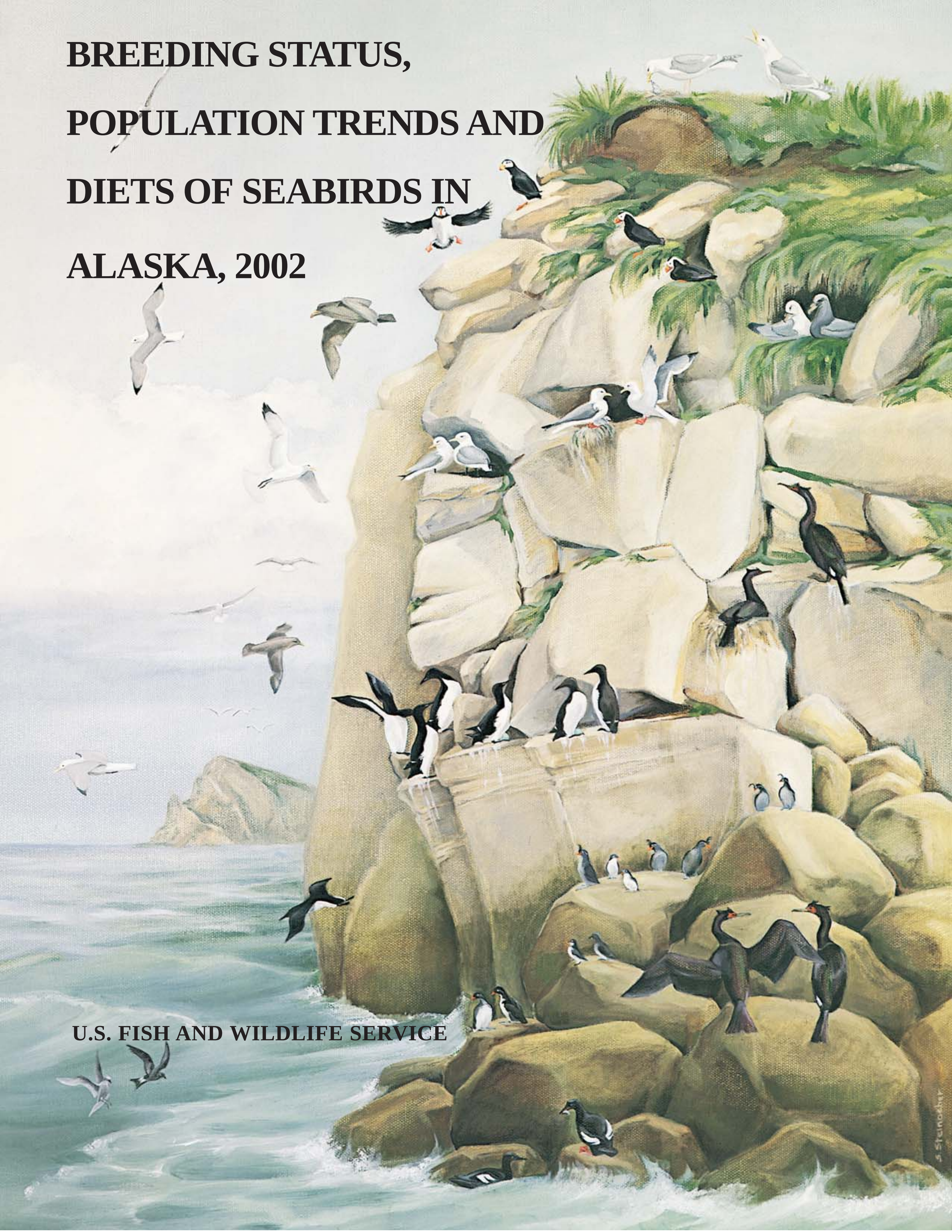
BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2002



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BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2002

Compiled By:

Donald E. Dragoo, G. Vernon Byrd, and David B. Irons[a]

Key words: *Aethia*, Alaska, Aleutian Islands, ancient murrelet, Bering Sea, black-legged kittiwake, *Cepphus*, *Cerorhinca*, Chukchi Sea, common murre, crested auklet, diet, double-crested cormorant, fork-tailed storm-petrel, *Fratercula*, *Fulmarus*, glaucous-winged gull, Gulf of Alaska, hatching chronology, horned puffin, *Larus*, Leach's storm-petrel, least auklet, long-term monitoring, northern fulmar, *Oceanodroma*, parakeet auklet, pelagic cormorant, *Phalacrocorax*, pigeon guillemot, population trends, Prince William Sound, productivity, red-faced cormorant, red-legged kittiwake, rhinoceros auklet, *Rissa*, seabirds, *Synthliboramphus*, thick-billed murre, tufted puffin, *Uria*, whiskered auklet.

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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 2002 data were gathered on northern fulmars, storm-petrels, cormorants, glaucous-winged gulls, kittiwakes, murres, pigeon guillemots, ancient murrelets, auklets, and/or puffins at ten 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 five other locations which are visited intermittently or are currently part of a research or monitoring program off refuges (e.g., Exxon Valdez Trustee Council-sponsored research).

In 2002, we recorded no cases of later than normal hatching chronology. All species were within normal bounds or were earlier than average. Surface plankton feeders (storm-petrels) were earlier than normal in all cases (species x site). Timing of nesting of diving plankton feeders (auklets) was normal in all but two cases, the exceptions being earlier than average hatching dates of least and crested auklets at St. Lawrence Island. Fish feeders (cormorants, gulls, kittiwakes, murres, murrelets, puffins) were earlier than normal in 26 of 37 cases and about normal in 11 cases.

Plankton feeders (storm-petrels and auklets) had average or below average rates of reproductive success in all but two cases. Least and crested auklets exhibited above average success at St. Lawrence Island in 2002. For surface fish feeders, gulls had above average or average rates of success at all sites. At Chukchi and Bering Sea locations kittiwakes had below average success in three of 14 instances, with average or above average productivity at the remaining sites. In the Gulf of Alaska, kittiwake success was above average in all four cases. Monitored species of diving fish feeders (cormorants, murres, murrelets, rhinoceros auklets and puffins) had average or above average rates of productivity in the majority of instances in Alaska in 2002. Below average success was recorded in 16 of 39 cases (species x sites), spread throughout the species mix and geographic regions.

Storm-petrel populations were increasing at two colonies and stable at the remaining sites. Trends for fish feeders (fulmars, cormorants, gulls, kittiwakes, murres, guillemots, rhinoceros auklets, puffins) exhibited upward and downward trends in about equal numbers of cases (species x site). Stable populations were seen in 48 of 81 cases. 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 stable at Kasatochi Island while crested auklets appeared to be increasing at that colony.

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INTRODUCTION

This report is the seventh 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 and 2003 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. 2002). 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 all of these in 2002. Furthermore, data are recorded annually or semiannually at other sites on in Alaska. 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 2002 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.

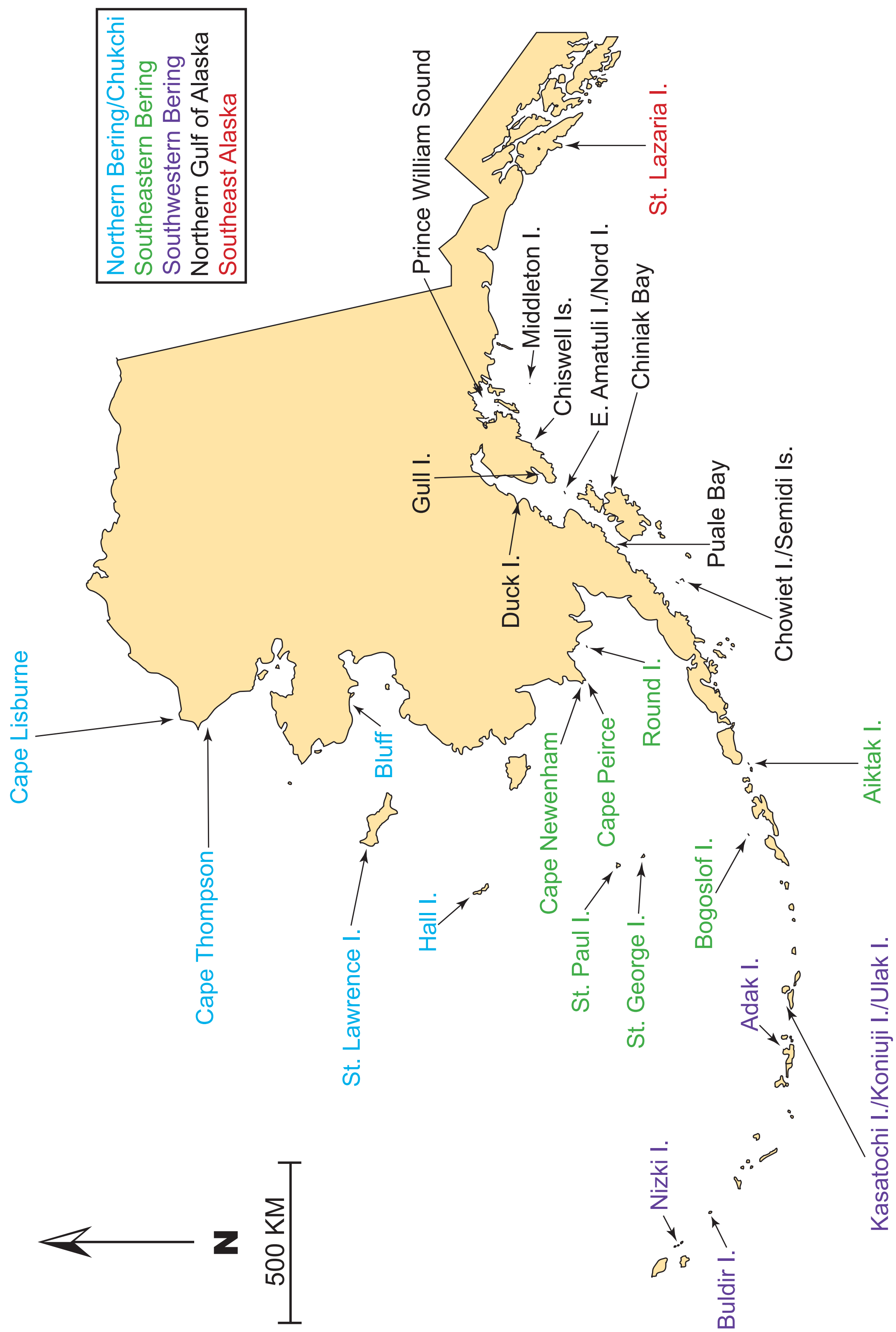


Figure 1. Map of Alaska showing the locations of seabird monitoring sites summarized in this report. Font colors indicate geographic regions.

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) (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 2002, and compares 2002 results with previous years. For sites with at least two years of data prior to 2002, 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 "normal"; larger deviations represented relatively early or late dates. For productivity, we defined significant deviations from "normal" as 20% or greater 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 if $p<0.05$ and are reported as percent per annum increase or decline. Corrected population data were used for the Pribilof Islands (Renner and Howard 2003).

Diets of seabirds are reported as percent occurrence of prey types in either the nestling or adult diets. 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. Data are reported in stacked bar graphs to facilitate having 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 several hundred percent. The cumulative percent occurrence provides information on the average number of prey types per sample. For example, a cumulative percent occurrence of 400% for least auklets indicates that on average each bird consumed four 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 2002.

Productivity.–No data for 2002.

Populations.–Northern fulmars were counted at three colonies in 2002 (Fig. 2). No significant trends were found at any of these sites. Highly variable attendance at colonies is reflected in large error bars.

Diet.–No data.

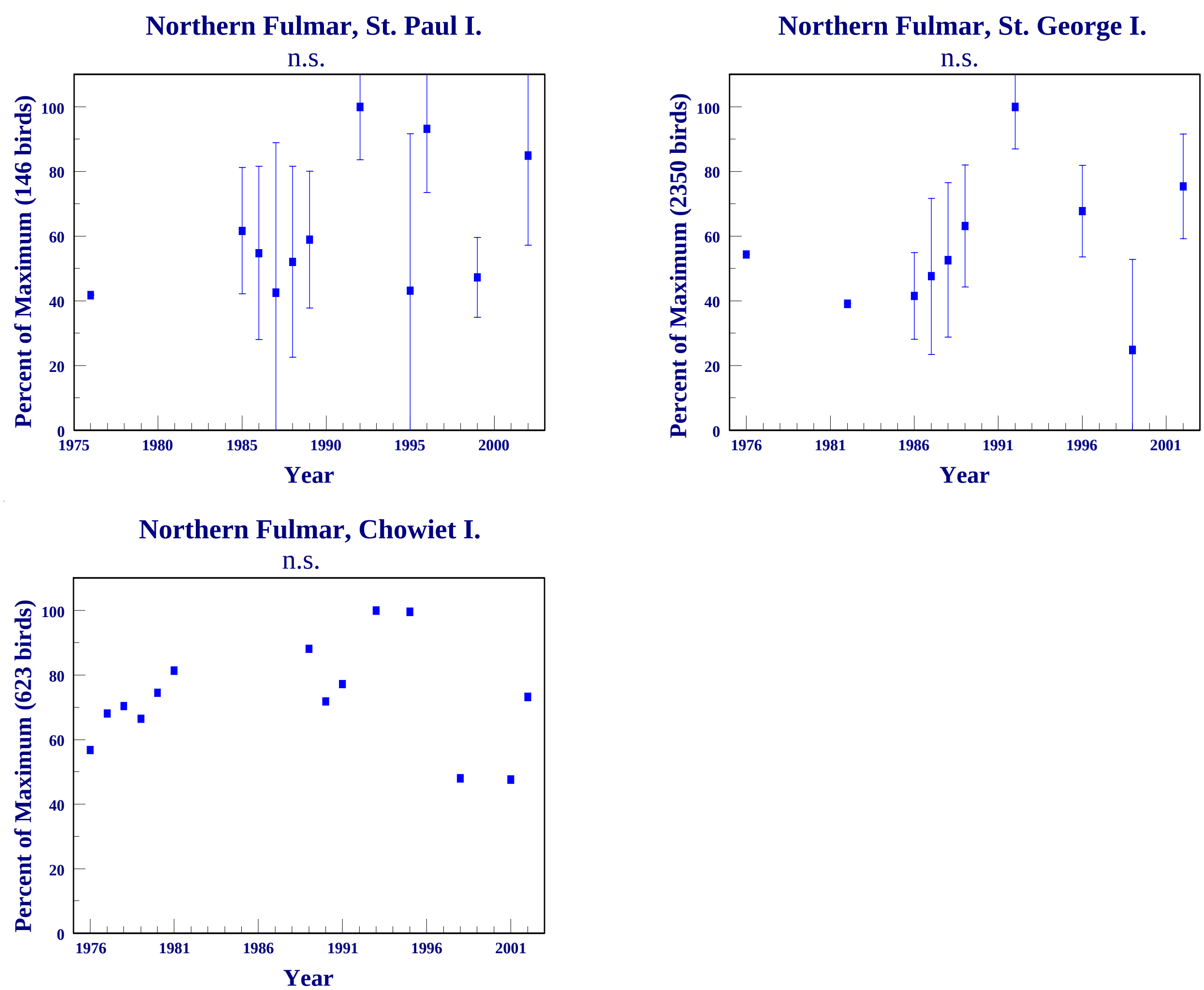


Figure 2. Trends in populations of northern fulmars at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent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

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

Breeding Chronology.–The mean hatching date for fork-tailed storm-petrels was relatively early at Aiktak Island in 2002 (Table 2, Fig. 3).

Table 2. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	1 Jul (20)[a]	3 Jul (20)	15 Jul[b] (5)[a]	Dykstra and Wynn 2002

[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 2002, productivity of fork-tailed storm-petrels ranged from 89% at Aiktak Island to 65% at Ulak Island (Table 3, Fig. 4). Compared to previous years, this species had approximately average success at all three of the sites where it was monitored.

Table 3. Reproductive performance of fork-tailed storm-petrels at Alaskan sites monitored in 2002.

Site	Chicks Fledged[a]/egg	No. of Plots	No. of Eggs	Reference
Buldir I.	0.72	6	65	Williams et al. 2002
Ulak I.	0.65	N/A[b]	62	Syria 2002
Aiktak I.	0.89	4	25	Dykstra and Wynn 2002

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

[b]Not applicable or not reported.

Populations.–Fork-tailed and Leach's storm-petrel burrows were combined at most sites for population monitoring purposes. Storm-petrel populations have increased by 9.3% per annum at Aiktak Island since 1990 and by 7.4% per annum at St. Lazaria Island since 1993 (Fig. 5). No other monitored colonies exhibited significant trends.

Diet.–Myctophids dominated the diets of fork-tailed storm-petrels at both Buldir and St. Lazaria islands. Fork-tailed storm-petrels at Buldir Island ate a more diverse diet than those at St. Lazaria Island including amphipods and squid. In a small sample from Aiktak Island, storm-petrel diets consisted entirely of an unidentified species of amphipod of the genus *Parathemisto* (Fig. 6).

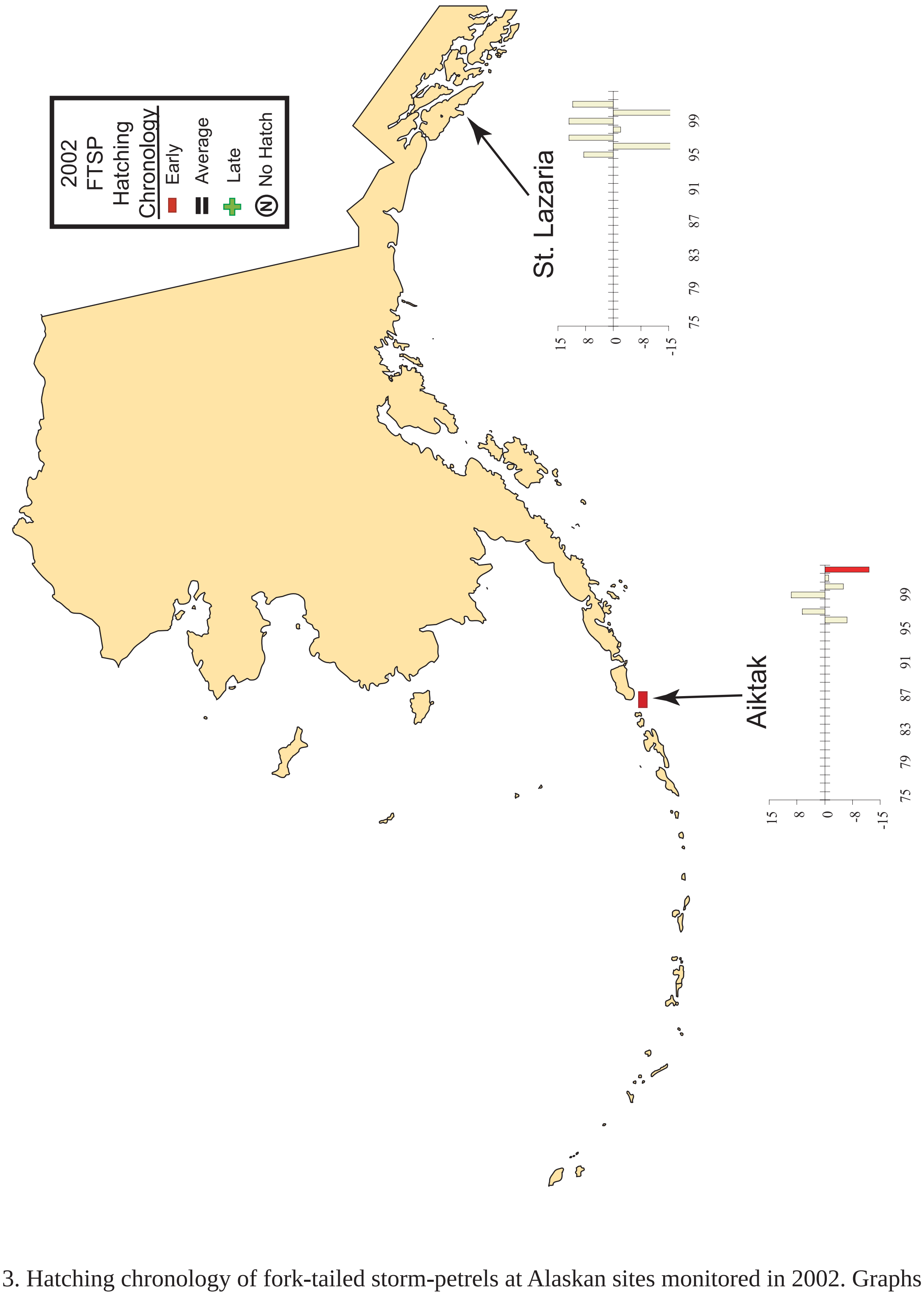


Figure 3. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

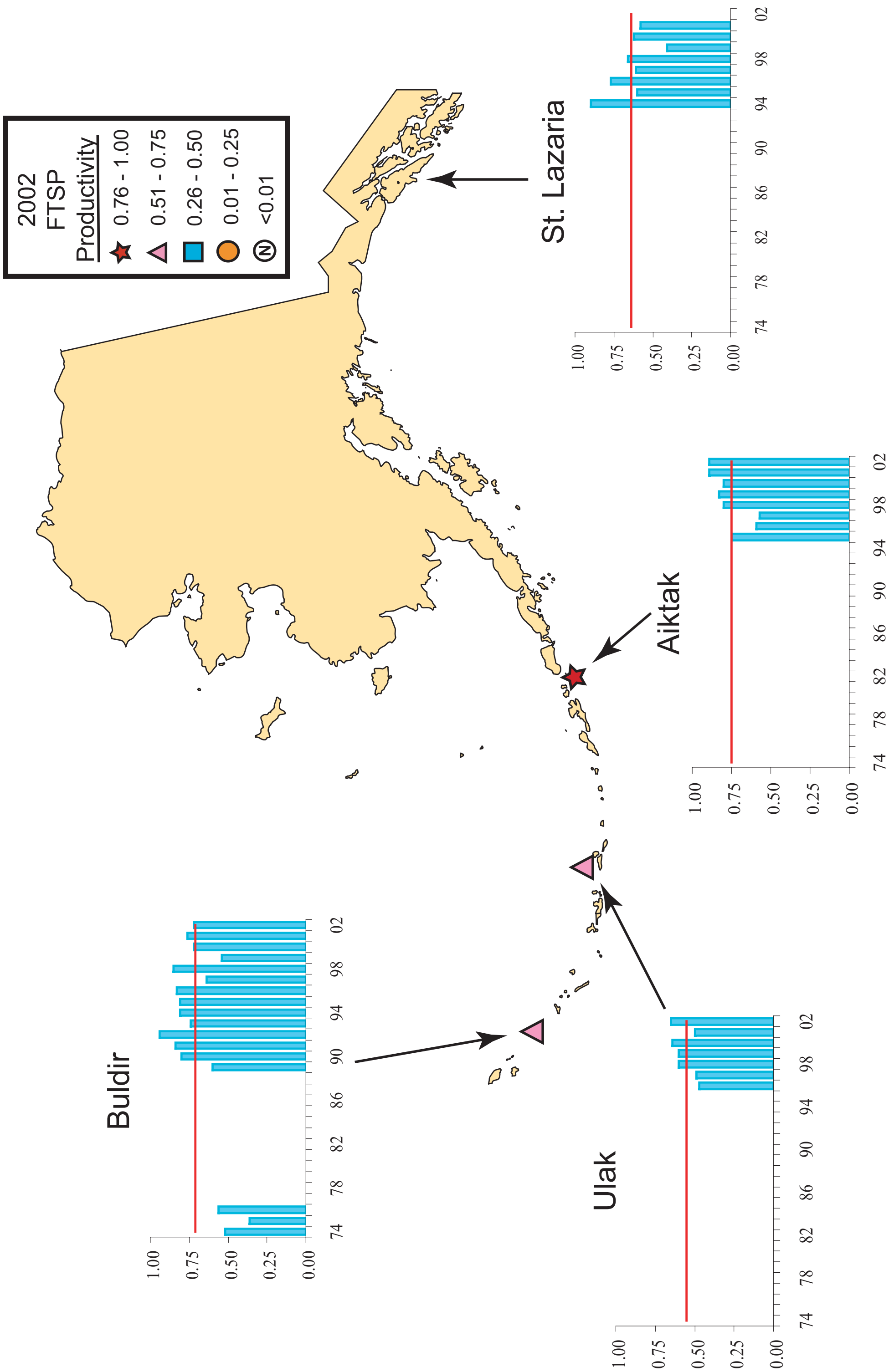


Figure 4. Productivity of fork-tailed storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

