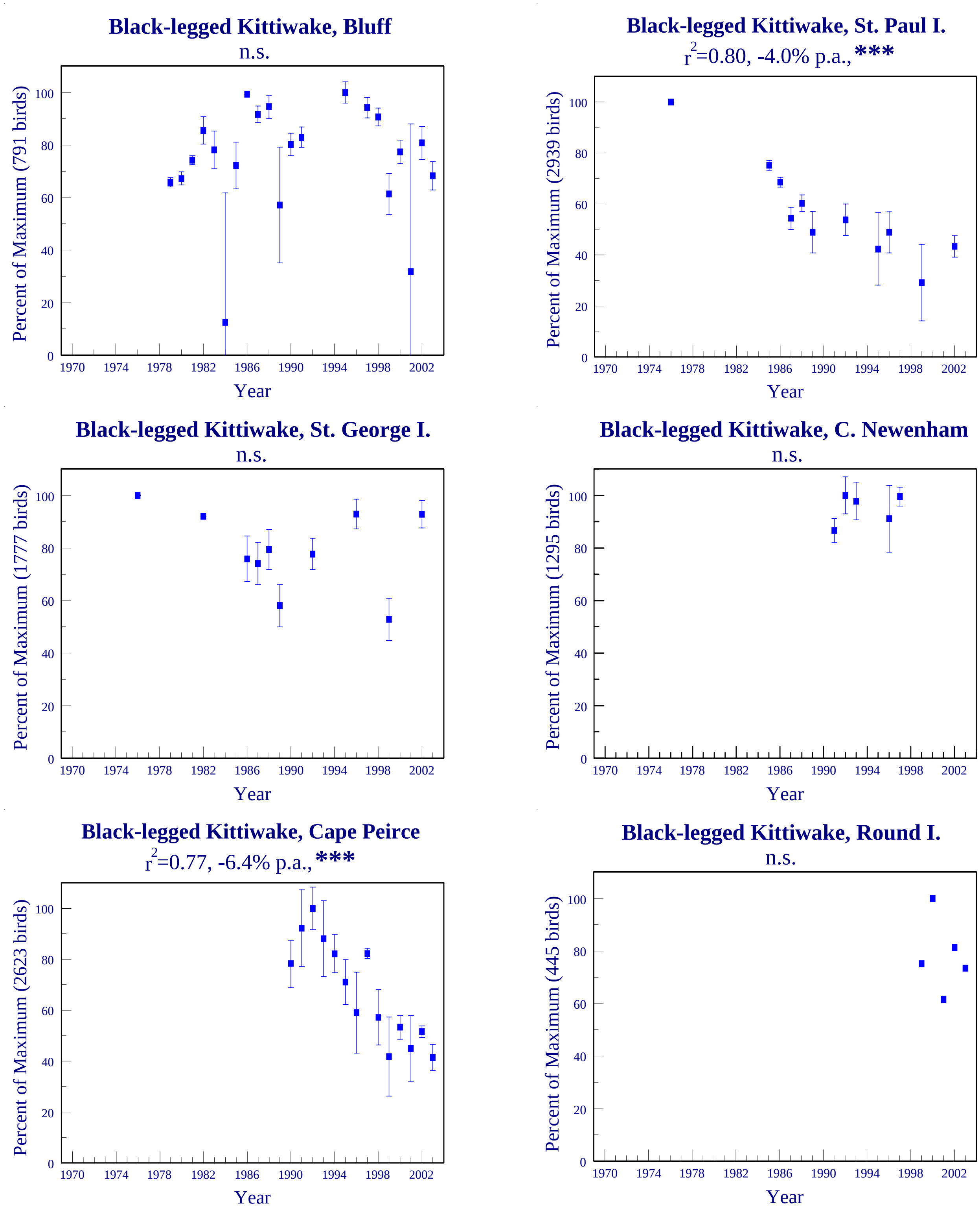


Figure 22 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

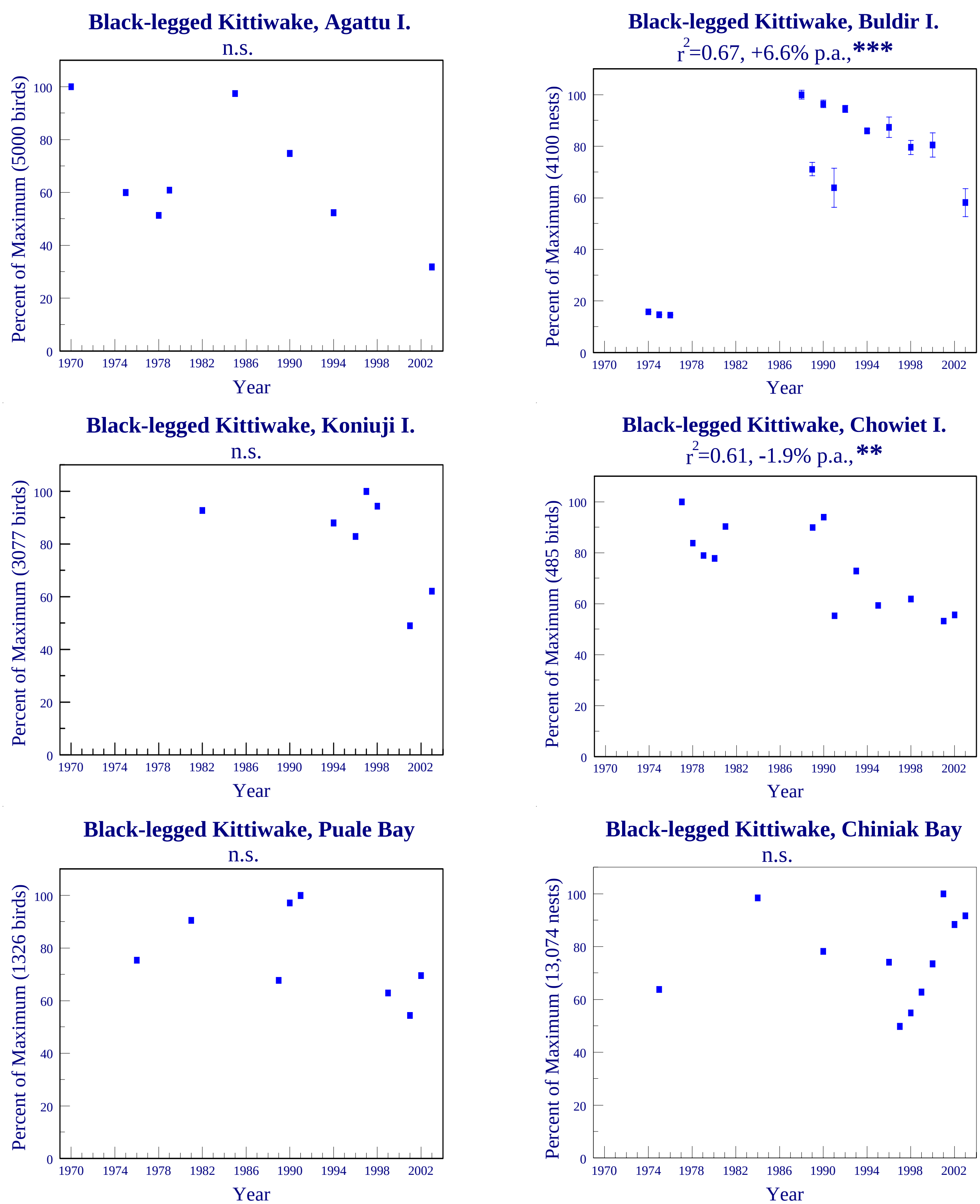


Figure 22 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

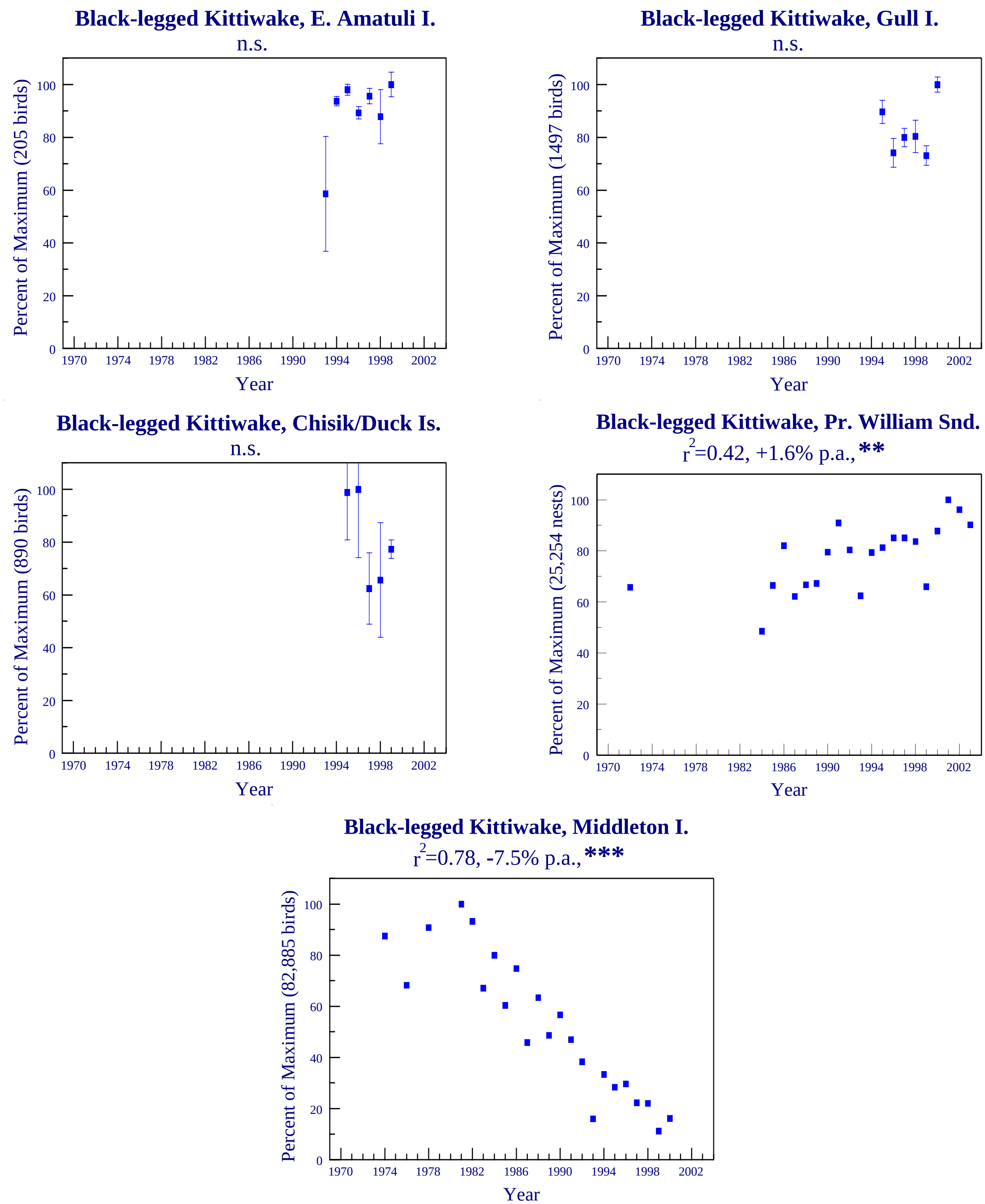


Figure 22 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

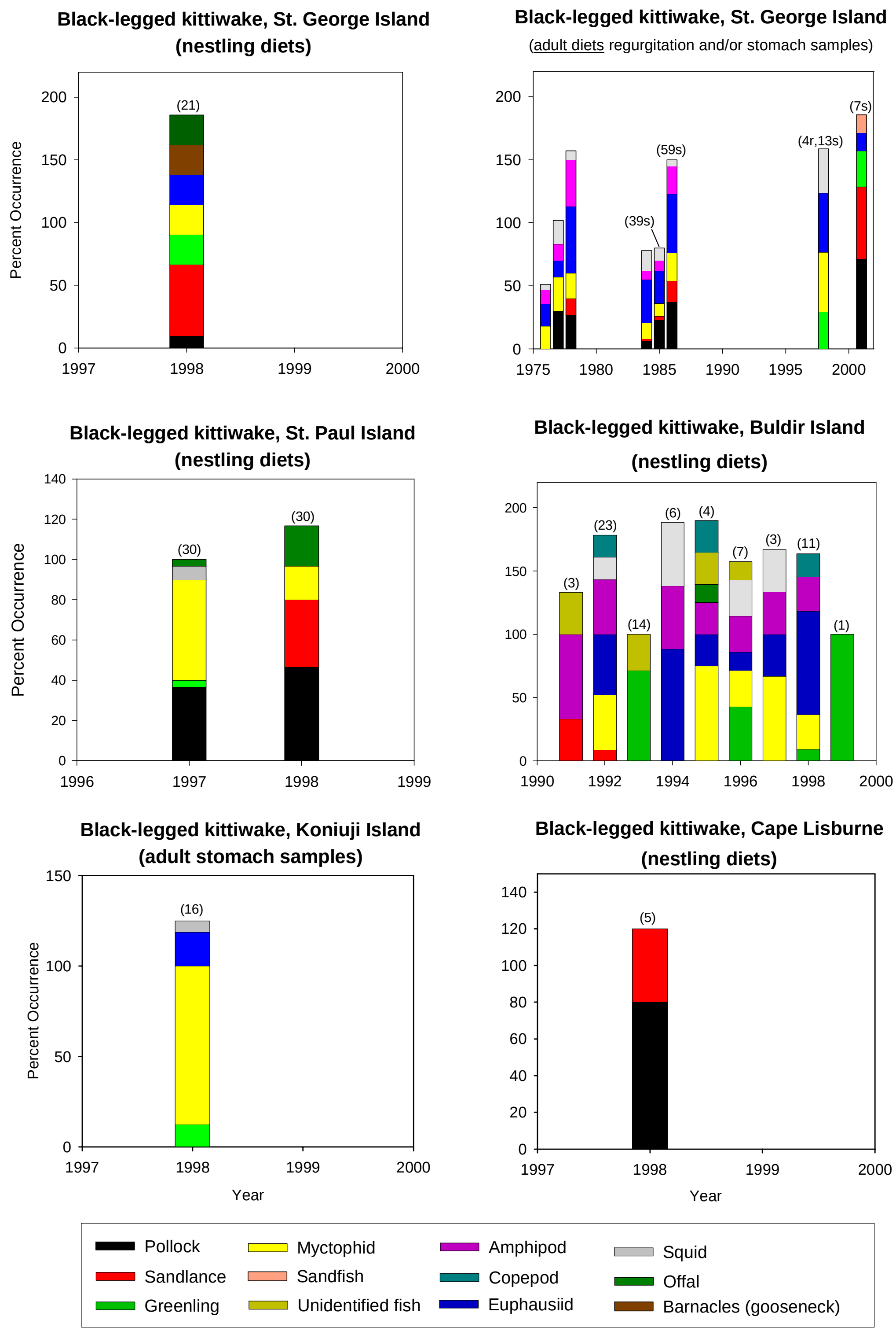


Figure 23. Diets of black-legged kittiwakes at Chukchi Sea and Bering Sea sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

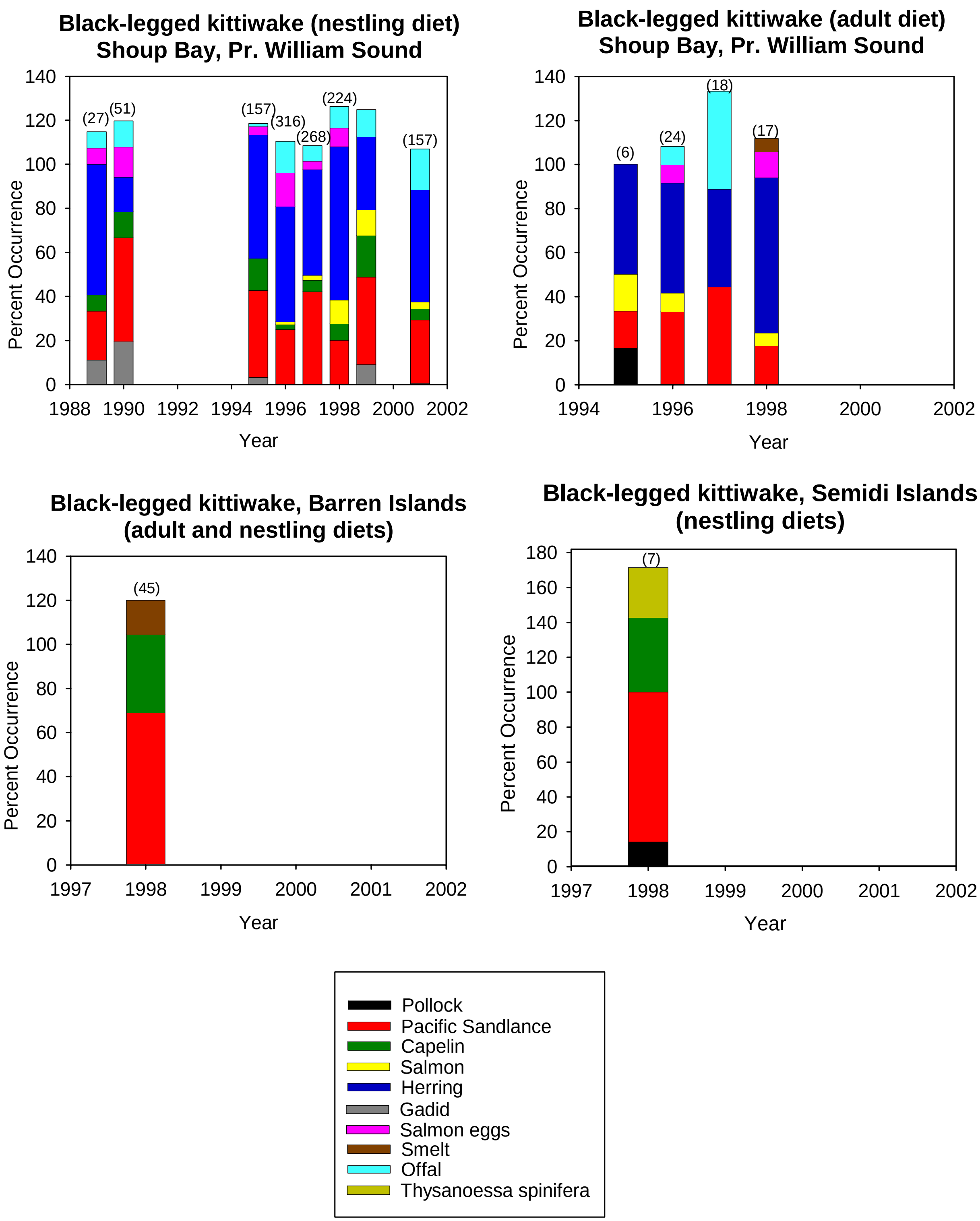
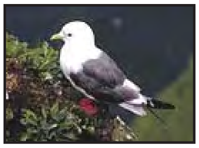


Figure 24. Diets of black-legged kittiwakes at Gulf of Alaska sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.



Red-legged Kittiwake (*Rissa brevirostris*)

Breeding Chronology .–Hatch date was late at St. Paul Island and early at St. George Island (Table 13, Fig. 25). There were not enough hatchlings at Buldir Island to calculate a mean hatch date for that colony in 2003 (J. Williams Unpubl. Data).

Table 13. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2003.

Site	Mean	Long-term Average	Reference
St. Paul I.	27 Jul (5)[a]	23 Jul[b] (18)[a]	Polito and Drew 2003
St. George I.	15 Jul (76)	19 Jul[b] (21)	McDonough and Erwin 2003

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.

[b]Mean of annual means.

Productivity .–In 2003, red-legged kittiwakes experienced about average productivity at St. George Island (Table 14, Fig. 26). Estimated productivity was below average at St. Paul and Buldir islands.

Table 14. Reproductive performance of red-legged kittiwakes at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest[a]	No. of Plots	No. of Nests	Reference
St. Paul I.	0.08	4	50	Polito and Drew 2003
St. George I.	0.23	10	277	McDonough and Erwin 2003
Buldir I.	0.12	N/A[b]	17	Jones et al. 2005

[a]Total chicks fledged/Total nests.

[b]Not applicable or not reported.

Populations .–Red-legged kittiwakes declined significantly at St. Paul (-2.6% per annum) and Koniuji (-15.6%) islands . This species exhibited a positive population trend at Buldir Island (+3.2% per annum), and no trend at St. George Island (Fig. 27).

Diet .–Myctophids dominated the diets of red-legged kittiwakes. Squid, amphipods, and euphausiids were of secondary importance at St. George and Buldir islands (Fig. 28). Walleye pollock and Pacific sandlance occurred only in minor amounts in red-legged kittiwake diets.