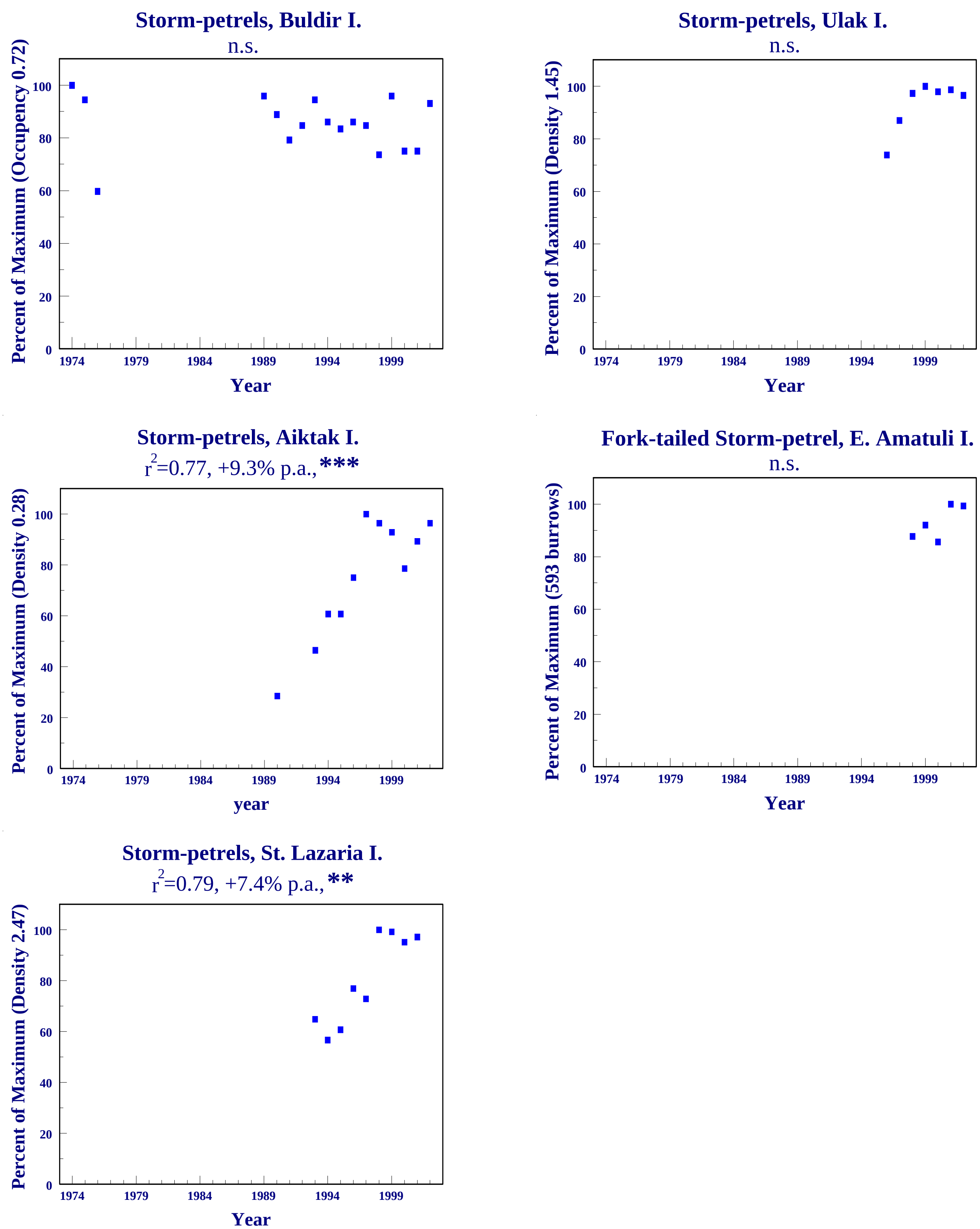


Figure 5. Trends in populations of storm-petrels at Alaskan sites. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

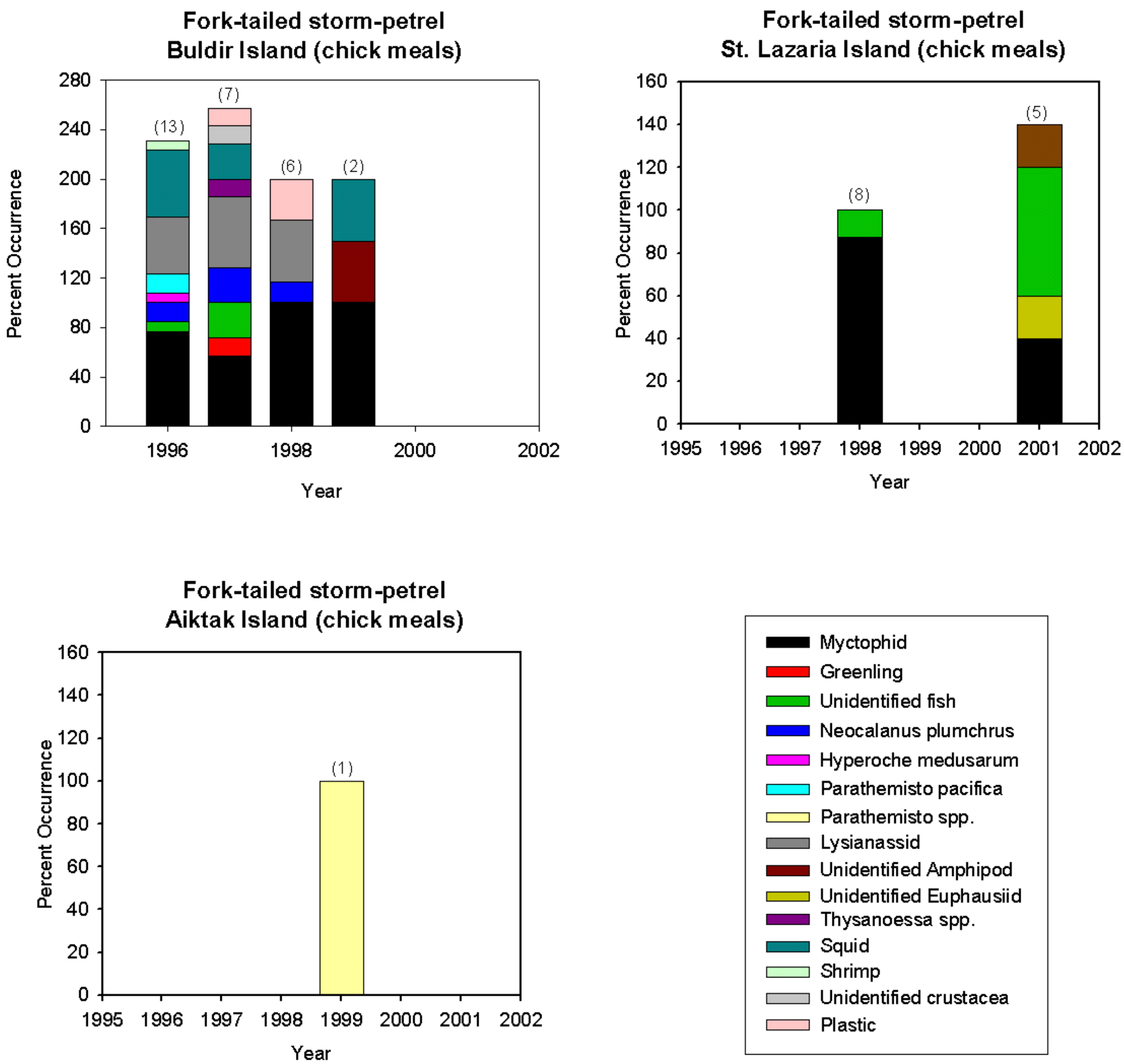


Figure 6. Diets of fork-tailed storm-petrels at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

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

Breeding Chronology.–The mean hatching date for Leach’s storm-petrels was relatively early at Aiktak Island in 2002 (Table 4, Fig. 7).

Table 4. Hatching chronology of Leach’s storm-petrels at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	22 Jul (10)[a]	22 Jul (10)	31 Jul[b] (5)[a]	Dykstra and Wynn 2002

[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 2002, productivity of Leach’s storm-petrels ranged from 66% at Buldir Island to 39% at Aiktak Island (Table 5, Fig. 8). Compared to previous years, this species had below average success at Aiktak Island and approximately average productivity at Buldir Island.

Table 5. Reproductive performance of Leach’s storm-petrels at Alaskan sites monitored in 2002.

Site	Chicks Fledged[a]/egg	No. of Plots	No. of Eggs	Reference
Buldir I.	0.66	6	85	Williams et al. 2002
Aiktak I.	0.39	6	15	Dykstra and Wynn 2002

[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 +9.3% per annum at Aiktak Island and by +7.4% 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 with lesser amounts of amphipods and unidentified fish. At Buldir Island Leach’s storm-petrels ate a more diverse diet than at St. Lazaria secondarily relying on a variety of amphipods and euphausiids. In a small sample from Aiktak Island, Leach’s storm-petrel diet consisted entirely of unidentified fish (Fig. 9).

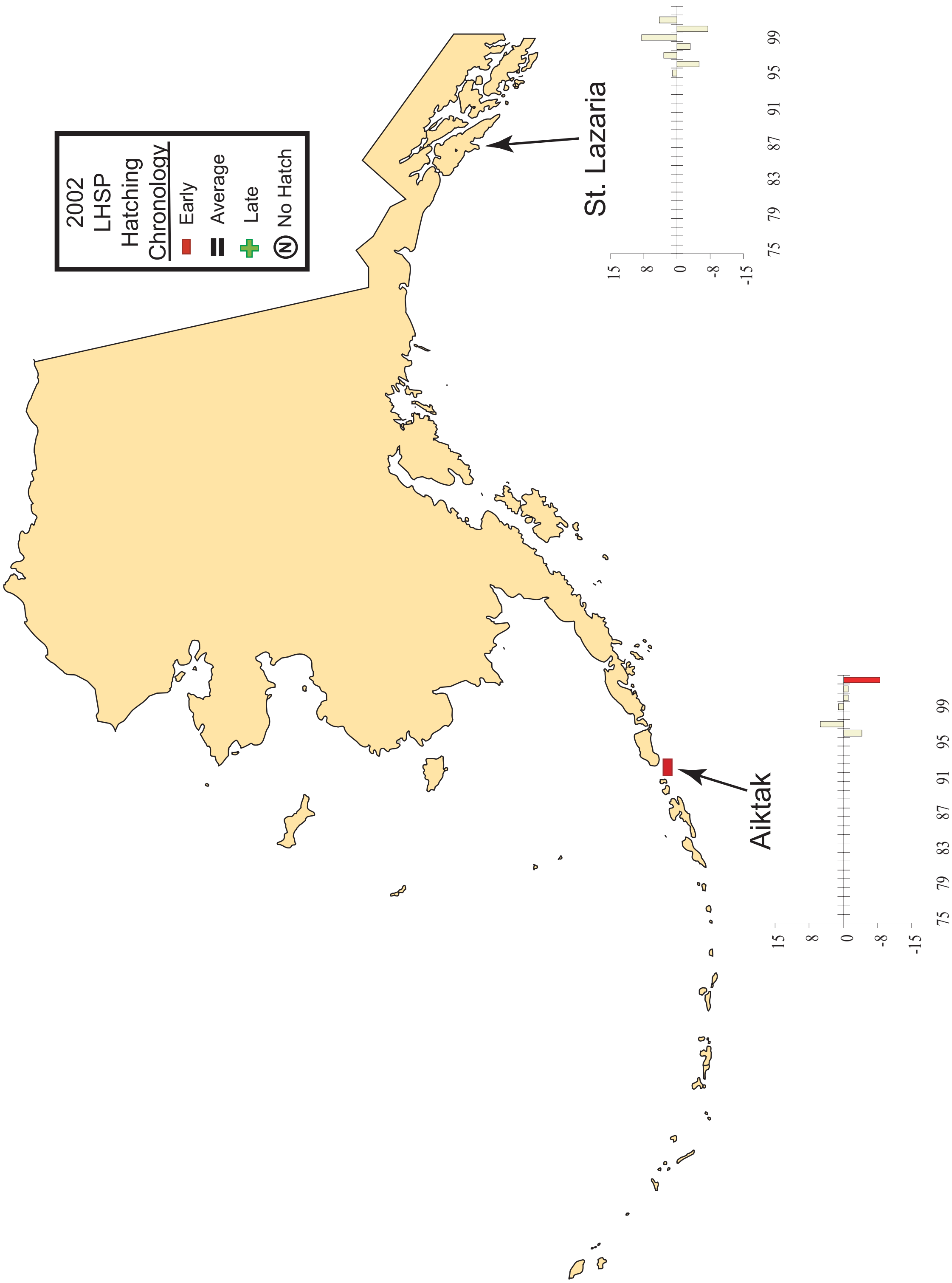


Figure 7. Hatching chronology of Leach's storm-petrels at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

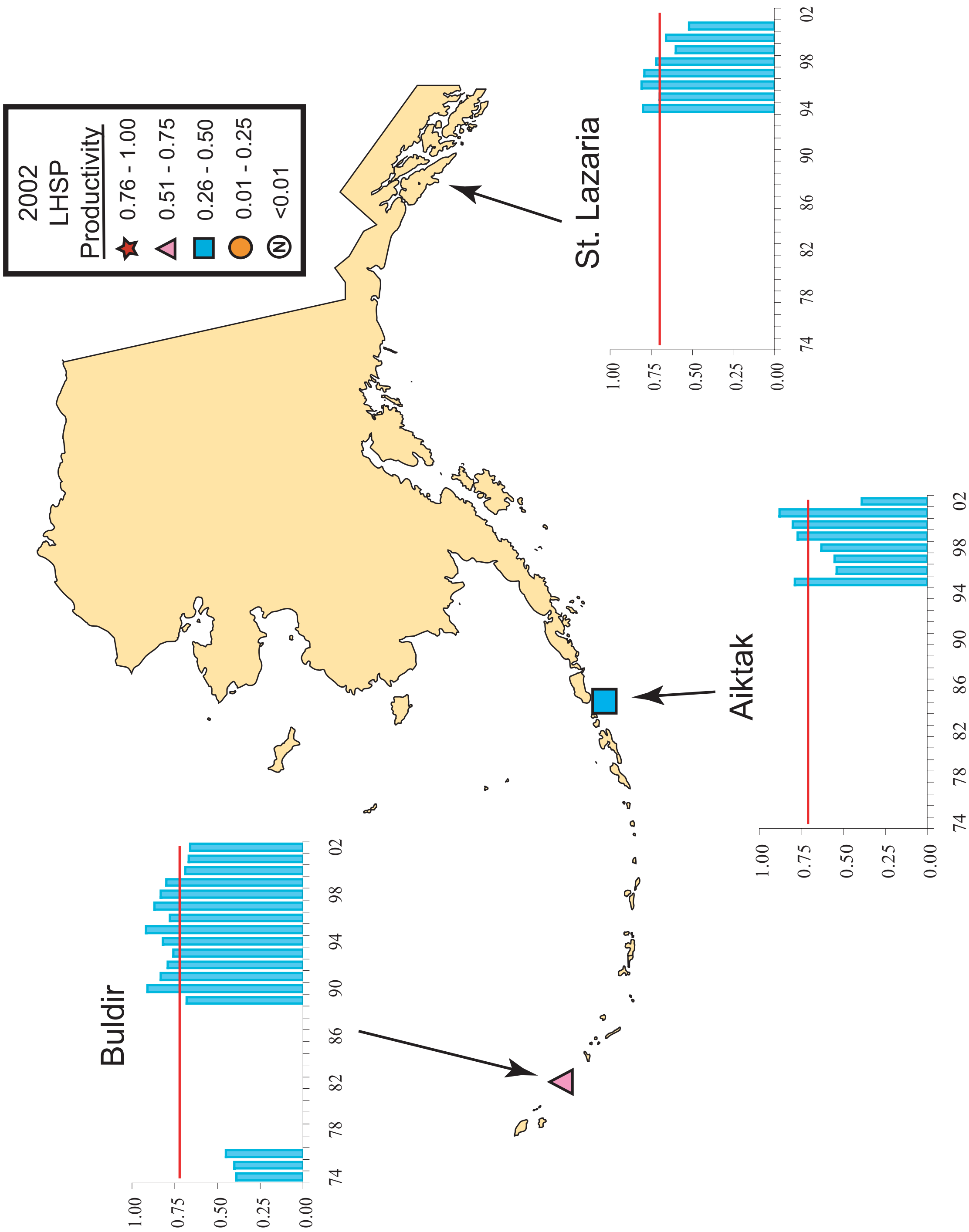


Figure 8. Productivity of Leach's storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

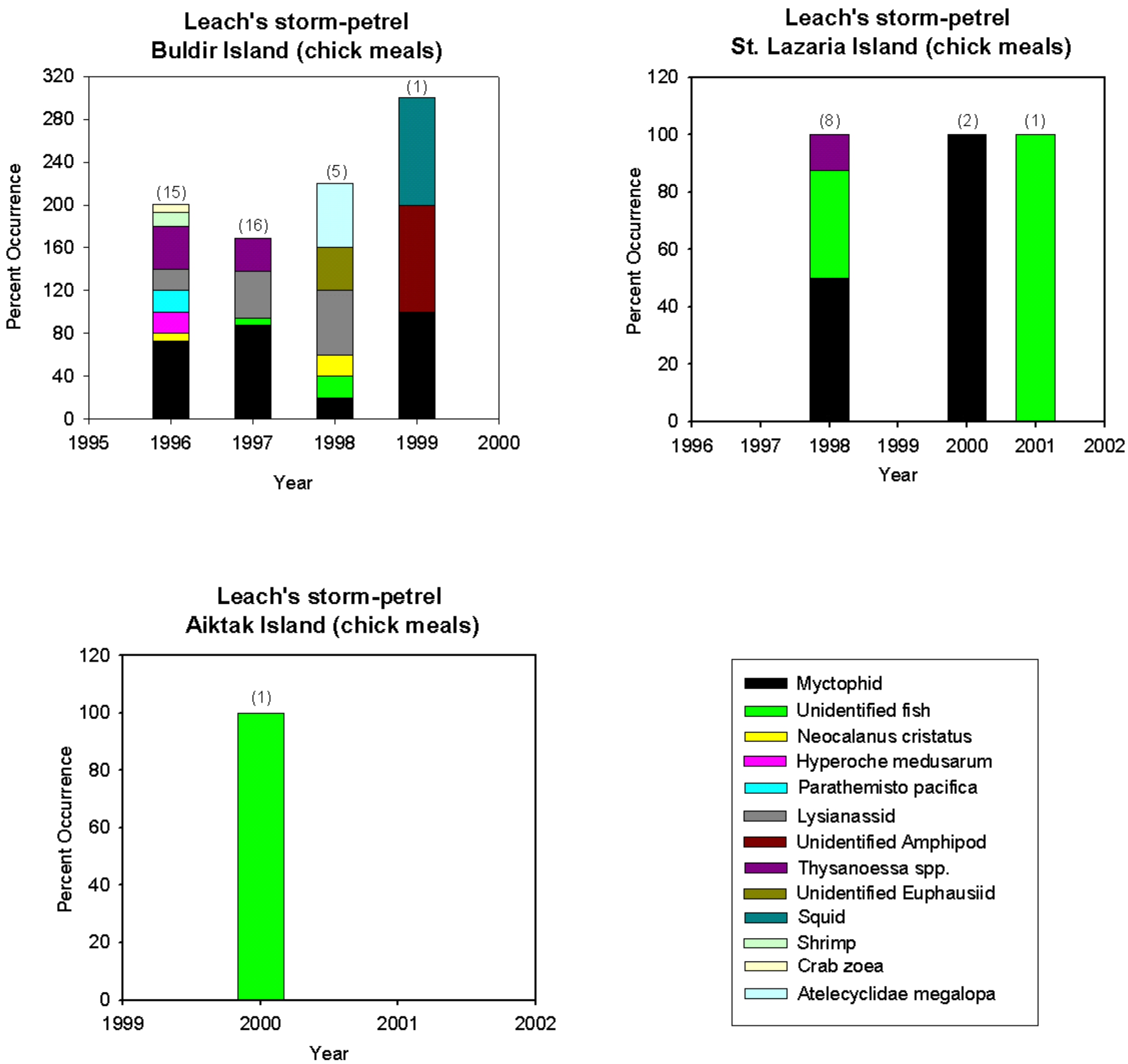


Figure 9. Diets of Leach's storm-petrels at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Double-crested Cormorant (*Phalacrocorax auritus)*

Breeding Chronology.–No data for 2002.

Productivity.–In 2002, double-crested cormorants averaged just over one chick per nest at Puale Bay, lower than in 2001 (Table 6). This species had fairly low productivity at Aiktak Island as well.

Table 6. Reproductive performance of double-crested cormorants at Alaskan sites monitored in 2002.

Site	Chicks Fledged/Nest	No. of Nests	Reference
Aiktak I.	0.60	15	Dykstra and Wynn 2002
Puale B.	1.33	3	Kaler et al. 2003

Populations.–No data.

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

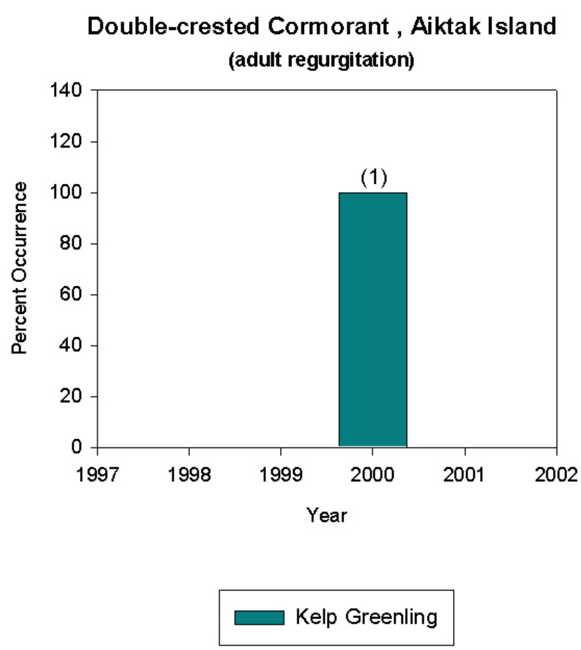


Figure 10. Diets of double-crested cormorants at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally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

Red-faced Cormorant (*Phalacrocorax urile*)

Breeding Chronology .–Red-faced cormorant eggs hatched on 7 July on average at Puale Bay in 2002 (Table 7), earlier than in 2001.

Table 7. Hatching chronology of red-faced cormorants at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Puale B.	—	7 Jul (131)[a]	N/A[b]	Kaler et al. 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]Not applicable or not reported.

Productivity .–In 2002, productivity of red-faced cormorants ranged from 0.60 chicks fledged per nest at Ulak Island to 2.29 chicks fledged at Puale Bay (Table 8). Productivity was average or higher at most sites where this species was monitored in 2002 with the exception of Ulak and Aiktak islands, where success was relatively low (Fig. 11).

Table 8. Reproductive performance of red-faced cormorants at Alaskan sites monitored in 2002.

Site	Chicks Fledged/Nest	No. of Plots	No. of Nests	Reference
St. George I.	1.90	2	31	Moore and Boyd 2002
Ulak I.	0.60[a]	N/A[b]	68	Syria 2002
Kasatochi I.	2.10	N/A	22	Syria 2002
Aiktak I.	1.12	N/A	49	Dykstra and Wynn 2002
Puale B.	2.29	N/A	144	Kaler et al. 2003
Chiniak B.	0.96[a]	2	51	Kildaw et al. 2003

[a]Value obtained from onetime 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 -12.9% 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.

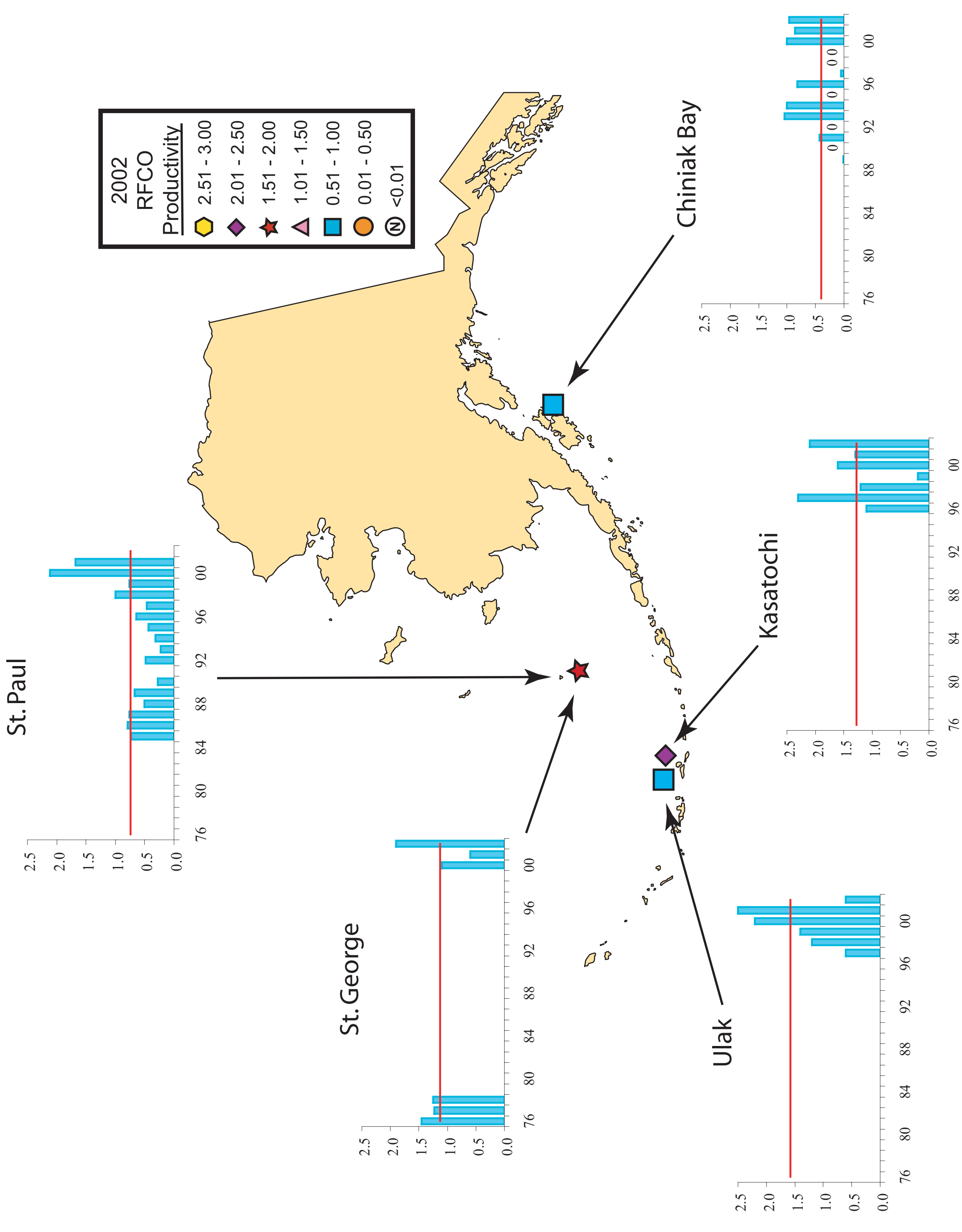


Figure 11. Productivity of red-faced cormorants (chicks fledged/nest) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

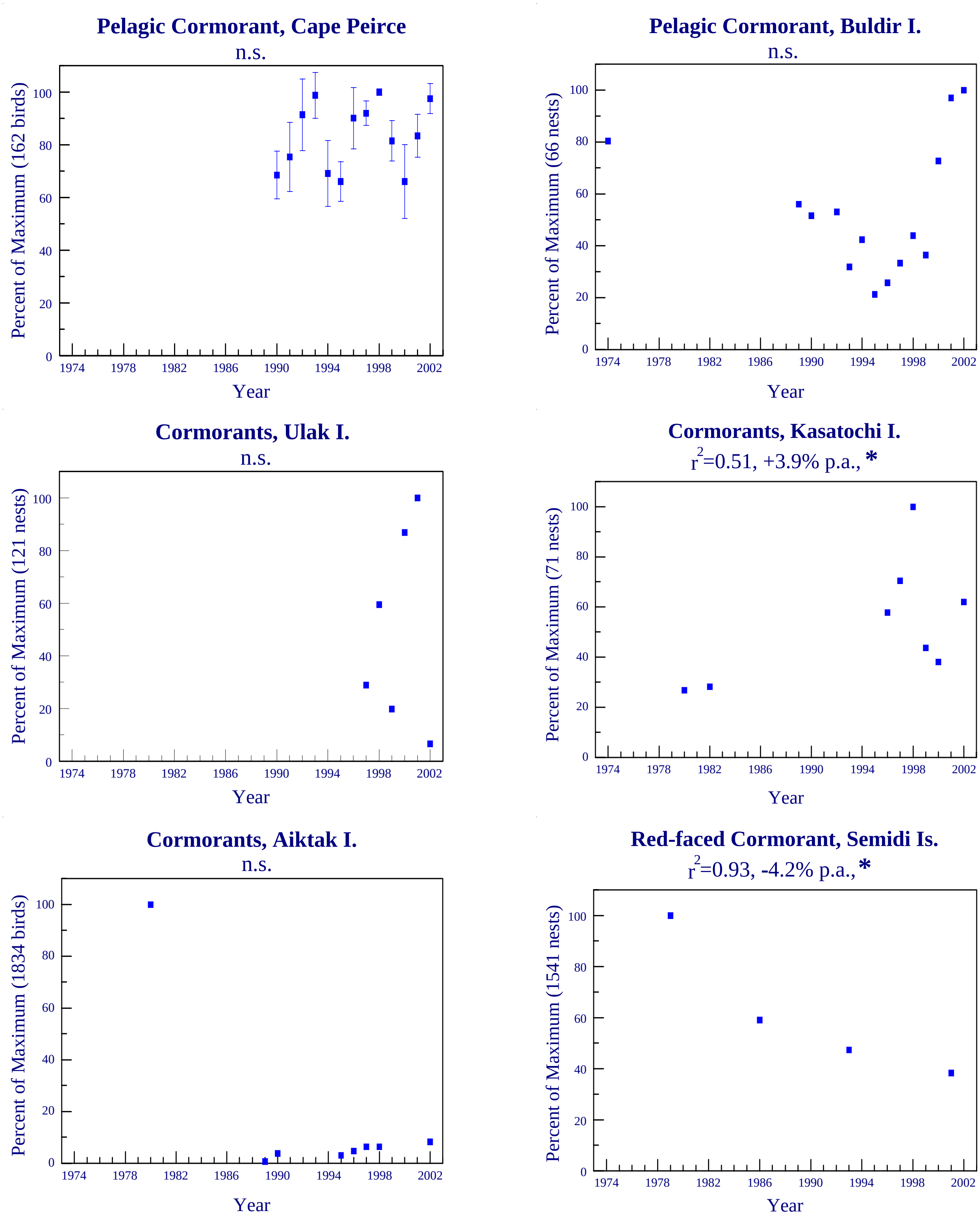


Figure 12. Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent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

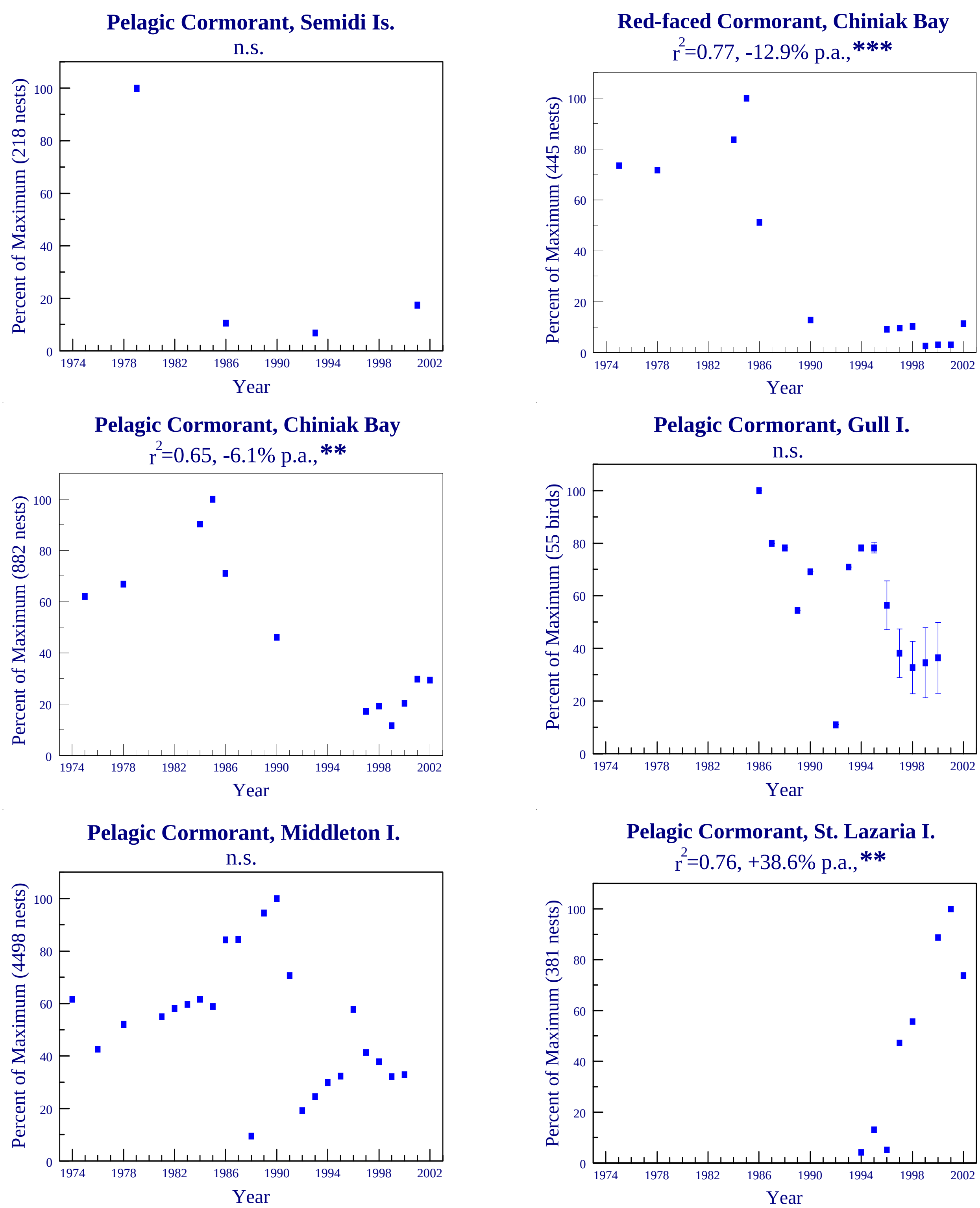


Figure 12 (continued). Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Breeding Chronology .–Hatching dates for pelagic cormorants were about average at Cape Peirce in 2002 (Table 9).

Table 9. Hatching chronology of pelagic cormorants at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Cape Peirce	—	18 Jun (43)[a]	20 Jun[b] (10)[a]	R. MacDonald Unpubl. Data 2002

[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 average or above at most sites monitored in 2002 (Table 10, Fig. 13). Success was below average at Ulak, Aiktak and St. Lazaria islands.

Table 10. Reproductive performance of pelagic cormorants at Alaskan sites monitored in 2002.

Site	Chicks Fledged/Nest	No. of Plots	No. of Nests	Reference
Cape Peirce	1.65	12	52	R. MacDonald Unpubl. Data 2002
Round I.	2.92	1	12	Cody 2002
Buldir I.	0.90	N/A[a]	66	Williams et al. 2002
Ulak I.	0.80[b]	N/A	5	Sryia 2002
Kasatochi I.	1.40	N/A	13	Syria 2002
Aiktak I.	1.06	N/A	18	Dykstra and Wynn 2002
Chiniak B.	0.98[b]	8	259	Kildaw et al. 2003
St. Lazaria I.	0.60	4	281	L. Slater Unpubl. Data

[a]Not applicable or not reported.

[b]Value obtained from onetime 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 significant positive trends for cormorants at Kasatochi Island (+3.9% per annum) and for pelagic cormorants at St. Lazaria Island (+38.6% per annum). Pelagic cormorants declined at Chiniak Bay (-6.1% per annum).

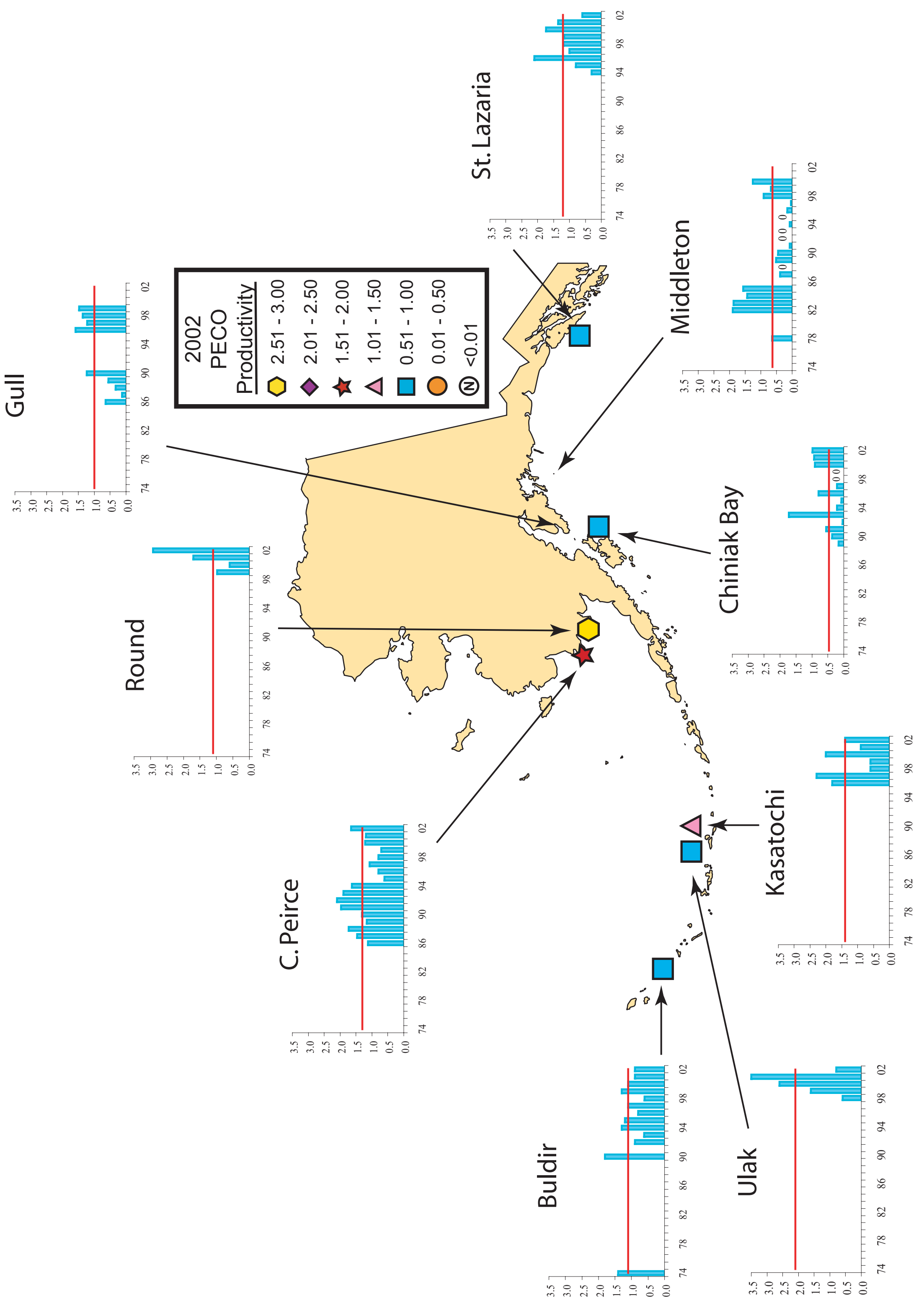


Figure 13. Productivity of pelagic cormorants (chicks fledged/nest) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

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

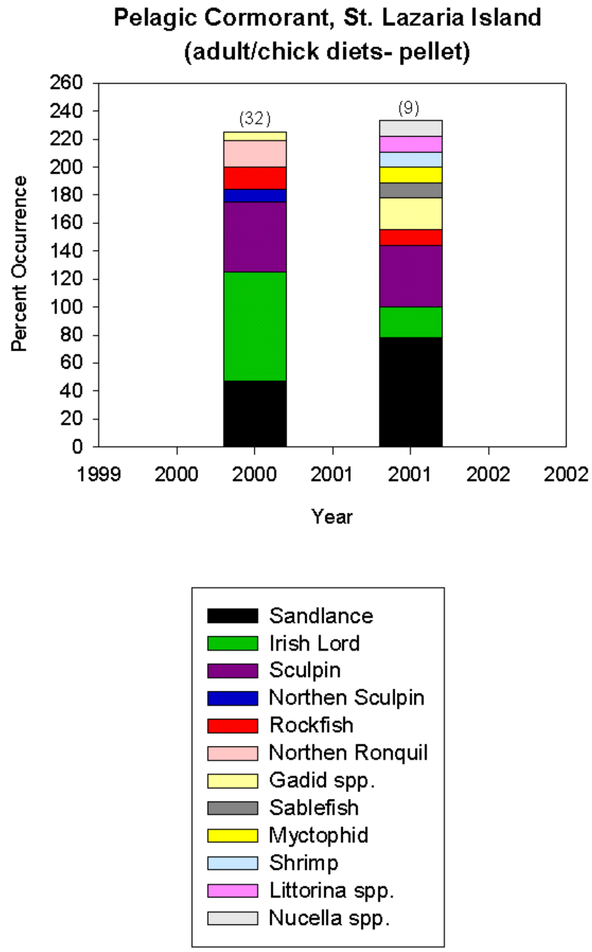


Figure 14. Diets of pelagic cormorants at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds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

Glaucous-winged Gull *(Larus glaucescens*)

Breeding Chronology .–Mean hatch dates for gulls occurred in late June at Aiktak and St. Lazaria islands in 2002 (Table 11, Fig. 15), relatively early for both sites. Mean hatch at Puale Bay was about the same as in 2001.

Table 11. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	27 Jun (95)[a]	27 Jun (95)[a]	9 Jul[b] (7)[a]	Dykstra and Wynn 2002
Puale Bay	—	4 Jul (21)	N/A[c]	Kaler at al. 2003
St. Lazaria I.	27 Jun (33)	29 Jun (33)	4 Jul[b] (3)	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.

[c]Not applicable or not reported.

Productivity .–Hatching success in 2002 ranged from 80 % at Aiktak and St. Lazaria islands to 41% at Buldir Island (Table 12, Fig. 16). Success was average or above at all monitored colonies.

Table 12. Reproductive performance of glaucous-winged gulls at Alaskan sites monitored in 2002.

Site	Hatching Success[a]	No. of Plots	No. of Nests	Reference
Buldir I.	0.41	N/A[b]	38	Williams et al. 2002
Aiktak I.	0.80	2	190	Dykstra and Wynn 2002
Chowiet I.	0.53	3	138	Wang 2002
Puale Bay	0.59	N/A	8	S. Savage Unpubl. Data
St. Lazaria I.	0.80	3	41	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 (-21.1% 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 predominantly consisting of herring and sand lance with lesser amounts of avian prey, sea urchins, other invertebrates, 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 (Fig. 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.

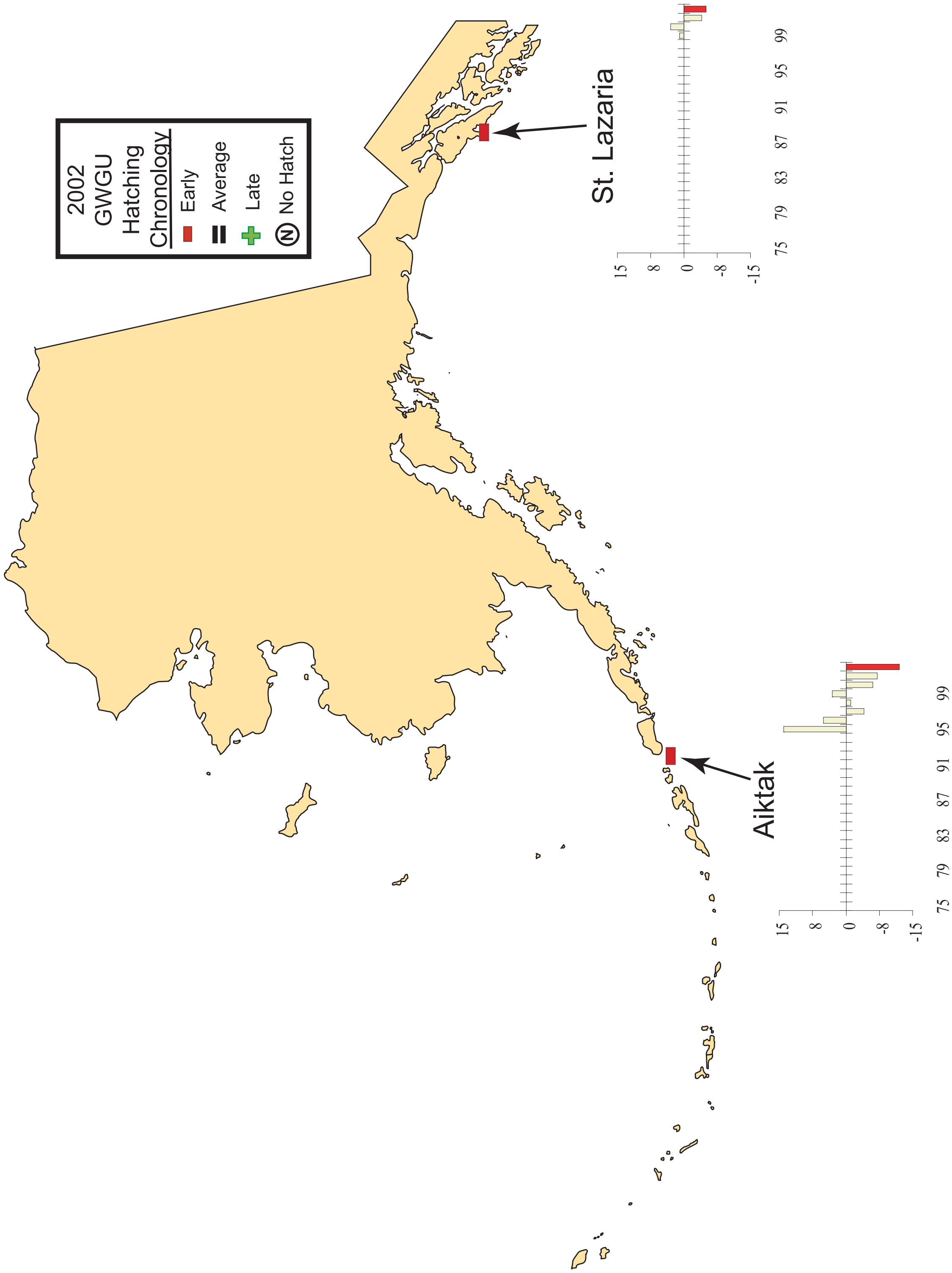


Figure 15. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

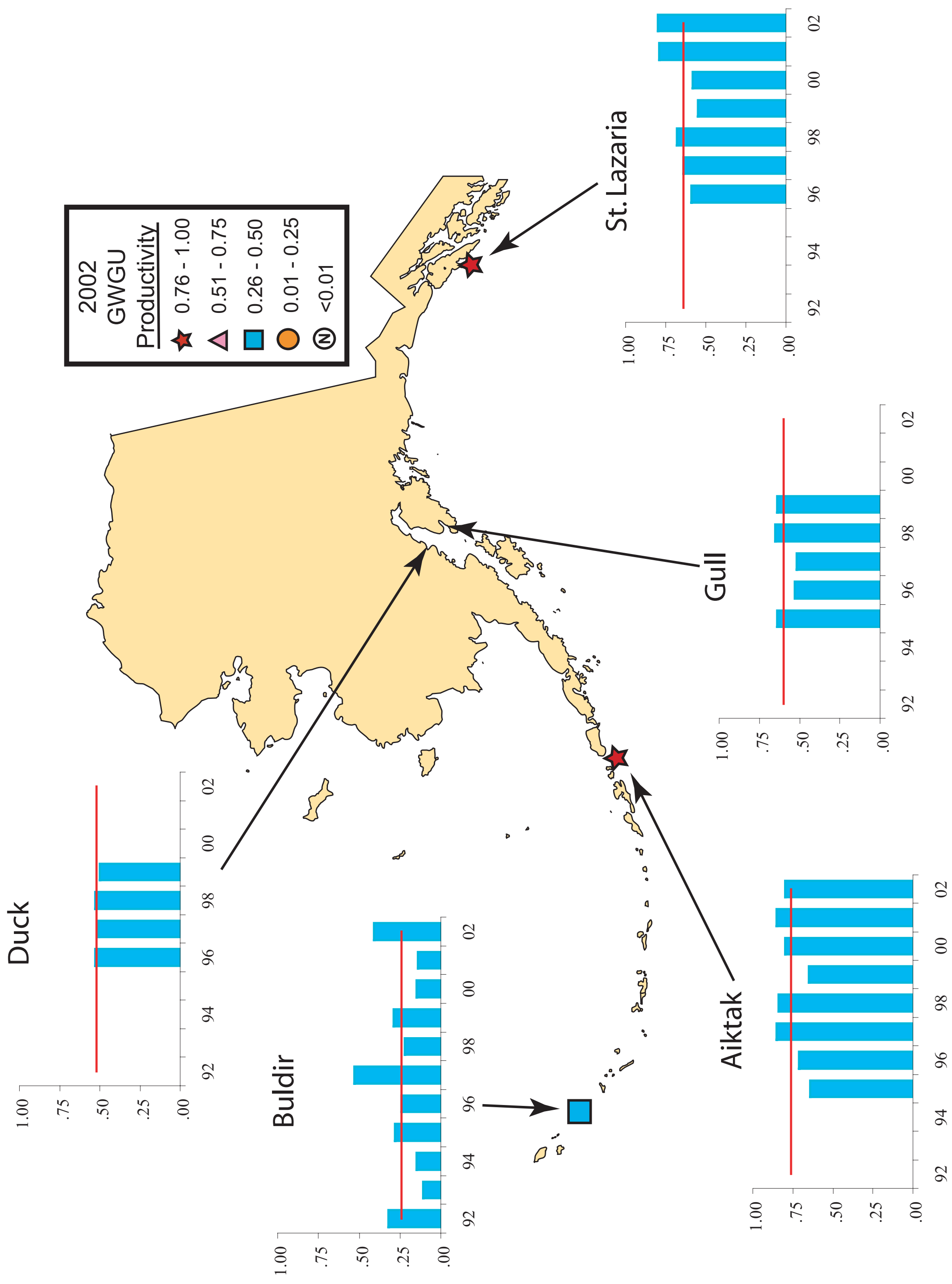


Figure 16. Productivity of glaucous-winged gulls (hatching success) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