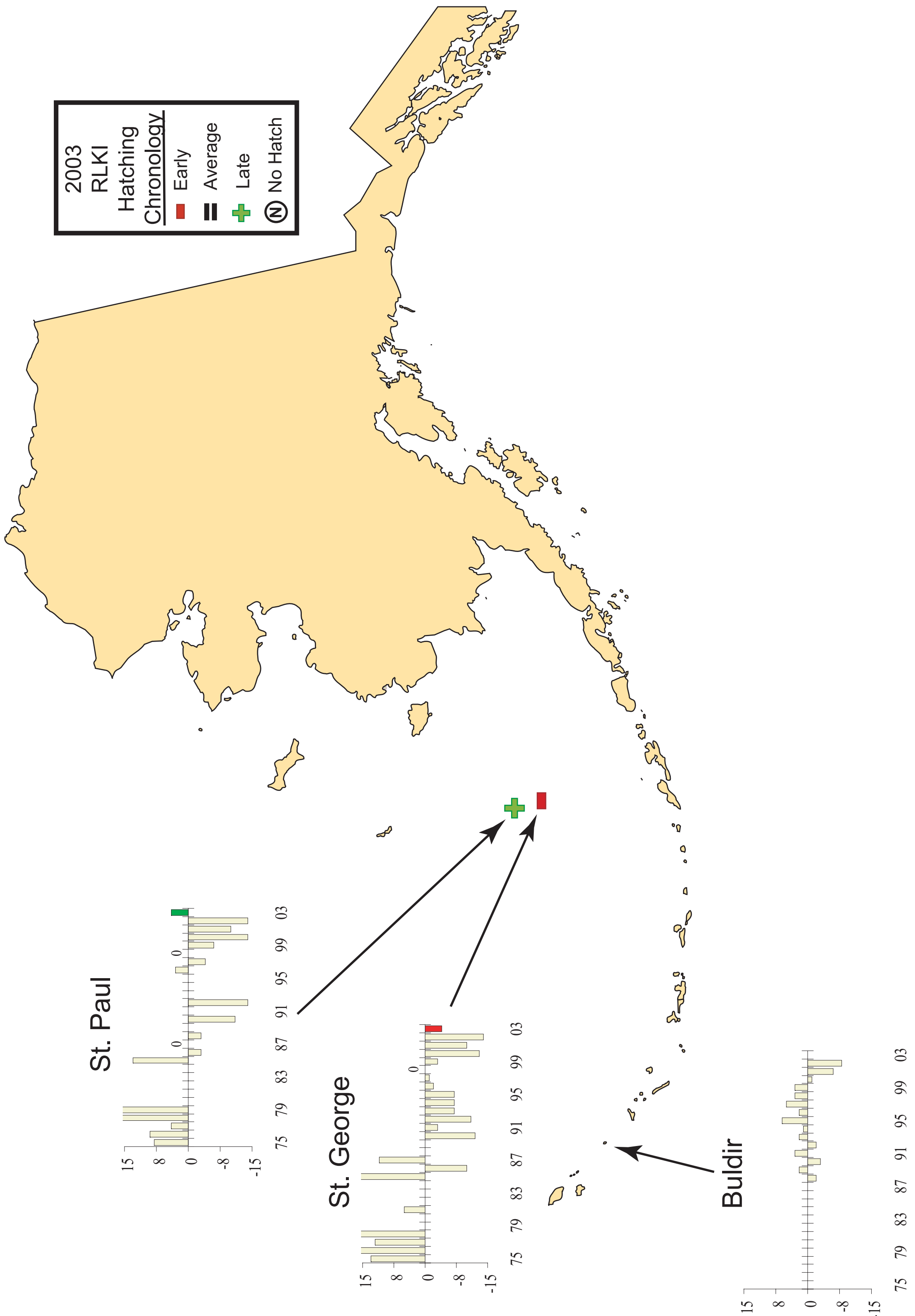


Figure 25. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

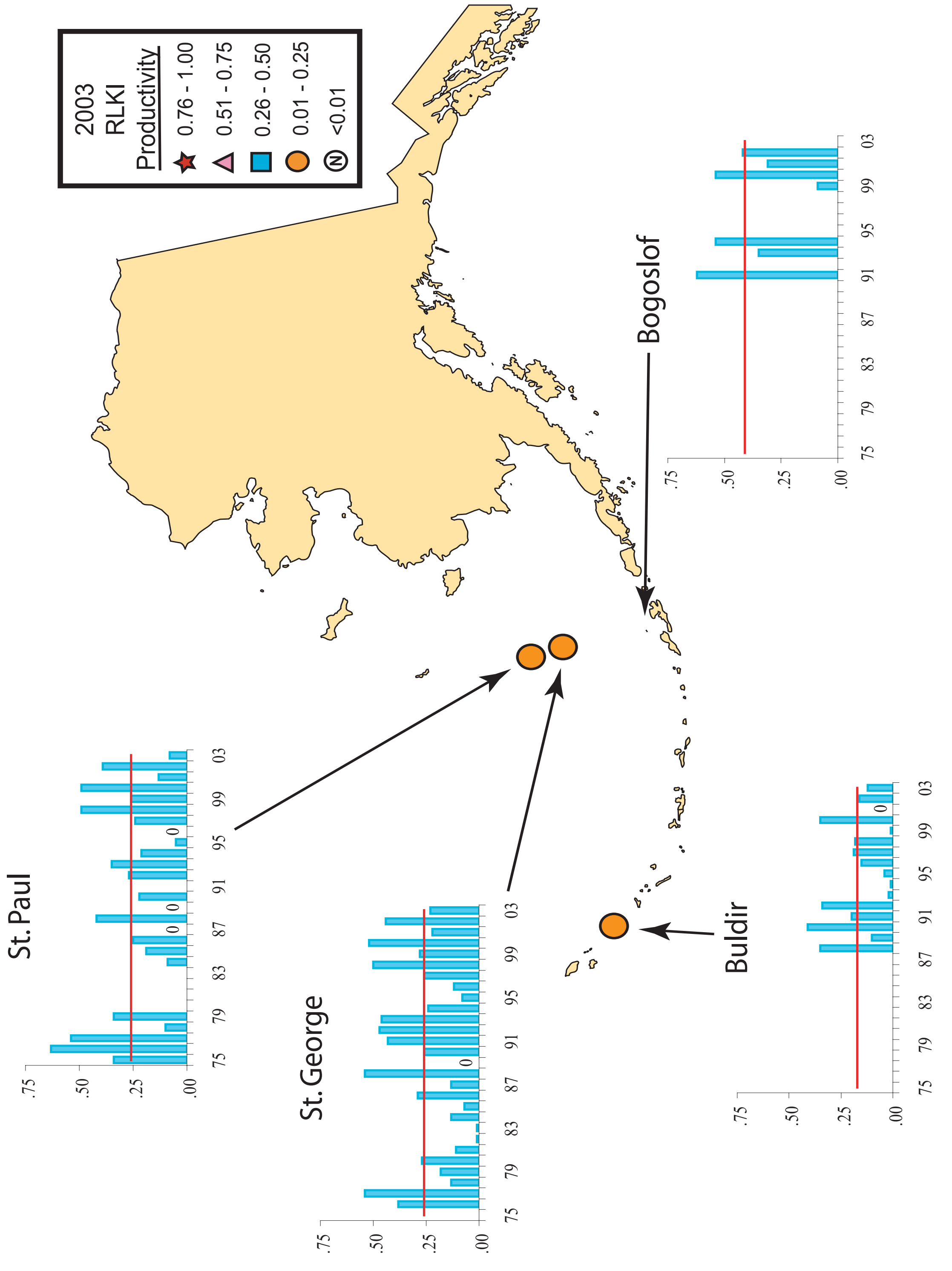


Figure 26. Productivity of red-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

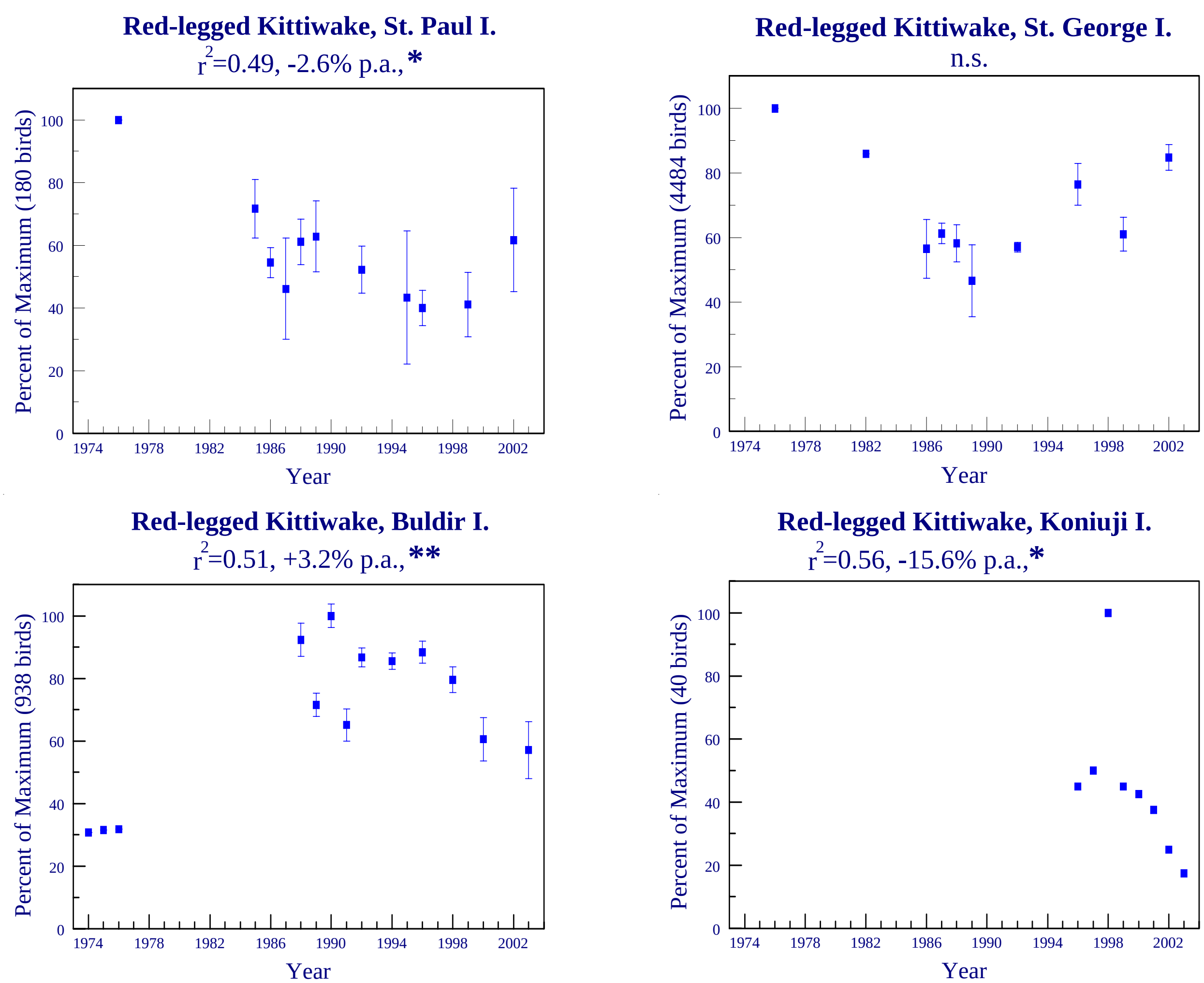


Figure 27. Trends in populations of red-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

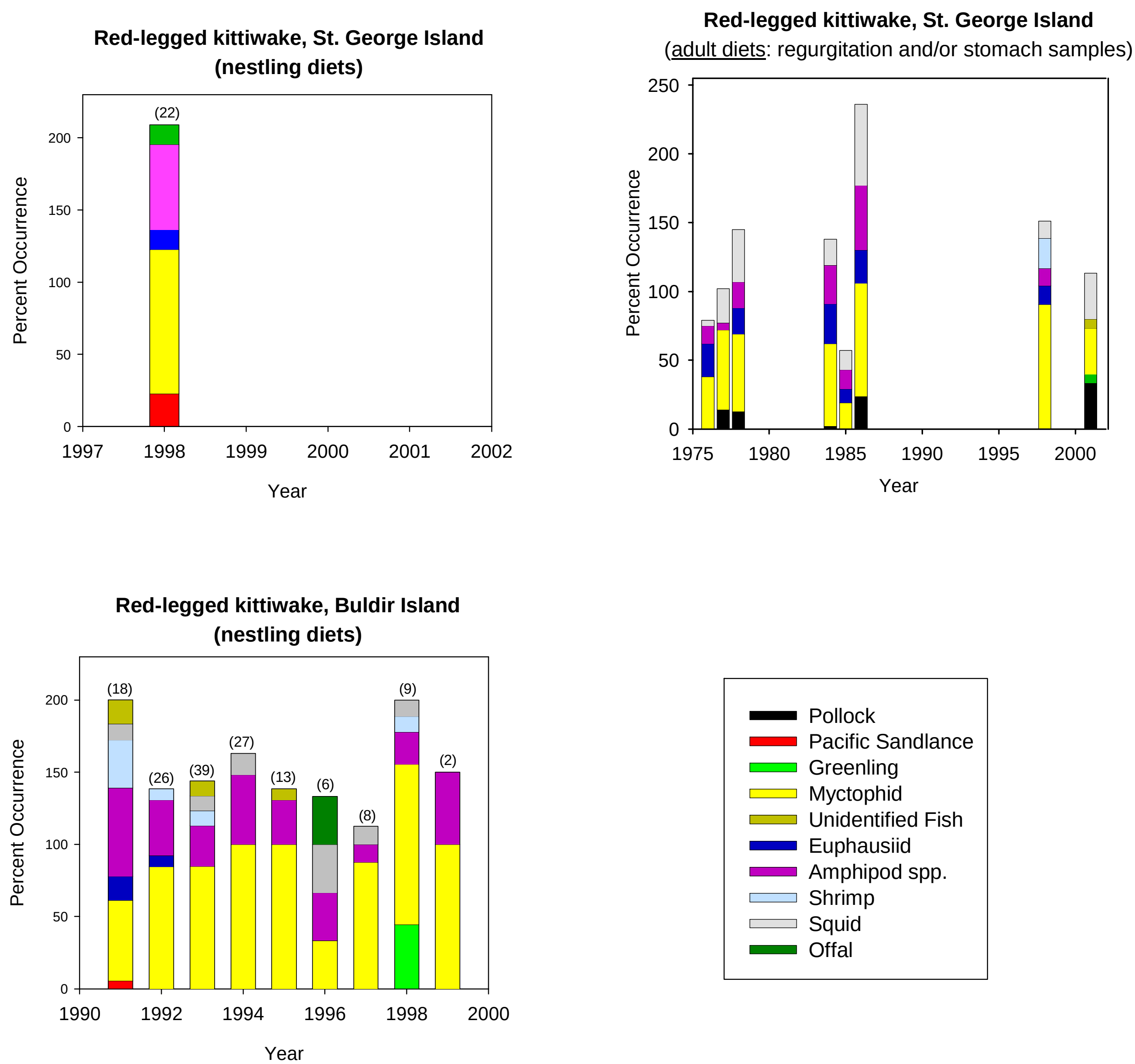
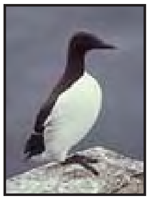


Figure 28. Diets of red-legged kittiwakes at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.



Common Murre (*Uria aalge*)

Breeding Chronology.–Timing of common murre nesting events in 2003 was earlier than average at six of the nine monitored sites (where eggs were laid) and average at the remainder (Table 15, Fig. 29).

Table 15. Hatching chronology of common murres at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	20 Jul (30)[a]	—	2 Aug[b] (4)[a]	Sheffield et al. 2005
Bluff	22 Jul (N/A[c])	—	26 Jul[b] (26)	Murphy 2003
St. Paul I.	—	29 Jul (51)	5 Aug[d] (18)	Polito and Drew 2003
St. George I.	—	1 Aug (24)	4 Aug[d] (19)	McDonough and Erwin 2003
Cape Peirce	—	15 Jul (104)	22 Jul[d] (14)	R. MacDonald Unpubl. Data
Buldir I.	19 Jul (7)	21 Jul (7)	18 Jul[d] (6)	Jones et al. 2005
Puale B.	—	16 Aug (284)	23 Aug[d] (6)	Levandoski and Savage 2004
E. Amatuli I.	11 Aug (158)	9 Aug (158)	6 Aug[d] (10)	A. Kettle Unpubl. Data
St. Lazaria I.	—	4 Aug (53)	13 Aug[d] (9)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual medians.
[c]Not applicable or not reported.
[d]Mean of annual means.

Productivity.–Common murre productivity was average or above average at all but two of the sites monitored in 2003 (Table 16, Fig. 30). No murres laid eggs and no chicks were produced for the sixth consecutive year at Kasatochi Island. Productivity also was below average at St. George Island in 2003.

Populations.–At sites where counts of murres are made from the water, it is difficult to accurately assign every individual to a species. As a result, common and thick-billed murres often are combined at these colonies for population trend analysis. We found significant negative trends in common murre numbers at St. Paul and Chisik/Duck islands (-3.6% and -9.0% per annum, respectively) as well as at Cape Peirce (-4.5% per annum). We found a positive trend for this species at Gull Island (+7.1% per annum, Fig. 31). Where murres were not identified to species, we found significant negative trends at Middleton and St. Lazaria islands (-4.9% and -4.6 % per annum, respectively). Significant positive trends were evident for murres at Cape Lisburne (+4.6% per annum), and Agattu and Chowiet islands (+2.7% and +0.9% per annum, respectively, Fig. 31).

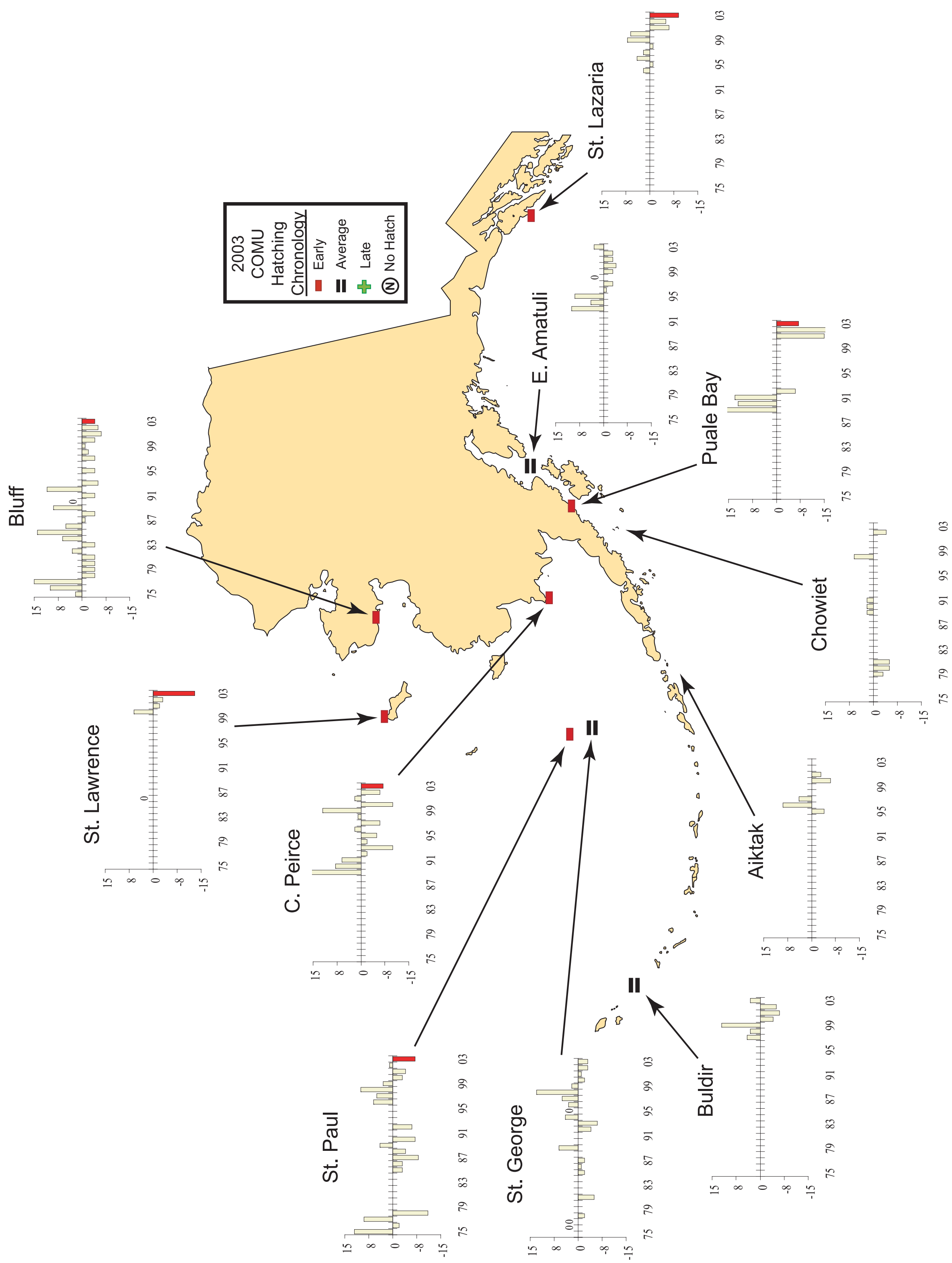


Figure 29. Hatching chronology of common murres at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

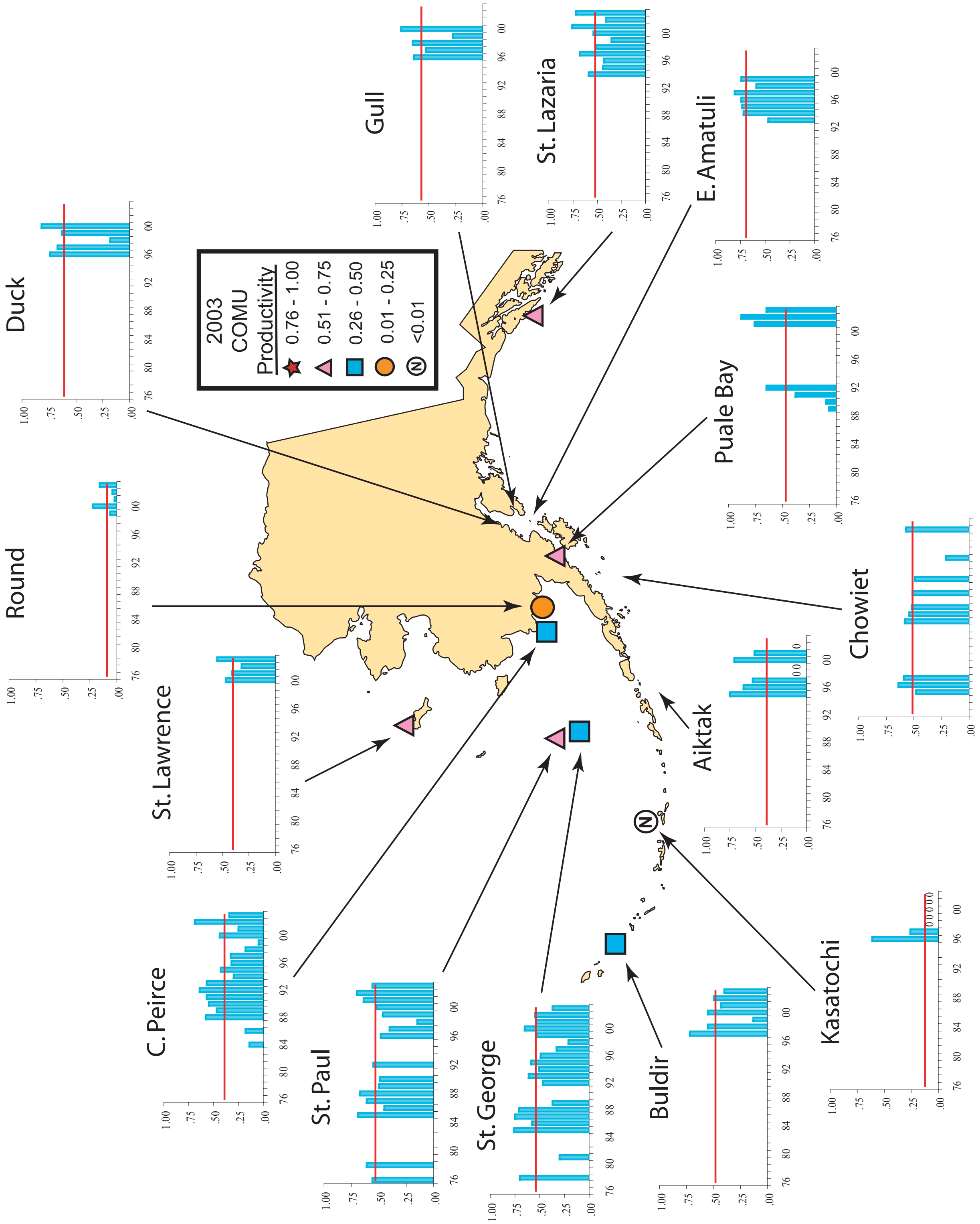


Figure 30. Productivity of common murres (chicks fledged/nest site) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

Table 16. Reproductive performance of common murres at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
St. Lawrence I.	0.55	7	42	Sheffield et al. 2005
St. Paul I.	0.56	6	129	Polito and Drew 2003
St. George I.	0.37	6	110	McDonough and Erwin 2003
Cape Peirce	0.34	7	179	R. MacDonald Unpubl. Data
Round I.	0.16	5	50	Cody 2003
Buldir I.	0.40	N/A[b]	15	Jones et al. 2005
Kasatochi I.	0.00	N/A	0	Barton and Lindquist 2003
Puale B.	0.65	17	470	Levandoski and Savage 2004
St. Lazaria I.	0.72	N/A	69	L. Slater Unpubl. Data

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.