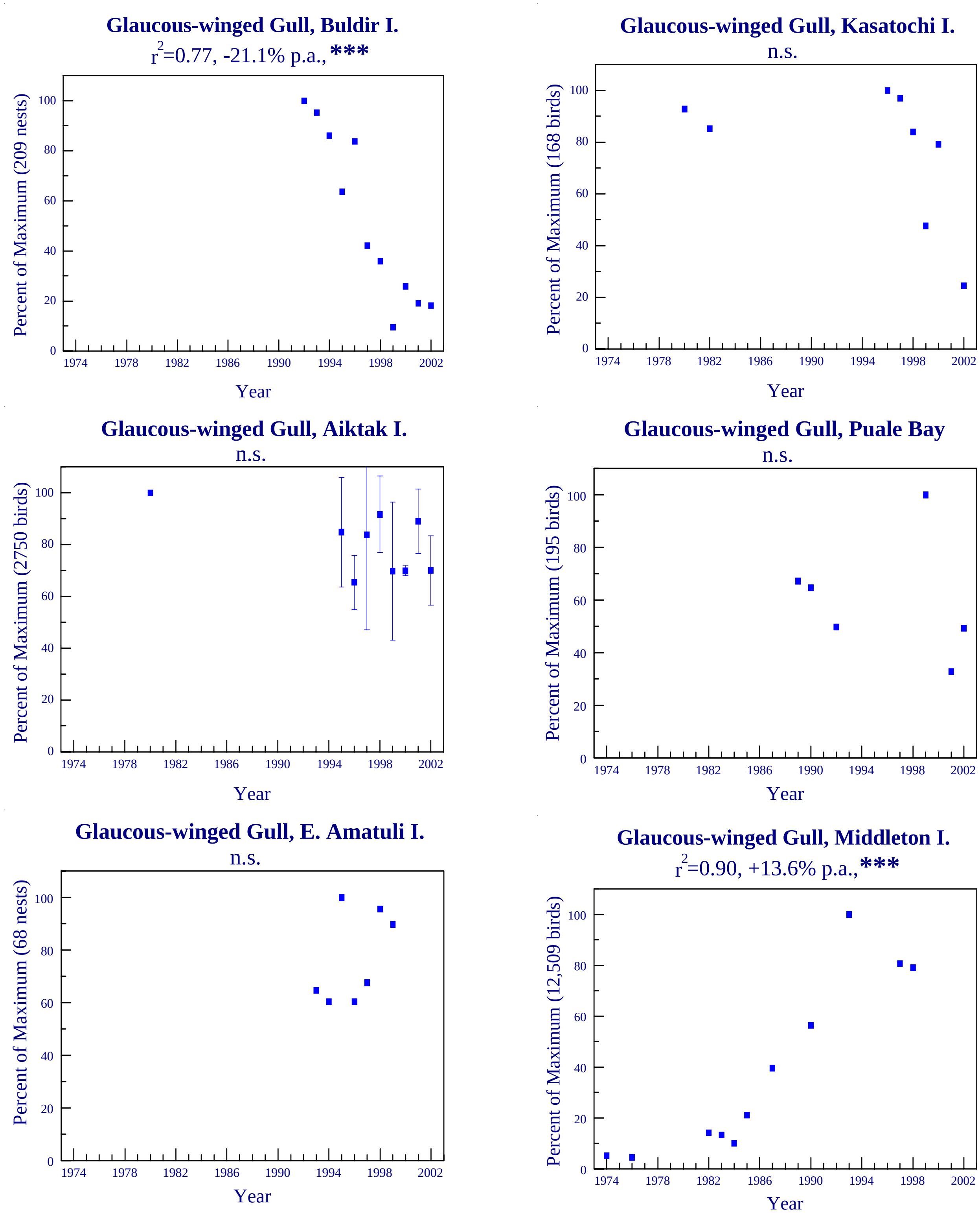


Figure 17. Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

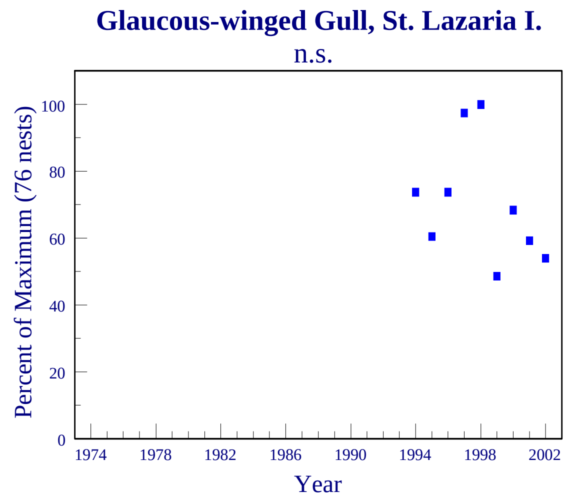


Figure 17 (continued). Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline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

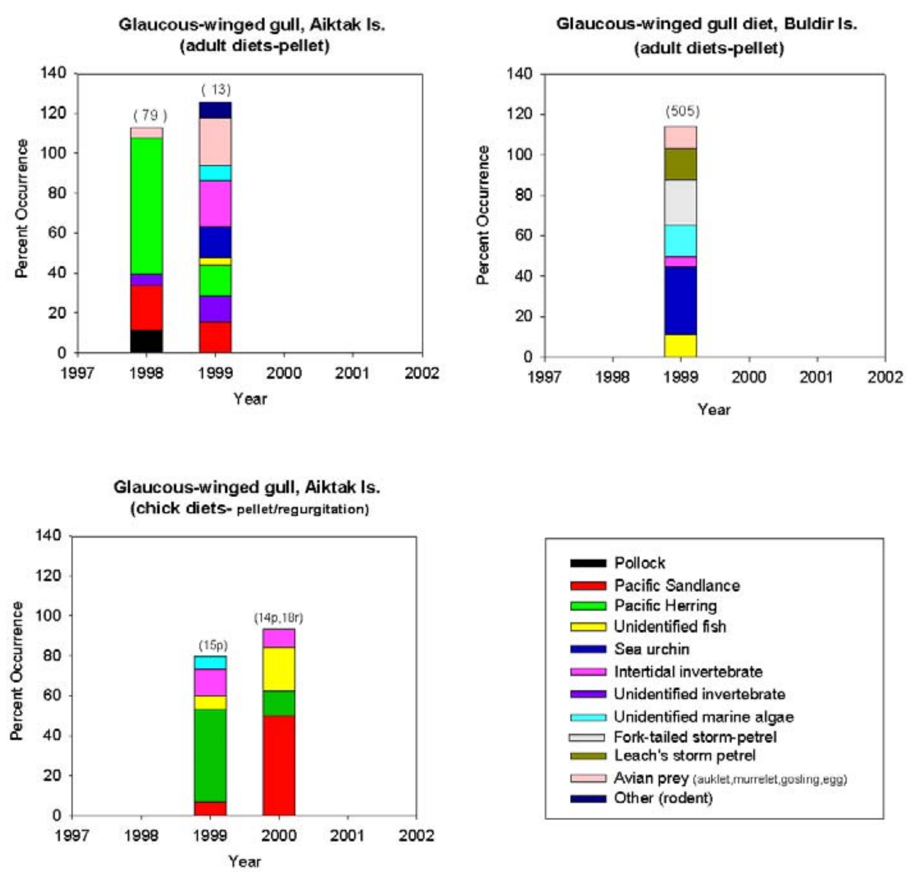


Figure 18. Diets of glaucous-winged gulls at Bering Sea sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally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

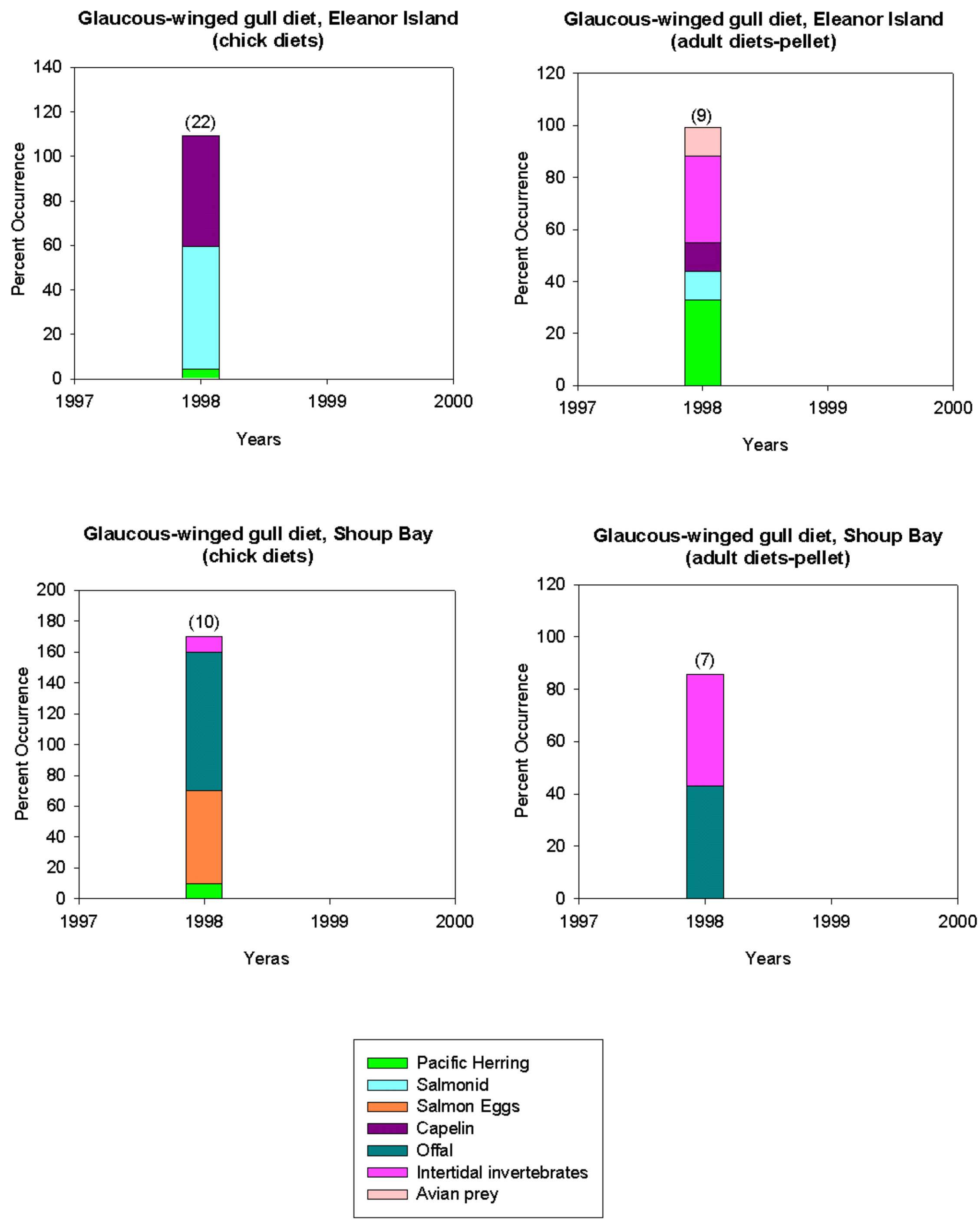


Figure 19. Diets of glaucous-winged gulls at Gulf of Alaska sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally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

Black-legged Kittiwake (*Rissa tridactyla*)

Breeding Chronology .–In 2002, nesting was relatively early at all monitored sites (Table 13, Fig. 20).

Table 13. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	—	15 Jul (58)[a]	21 Jul[b] (3)[a]	Gall et al. 2003
Bluff	—	17 Jul (N/A[c])	25 Jul[b] (23)	Murphy 2002
St. Paul I.	—	4 Jul (210)	21 Jul[b] (18)	Howard 2002
St. George I.	—	3 Jul (71)	19 Jul[b] (17)	Moore and Boyd 2002
Cape Peirce	—	1 Jul (155)	11 Jul[b] (13)	R. MacDonald Unpubl. Data
Buldir I.	—	27 Jun (147)	6 Jul[b] (14)	Williams et al. 2002
Chowiet I.	—	8 Jul (108)	16 Jul[b] (9)	Wang 2002
E. Amatuli I.	5 Jul (186)	4 Jul (186)	12 Jul[b] (8)	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 2002 ranged from a near complete failure at Cape Lisburne to 1.26 chicks fledged per nest at Bogoslof Island (Table 14). Productivity was above average at all but three of the northern and western sites monitored this year and above average at all monitored colonies in the Gulf of Alaska (Fig. 21).

Populations .–Significantly negative population trends have occurred at St. Paul (-4.0% per annum), Chowiet (-1.9%), and Middleton (-7.5%) islands and at Cape Peirce (-6.3%, Fig. 22). Significant increases have occurred at Buldir Island (+7.9% per annum) and Prince William Sound (+1.5%).

Diet .–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 pollock, greenling, myctophids and euphausiids. Pollock and sand lance 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 (Figure 23).

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

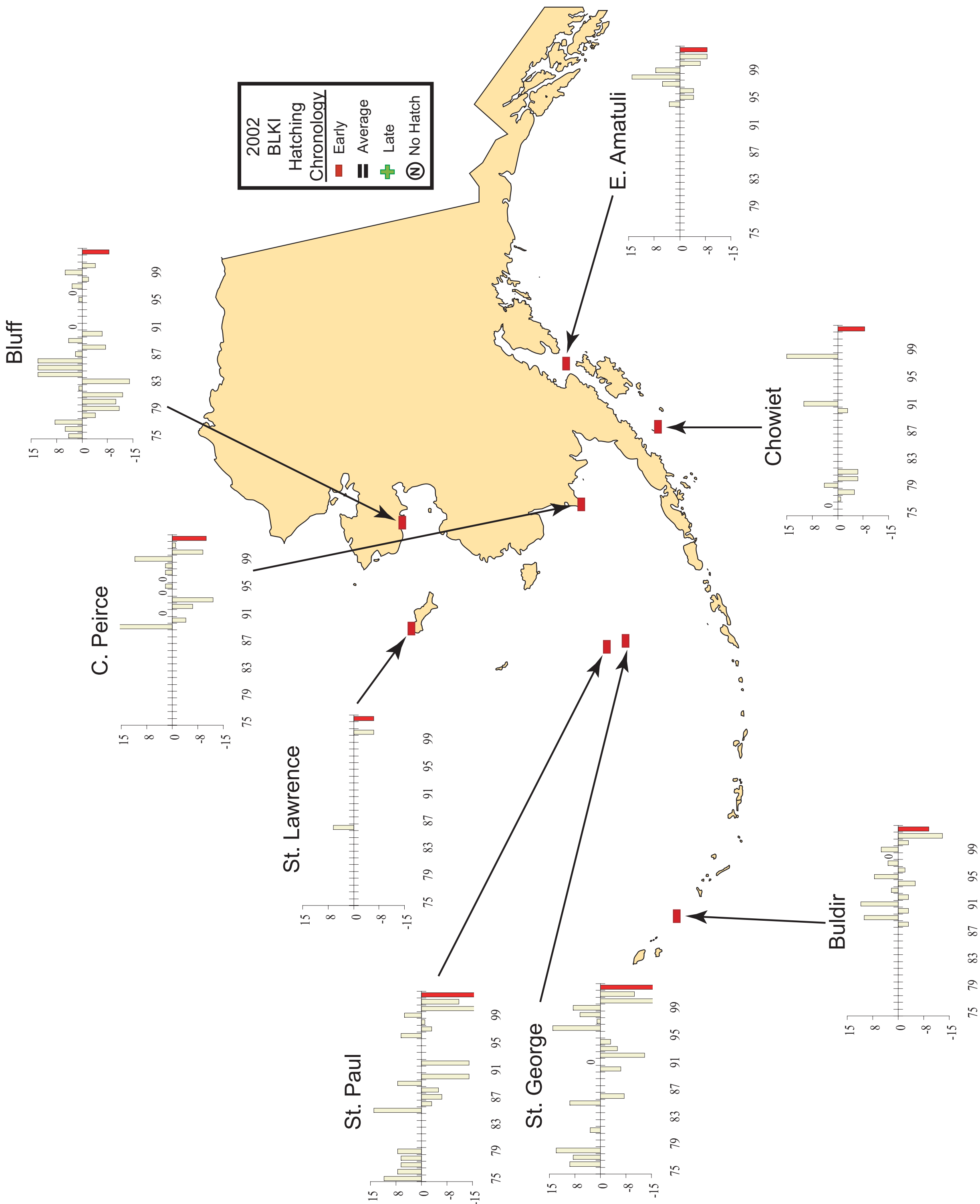


Figure 20. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

Table 14. Reproductive performance of black-legged kittiwakes at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest[a]	No. of Plots	No. of Nests	Reference
C. Lisburne	<0.01[b]	N/A[c]	243	D. Roseneau Unpubl. Data
St. Lawrence I.	0.18	N/A	136	Gall et al. 2003
Bluff	0.66[b]	5	115	Murphy 2002
St. Paul I.	0.80	15	343	Howard 2002
St. George I.	0.67	5	113	Moore and Boyd 2002
Cape Peirce	0.64	8	215	R. MacDonald Unpubl. Data
Round I.	0.51	2	51	Cody 2002
Buldir I.	0.07	7	299	Williams et al. 2002
Koniuji I.	0.80[b]	6	228	Syria 2002
Bogoslof I.	1.26[b]	N/A	394	Williams and Sowls Unpubl. Data
Chowiet I.	0.43	7	143	Wang 2002
Chiniak B.	0.41[b]	22	11,549	Kildaw et al. 2003
E. Amatuli I.	0.89	10	436	A. Kettle Unpubl. Data
Pr. Will. Snd.	0.34[b]	N/A	24,275	D. B. Irons Unpubl. Data

[a]Total chicks fledged/Total nests.

[b]Short visit.

[c]Not applicable or not reported.

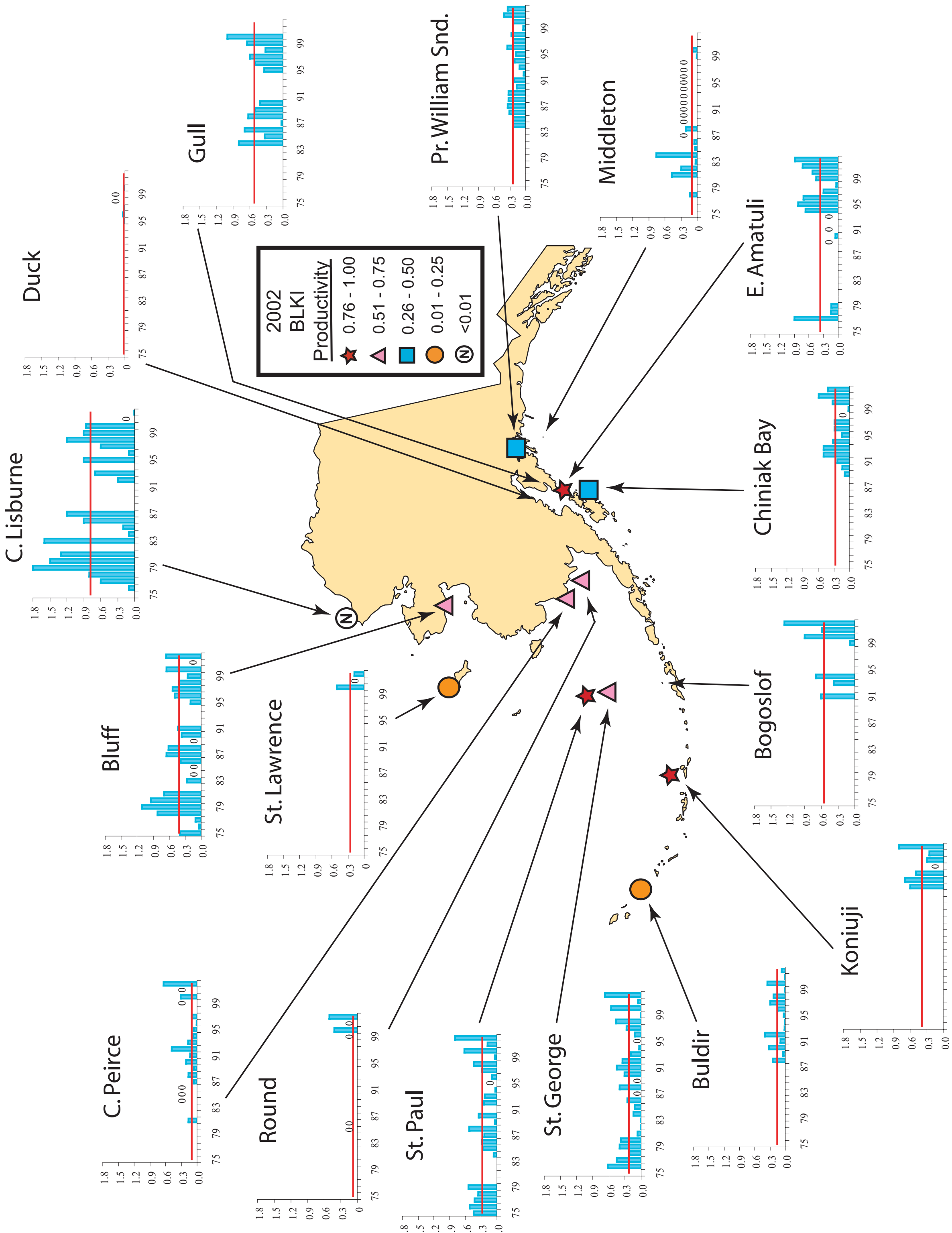


Figure 21. Productivity of black-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

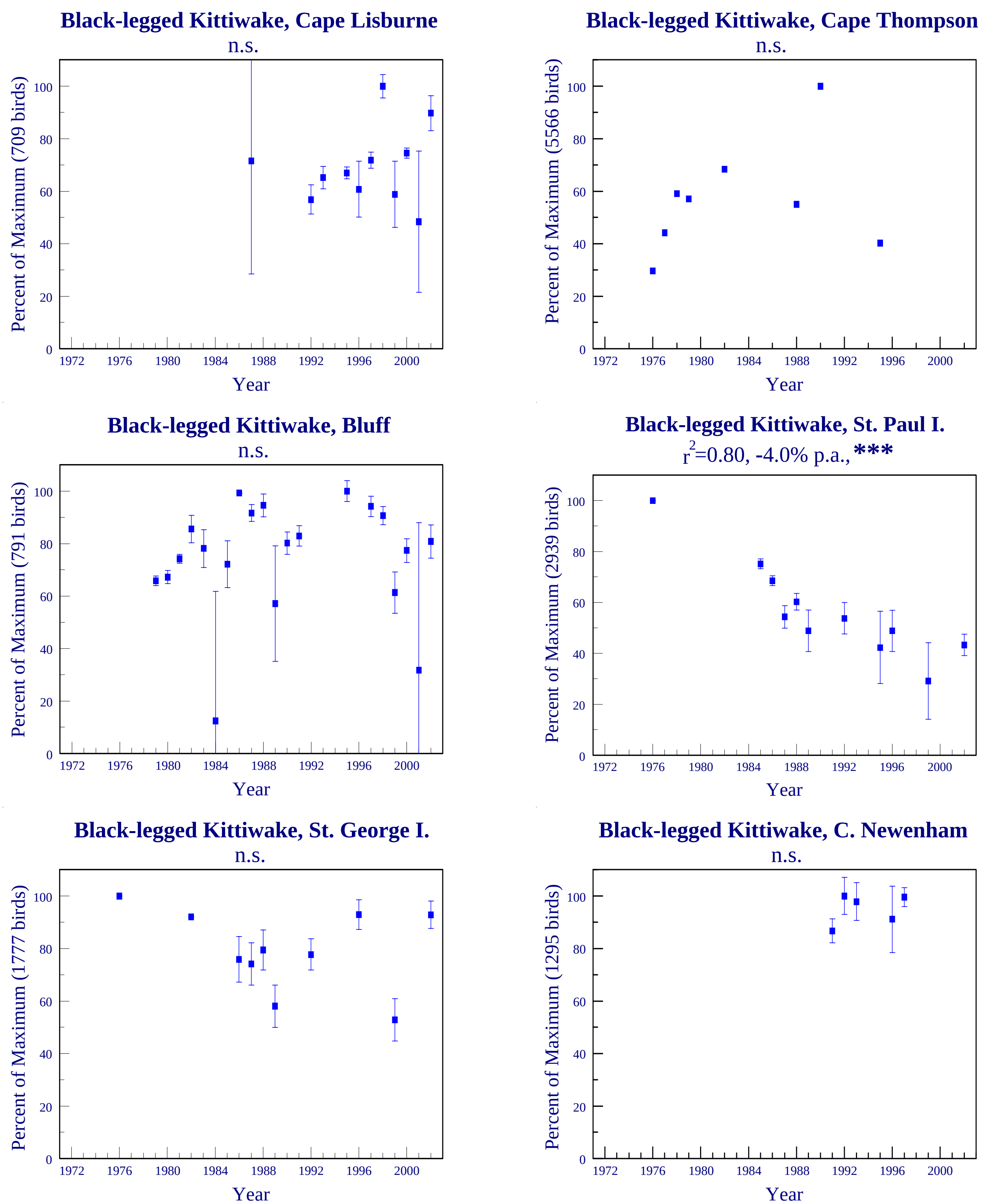


Figure 22. Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

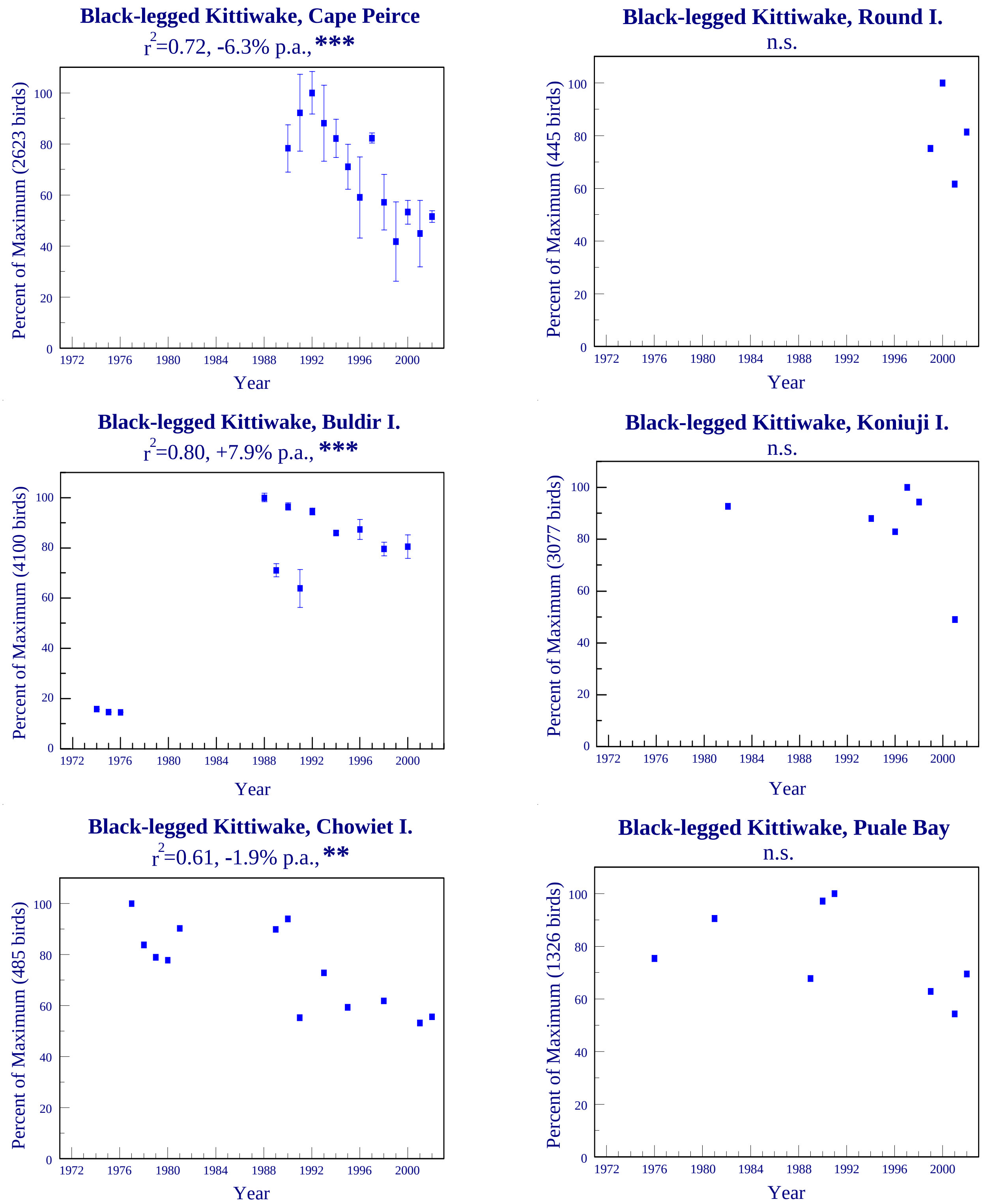


Figure 22 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline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

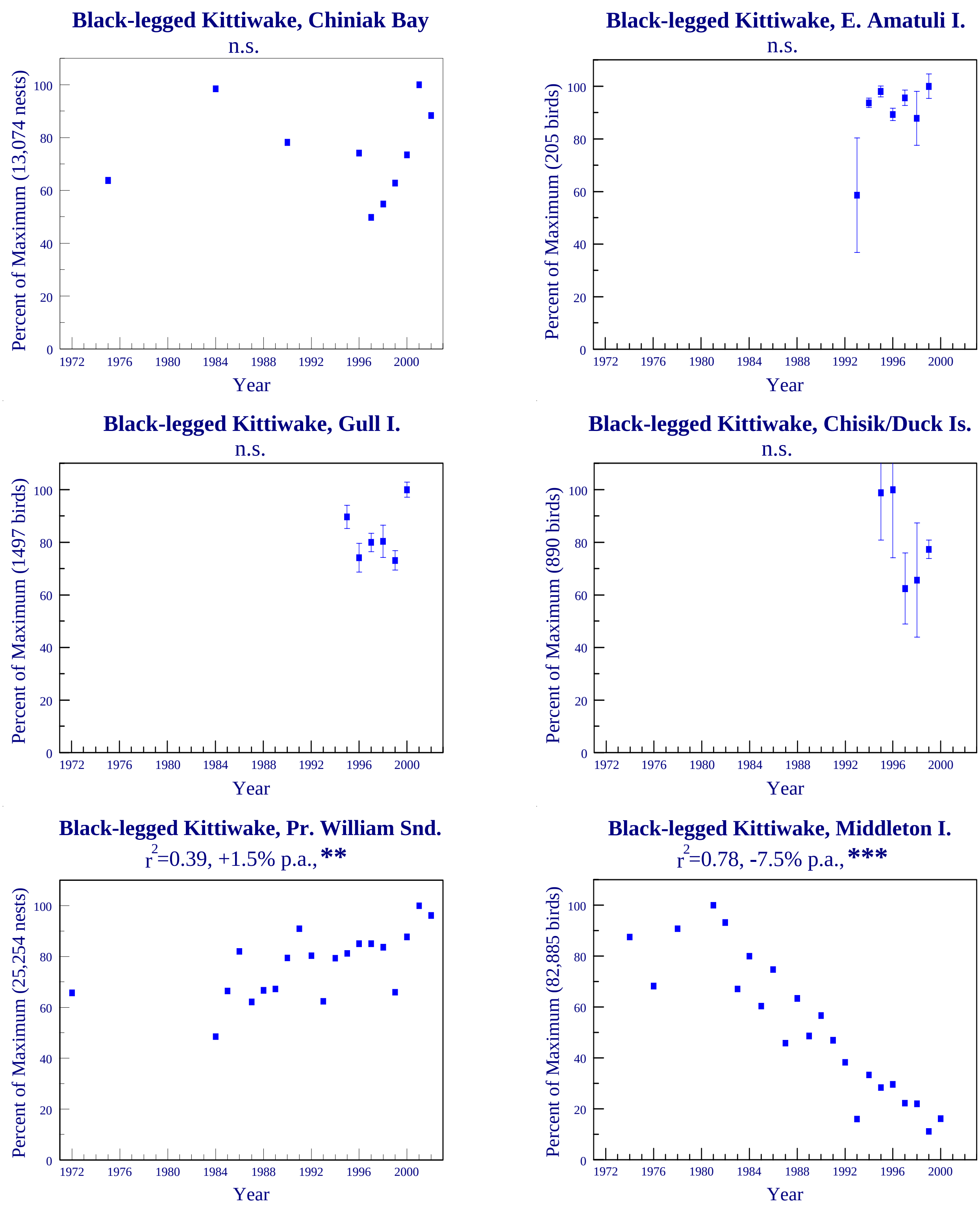


Figure 22 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline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

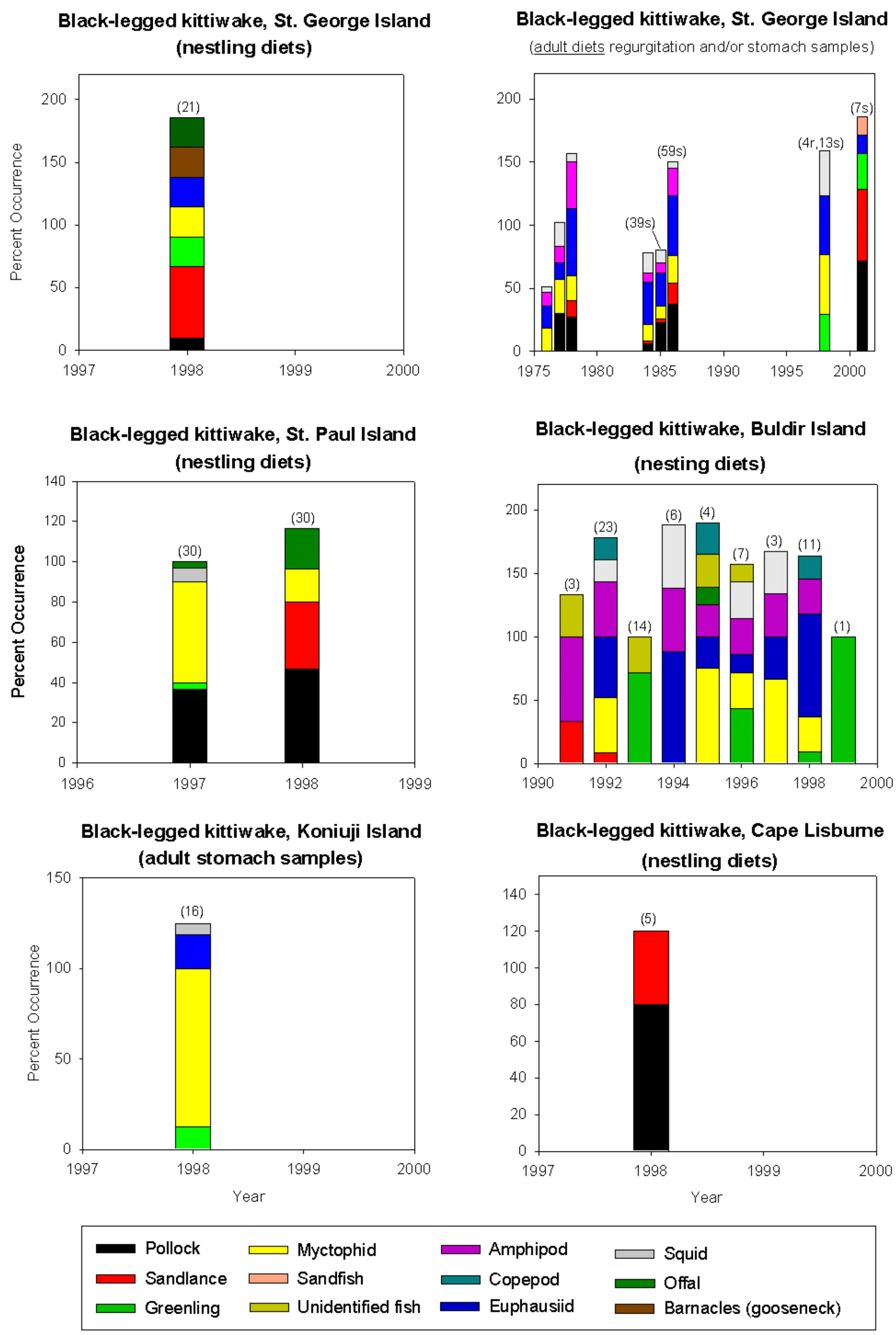


Figure 23. Diets of black-legged kittiwakes at Chukchi Sea and Bering Sea sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence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

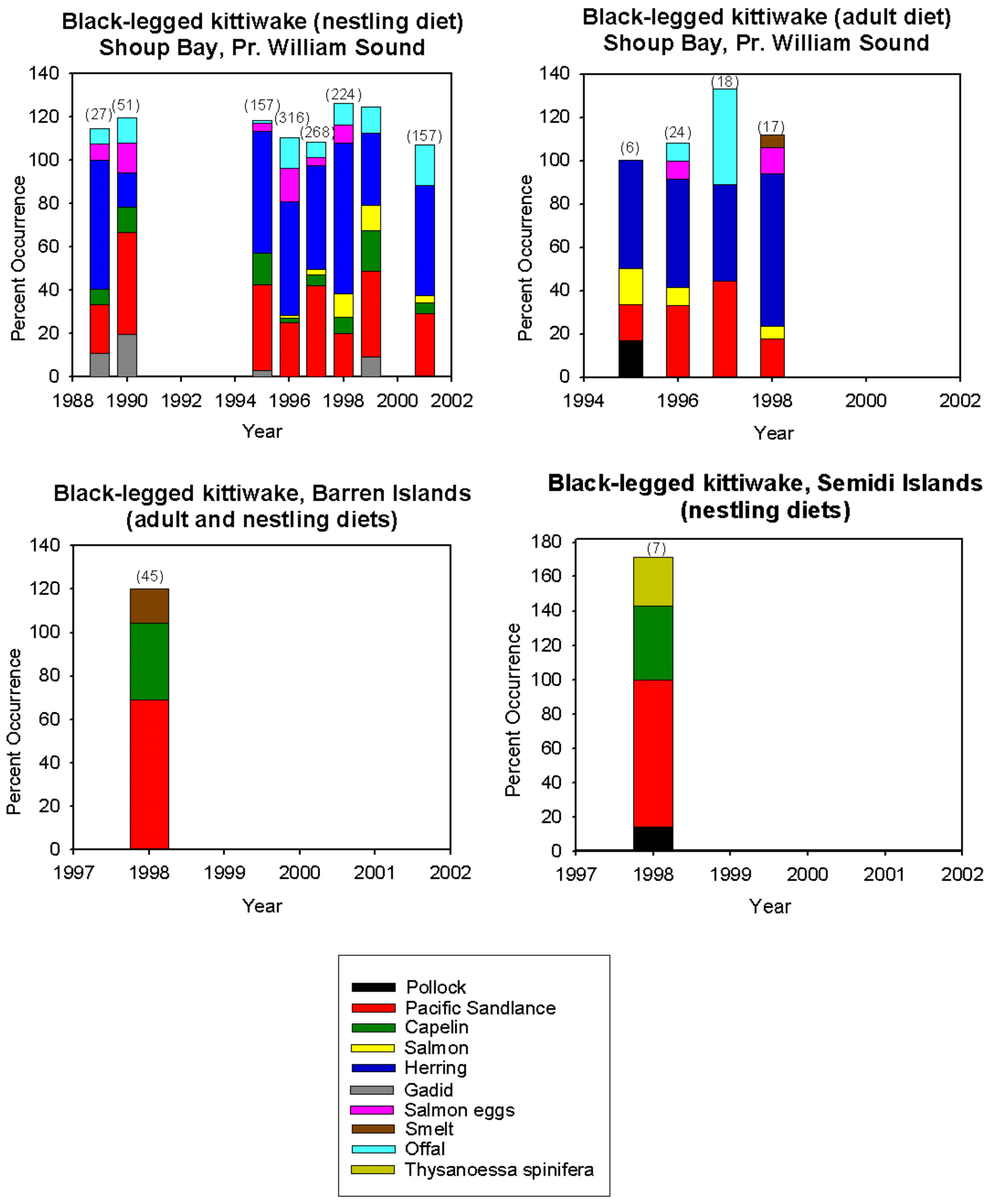


Figure 24. Diets of black-legged kittiwakes at Gulf of Alaska sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally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

Red-legged Kittiwake (*Rissa brevirostris*)

Breeding Chronology.–Hatch dates at all three monitored sites were earlier than normal in 2002 (Table 15, Fig. 25).

Table 15. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2002.

Site	Mean	Long-term Average	Reference
St. Paul I.	9 Jul (16)[a]	23 Jul[b] (16)[a]	Howard 2002
St. George I.	5 Jul (115)	19 Jul[b] (20)	Moore and Boyd 2002
Buldir I.	2 Jul (23)	10 Jul[b] (14)	Williams et al. 2002

[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 2002, red-legged kittiwakes experienced about average productivity at Buldir and Bogoslof islands (Table 16, Fig. 26). Estimated productivity was above average at the other moniotored sites.

Table 16. Reproductive performance of red-legged kittiwakes at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest[a]	No. of Plots	No. of Nests	Reference
St. Paul I.	0.39	3	38	Howard 2002
St. George I.	0.44	10	275	Moore and Boyd 2002
Buldir I.	0.16	N/A[b]	43	Williams et al. 2002
Bogoslof I.	0.42[c]	N/A	24	Williams and Sowls Unpubl. Data

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

Populations.–Red-legged kittiwakes declined significantly at St. Paul Island (-2.6% per annum). This species exhibited a positive population trend at Buldir Island (+4.1% per annum, Fig. 27).