[b]Not applicable or not reported.

Diet .–Common murre diets exhibited significant geographic variability. St. George Island common murres ate euphausiids and walleye pollock with lesser amounts of squid (Fig. 32). Common murres from Buldir and Koniuji islands ate predominantly squid with lesser amounts of pollock and Pacific herring. Common murres at Chowiet and Aiktak islands ate mostly Pacific sandlance and pollock.

Barren islands Common murres fed their chicks almost exclusively capelin (Fig. 32). Note that the Barren Islands data were from a large number of bill load observations while the other locations had smaller numbers of adult stomach samples. The prey items brought to chicks may differ from the prey adults select for themselves.

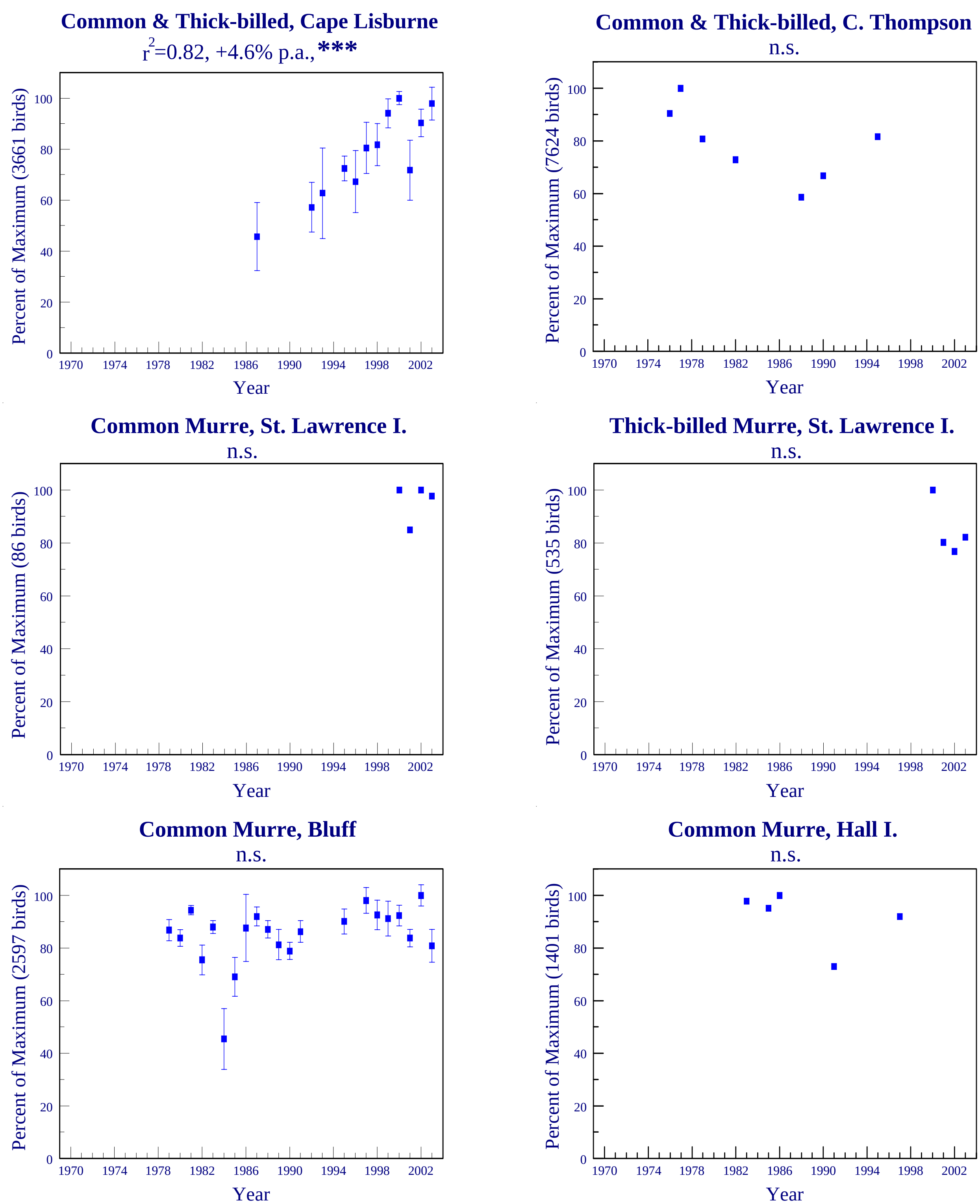


Figure 31. Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

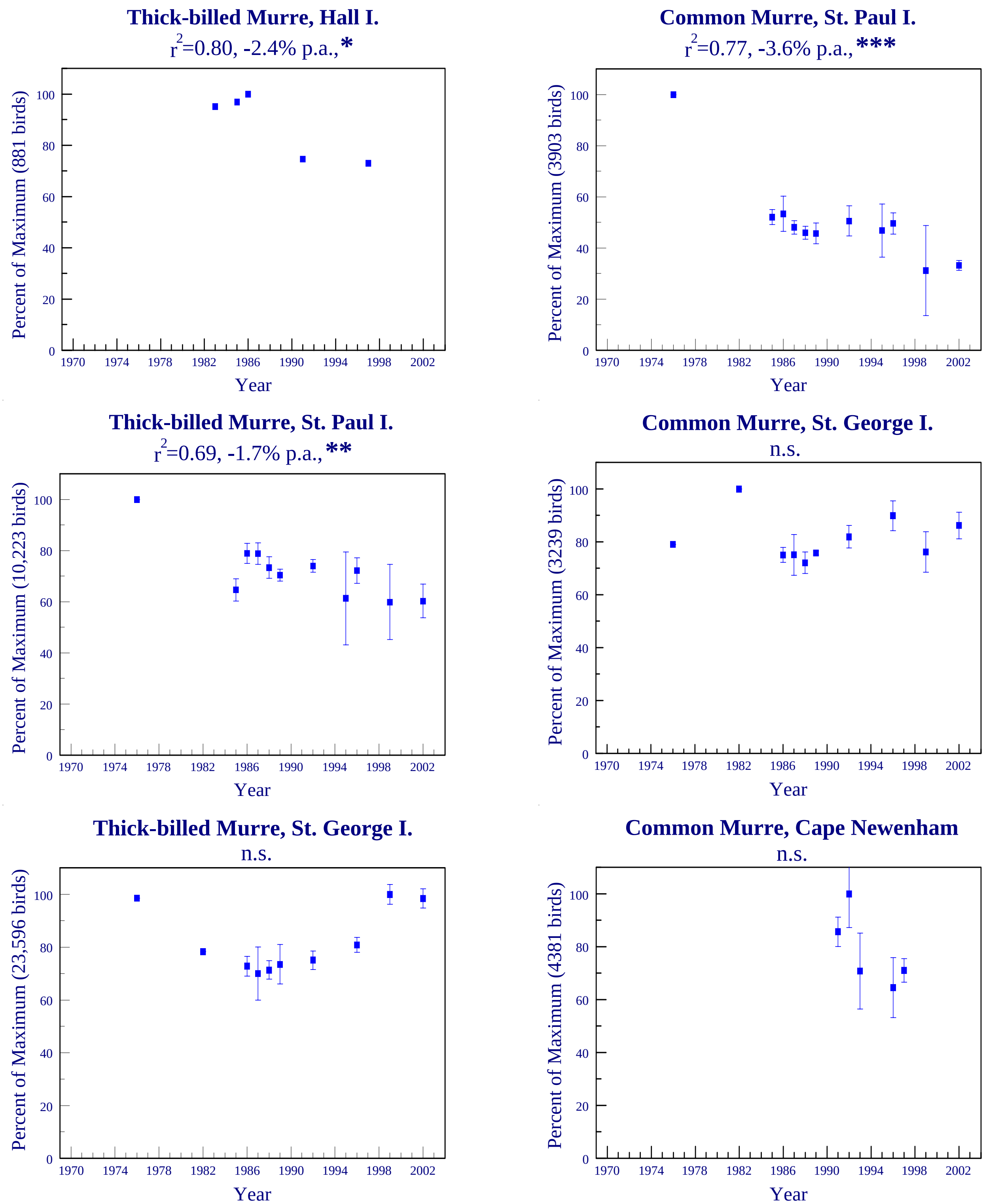


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

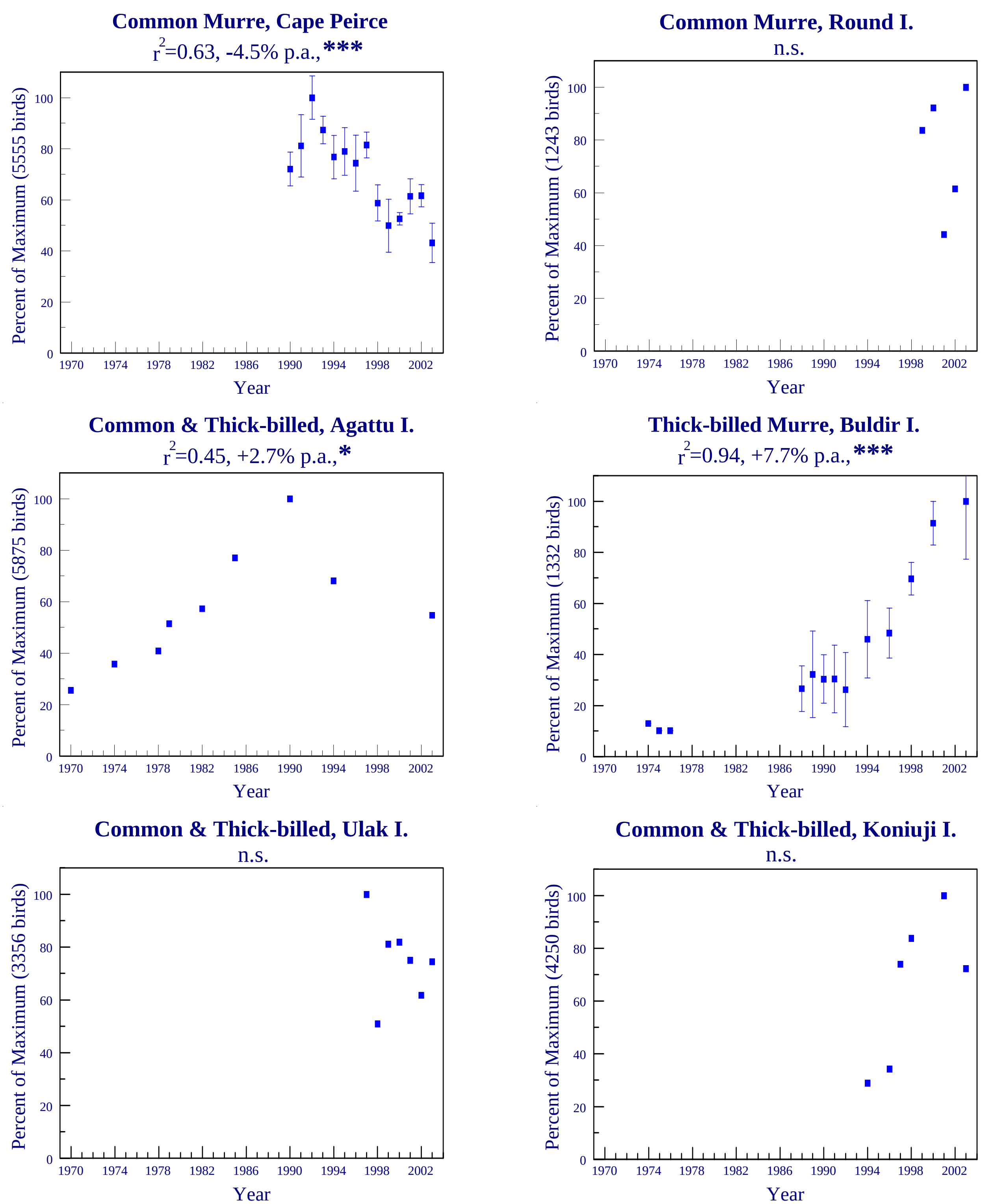


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

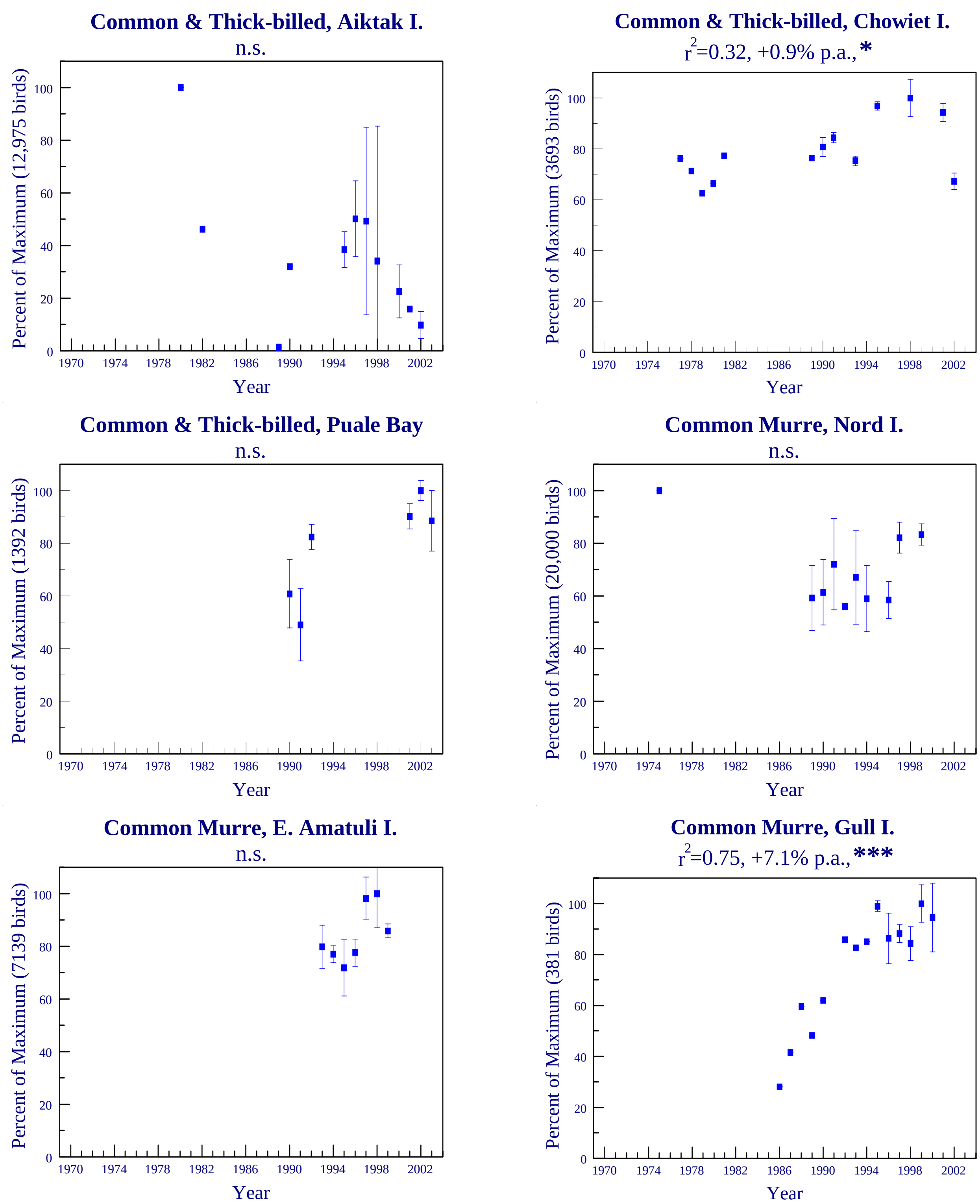


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

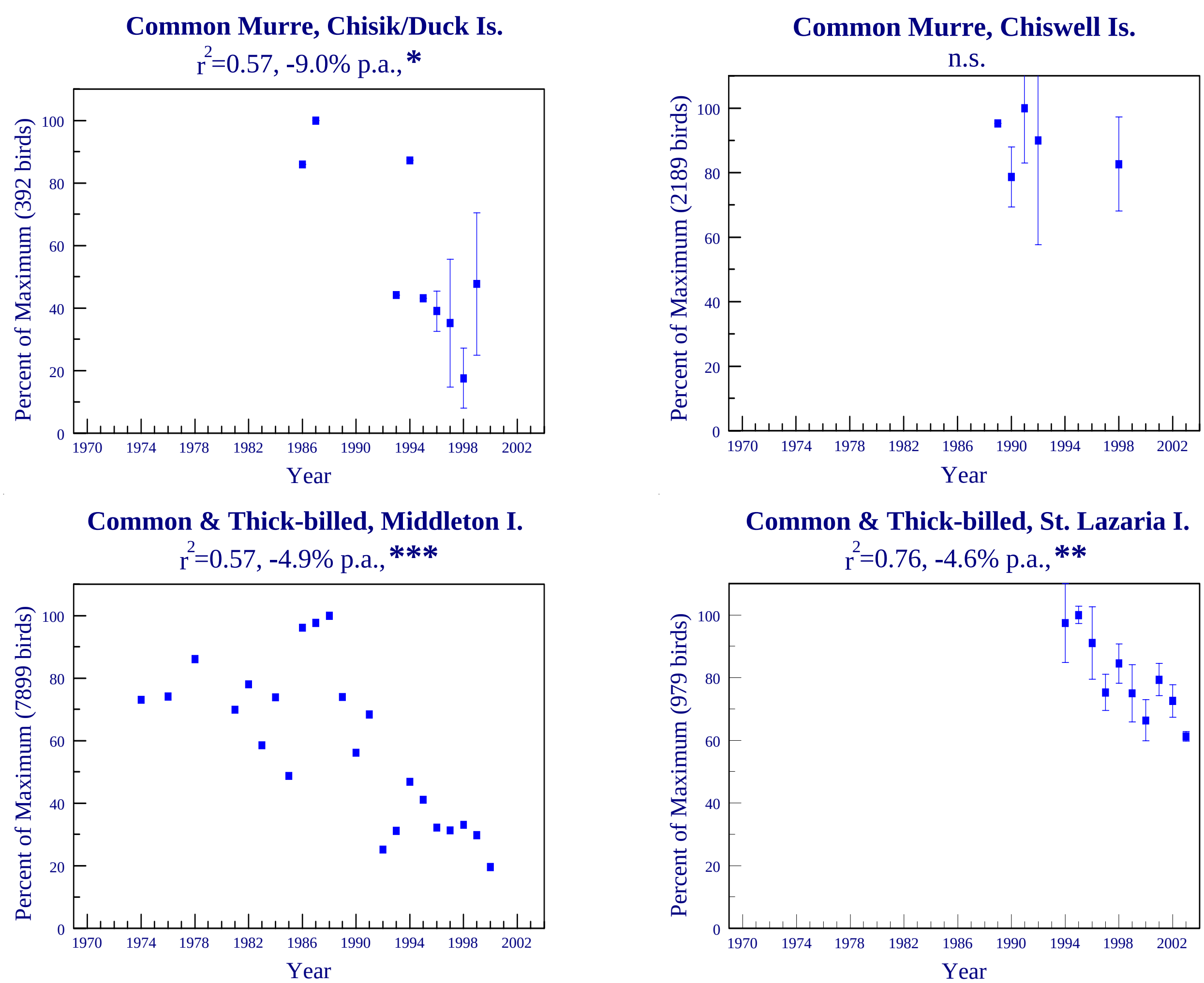


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

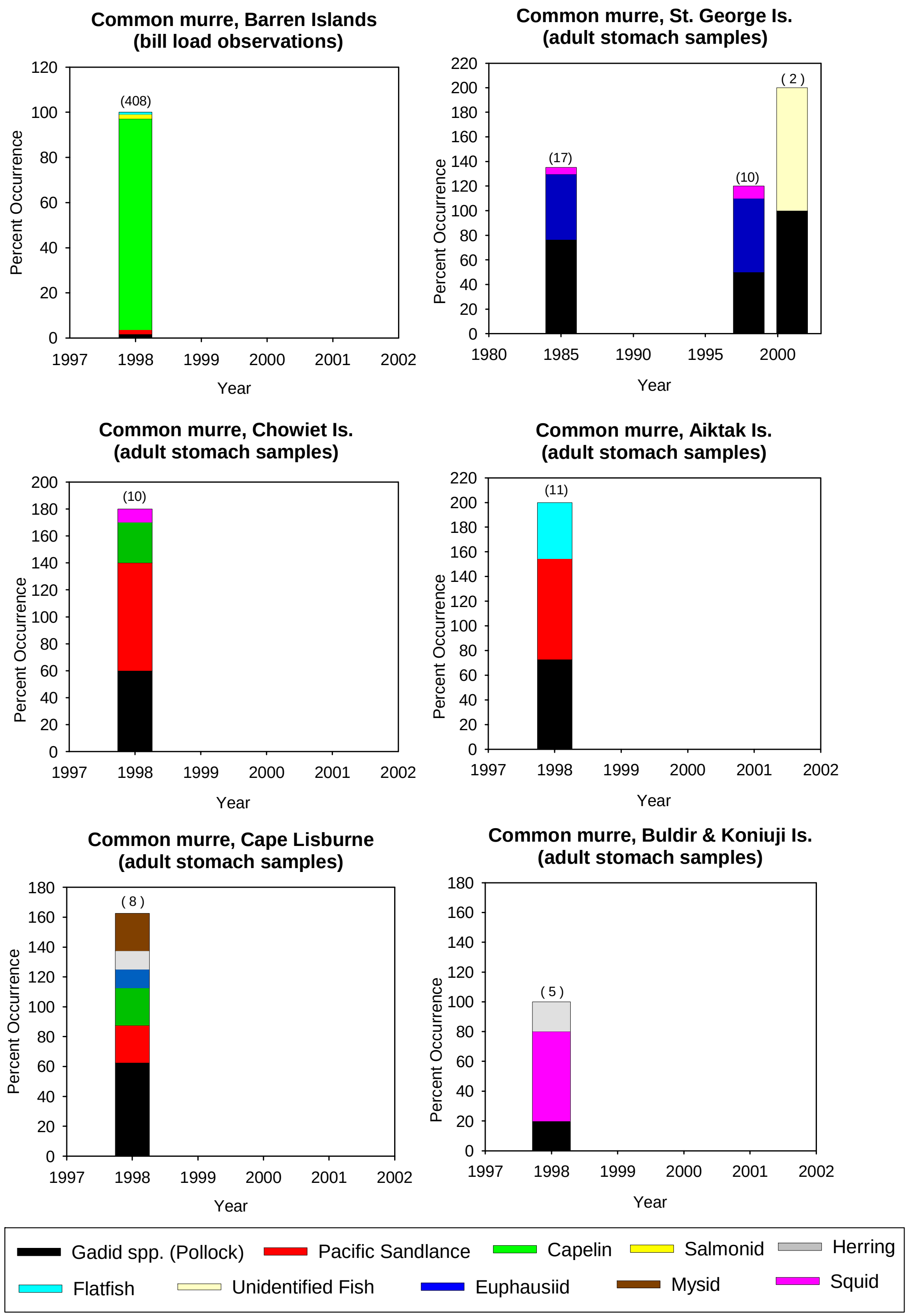


Figure 32. Diets of common murres at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Thick-billed Murre (*Uria lomvia*)

Breeding Chronology .–In 2003, thick-billed murre chicks hatched on about average dates at the Pribilof Islands, were late at Buldir Island, and early at St. Lawrence and St. Lazaria islands and Puale Bay. (Table 17, Fig. 33).