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

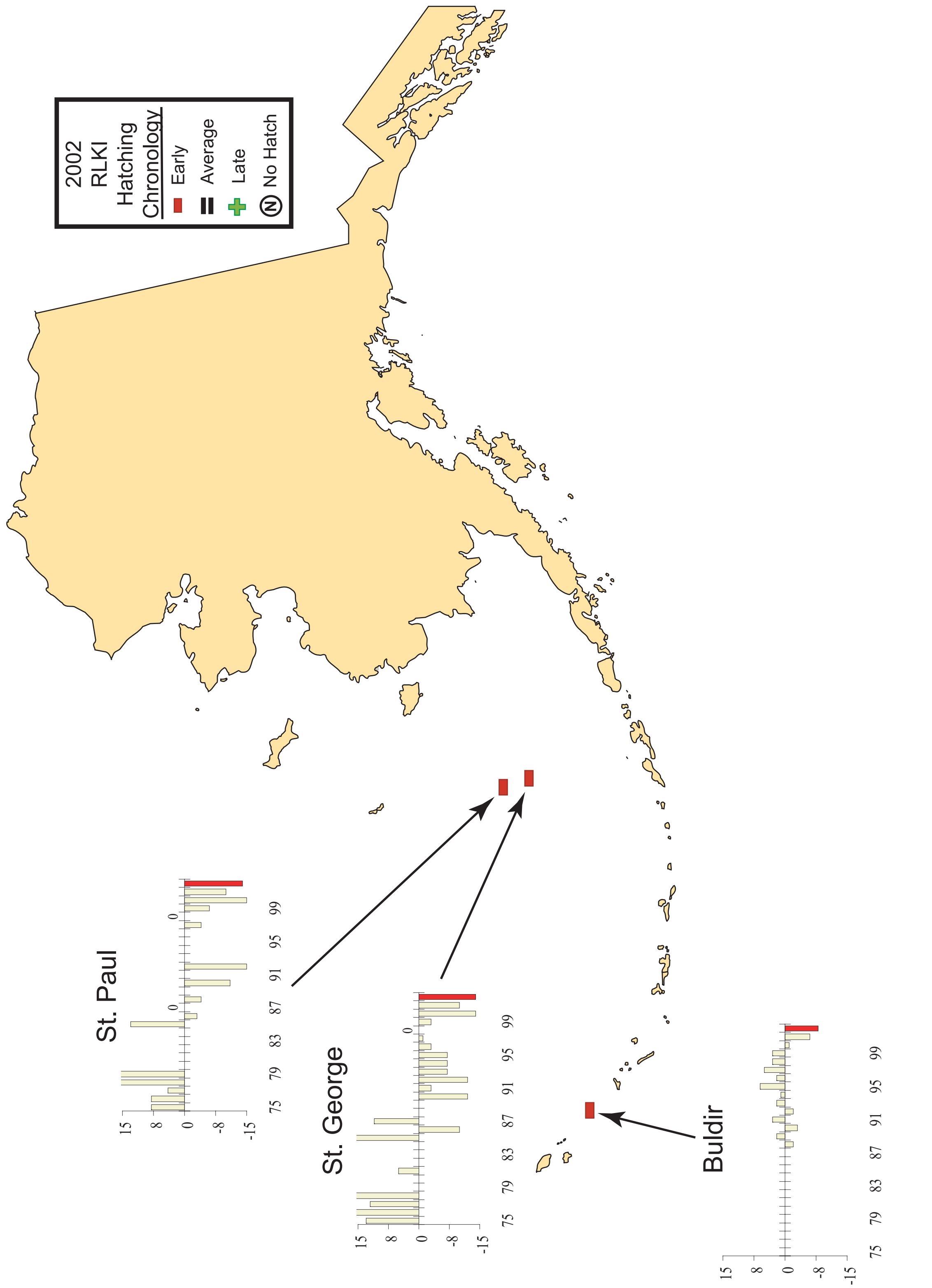


Figure 25. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

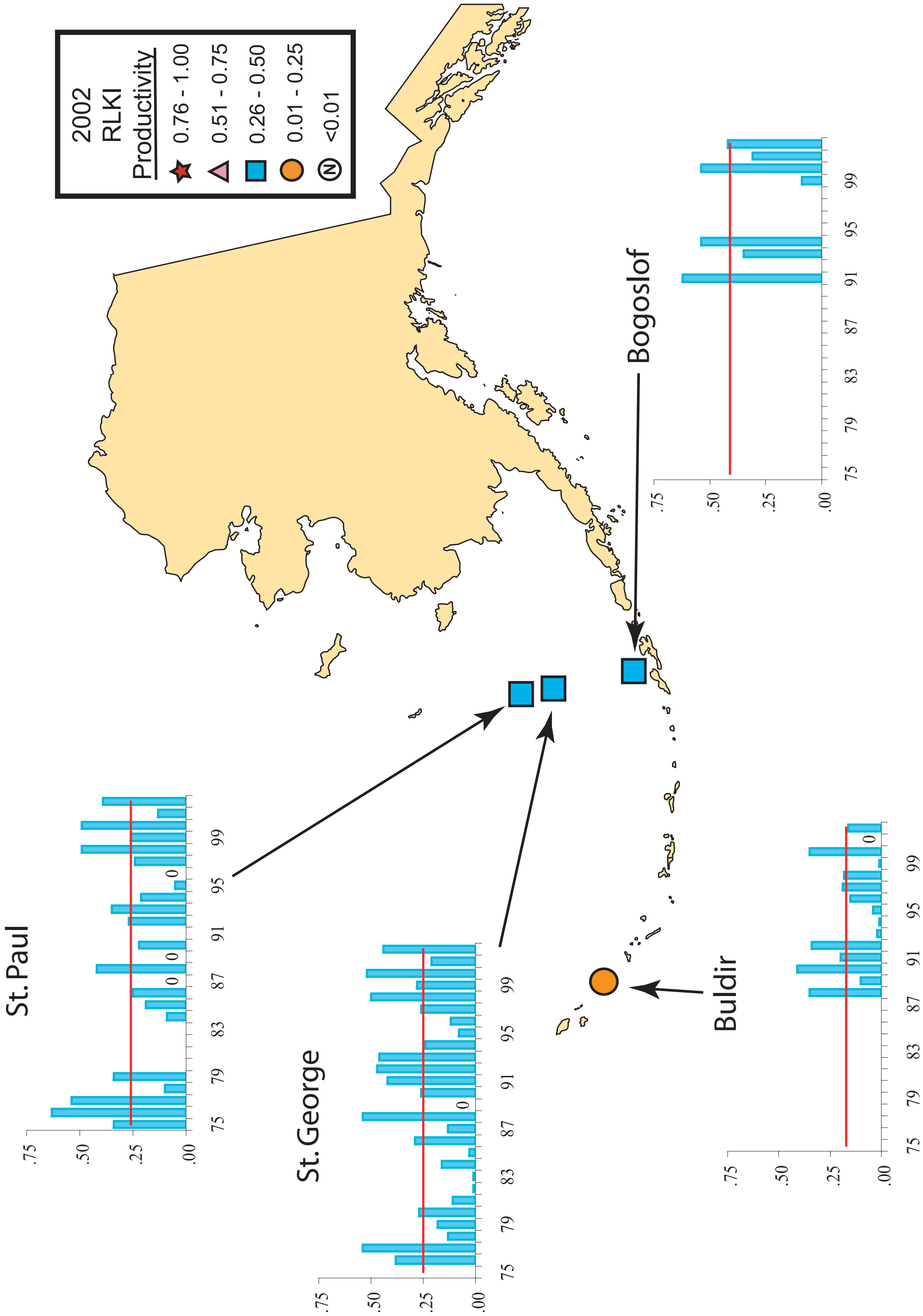


Figure 26. Productivity of red-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

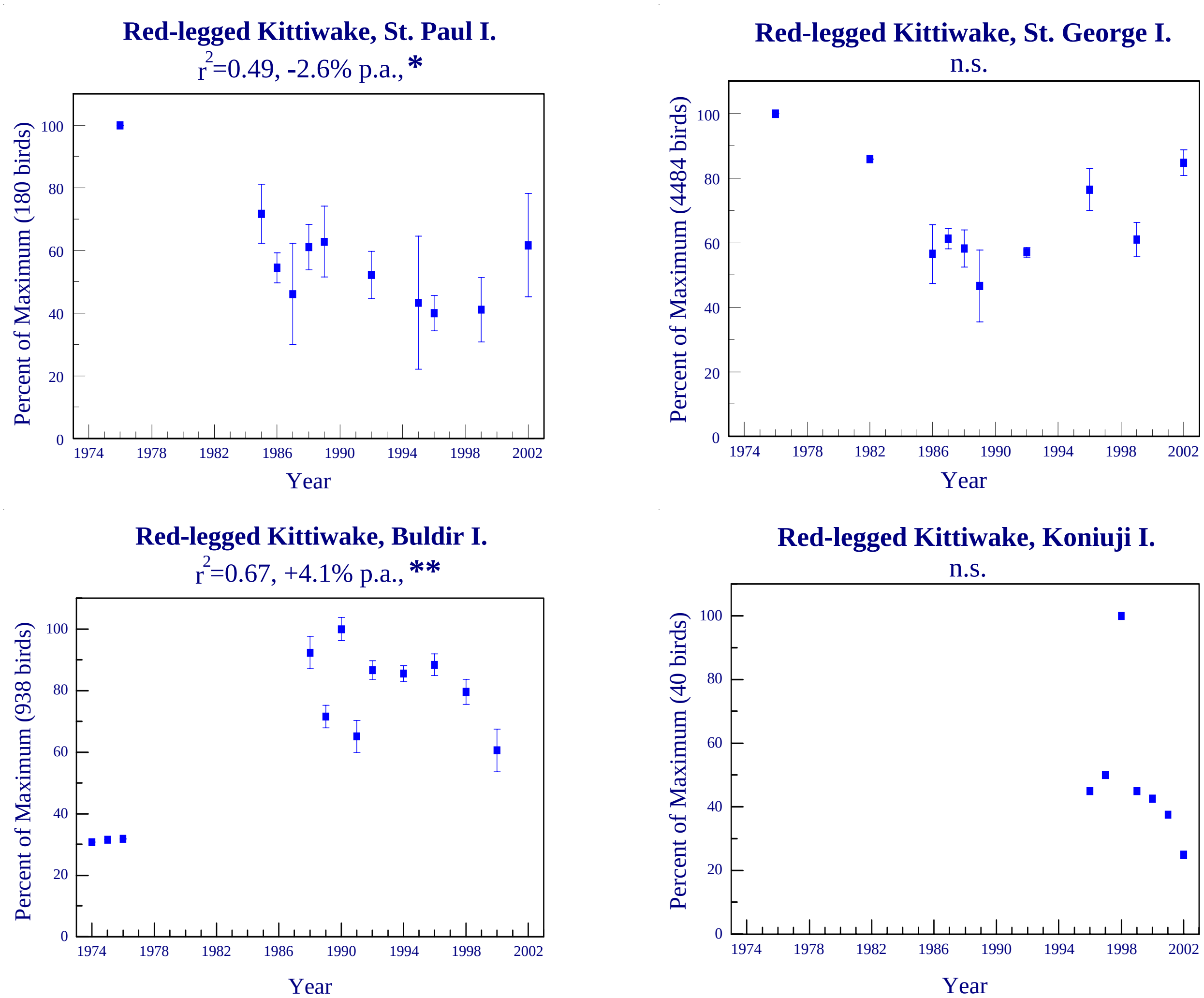


Figure 27. Trends in populations of red-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

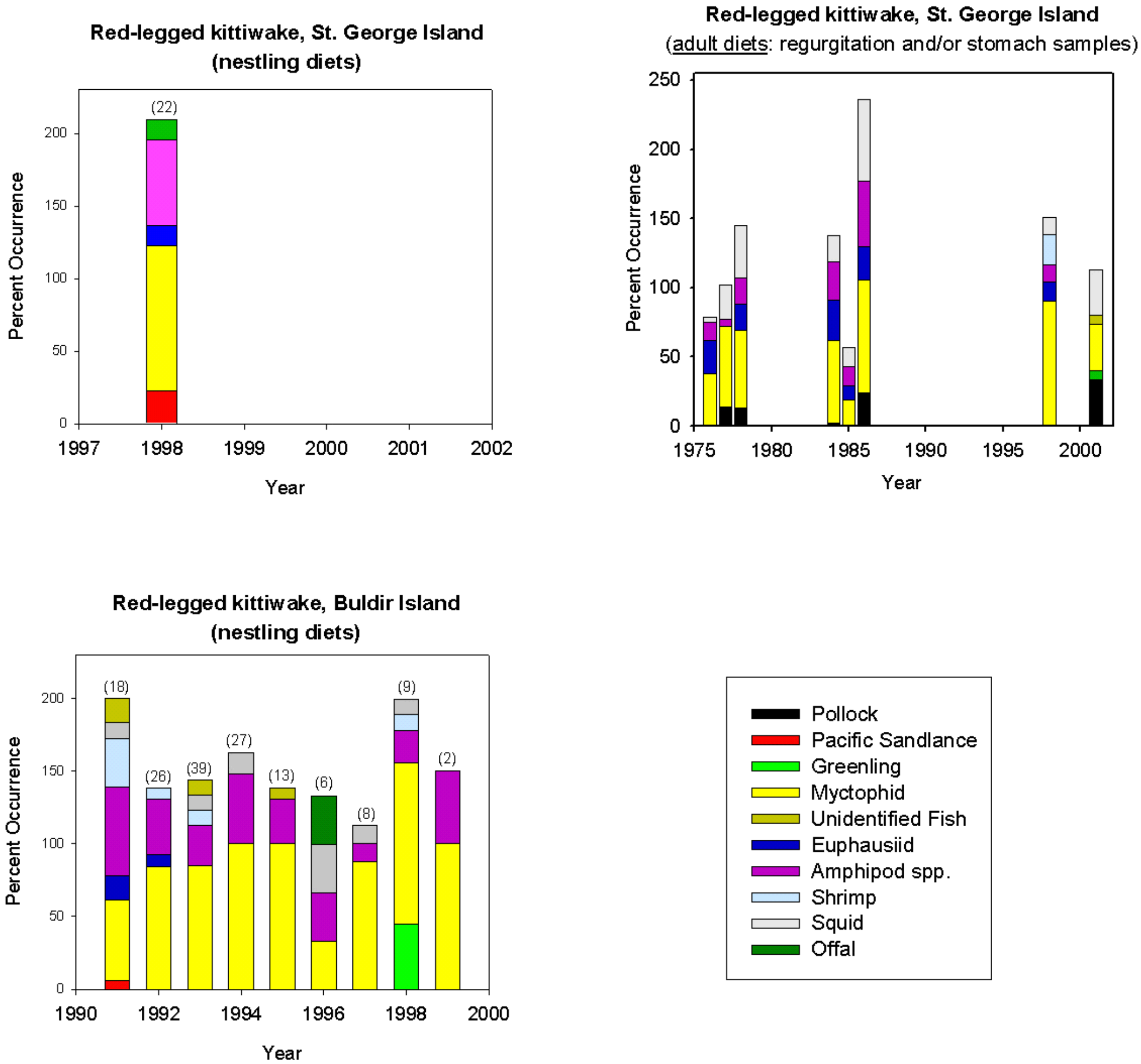


Figure 28. Diets of red-legged kittiwakes at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds 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 2002 was earlier than average at all but two of the 10 monitored sites (where eggs were laid) and average at the remainder (Table 17, Fig. 29).

Table 17. Hatching chronology of common murres at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	—	30 Jul (15)[a]	3 Aug[b] (3)[a]	Gall et al. 2003
Bluff	21 Jul (N/A[c])	—	26 Jul[d] (25)	Murphy 2002
St. Paul I.	—	6 Aug (82)	4 Aug[b] (17)	Howard 2002
St. George I.	—	1 Aug (30)	4 Aug[b] (18)	Moore and Boyd 2002
Cape Peirce	—	16 Jul (73)	23 Jul[b] (13)	R. MacDonald Unpubl. Data
Buldir I.	11 Jul (7)	13 Jul (7)	19 Jul[b] (5)	Williams et al. 2002
Chowiet I.	—	19 Jul (107)	23 Jul[b] (8)	Wang 2002
Puale B.	—	6 Aug (536)	27 Aug[b] (5)	Kaler et al. 2003
E. Amatuli I.	5 Aug (158)	3 Aug (158)	7 Aug[b] (9)	A. Kettle, Unpubl. Data
St. Lazaria I.	—	8 Aug (47)	14 Aug[b] (8)	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.
[c]Not applicable or not reported.
[d]Mean of annual medians.

Productivity.–Common murre productivity was average or above average at about half of the sites monitored in 2002 (Table 18, Fig. 30). No murres laid eggs and no chicks were produced for the fifth consecutive year at Kasatochi Island. Likewise, no eggs were laid by this species at Aiktak Island in 2002. Productivity also was below average at St. Lawrence, Round and St. Lazaria islands.

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 (-3.9% 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 Puale Bay (-4.4% per annum) as well as Middleton and St. Lazaria islands (-4.9% and -4.2 % per annum, respectively). Significant positive trends were evident for murres at Cape Lisburne (+4.7% per annum), and Koniuji and Chowiet islands (+19.3% and +0.9% per annum, respectively, Fig. 31).

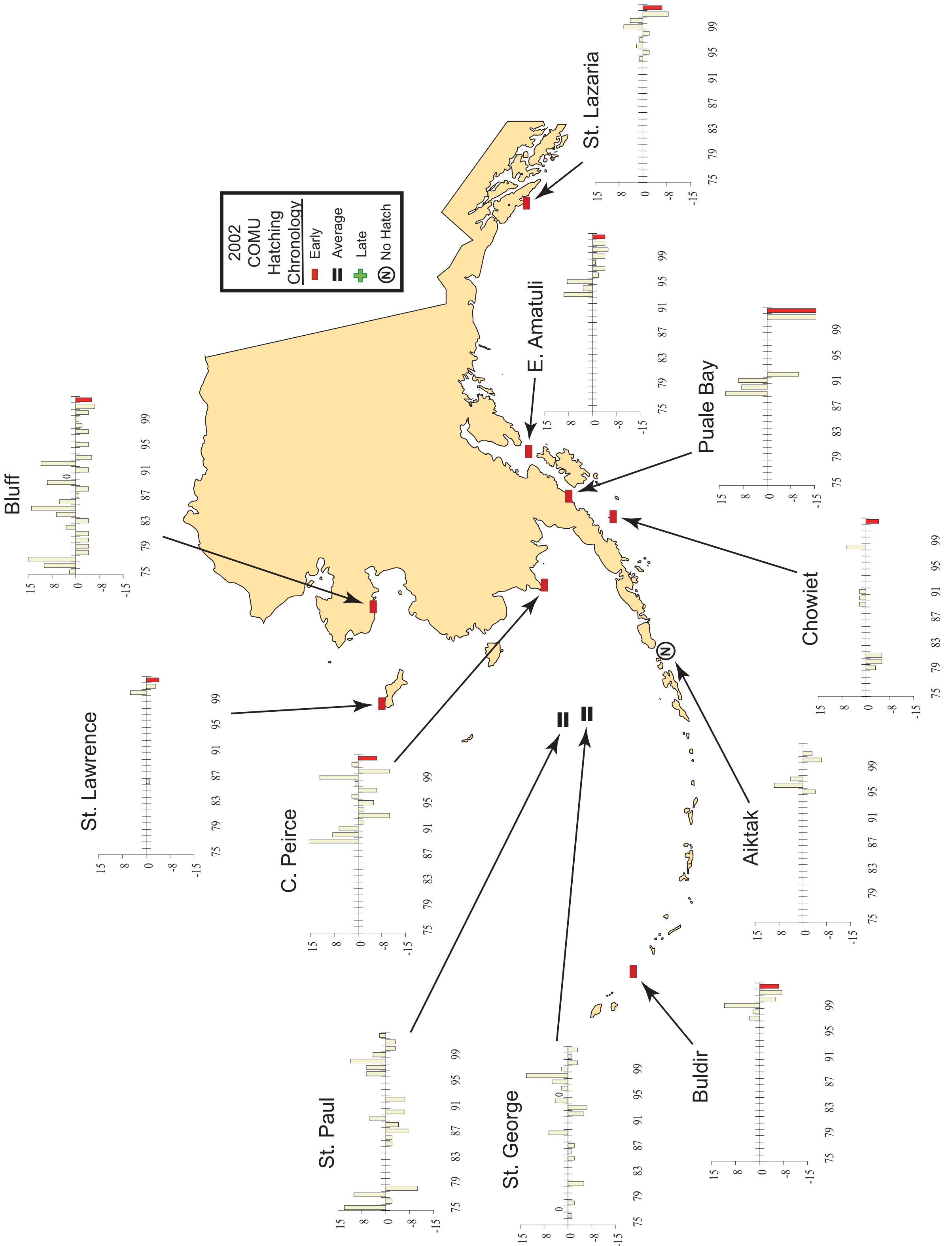


Figure 29. Hatching chronology of common murres at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

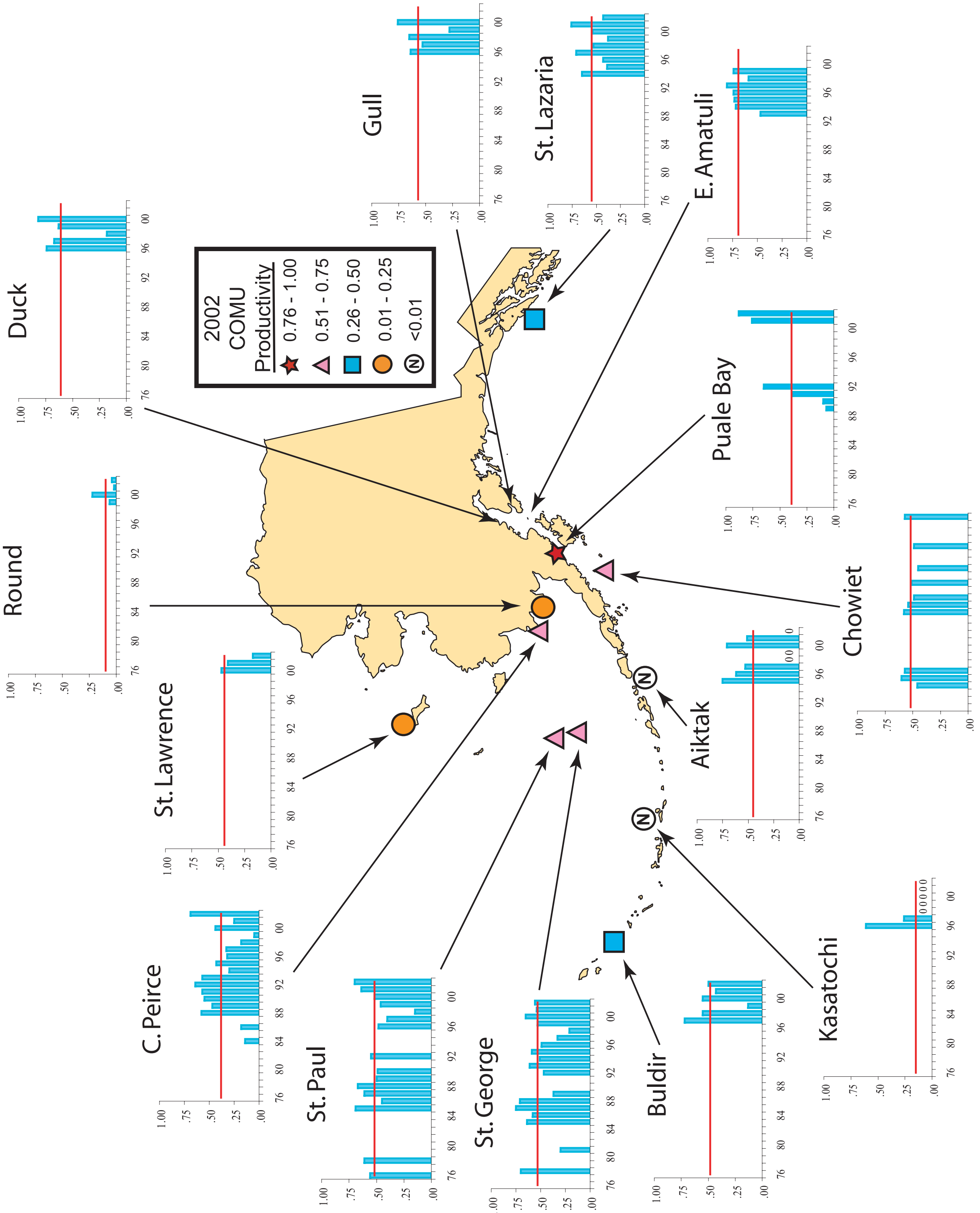


Figure 30. Productivity of common murres (chicks fledged/nest site) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

Table 18. Reproductive performance of common murres at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
St. Lawrence I.	0.17	6	36	Gall et al. 2003
St. Paul I.	0.70	6	86	Howard 2002
St. George I.	0.56	5	95	Moore and Boyd 2002
Cape Peirce	0.69	6	106	R. MacDonald Unpubl. Data
Round I.	0.04	2	50	Cody 2002
Buldir I.	0.50	N/A[b]	10	Williams et al. 2002
Kasatochi I.	0.00	N/A	0	Syria 2002
Aiktak I.	0.00	N/A	0	Dykstra and Wynn 2002
Chowiet I.	0.57	13	215	Wang 2002
Puale B.	0.88	17	616	Kaler et al. 2003
St. Lazaria I.	0.43	5	73	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 (Fig. 32). St. George Island common murres ate euphausiids and pollock with lesser amounts of squid. Common murres from Buldir and Koniuji islands ate predominantly squid with lesser amounts of pollock and herring. Common murres at Chowiet and Aiktak islands ate mostly sand lance and pollock.

Barren islands common murres fed their chicks almost exclusively capelin. 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.

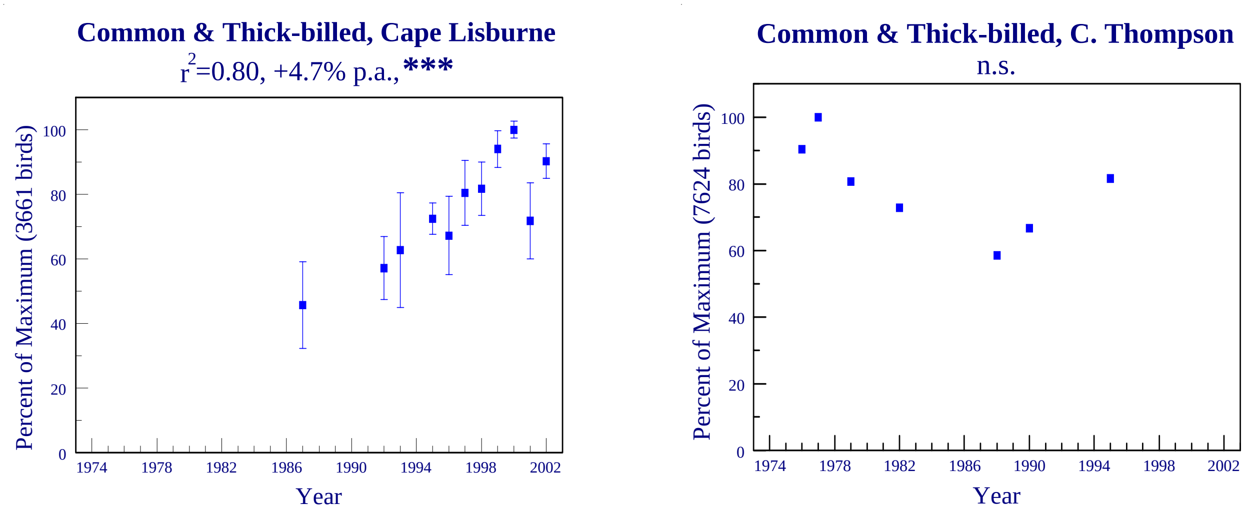


Figure 31. Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change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

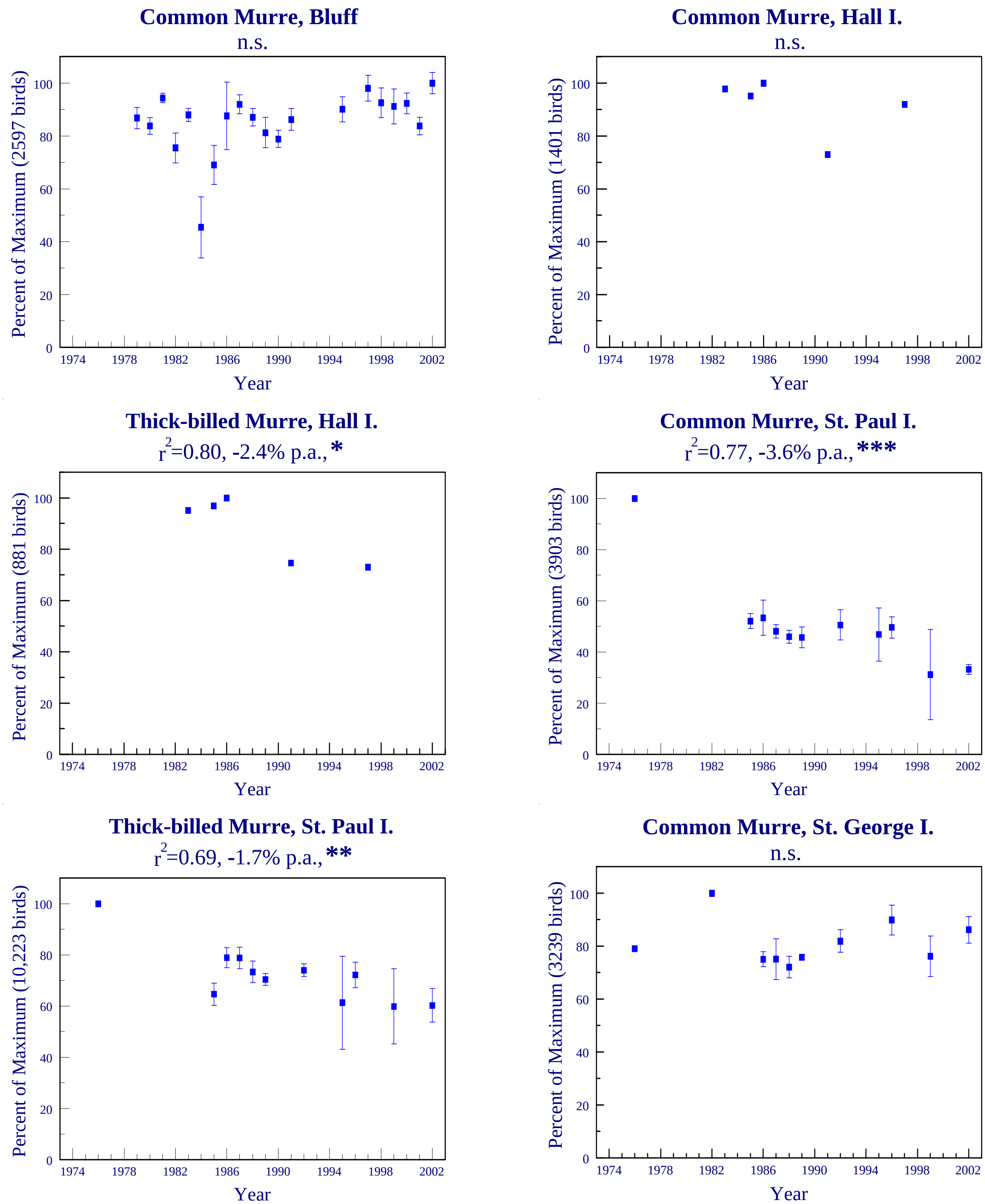


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

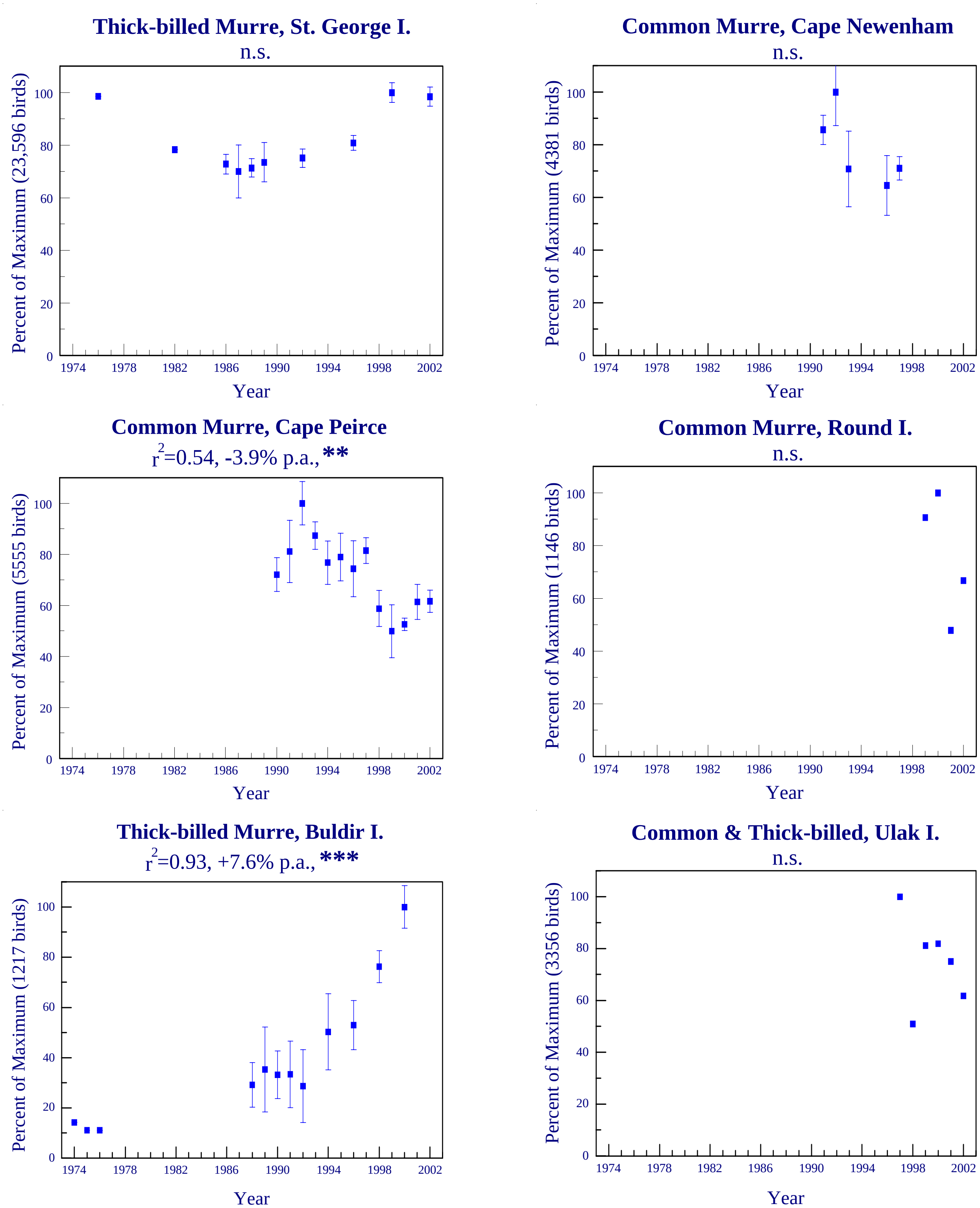


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

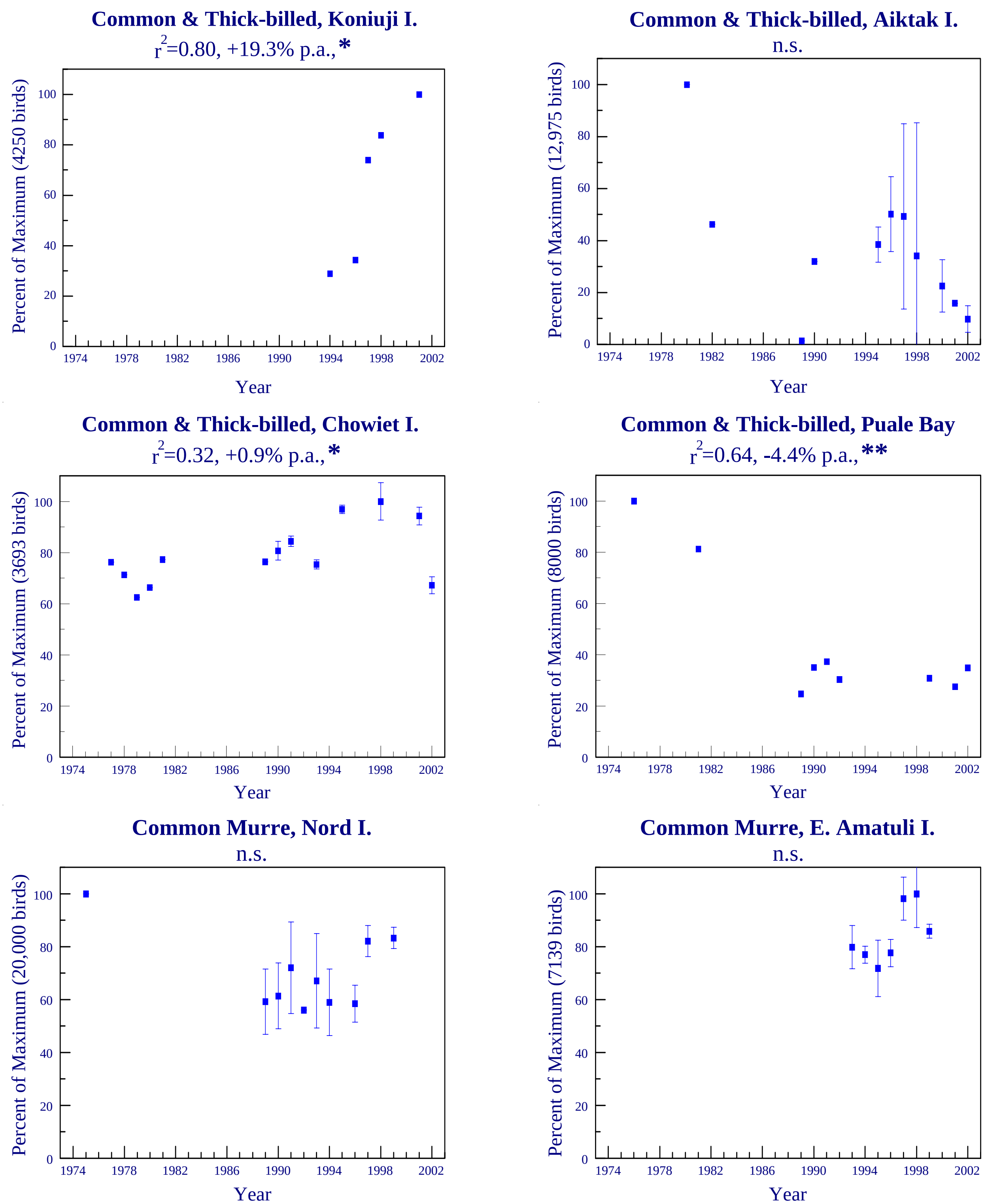


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

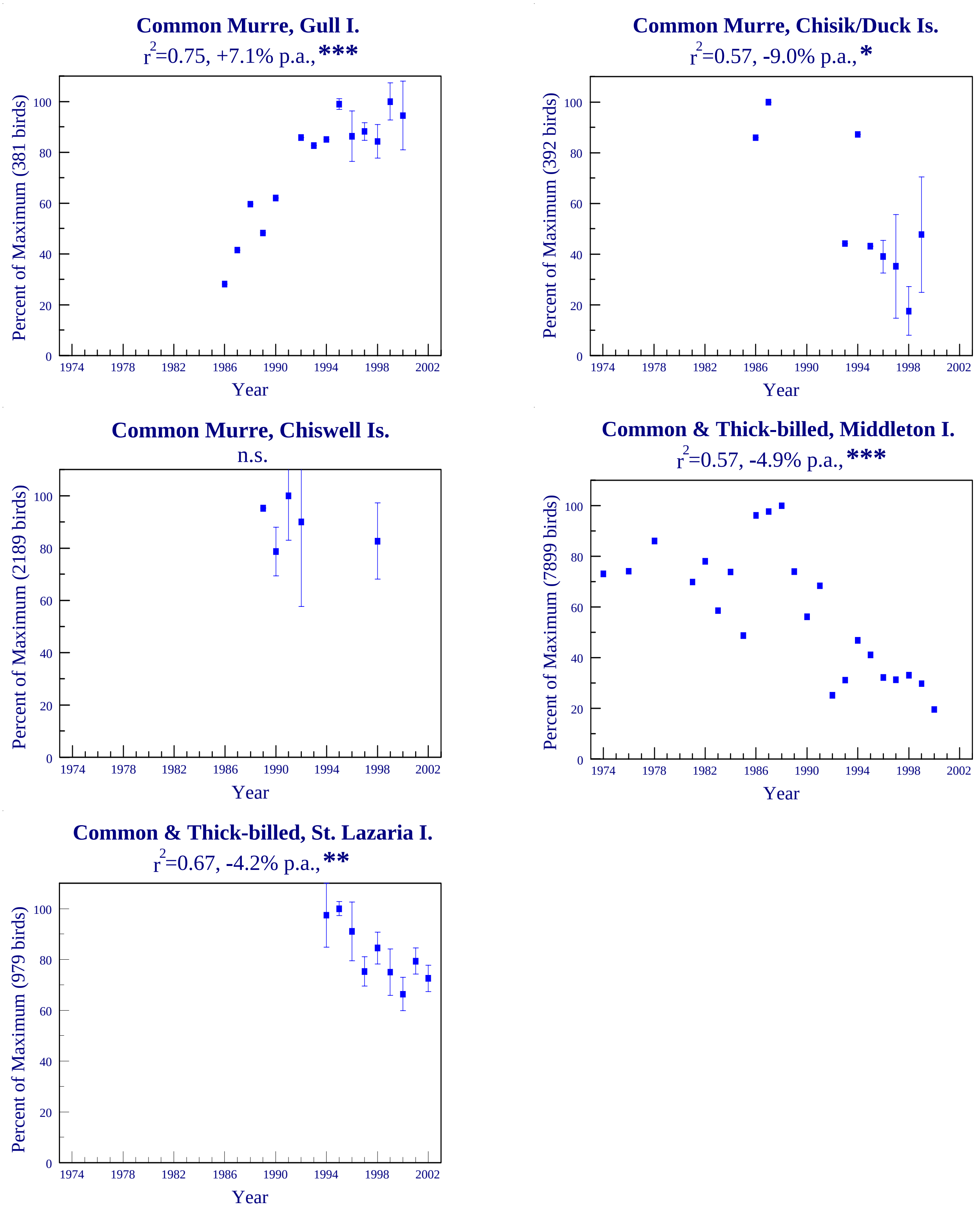


Figure 31 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

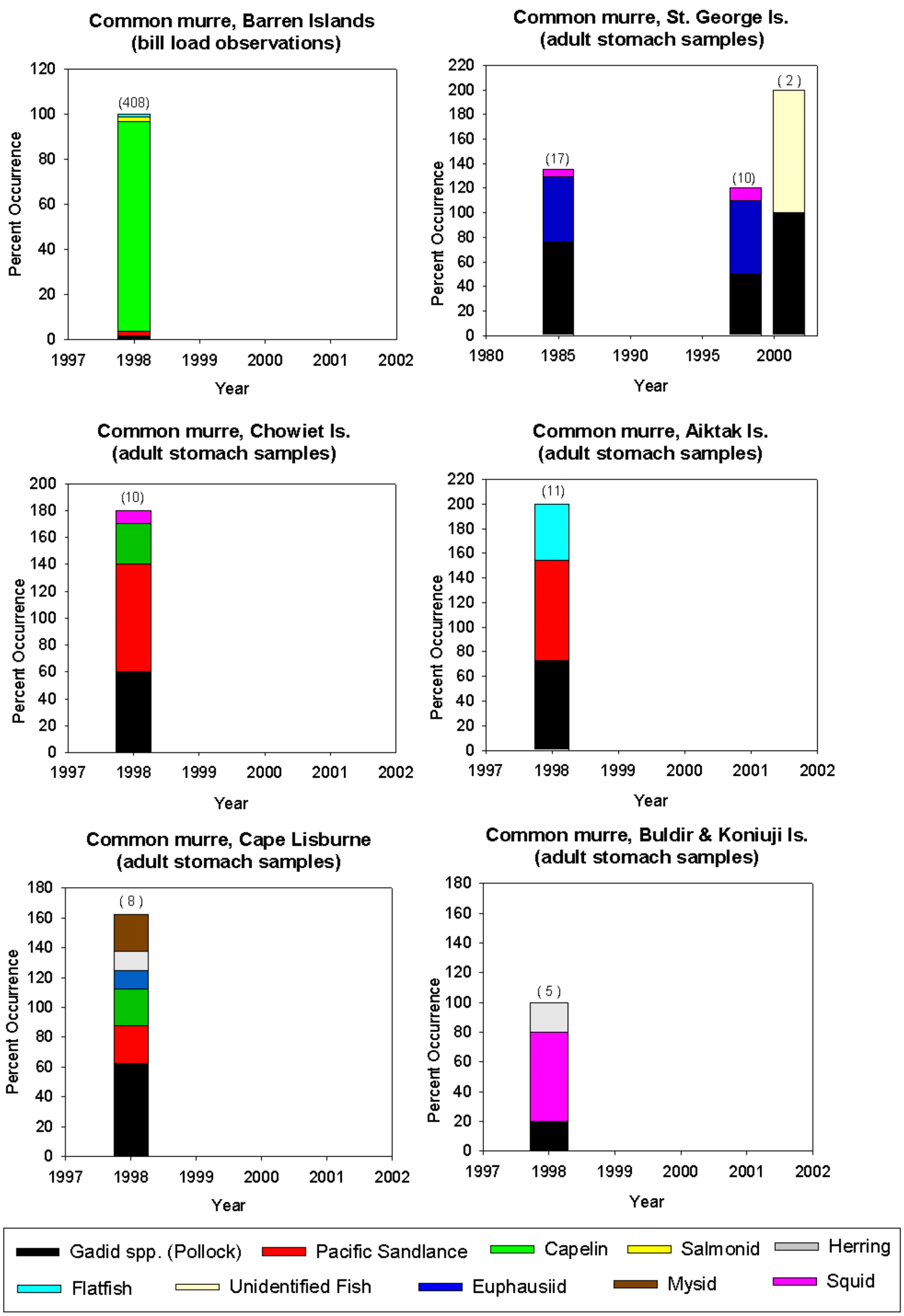


Figure 32. Diets of common murres at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more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

Thick-billed Murre (*Uria lomvia*)

Breeding Chronology .–In 2002, thick-billed murre chicks hatched on about average dates at all monitored Bering Sea and Aleutian Island sites (where eggs were laid) and were early at two of the three monitored Gulf of Alaska locations, the exception being Chowiet Island (Table 19, Fig. 33).

Table 19. Hatching chronology of thick-billed murres at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	—	30 Jul (114)[a]	1 Aug[b] (3)[a]	Gall et al. 2003
St. Paul I.	—	7 Aug (153)[a]	4 Aug[b] (18)	Howard 2002
St. George I	—	27 Jul (151)	31 Jul[b] (20)	Moore and Boyd 2002
Buldir I.	11 Jul (50)	13 Jul (50)	16 Jul[b] (14)	Williams et al. 2002
Chowiet I.	15 Jul (36)	17 Jul (36)	20 Jul[b] (7)	Wang 2002
Puale B.	—	6 Aug (26)	24 Aug[b] (5)	Kaler et al. 2003
St. Lazaria I.	—	5 Aug (28)	11 Aug[b] (8)	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 .–Rates of success in 2002 were average or above at most monitored colonies (Table 20, Fig. 34). Thick-billed murres laid no eggs and failed to produce any young, for the fifth year in a row, at Kasatochi Island. Likewise, no eggs were laid at Aiktak Island in 2002. Productivity also was below average at St. Lawrence Island.

Table 20. Reproductive performance of thick-billed murres at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
St. Lawrence I.	0.35	9	162	Gall et al. 2003
St. Paul I.	0.57	13	265	Howard 2002
St. George I.	0.53	14	371	Moore and Boyd 2002
Buldir I.	0.69	7	239	Williams et al. 2002
Kasatochi I.	0.00	N/A[b]	0	Syria 2002
Aiktak I.	0.00	N/A	0	Dykstra and Wynn 2002
Chowiet I.	0.36	N/A	97	Wang 2002
Puale B.	0.83	N/A	30	Kaler et al. 2003
St. Lazaria I.	0.42	4	53	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 (+7.6% per annum, Fig. 31).