Table 17. Hatching chronology of thick-billed murres at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	19 Jul (122)[a]	—	1 Aug[b] (4)[a]	Sheffield et al. 2005
St. Paul I.	—	7 Aug (145)	5 Aug[c] (18)	Polito and Drew 2003
St. George I	—	28 Jul (99)	31 Jul[c] (21)	McDonough and Erwin 2003
Buldir I.	19 Jul (316)	20 Jul (316)	16 Jul[c] (15)	Jones et al. 2005
Puale B.	—	17 Aug (10)	21 Aug[c] (6)	Levandoski and Savage 2004
St. Lazaria I.	—	31 Jul (39)	10 Aug[c] (9)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.

[b]Mean of annual medians

[c]Mean of annual means.

Productivity .–Rates of success in 2003 were average or above at most monitored colonies (Table 18, Fig. 34). Thick-billed murres laid no eggs and failed to produce any young for the sixth year in a row at Kasatochi Island.

Table 18. Reproductive performance of thick-billed murres at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
St. Lawrence I.	0.45	9	171	Sheffield et al. 2005
St. Paul I.	0.46	20	425	Polito and Drew 2003
St. George I.	0.43	15	418	McDonough and Erwin 2003
Buldir I.	0.70	7	318	Jones et al. 2005
Kasatochi I.	0.00	N/A[b]	0	Barton and Lindquist 2003
Puale B.	0.58	N/A	24	Levandoski and Savage 2004
St. Lazaria I.	0.75	N/A	48	L. Slater Unpubl. Data

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.

[b]Not applicable or not reported.

Populations .–Thick-billed murres declined at Hall and St. Paul islands (-2.4% and -1.7% per annum, respectively) and increased at Buldir Island (+7.7% per annum, Fig. 31).

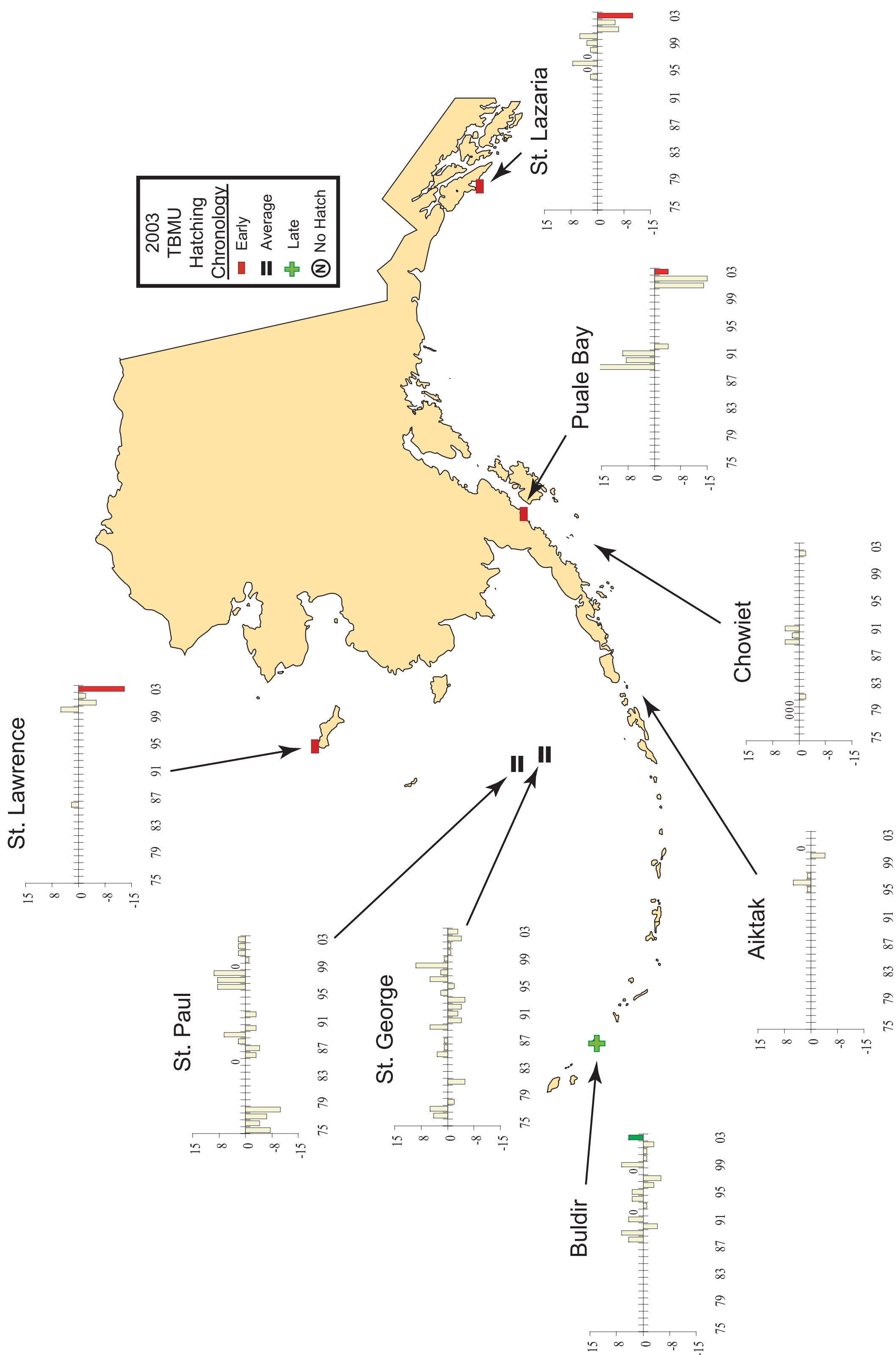


Figure 33. Hatching chronology of thick-billed murre at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

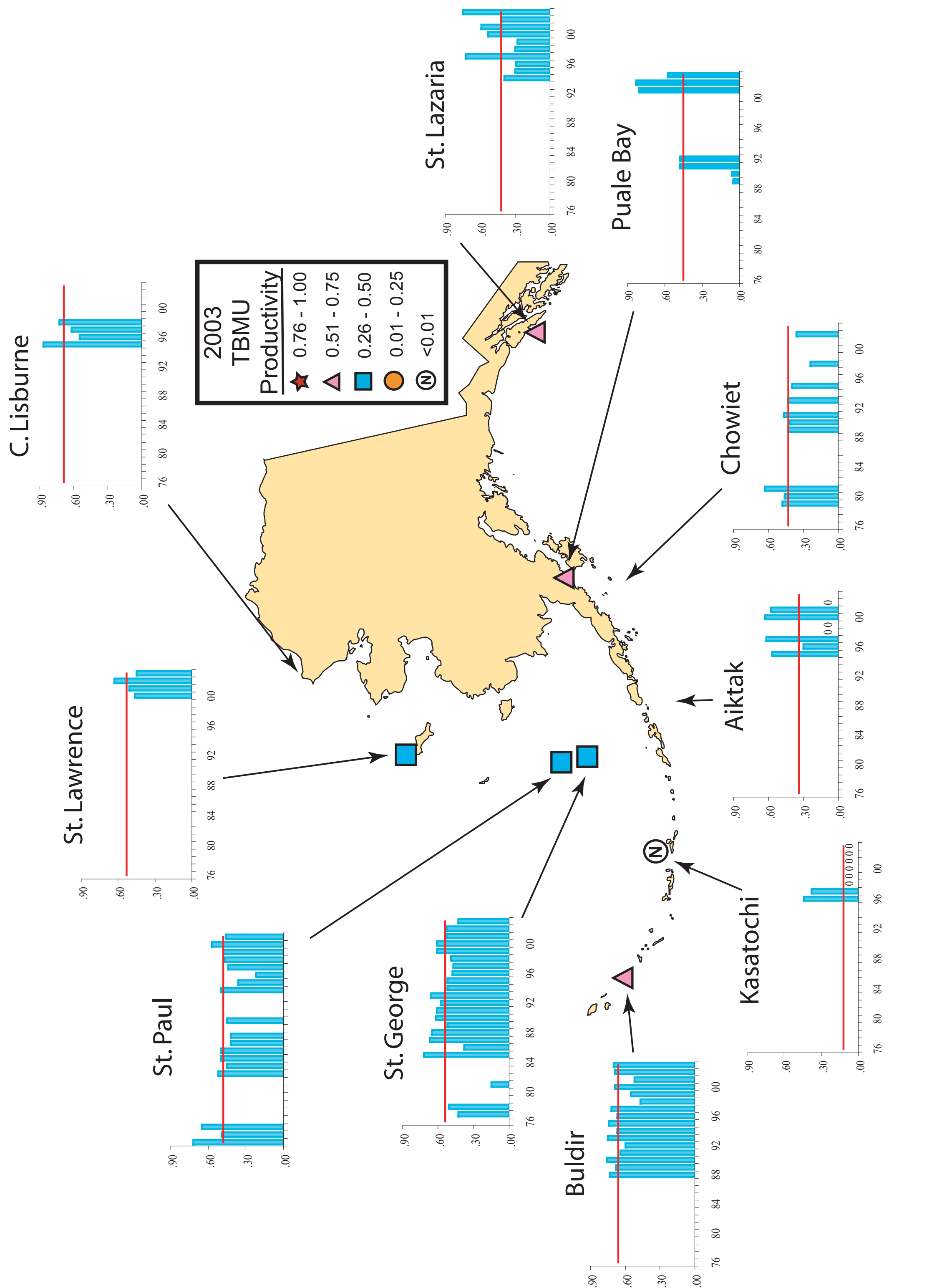


Figure 34. Productivity of thick-billed murres (chicks fledged/nest site) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

Diet.–Cape Lisburne thick-billed murre diets consisted of a majority of flatfish, sculpin and walleye pollock (Fig. 35). Thick-billed murre diets at St. George Island consisted entirely of pollock, unidentified fish, euphausiids and squid. The frequency at which these prey groups occurred varied widely among years. At Buldir Island, thick-billed murres ate almost exclusively squid with some myctophids. Thick-billed murre diets at Aiktak Island consisted of pollock and Pacific sandlance.

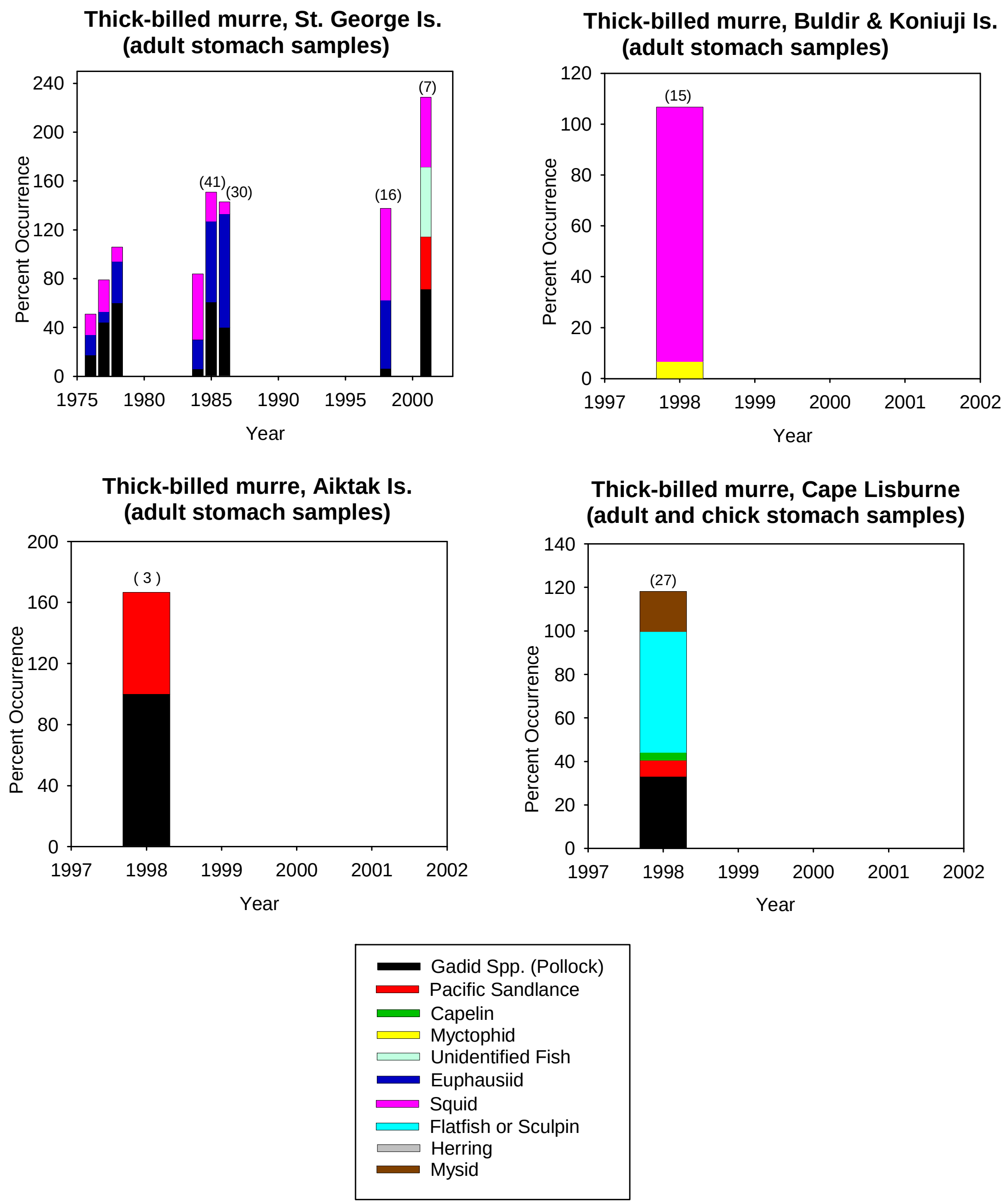


Figure 35. Diets of thick-billed murres at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Pigeon Guillemot (*Cepphus columba*)

Breeding Chronology.–No data.

Productivity.–No data.

Populations.–We found a significant negative population trend for pigeon guillemots at Aiktak Island (-5.8% per annum) and at Prince William Sound (-6.7%), but not for populations at other sites (Fig. 36).

Diet.–In a small sample from Aiktak Island, pigeon guillemot diets consisted of greenling and sculpin (Fig. 37).

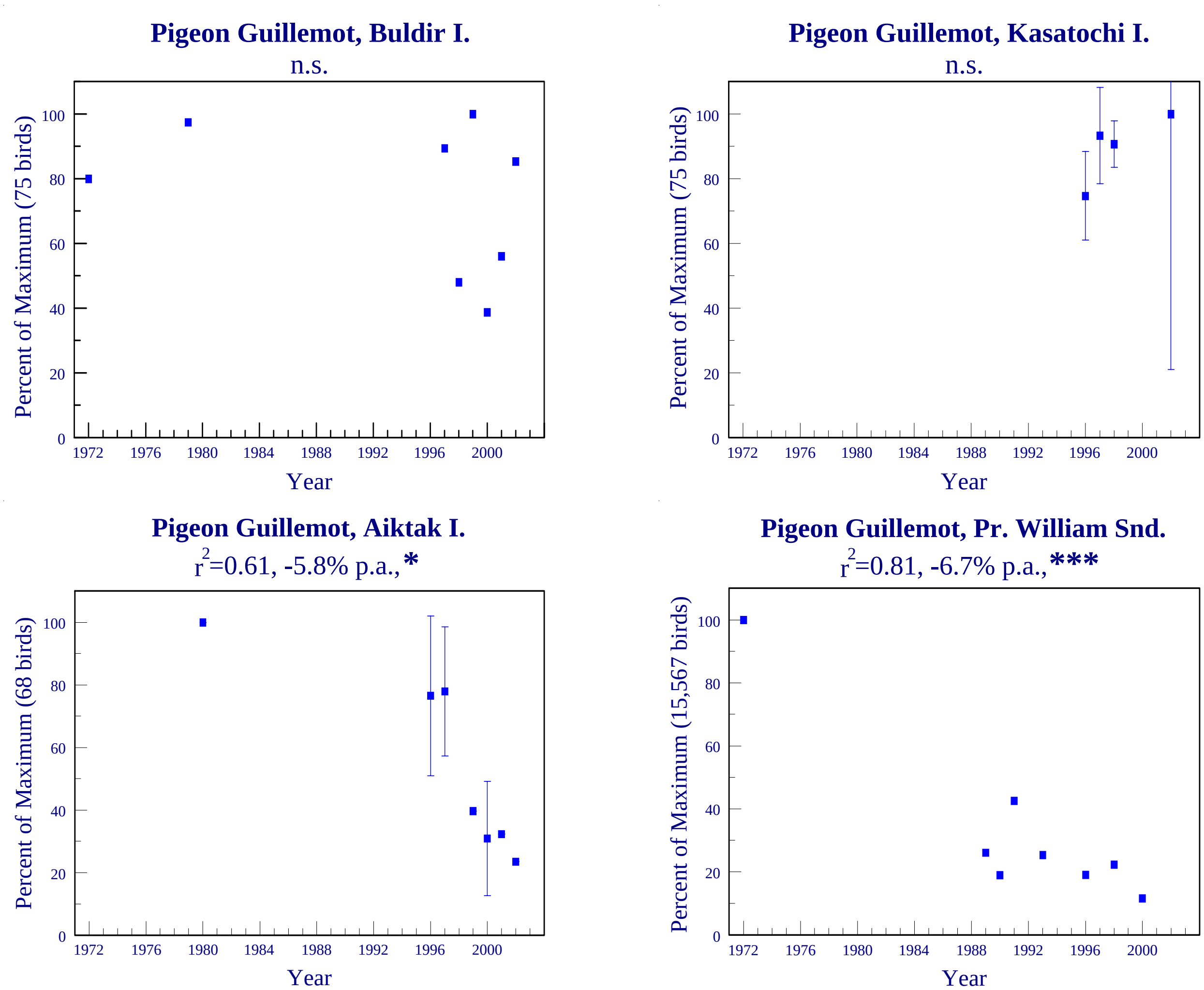


Figure 36. Trends in populations of pigeon guillemots at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

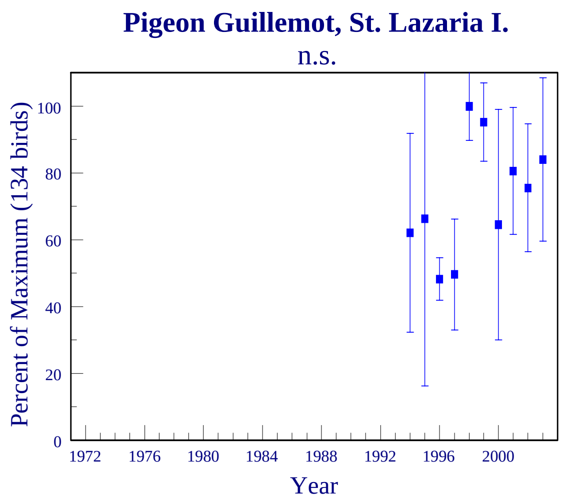


Figure 36 (continued). Trends in populations of pigeon guillemots at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

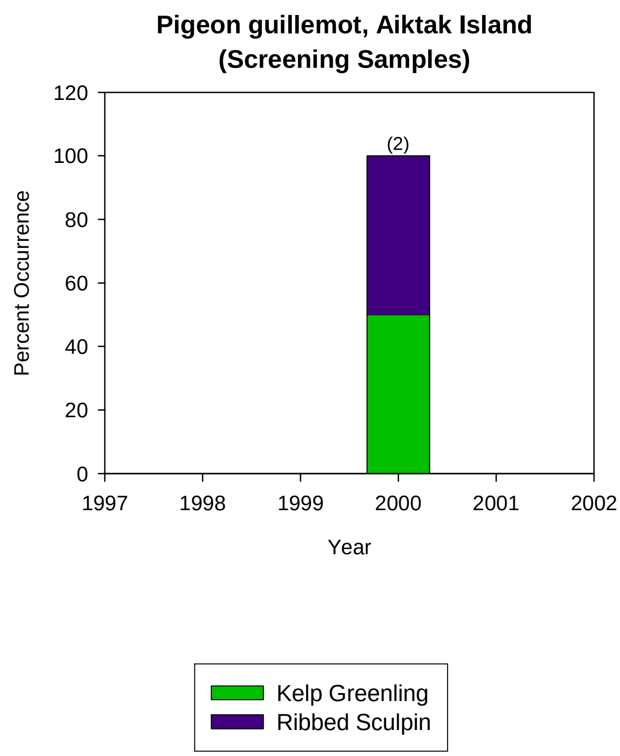


Figure 37. Diets of pigeon guillemots at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Parakeet Auklet (*Aethia psittacula*)

Breeding Chronology.–Parakeet auklets were monitored only at Buldir Island in 2003, where hatching chronology was about normal (Table 19).

Table 19. Hatching chronology of parakeet auklets at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	4 Jul (6)[a]	6 Jul (6)	3 Jul[b] (11)[a]	Jones et al. 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–In 2003, productivity at Buldir Island was about average (Table 20).

Table 20. Reproductive performance of parakeet auklets at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
Buldir I.	0.44	34	Jones et al. 2005

[a]Nest site is defined as a site where an egg was laid.

Populations.–No data.

Diet.–Diets of parakeet auklets were examined only at Buldir Island, where their diet consisted of a wide range of prey species primarily made up of *Neocalanus cristatus* and euphausiids (*Thysanoessa sp.*, *Euphausiid sp.*, Fig. 38). Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Neocalanus plumchrus/ flemingeri*, *Hyperoche medusarum*, *Parathemisto pacifica*, *Primno macropa*, *Atelecyclidae megalopa*, and crab zoea.

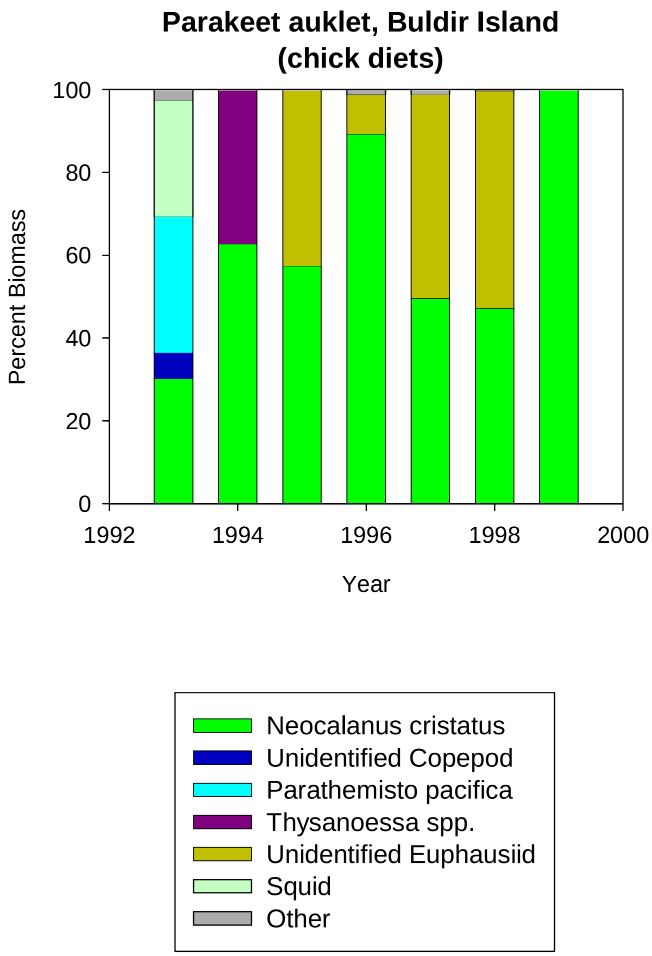


Figure 38. Diets of parakeet auklets at Alaskan sites. Samples represent adult gular pouch contents. Data are reported as percent biomass of prey type in the diet.

Least Auklet (*Aethia pusilla*)

Breeding Chronology.–The dates of hatching for least auklets were about average at St. Lawrence, Buldir and Kasatochi islands in 2003 (Table 21, Fig. 39).

Table 21. Hatching chronology of least auklets at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	27 Jul (95)[a]	—	29 Jul[b] (4)[a]	Sheffield et al. 2005
Buldir I.	26 Jun (14)	27 Jun (14)	27 Jun[c] (13)	Jones et al. 2005
Kasatochi I.	24 Jun (35)	25 Jun (35)	28 Jun[c] (7)	Barton and Lindquist 2003

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual medians.
[c]Mean of annual means.

Productivity.–Least auklets exhibited average or above average reproductive success in 2003 at all monitored sites except Buldir Island, where productivity was below normal (Table 22, Fig. 40).

Table 22. Reproductive performance of least auklets at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
St. Lawrence I.	0.67	109	Sheffield et al. 2005
Buldir I.	0.34	83	Jones et al. 2005
Kiska I.	0.50	202	Major and Jones 2003
Kasatochi I.	0.73	110	Barton and Lindquist 2003

[a]Nest site is defined as a site where an egg was laid.

Populations.–Least auklet populations are monitored only at Kasatochi Island, where a significant negative trend was found (-5.2% per annum, Fig. 41).

Diet.–Least auklets are planktivorous and feed on several types of prey. Copepods *(Calanus marshallae*, *Neocalanus plumchrus/flemingeri Neocalanus cristatus)*, amphipods (*Parathemisto pacifica, Parathemisto libellula, Parathemisto sp.*), and euphausiids (*Euphausiid furcilla, Euphausiid sp.*) were generally the most common prey (Figs 42 and 43). All least auklet diets were diverse and had several prey species in each sample. Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Ansiogammarus pugetensis, Calliopus laevsculus, Diastylis bidentata, Halirages bungi*, *Hyperoche medusarum, Diastylis bidentata,* and unidentified copepods.

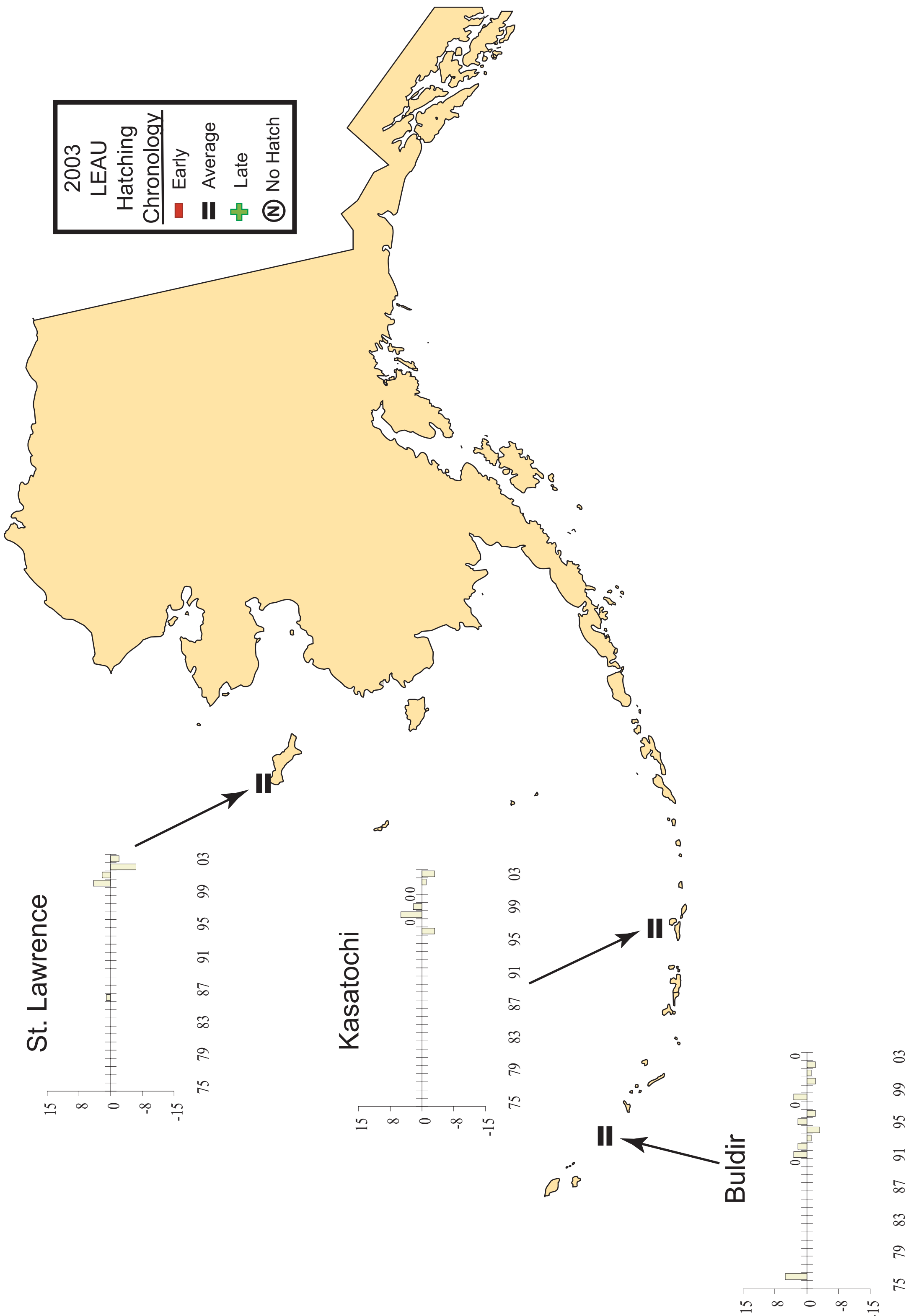


Figure 39. Hatching chronology of least auklets at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

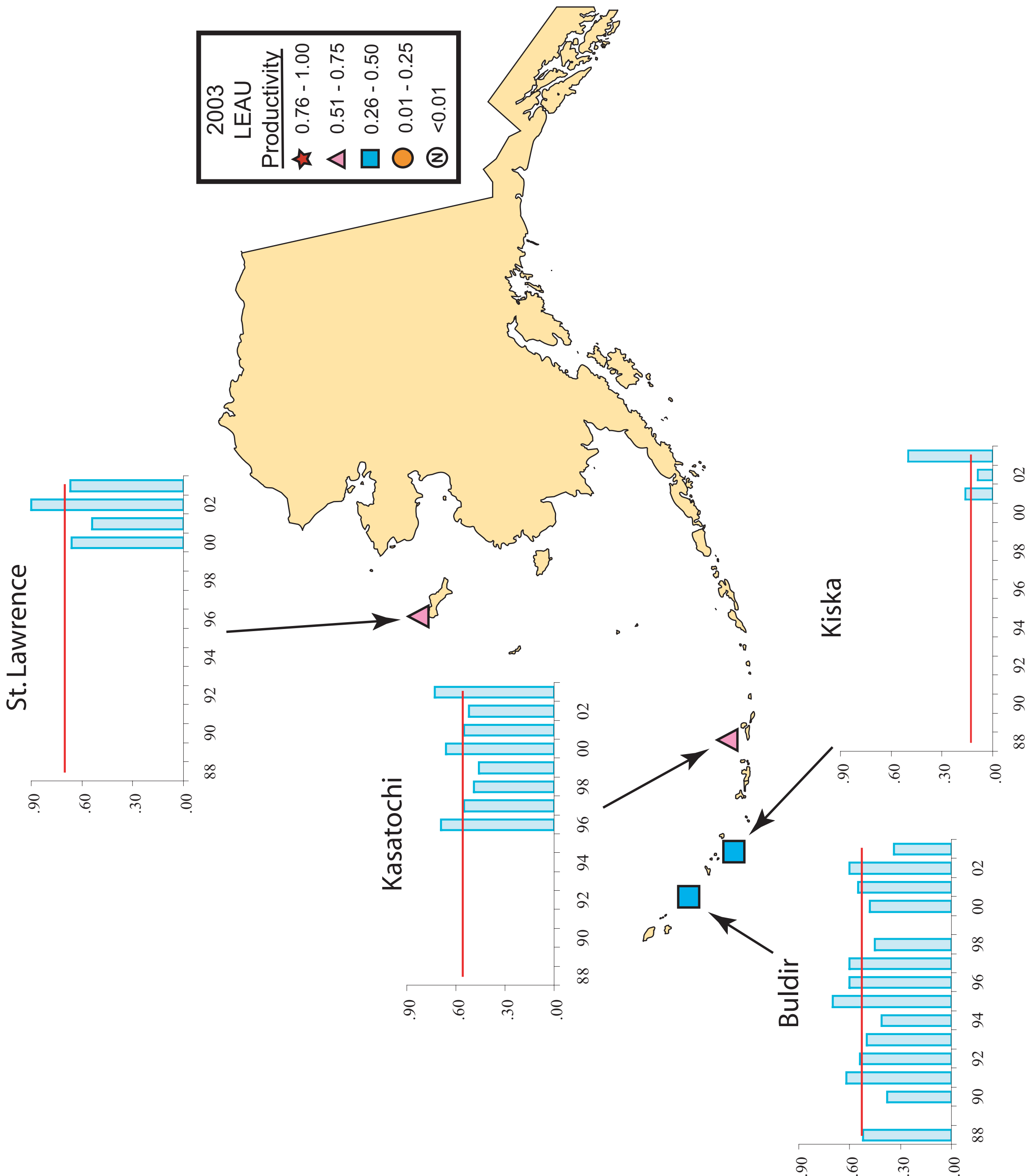


Figure 40. Productivity of least auklets (chicks fledged/nest site) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

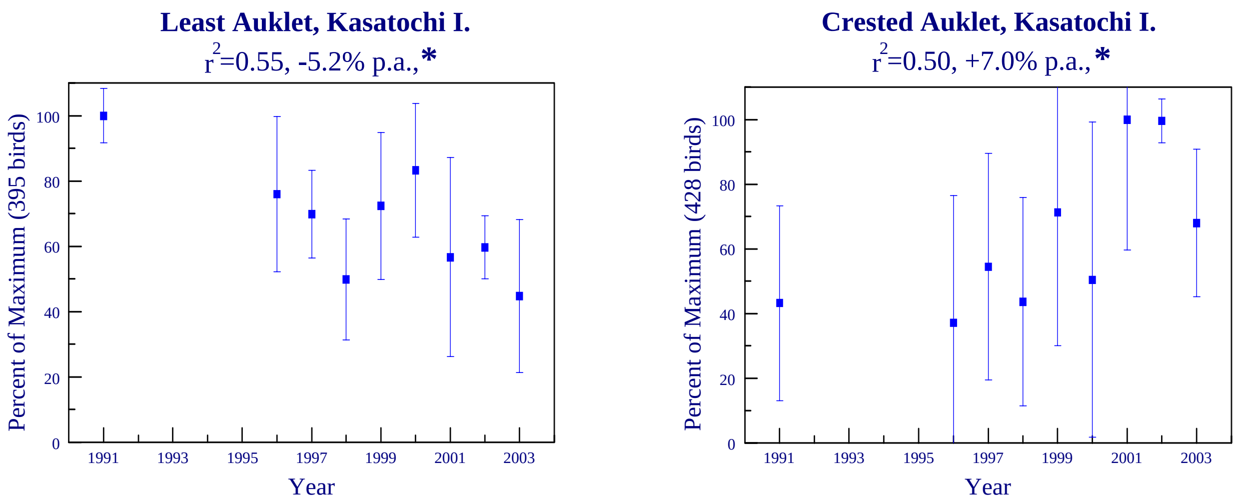


Figure 41. Trends in populations of least and crested auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

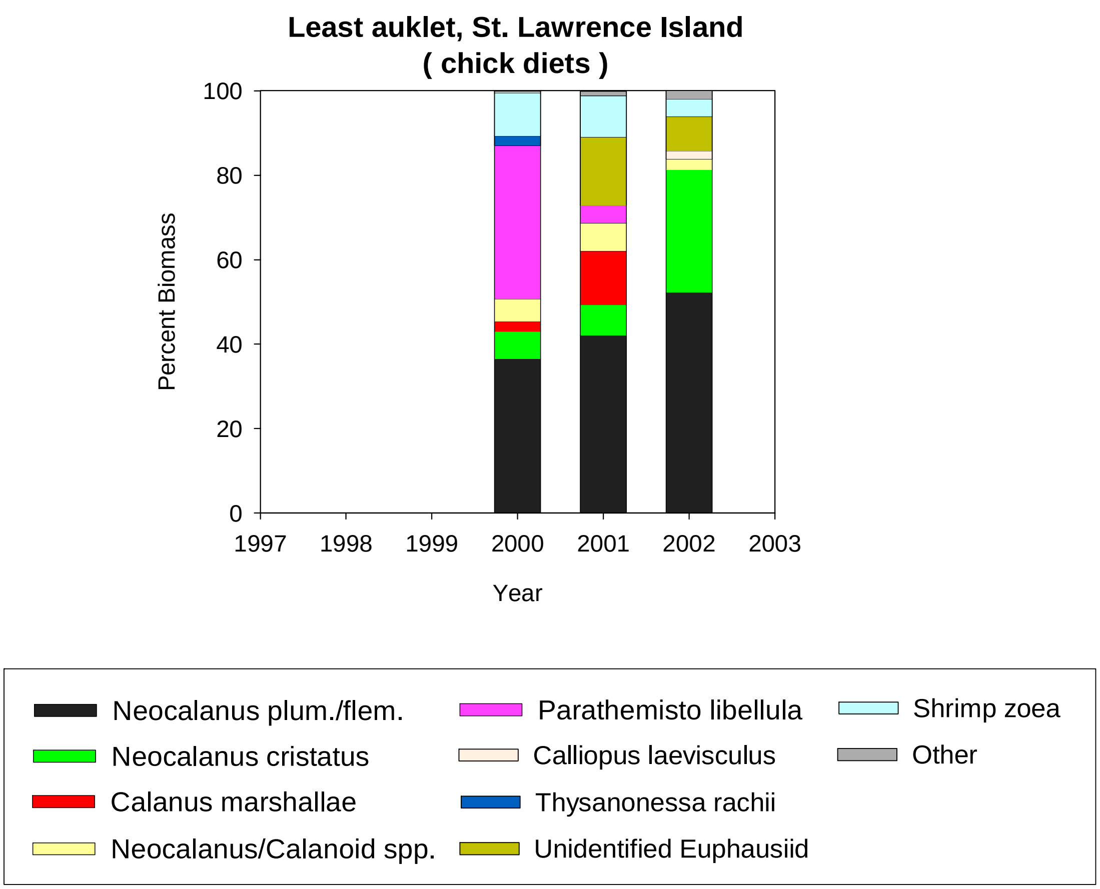


Figure 42. Diets of least auklets at St. Lawrence Island. Samples represent adult gular pouch contents. Data are reported as percent biomass of prey type in the diet.

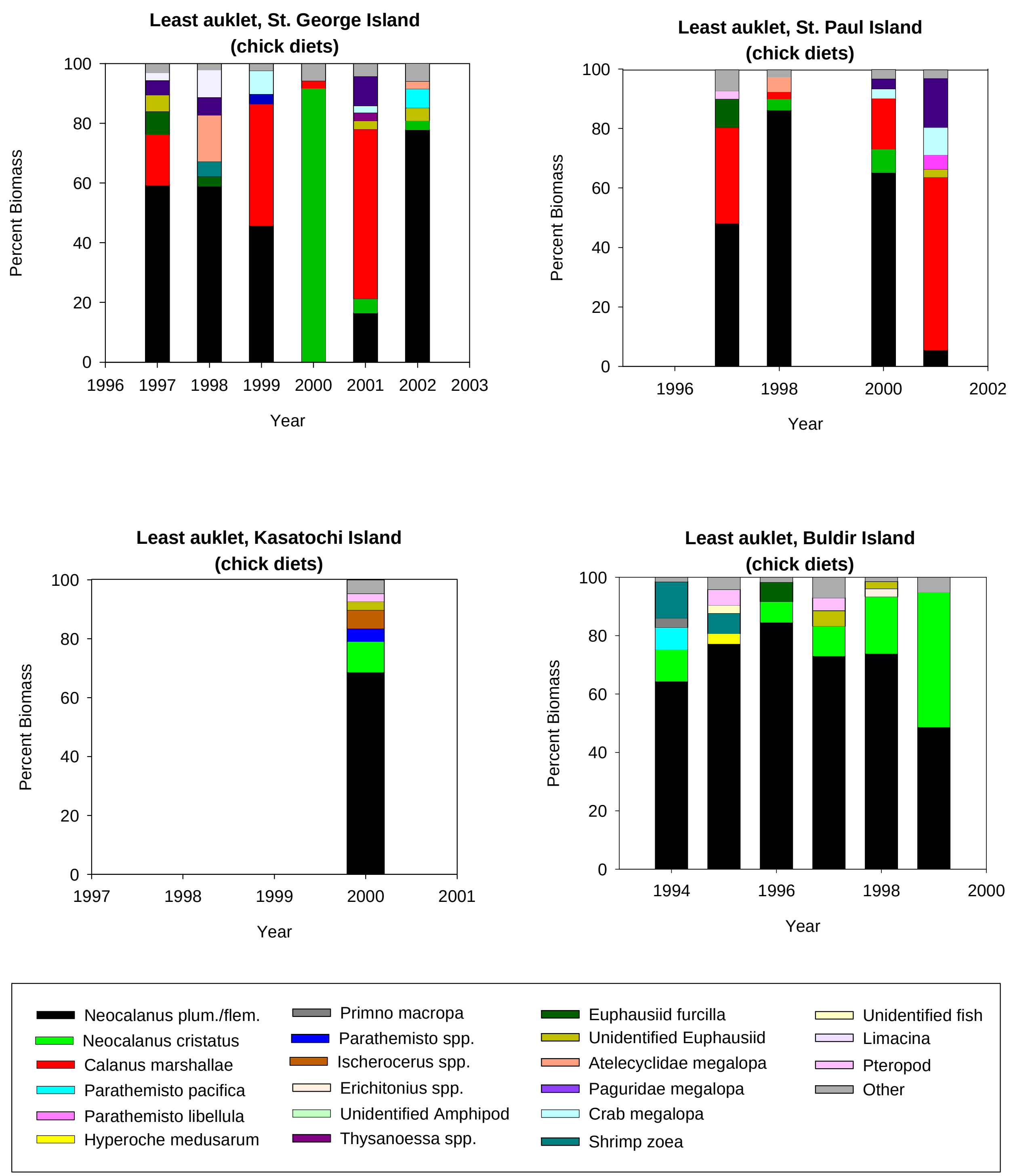
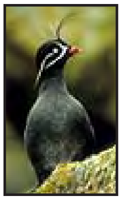


Figure 43. Diets of least auklets at southeastern Bering Sea and Aleutian Island sites. Samples represent adult gular pouch contents. Data are reported as percent biomass of prey type in the diet.



Whiskered Auklet (*Aethia pygmaea*)

Breeding Chronology.–The mean hatching date for whiskered auklets at Buldir Island in 2003 was about average (Table 23).

Table 23. Hatching chronology of whiskered auklets at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	25 Jun (4)[a]	25 Jun (4)	22 Jun[b] (13)[a]	Jones et al. 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means

Productivity.–Productivity of whiskered auklets at Buldir Island was about average for this species at the only site at which it was monitored in 2003 (Table 24).

Table 24. Reproductive performance of whiskered auklets at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
Buldir I.	0.55	44	Jones et al. 2005

[a]Nest site is defined as a site where an egg was laid.

Populations.–No data.

Diet.–Whiskered auklet diets were examined only at Buldir Island, where their diet consisted of a wide range of prey species predominantly made up of copepods (*Neocalanus plumchrus/ flemingeri*, *Neocalanus cristatus)* and euphausiids (*Thysanoessa sp., Euphausiid sp.*, Fig. 44). Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Calanus pacifica*, *Pachyptilus pacifica*, *Pareuchta birostrata*, *Hyperoche medusarum*, *Parathemisto pacifica*, *Primno macropa*, *Talitrid* sp., *Euphausiid furcilla*, *Limacina helicina*, *Pteropod sp.*, *Lophotrix frontairs*, and crab megalopa.

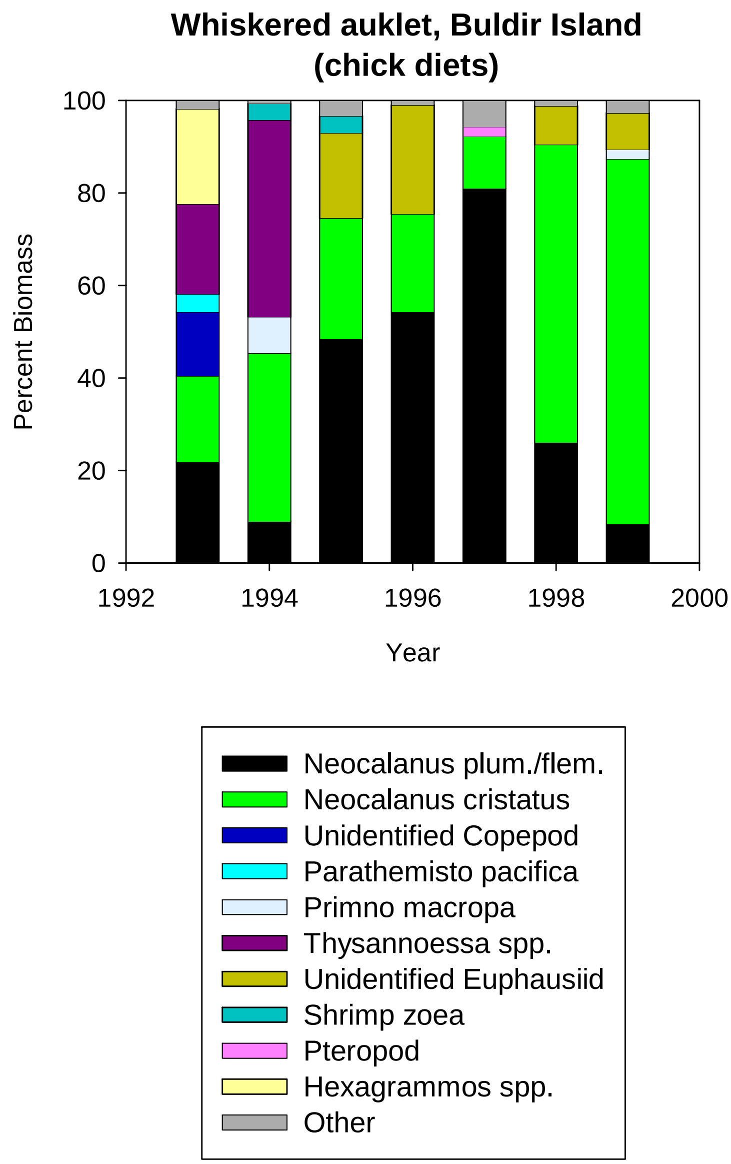


Figure 44. Diets of whiskered auklets at Alaskan sites. Samples represent adult gular pouch contents. Data are reported as percent biomass of prey type in the diet.

Crested Auklet (*Aethia cristatella*)

Breeding Chronology.–The mean date of hatching for crested auklets in 2003 was early at St. Lawrence Island, late at Buldir Island and about average at Kasatochi Island (Table 25, Fig. 45).

Table 25. Hatching chronology of crested auklets at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	27 July (107)[a]	—	1 Aug[b] (4)[a]	Sheffield et al. 2005
Buldir I.	4 Jul (9)	2 Jul (9)	28 Jun[c] (13)	Jones et al. 2005
Kasatochi I.	29 Jun (46)	1 Jul (46)	1 Jul[c] (7)	Barton and Lindquist 2003

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual medians.
[c]Mean of annual means.

Productivity.–Crested auklets exhibited average reproductive success in 2003 at all monitored sites except Buldir Island, where productivity was below normal (Table 26, Fig. 46).

Table 26. Reproductive performance of crested auklets at Alaskan sites monitored in 2003.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
St. Lawrence I.	0.73	125	Sheffield et al. 2005
Buldir I.	0.11	45	Jones et al. 2005
Kiska I.	0.45	20	Major and Jones 2003
Kasatochi I.	0.63	136	Barton and Lindquist 2003

[a]Nest site is defined as a site where an egg was laid.

Populations.–Crested auklet populations are monitored only at Kasatochi Island, where we found a significantly positive trend (+7.0% per annum, Fig. 41).

Diet.–Crested auklet diets at Kasatochi and Buldir islands primarily consisted of copepods (*Neocalanus cristatus)*, and euphausiids *(Thysanoessa sp., Euphausiid sp.,* Fig. 47). At St. Lawrence Island euphausiids (*Thysanoessa rachii* and *Thysanoessa sp.*) were the dominant prey species. Only prey taxa that were >2% of the diet are displayed in the figure, in years when these taxa or other taxa were <2% they were grouped into an "other" category. Taxa in the "other" category that are not in the figure include: *Neocalanus/calanoid sp., Calliopus laevisculus, Ansiogammarus pugetensis, Parathemisto sp., Primno macropa,* squid*, Diastylis bidentata,* crab megalopa/zoea, and larval fish.

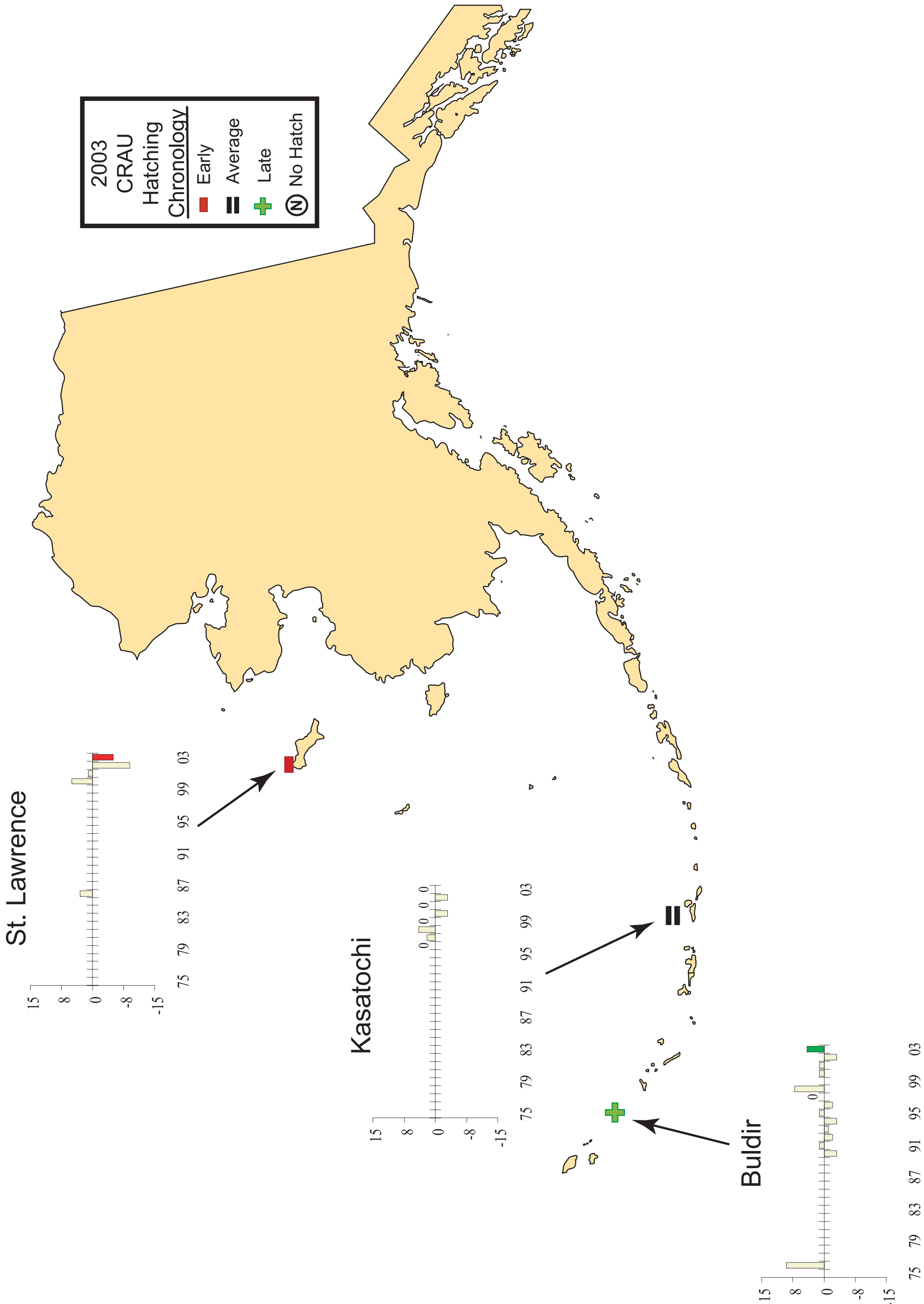


Figure 45. Hatching chronology of crested auklets at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

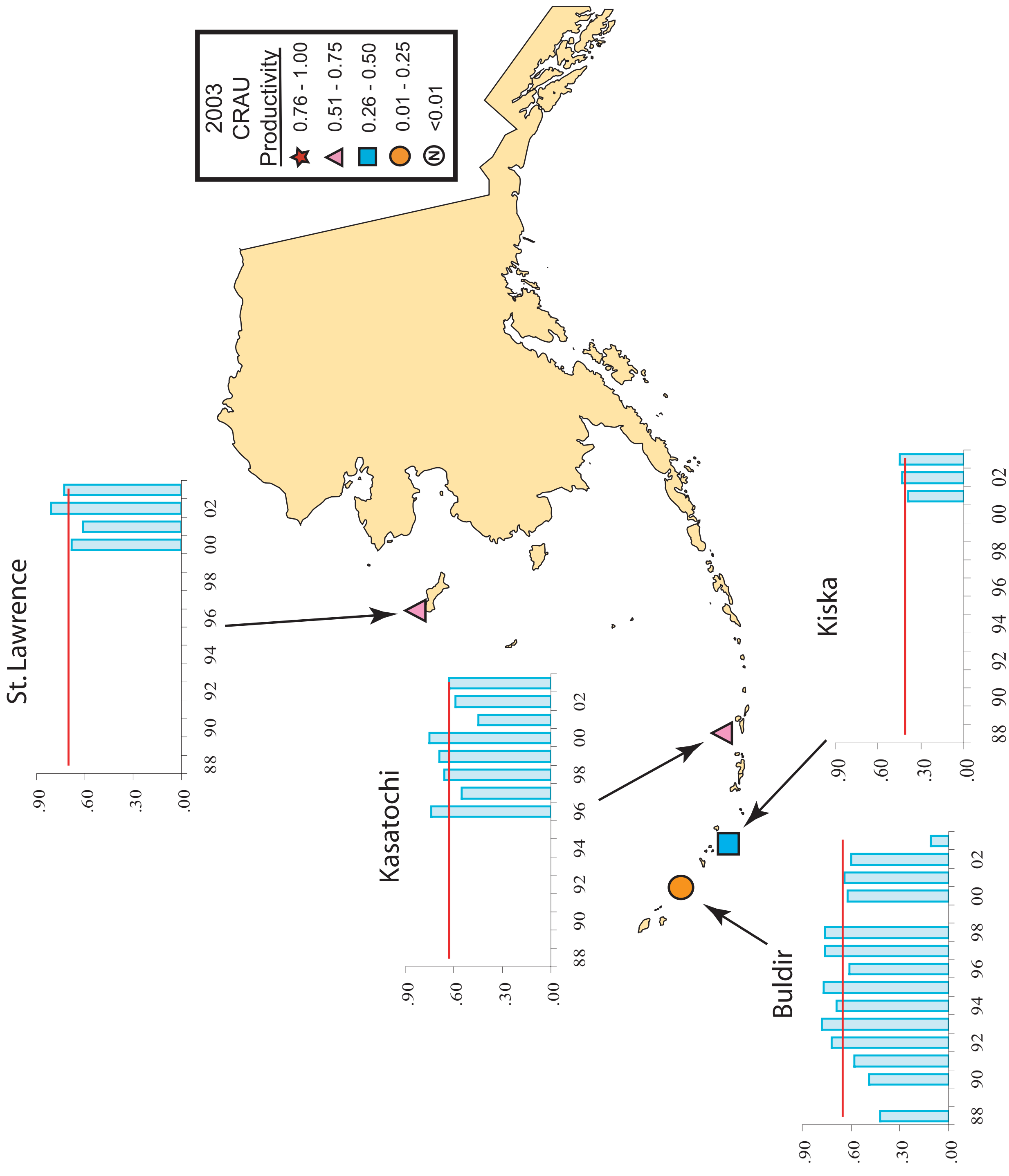


Figure 46. Productivity of crested auklets (chicks fledged/nest site) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

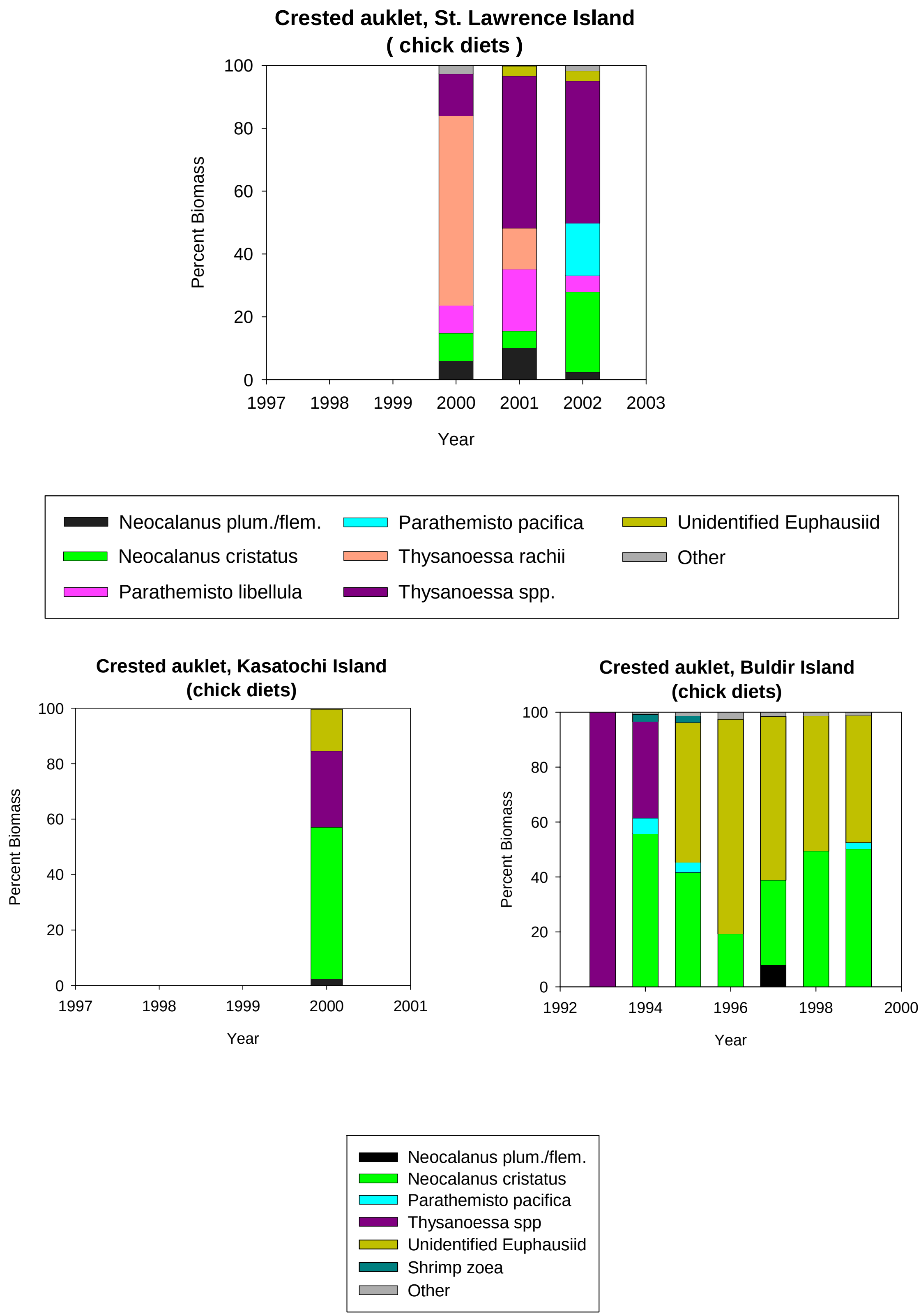


Figure 47. Diets of crested auklets at Alaskan sites. Samples represent adult gular pouch contents. Data are reported as percent biomass of prey type in the diet.

Rhinoceros Auklet (*Cerorhinca monocerata*)

Breeding Chronology.–Mean hatch date was later than average at St. Lazaria Island in 2003 (Table 27).

Table 27. Hatching chronology of rhinoceros auklets at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
St. Lazaria I.	25 Jun (14)[a]	25 Jun (14)	19 Jun[b] (2)[a]	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Productivity was higher than average at St. Lazaria Island in 2003 (Table 28).

Table 28. Reproductive performance of rhinoceros auklets at Alaskan sites monitored in 2003.

Site	Chicks Fledged/Egg	No. of Plots	No. of Eggs	Reference
St. Lazaria I.	0.71	3	149	L. Slater Unpubl. Data

Populations.–We found no significant no trend in populations of rhinoceros auklets at St. Lazaria Island, the only location where populations of this species were monitored (Fig. 48).

Diet.–Rhinoceros auklet diets from Chowiet Island primarily consisted of Pacific sandlance and some capelin (Fig. 49). On Middleton Island auklets predominately ate Pacific sandlance with lesser amounts of sandfish and greenling. In a small sample from St. Lazaria Island auklet diets consisted entirely of salmon.

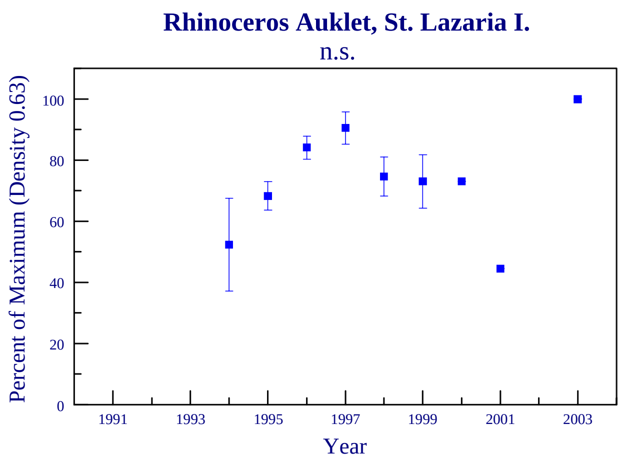


Figure 48. Trends in populations of rhinoceros auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

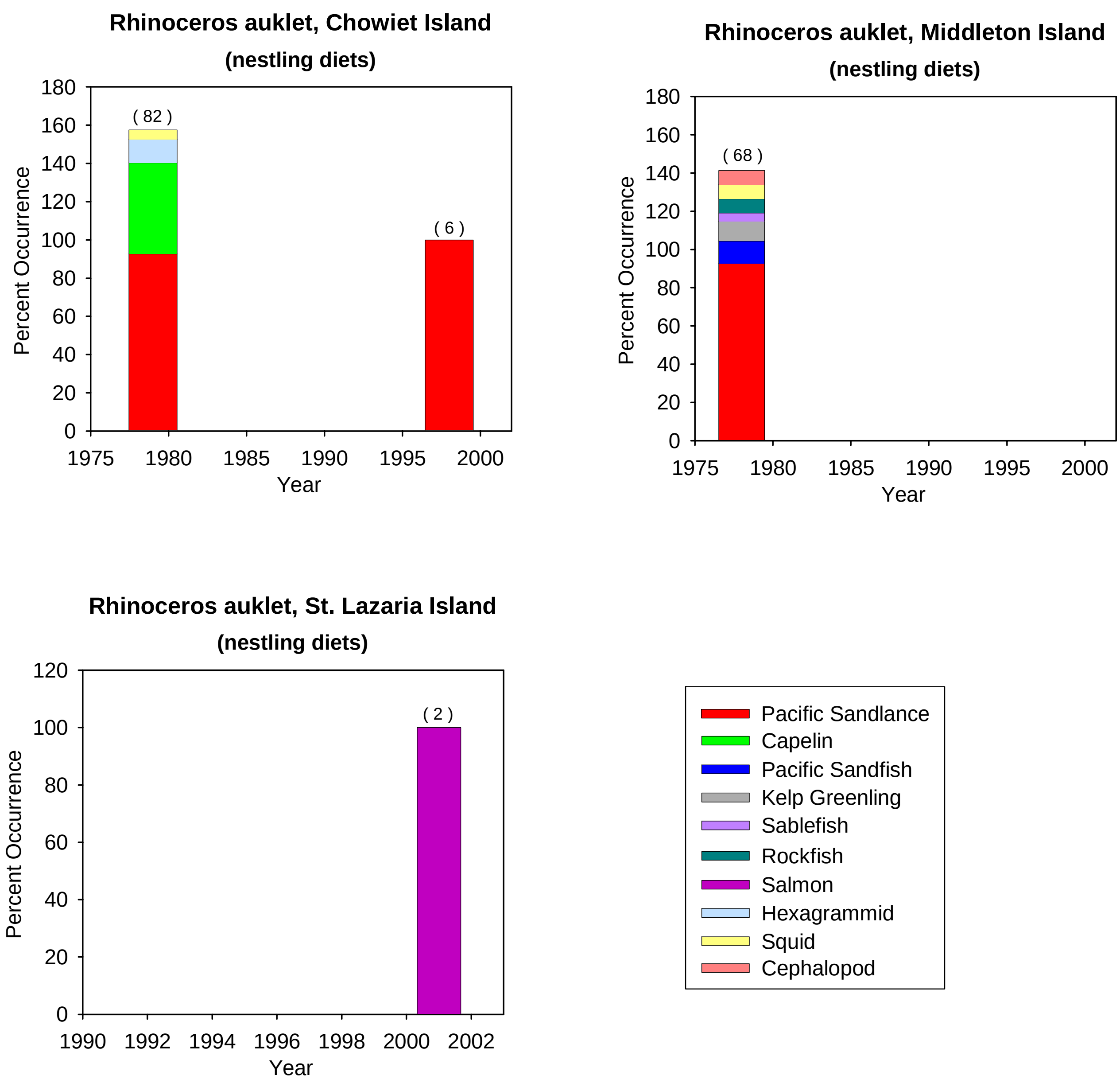
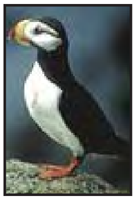


Figure 49. Diets of rhinoceros auklets at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.



Horned Puffin (*Fratercula corniculata*)

Breeding Chronology.–Mean hatch date was about average for this species at Buldir Island in 2003 (Table 29).

Table 29. Hatching chronology of horned puffins at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	19 Jul (10)[a]	23 Jul (10)	23 Jul[b] (15)[a]	Jones et al. 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Horned puffins exhibited about average productivity at Buldir Island in 2003 (Table 30, Fig. 50).

Table 30. Reproductive performance of horned puffins at Alaskan sites monitored in 2003.

Site	Chicks Fledged/Egg	No. of Eggs	Reference
Buldir I.	0.50	26	Jones et al. 2005

Populations.–No data.

Diet.–Horned puffin diets at Buldir Island consisted of a majority of greenling, Pacific sandlance and some squid. Horned puffins at the Semidi Islands predominately caught sandlance. In a small sample from Aiktak Island puffin diets consisted of sandlance and tomcod (Fig. 51).

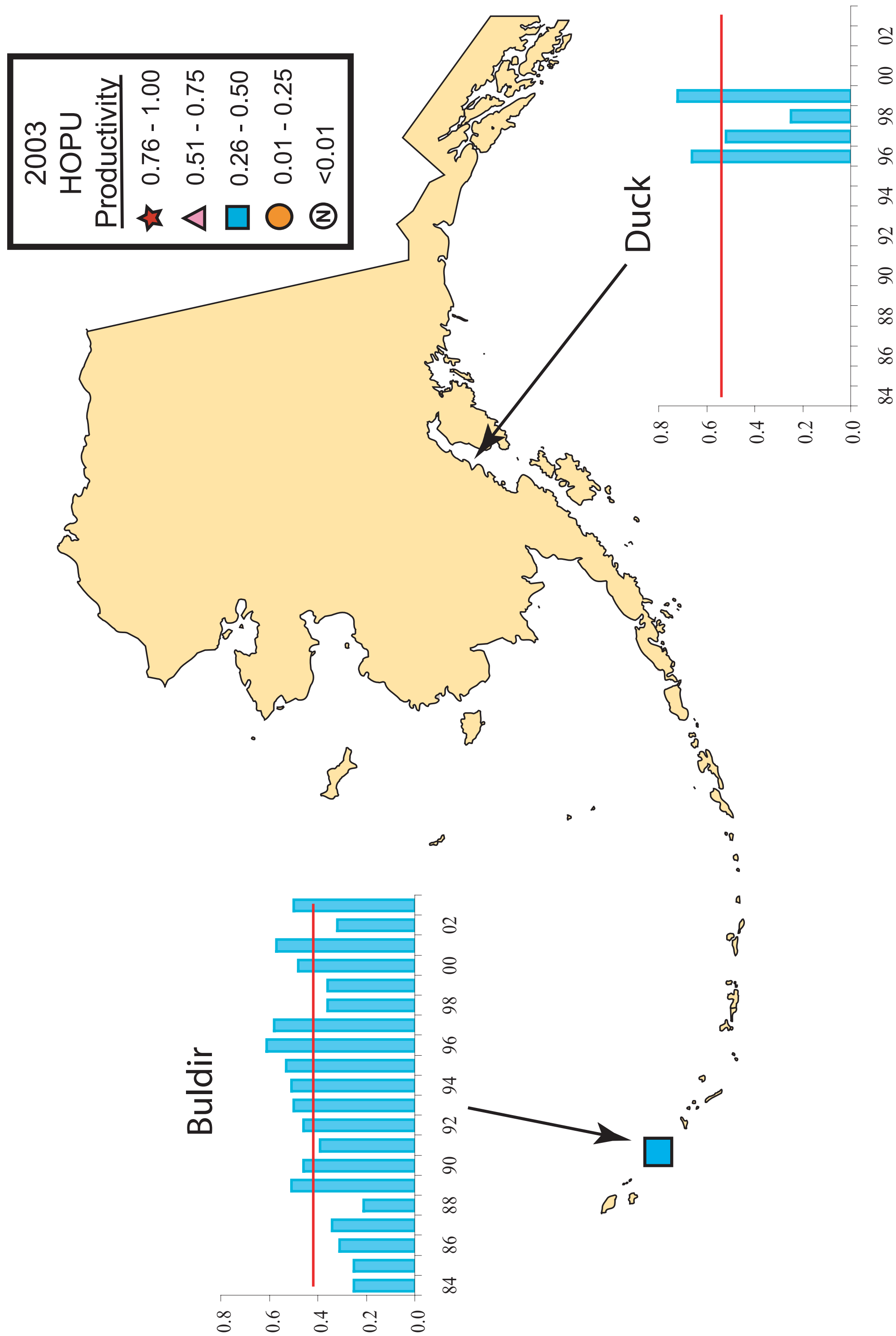


Figure 50. Productivity of horned puffins (chicks fledged/egg) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

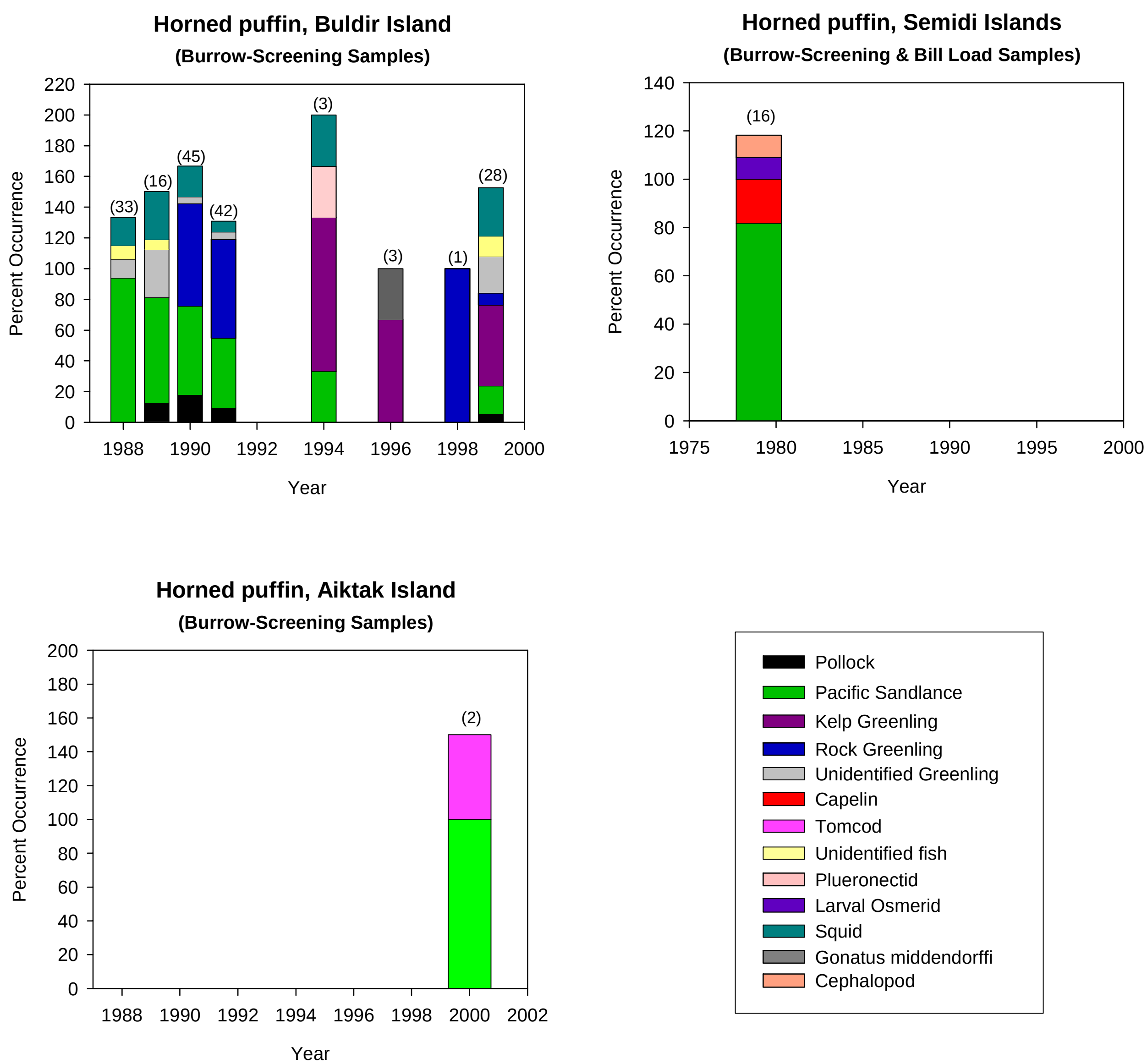


Figure 51. Diets of horned puffins at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Tufted Puffin (*Fratercula cirrhata*)

Breeding Chronology.–Hatch dates for tufted puffins were later than normal at Buldir Island in 2003 (Table 31, Fig. 52).

Table 31. Hatching chronology of tufted puffins at Alaskan sites monitored in 2003.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	27 Jul (3)[a]	23 Jul (3)	13 Jul[b] (14)[a]	Jones et al. 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Tufted puffin productivity was about average at Buldir Island and above average at St. Lazaria Island in 2003 (Table 32, Fig. 53).

Table 32. Reproductive performance of tufted puffins at Alaskan sites monitored in 2003.

Site	Chicks Fledged[a]/Egg	No. of Eggs	Reference
Buldir I.	0.38	13	Jones et al. 2005
St. Lazaria I.	0.79	102	L. Slater Unpubl. Data

[a]Fledged chick defined as being still alive at last check in August or September.

Populations.–We found significant positive population trends at Nizki, Adak, Bogoslof and Aiktak islands (+8.7%, +18.3%, +3.3% and +2.5% per annum, respectively, Fig. 54). No trends were evident at any other monitored sites.

Diet.–The most frequently occurring prey species at Aiktak Island was walleye pollock (Fig. 55). Tufted puffins at the Barren Islands caught primarily capelin with lesser amounts of pollock and Pacific sandlance. Puffins from Buldir Island foraged on a variety of prey with the dominant prey species changing from year to year. On Middleton Island puffins mainly ate sandlance with lesser amounts of squid and cephalopods.

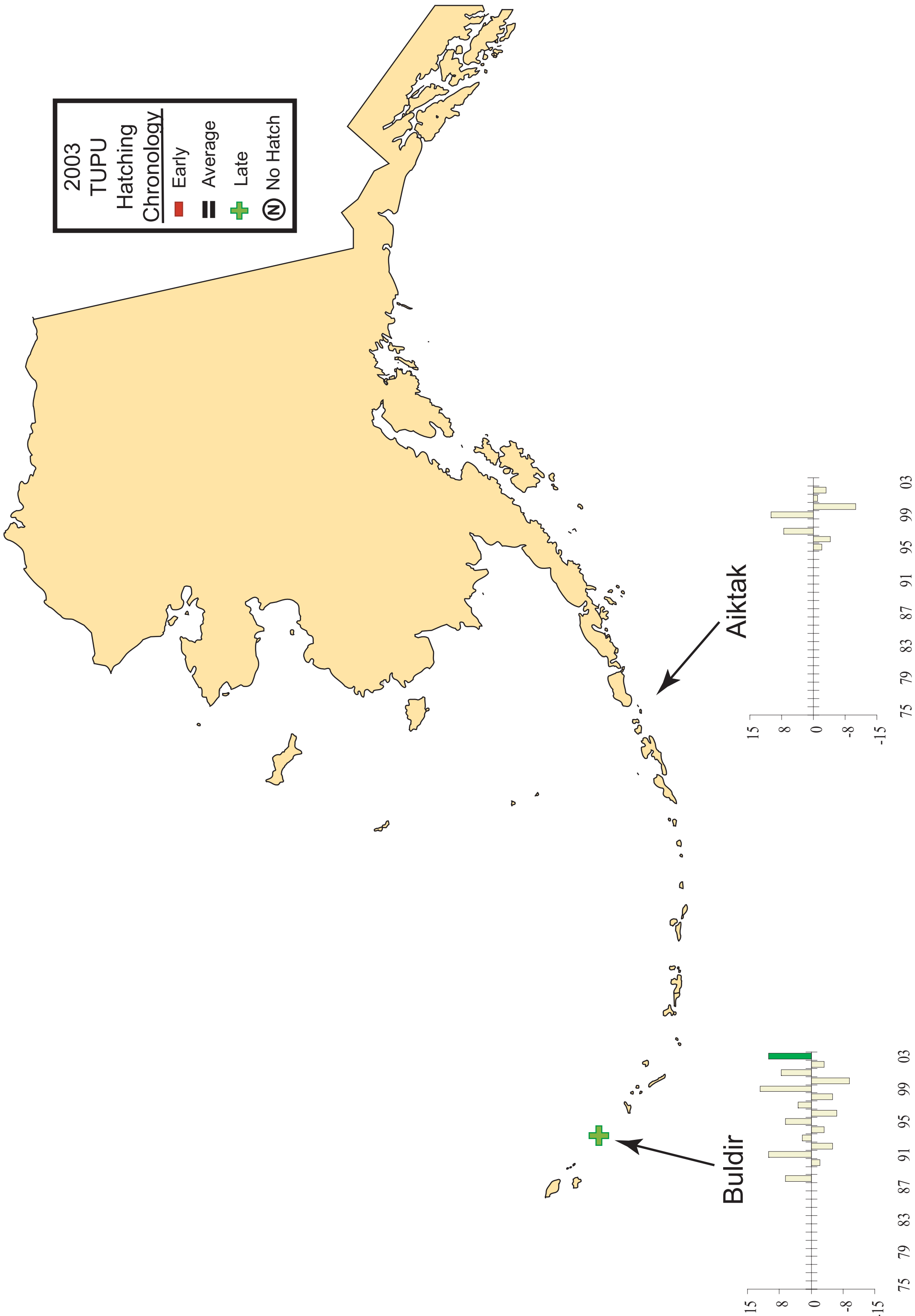


Figure 52. Hatching chronology of tufted puffins at Alaskan sites monitored in 2003. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

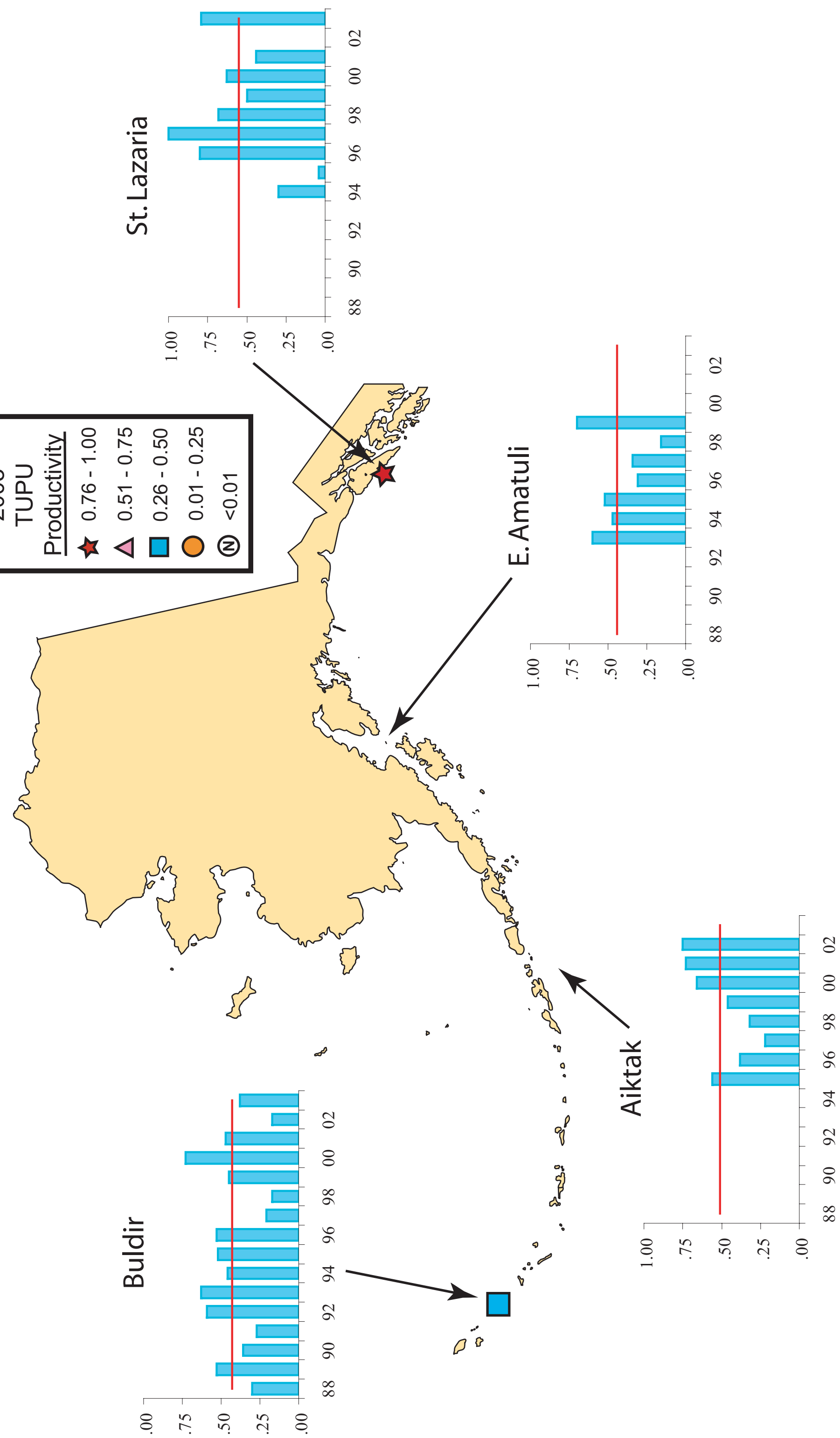


Figure 53. Productivity of tufted puffins (chicks fledged/egg) at Alaskan sites monitored in 2003. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

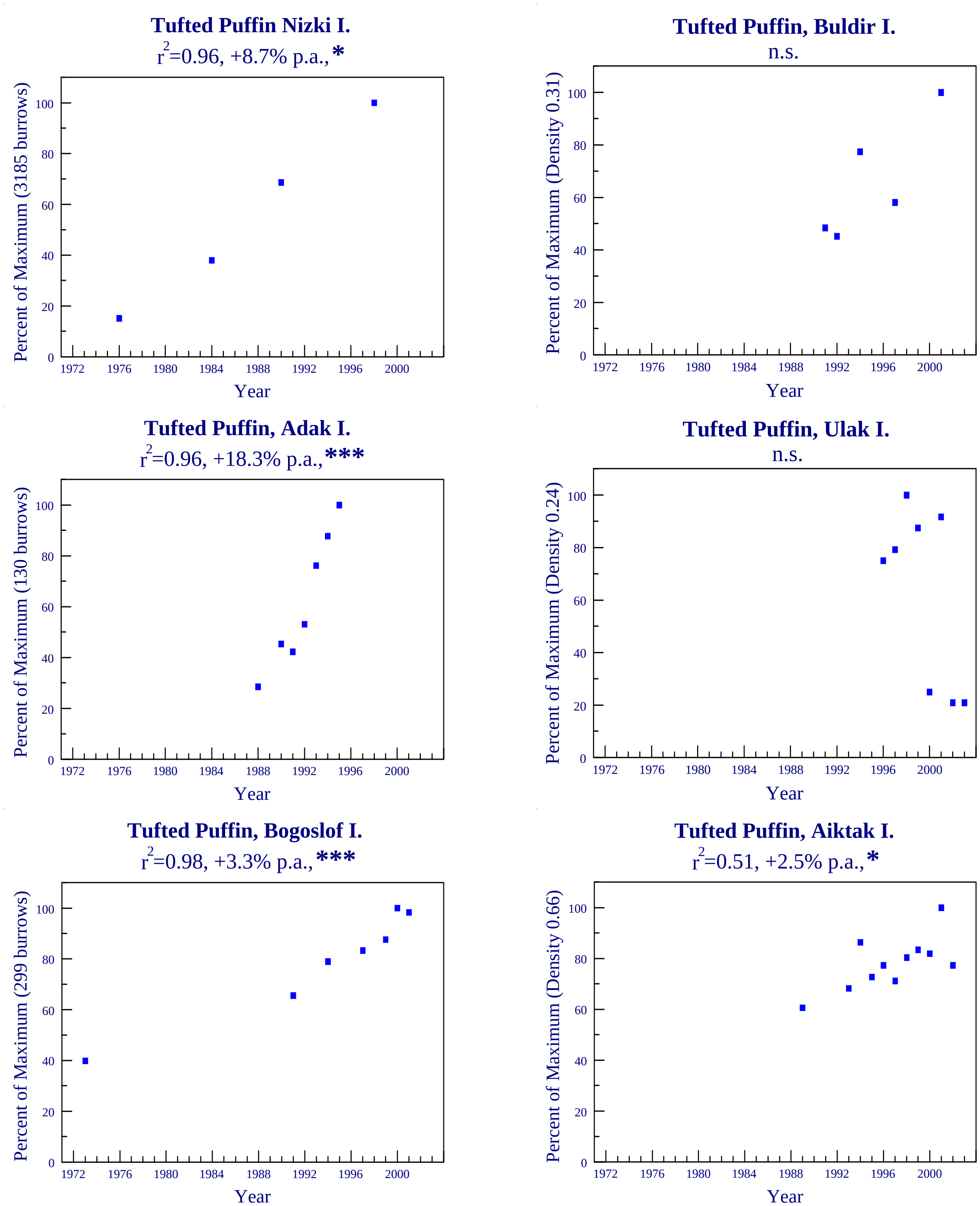
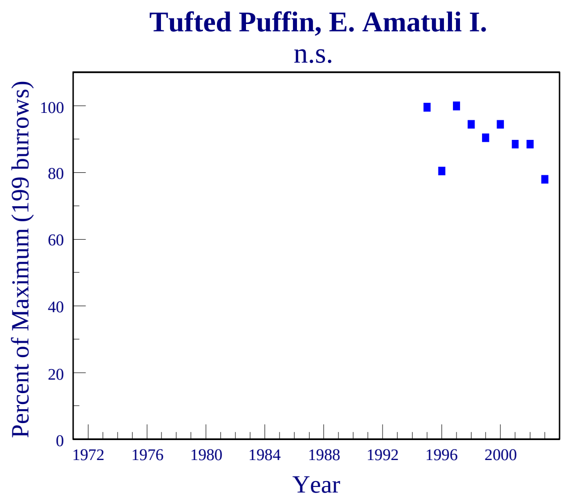


Figure 54. Trends in populations of tufted puffins at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).



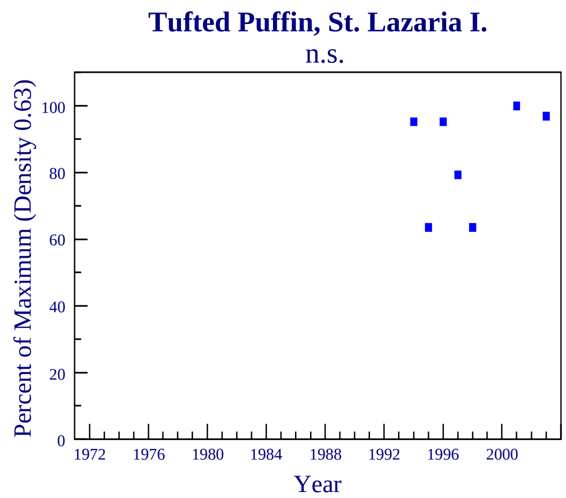


Figure 54 (continued). Trends in populations of tufted puffins at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

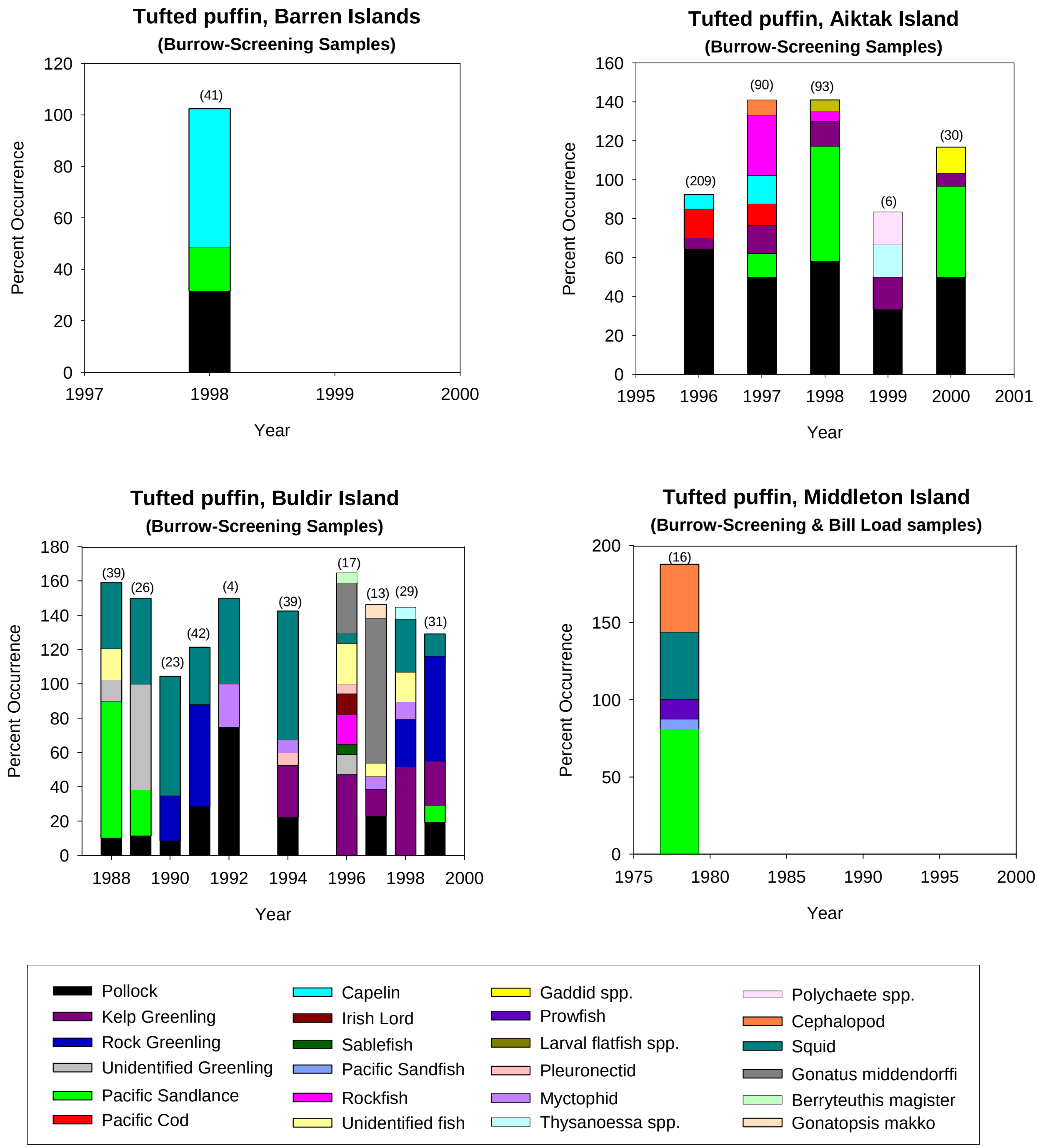


Figure 55. Diets of tufted puffins at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

SUMMARY

Species Differences

Surface Plankton-Feeders.–In 2003, timing of hatching was early for both fork-tailed and Leach's storm-petrels at St. Lazaria Island (Table 33). Fork-tailed storm-petrels (FTSP) had above average reproductive success at Buldir, Ulak and St. Lazaria islands in 2003 (Table 34). Leach's storm-petrel (LHSP) productivity was above average at Buldir Island and average at St. Lazaria Island. Storm-petrel (STPE) burrow densities and counts (both species combined) have increased or remained stable in recent years (Table 35).

Surface Fish-Feeders.–We found no significant trends for northern fulmar (NOFU) populations at the Pribilof Islands or at Chowiet Island (Table 35).

Glaucous-winged gulls (GWGU) are treated here, although they are opportunistic feeders taking other birds as well as fish for prey. In 2003, gull mean hatch date was later than average at Puale Bay and average at St. Lazaria Island (Table 33). Gulls had below average success at Puale Bay and St. Lazaria Island, and above average reproduction at Buldir Island (Table 34). Gull populations showed positive or stable trends at all but one colony (Table 35). Numbers of this species have declined significantly at Buldir Island.

Black-legged kittiwake (BLKI) hatch dates were earlier than normal at St. Paul and St. George islands and Cape Peirce, late at Buldir Island and average elsewhere in 2003 (Table 33). Black-legged kittiwake productivity was average or above everywhere except Buldir Island, where success was below average (Table 34). Black-legged kittiwake populations exhibited stable trends at 13 sites, significant declines at four colonies and significant positive trends at two locations (Table 35).

Red-legged kittiwake (RLKI) eggs hatched later than normal in 2003 at St. Paul Island and early at St. George Island (Table 33). Reproductive success was lower than average at St. Paul and Buldir islands, and about average at St. George Island in 2003 (Table 34). This species exhibited significant negative population trends at St. Paul and Koniuji islands, no trend at St. George Island and a significant increase at Buldir Island (Table 35).

Diving Fish-Feeders (nearshore).–Timing of hatching was about average for pelagic cormorants (PECO) at Cape Peirce in 2003 (Table 33). Red-faced cormorants (RFCO) had above average reproductive success at St. Paul and St. George islands in 2003 (Table 34). Red-faced cormorant productivity was below average at Ulak and Kasatochi islands, and at Chiniak Bay. Pelagic cormorants exhibited below average success at most monitored colonies, the exception being above average productivity at Cape Peirce. We found significant declines of red-faced cormorants at the Semidi Islands and Chiniak Bay (Table 35). Pelagic cormorants showed no significant trends at most monitored colonies whereas numbers of this species were increasing significantly at St. Lazaria Island and declining at Chiniak Bay. Unspecified cormorant populations are stable at three of the five monitored colonies, declining at Shemya Island and increasing significantly at Kasatochi Island.

Pigeon guillemot (PIGU) numbers showed significant declines at Aiktak Island and Prince William Sound but no trends at Buldir, Kasatochi or St. Lazaria islands (Table 35).

Table 33. Seabird relative breeding chronology compared to averages for past years within regions[a]. Only sites for which there were data from 2003 are included.

Region	Site	FTSP	LHSP	PECO	GWGU	BLKI	RLKI	COMU	TBMU	PAAU	LEAU	WHAU	CRAU	HOPU	TUPU
N. Bering/ Chukchi	St. Lawrence I.					=		–	–		=		–		
	Bluff					=		–							
SE Bering	St. Paul I.					–	+	–	=						
	St. George I.					–	–	=	=						
	C. Peirce			=		–		–							
SW Bering	Buldir I.					+		=	+	=	=	=	+	=	+
	Kasatochi I.										=		=		
Gulf of Alaska	Puale Bay				+			–	–						
	E. Amatuli I.					=		=							
Southeast	St. Lazaria I.	–	–		=			–	–						

[a] Codes:
"– " indicates hatching chronology was > 3 days earlier than the average for this site or region,
"=" indicates within 3 days of average
"+" indicates hatching chronology was > 3 days later than the average for this site or region.

Table 34. Seabird relative productivity levels compared to averages for past years within regions[a]. Only sites for which there were data from 2003 are included.

Region	Site	FTSP	LHSP	RFCO	PECO	GWGU	BLKI	RLKI	COMU	TBMU	PAAU	LEAU	WHAU	CRAU	RHAU	HOPU	TUPU
N. Bering/ Chukchi	C. Lisburne						=										
	St. Lawrence I.						+		+	=		=		=			
	Bluff						+										
SE Bering	St. Paul I.			+			+	–	=	=							
	St. George I.			+			+	=	–	=							
	C. Peirce				+		+		=								
	Round I.				–		+		+								
SW Bering	Buldir I.	+	+		–	+	–	–	=	=	=	–	=	–		=	=
	Kiska I.											+		=			
	Ulak I.	+		–	–												
	Kasatochi I.			–	–				–	–		+		=			
	Koniuji I.						+										
Gulf of Alaska	Puale Bay					–			+	+							
	Chiniak Bay			–	–		=										
	E. Amatuli I.						+										
	Pr. Will. Snd.						+										
Southeast	St. Lazaria I.	+	=		–	–			+	+					+		+

[a] Codes:
"– " indicates productivity was > 20% below the average for this site or region,
"=" indicates within 20% of average
"+" indicates productivity was > 20% above the average for this site or region.

Table 35. Seabird population trends compared within regions[a].

Region	Site	NOFU	STPE	RFCO	PECO	UNCO	GWGU	BLKI	RLKI	COMU	TBMU	UNMU	PIGU	LEAU	CRAU	RHAU	TUPU
N. Bering/ Chukchi	St. Lawrence I.									=	=						
	C. Lisburne							=				+					
	C. Thompson							=				=					
	Bluff							=		=							
	Hall I.									=	–						
SE Bering	St. Paul I.	=						–	–	–	–						
	St. George I.	=						=	=	=	=						
	C. Newenham							=		=							
	C. Peirce				=			–		–							
	Round I.							=		=							
	Bogoslof I.																+
	Aiktak I.		+			=	=					=	–				+
SW Bering	Agattu I							=				+					
	Nizki/Alaid Is.					=											+
	Shemya I.					–											
	Buldir I.		+		=		–	+	+		+		=				=
	Adak I.																+
	Ulak I.		=			=						=					=
	Kasatochi I.					+	=						=	–	+		
	Koniuji I							=	–			=					
Gulf of Alaska	Semidi Is.			–	=												
	Chowiet I.	=						–				+					
	Puale Bay						=	=				=					
	Chiniak Bay			–	–			=									
	Nord I.									=							
	E. Amatuli I.		=				=	=		=							=
	Gull I.				=			=		+							
	Chisik/Duck Is.							=		–							
	Chiswell Is.									=							
	P. William Snd							+					–				
	Middleton I.				=		+	–				–					
Southeast	St. Lazaria I.		+		+		=					–	=			=	=

[a]Codes:
"– " indicates a significant (p<0.05) negative population trend for this site or region,
"=" indicates no significant trend(p>=0.05)
"+" indicates a significant (p<0.05) positive population trend for this site or region.

Diving Fish-Feeders (offshore).–Timing of common murre (COMU) hatching in 2003 was early at six of nine monitored sites and average at the others (Table 33). Thick-billed murre (TBMU) chronology was earlier than average at St. Lawrence Island, St. Lazaria Island and Puale Bay, late at Buldir Island, and average elsewhere.

Common murres exhibited average or below average reproductive success at all sites except St. Lawrence, Round and St. Lazaria islands, and Puale Bay, where success was above normal (Table 34). This species again failed completely at Kasatochi Island in 2003. Thick-billed murres also failed at Kasatochi Island in 2003. Average or above average productivity was achieved by this species at all other sites where it was monitored.

Numbers of common murres showed significant increasing trends at one colony (Gull Island), declines at three sites and remained relatively stable at nine locations (Table 35). Thick-billed murre populations exhibited significant declining trends at two sites, increases at one colony and stable numbers at two locations. At colonies where murres were not identified to species during counts (UNMU), numbers significantly increased or remained stable at eight sites and showed significant negative trends at two locations.

We found no trends in populations of rhinoceros auklets (RHAU) at St. Lazaria Island (Table 34).

Horned puffins (HOPU) exhibited approximately normal hatching chronology and productivity at Buldir Island in 2003 (Tables 33 and 34).

Tufted puffin (TUPU) eggs hatched later than the norm at Buldir Island in 2003 (Table 33) and reproductive success for this species was average there, and above average at St. Lazaria Island (Table 34). Significant positive population trends were found for tufted puffins at four colonies but we found no significant trends for this species elsewhere (Table 35).

Diving Plankton-Feeders.–Parakeet (PAAU), least (LEAU), whiskered (WHAU) and crested (CRAU) auklets had approximately average nesting chronologies at most sites where they were monitored in 2003 (Table 33). Timing for crested auklets was early at St. Lawrence Island and late at Buldir Island. Productivity was average for parakeet auklets at Buldir Island in 2003 (Table 34). Least, whiskered and crested auklets had average success at most monitored sites. Productivity was above average for least auklets at Kiska and Kasatochi islands. Both least and crested auklets exhibited lower than normal success at Buldir Island in 2003. Populations of least auklets showed a negative trend at Kasatochi Island whereas crested auklet numbers increased significantly there (Table 35).

Regional Differences

Northern Bering/Chukchi.–Common and thick-billed murres hatched earlier than normal at St. Lawrence Island and Bluff in 2003 (Table 33). Black-legged kittiwake and least auklet timing was about average at St. Lawrence Island whereas hatch was relatively early for crested auklets at this colony. Mean hatch date was about average at Bluff in 2003. Reproductive success was average for black-legged kittiwakes at Cape Lisburne and above average at St. Lawrence Island and Bluff in 2003 (Table 34). Murre productivity was normal or above at St. Lawrence Island. Least and crested auklets exhibited average success at that colony. The only population trend data from this region were for offshore fish-feeders (kittiwakes and murres). We found no significant trends in black-legged kittiwake numbers (Table 35). Common murre populations exhibited no trend at St. Lawrence Island, Bluff or

Hall Island. Thick-billed murre populations exhibited no trend at St. Lawrence Island but declined significantly at Hall Island. Unspecified murres showed no trend at Cape Thompson but increased significantly at Cape Lisburne.

Southeastern Bering.–Nearly all species of fish-feeders exhibited early or normal timing in this region, with six of 11 cases having an earlier than average breeding chronology in 2003 (Table 33). Red-legged kittiwake eggs hatched later than average at St. Paul Island in 2003.

Cormorants experienced above average productivity in this region with the exception of below average success of pelagic cormorants at Round Island (Table 34). Black-legged kittiwakes exhibited higher than normal productivity in all instances in this region in 2003. Red-legged kittiwakes had below average productivity at St. Paul Island and normal success at St. George Island. Murre productivity was average or above average in five of the six instances in this region in 2003. Common murres had lower than normal success at St. George Island.

Northern fulmar numbers appeared to be stable at both monitored colonies in this region. (Table 35). Storm-petrel populations increased significantly in the eastern Aleutians (Aiktak Island). There were no clear patterns in population trends among fish-feeders in this region: 1) neither pelagic nor unspecified cormorants showed a trend; 2) glaucous-winged gull numbers appeared to be stable at Aiktak Island; 3) we found significant negative trends for black-legged kittiwakes at Cape Peirce and St. Paul Island but no trends for this species at the three other monitored sites; 4) red-legged kittiwakes exhibited significant declines at St. Paul Island but not at St. George Island; 5) we found significant negative population trends for common murres at St. Paul Island and Cape Peirce, and for thick-billed murres at St. Paul Island. Murre numbers showed no trends at other monitored sites; 6) pigeon guillemot populations declined significantly at Aiktak Island; and 7) tufted puffin population trends were significantly positive at both Bogoslof and Aiktak islands.

Southwestern Bering.–Kittiwake and murre breeding chronology was either later than usual or about average in 2003 (Table 33). Plankton-feeders (auklets) also exhibited normal breeding chronology in this region, except that crested auklet eggs hatched later than average at Buldir Island in 2003. Horned puffin chronology was about average at Buldir Island. Tufted puffins exhibited later than normal hatching chronology at that colony in 2003.

Both species of storm-petrel had above average productivity in this region in 2003 (Table 34). Cormorant success was below average at all of the sites monitored in this region. Glaucous-winged gull productivity was above average at Buldir Island. Black-legged kittiwakes experienced below average production at Buldir Island and above average success at Koniuji Island in 2003. Red-legged kittiwakes also had below average productivity at Buldir Island. Common and thick-billed murre productivity was about average at Buldir Island but both species failed to lay eggs at Kasatochi Island for the sixth year in a row. Auklets exhibited average or below average productivity at southwestern Bering Sea colonies monitored in 2003, with the exception of above average success for least auklets at Kasatochi Island. Both horned and tufted puffins had average productivity at Buldir Island.

Storm-petrel populations increased significantly at Buldir Island but were stable at Ulak Island (Table 35). We found no significant trends in cormorant populations at Nizki/Alaid islands, Buldir Island or Ulak Island but cormorants significantly increased at Kasatochi Island and declined at Shemya Island. Glaucous-winged gulls showed a significant negative population trend at Buldir Island and no trend at Kasatochi Island. Both black- and red-legged kittiwakes increased significantly at Buldir Island but the former species exhibited no trend at Agattu Island. No trends were evident for black-legged kittiwakes at Koniuji Island but red-legged kittiwakes showed a significant decline at that colony. Murres were either stable or increasing in this region and pigeon guillemots exhibited no trends. Least auklet numbers declined significantly at Kasatochi Island but crested auklet populations at the same colony showed a significant positive trend. Tufted puffins exhibited positive trends at two of the four sites monitored in this region with no significant population changes at the remaining colonies.

Northern Gulf of Alaska.–Breeding chronology was normal or earlier than normal for murres and kittiwakes breeding in this region in 2003 (Table 33). Glaucous-winged gull eggs hatched later than average at Puale Bay.

Productivity was average or above average for murres and kittiwakes in this region in 2003 (Table 34). Cormorant and glaucous-winged gull success was below average.

Northern fulmars showed no trend in populations at Chowiet Island (Table 35). The same can be said for storm-petrels at East Amatuli Island. We found no significant population trends for either red-faced or pelagic cormorants in this region with the exception of a significant decline of red-faced cormorants at the Semidi Islands and a decline of both red-faced and pelagic cormorants at Chiniak Bay. Glaucous-winged gull counts indicated either no trends or increases in the northern Gulf of Alaska. Black-legged kittiwake trends were significantly down at two sites, up at one location and exhibited no trends at the remaining five colonies. We found significant positive trends for murre populations at Chowiet and Gull islands, significant declines at Chisik/Duck and Middleton islands and stable populations at four other colonies in this region. Pigeon guillemot populations declined in Prince William Sound. Tufted puffin numbers showed no trends at East Amatuli Island.

Southeast Alaska.–Storm-petrels and murres exhibited earlier than normal nesting chronology at St. Lazaria Island in 2003, and timing was average for glaucous-winged gulls there (Table 33). Productivity was higher than normal in five of eight cases, average for one case and below average for two (Table 34). Storm-petrel and pelagic cormorant numbers increased significantly at St. Lazaria Island (Table 35). Glaucous-winged gull, pigeon guillemot, rhinoceros auklet and tufted puffin populations were stable whereas murre numbers showed a significant negative trend at this colony.

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All photographs used in this report are Fish and Wildlife Service pictures except those of the fork-tailed storm-petrel, parakeet auklet, least auklet, tufted puffin and horned puffin which were taken by Ian Jones, and the ancient murrelet taken by Fiona Hunter, and used with permission. Cover art by Susan Steinacher.

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