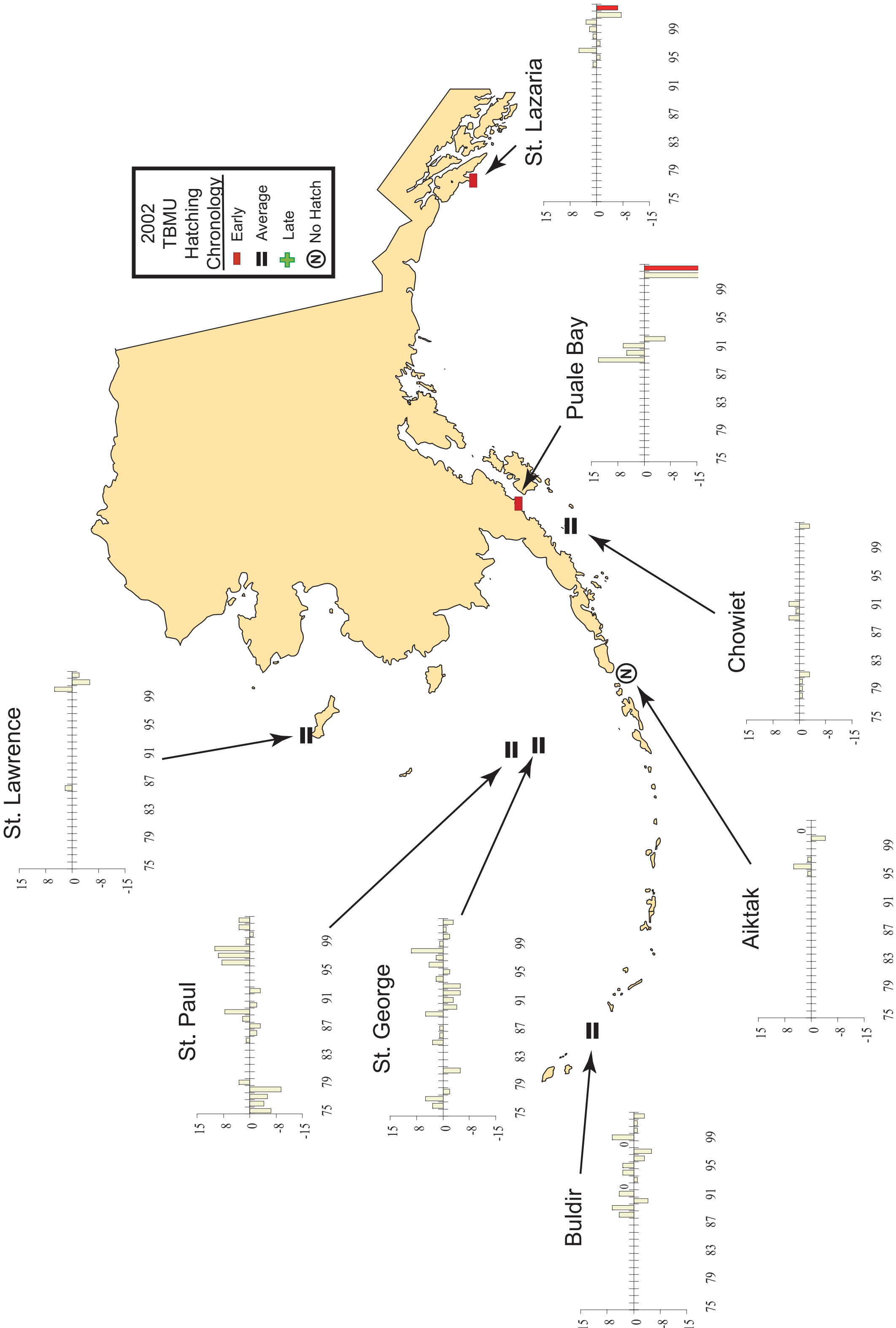


Figure 33. Hatching chronology of thick-billed murre at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

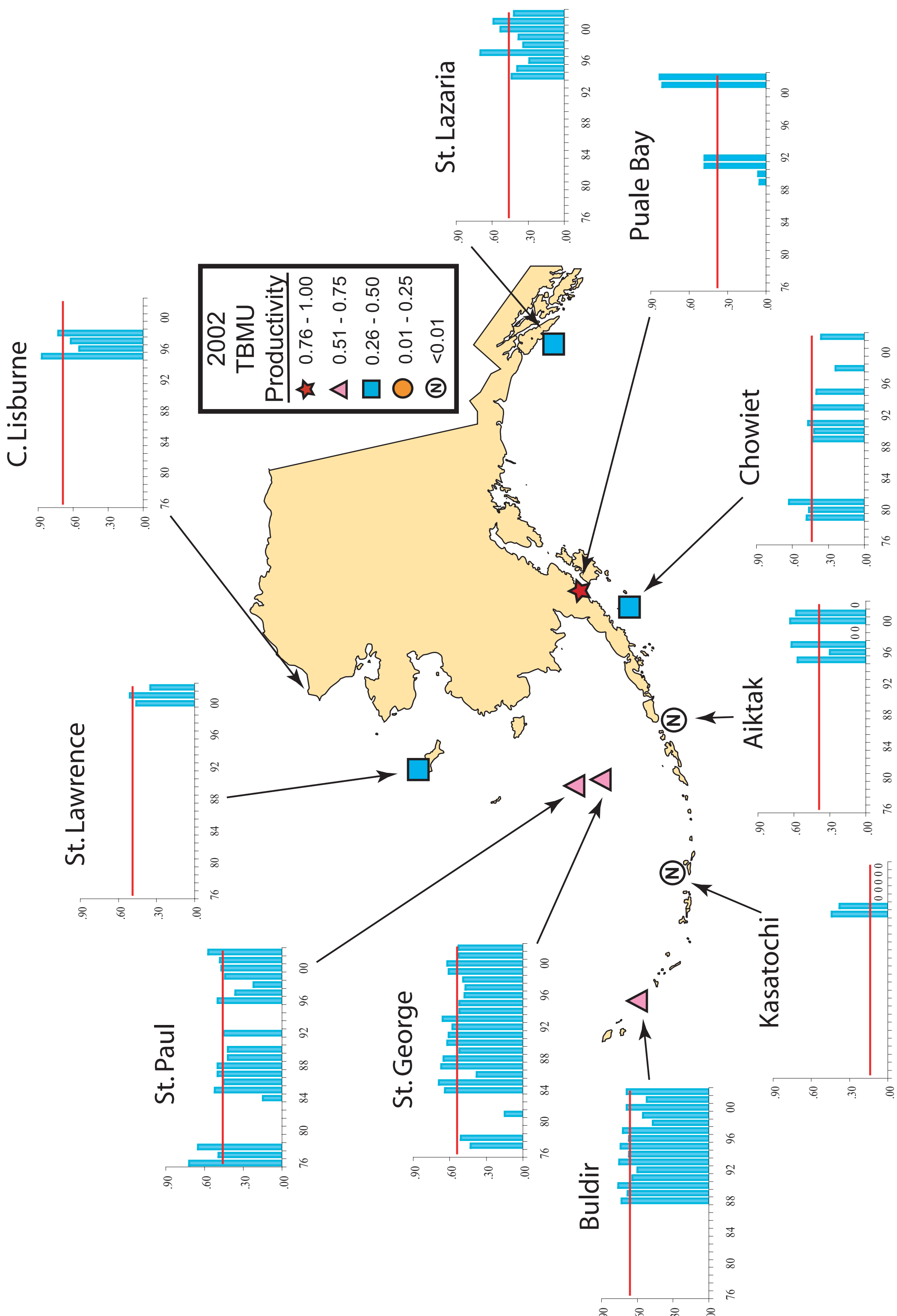


Figure 34. Productivity of thick-billed murres (chicks fledged/nest site) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

Diet.–Cape Lisburne thick-billed murre diets consisted of a majority of flatfish/sculpin and 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 sand lance.

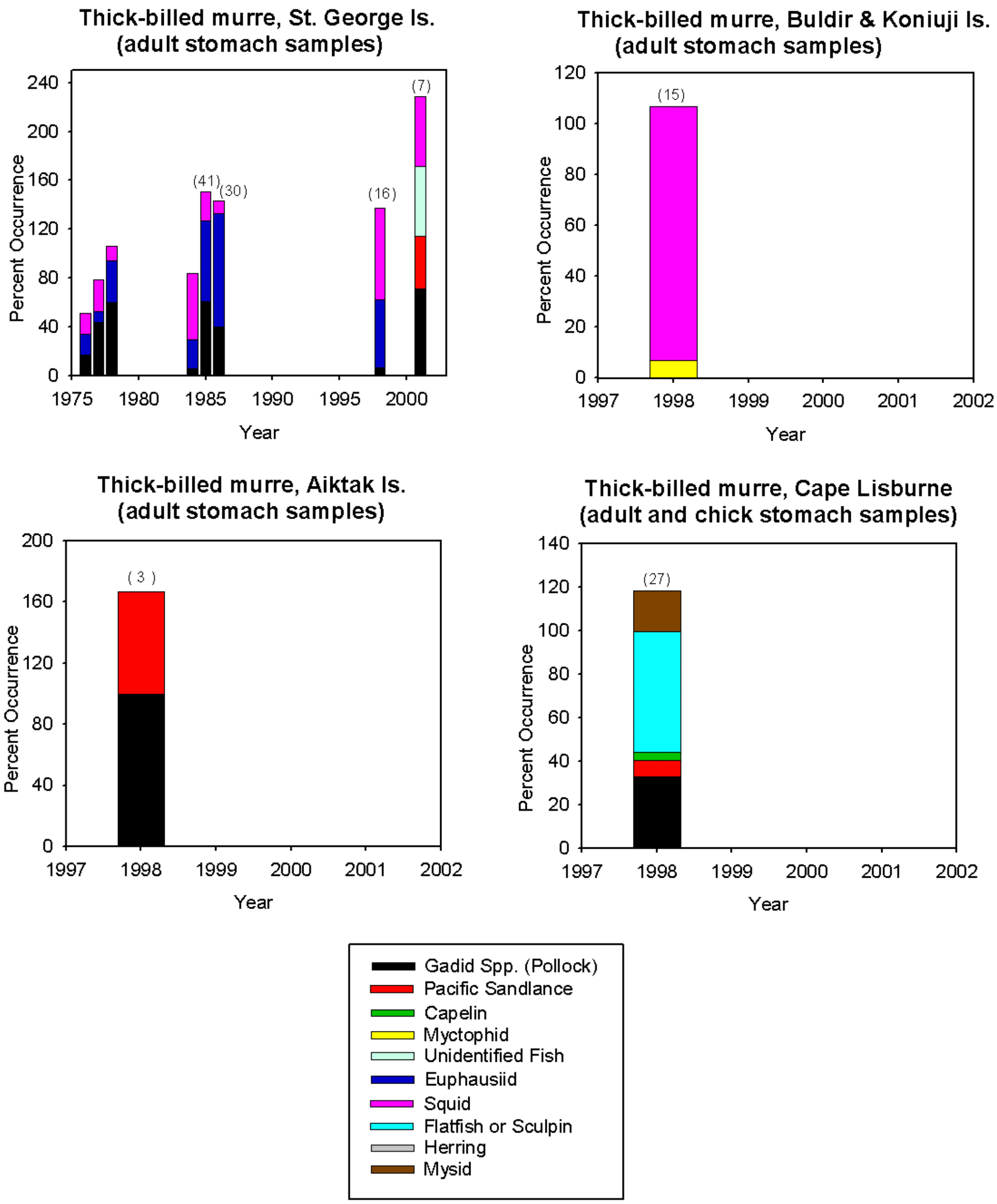


Figure 35. Diets of thick-billed murres at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds 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), 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).

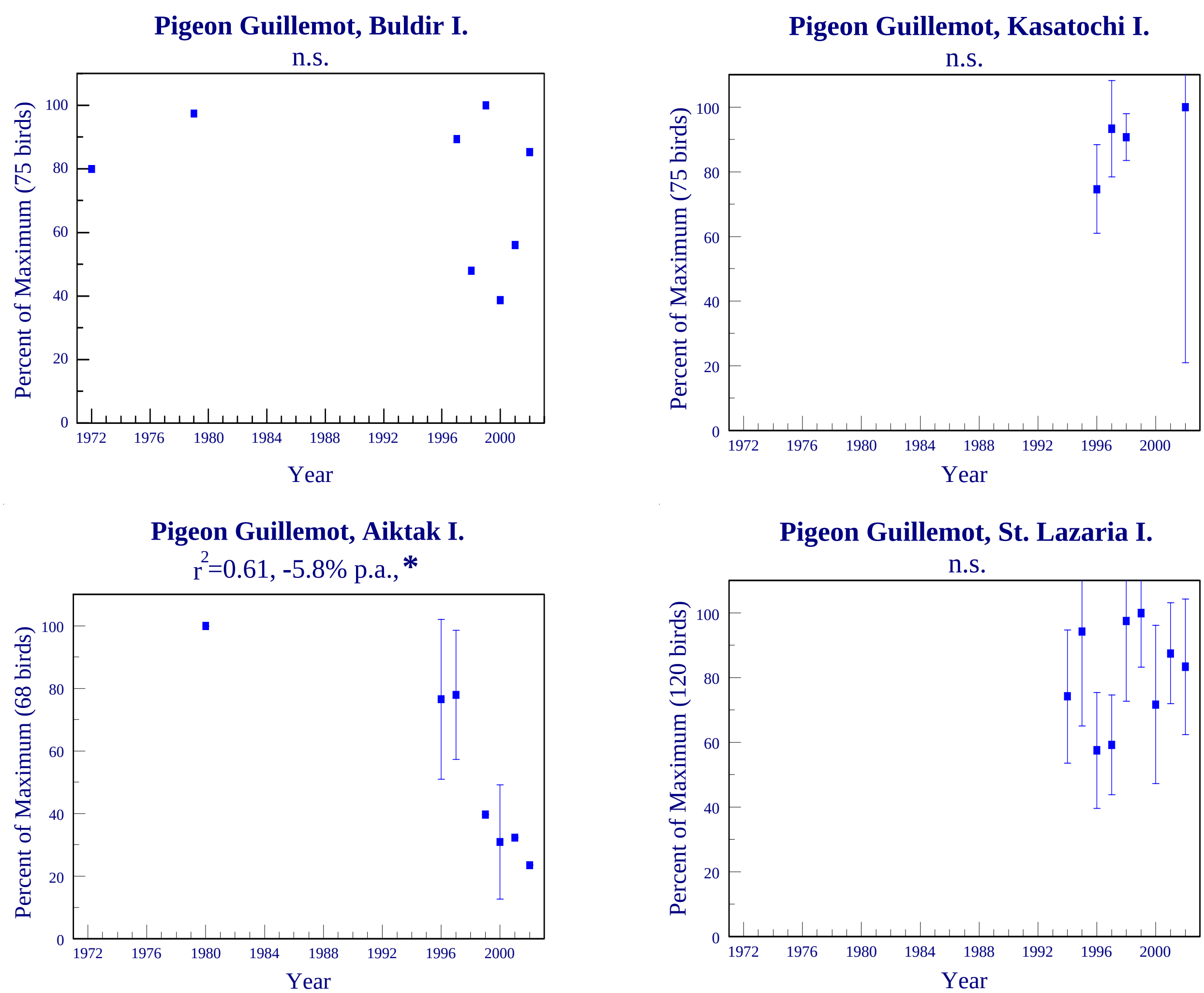


Figure 36. Trends in populations of pigeon guillemots at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

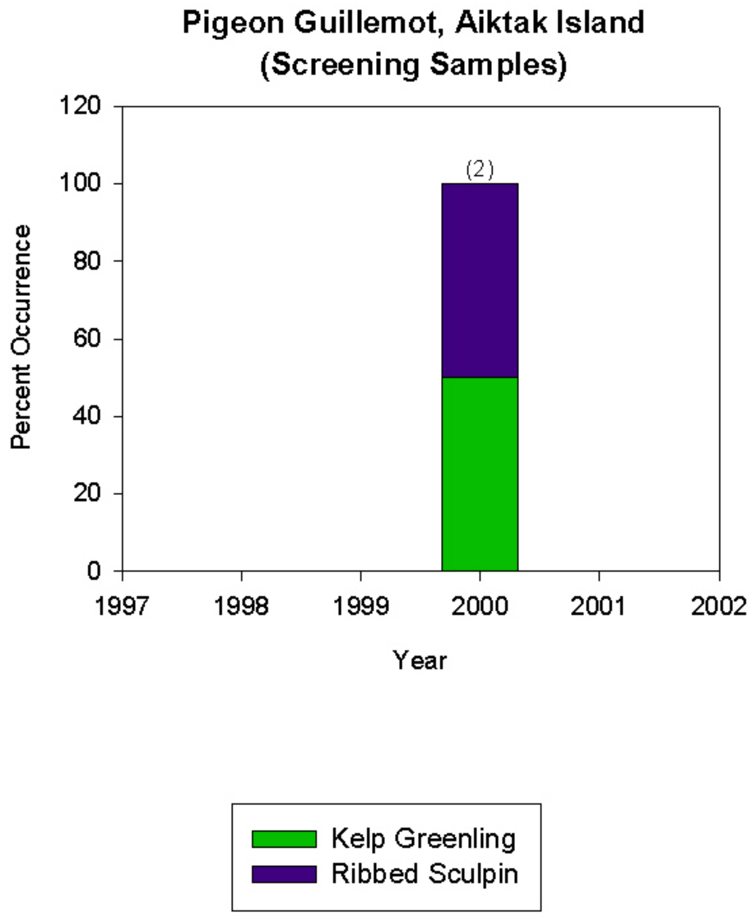


Figure 37. Diets of pigeon guillemots at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to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

Ancient Murrelet (*Synthliboramphus antiquus*)

Breeding Chronology.–The mean hatching date for ancient murrelets was earlier than average at Aiktak Island, the only site monitored in 2002 (Table 21).

Table 21. Hatching chronology of ancient murrelets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	28 Jun (33)[a]	30 Jun (33)	6 Jul[b] (3)[a]	Dykstra and Wynn 2002

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date.
[b]Mean of annual means.

Productivity.–More than three-quarters of ancient murrelet eggs hatched at Aiktak Island in 2002 (Table 22), about average for this site.

Table 22. Reproductive performance of ancient murrelets at Alaskan sites monitored in 2002.

Site	Hatching Success[a]	No. of Nest Sites	Reference
Aiktak I.	0.87	35	Dykstra and Wynn 2002

[a]Total chicks hatched/Total known-fate eggs.

Populations.–No data.

Diet.–No data.

Parakeet Auklet (*Cyclorrhynchus psittacula*)

Breeding Chronology.–This species was monitored at two sites in 2002 (Table 23). The mean hatch date was about average at Buldir Island. This species hatched a few days earlier on average at Chowiet Island than at Buldir Island in 2002.

Table 23. Hatching chronology of parakeet auklets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	5 Jul (19)[a]	5 Jul (19)	3 Jul[b] (10)[a]	Williams et al. 2002
Chowiet I.	—	30 Jun (2)	N/A[c]	Wang 2002

[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.–In 2002, productivity at Buldir Island was below average (Table 24). Two nests found on Chowiet Island failed to fledge any chicks.

Table 24. Reproductive performance of parakeet auklets at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
Buldir I.	0.13	55	Williams et al. 2002

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

Populations.–No data.

Diet.–Diets of parakeet auklets were examined on Buldir Island and were dominated by copepods, and secondarily by amphipods and euphausiids (Fig. 38).

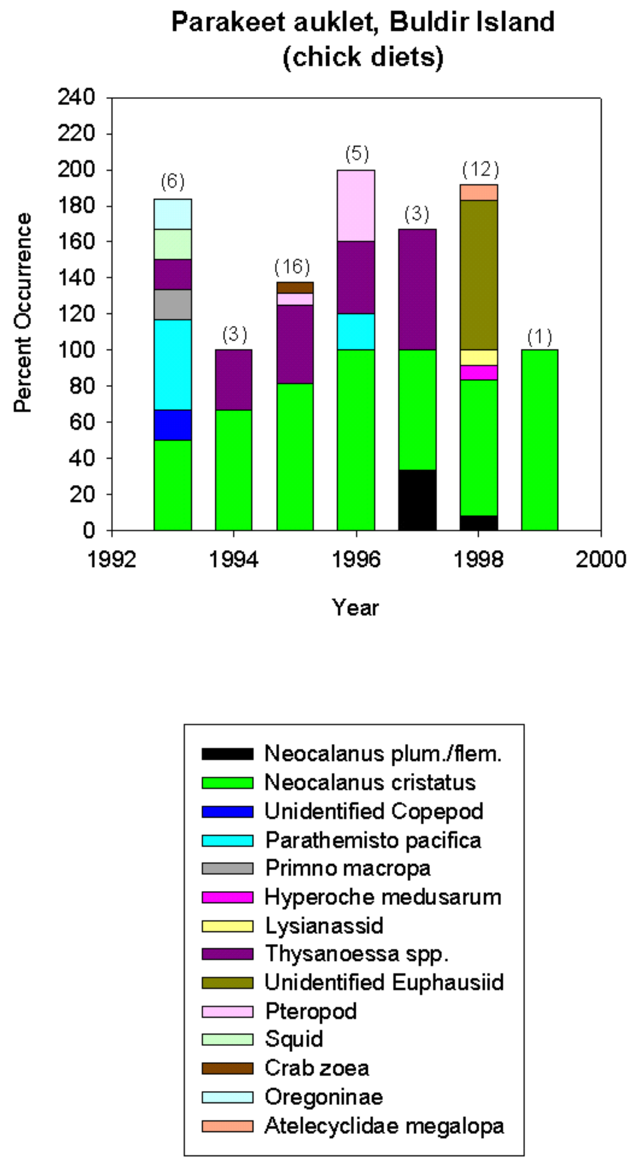


Figure 38. Diets of parakeet auklets at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Samples represent adult gular pouch contents. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Least Auklet (*Aethia pusilla*)

Breeding Chronology.–The dates of hatching for least auklets were about average at Buldir and Kasatochi islands but early at St. Lawrwnce Island in 2002 (Table 25, Fig. 39).

Table 25. Hatching chronology of least auklets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	—	23 Jul (86)[a]	31 Jul[b] (3)[a]	Gall et al. 2003
Buldir I.	27 Jun (13)	25 Jun (13)	27 Jun[b] (12)	Williams et al. 2002
Kasatochi I.	27 Jun (68)	27 Jun (68)	28 Jun[b] (6)	Syria 2002

[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.–Least auklets exhibited average or above average reproductive success in 2002 at all monitored sites (Table 26, Fig. 40).

Table 26. Reproductive performance of least auklets at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
St. Lawrence I.	0.89	89	Gall et al. 2003
Buldir I.	0.60	50	Williams et al. 2002
Kasatochi I.	0.52	97	Syria 2002

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

Populations.–Least auklet populations are monitored only at Kasatochi Island, where no trend was found (Fig. 41).

Diet.–Least auklets are planktivorous and feed on several types of prey (Figs. 42 and 43). Copepods *(Calanus marshallae*, *Neocalanus plumchrus*/*flemingeri Neocalanus cristatus)* and euphausiids were generally the most common prey. All least auklet diets were diverse and had several prey species in each sample (indicated by the cumulative “Percent Occurrence” being more than 500% in some cases).

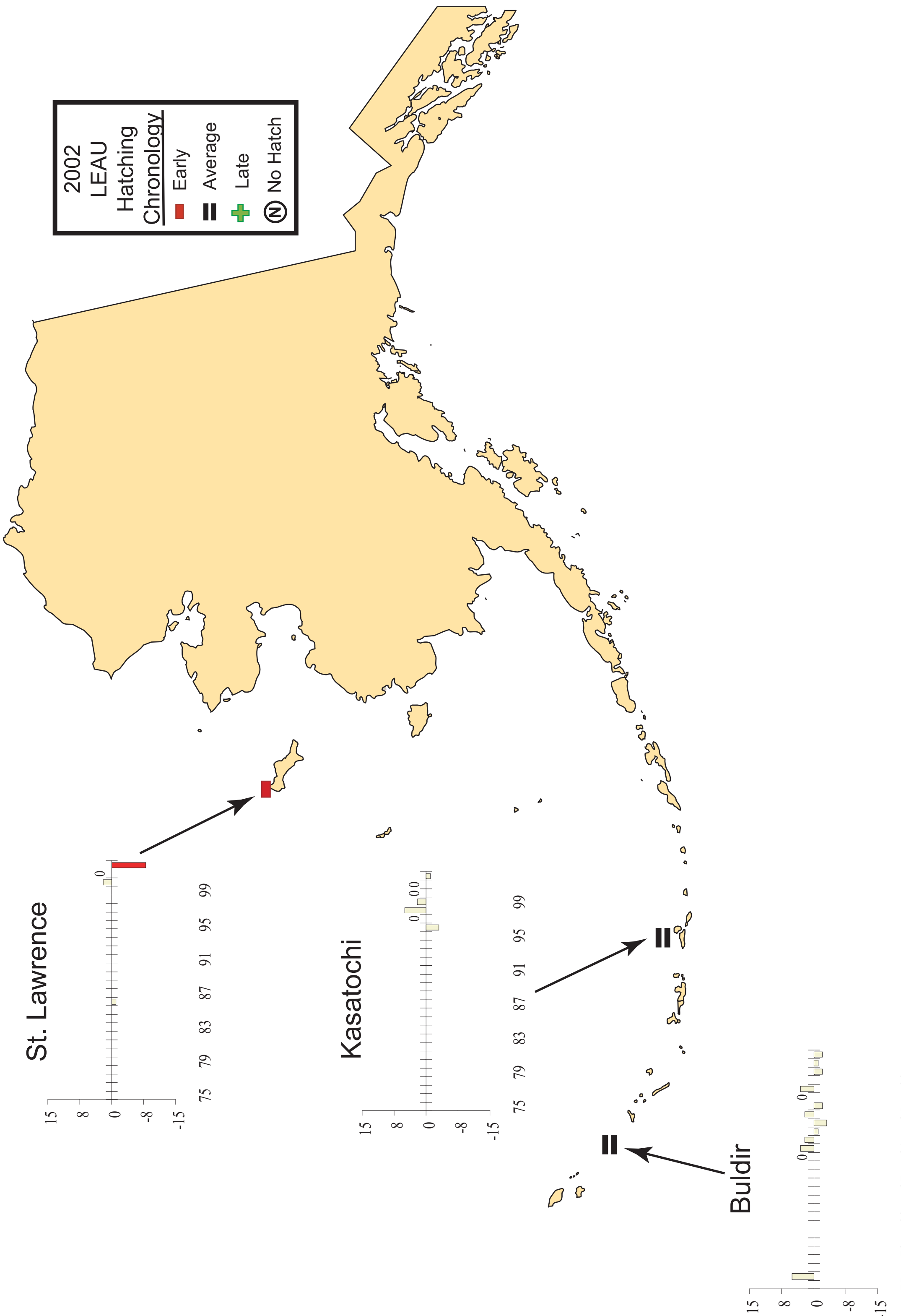


Figure 39. Hatching chronology of least auklets at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

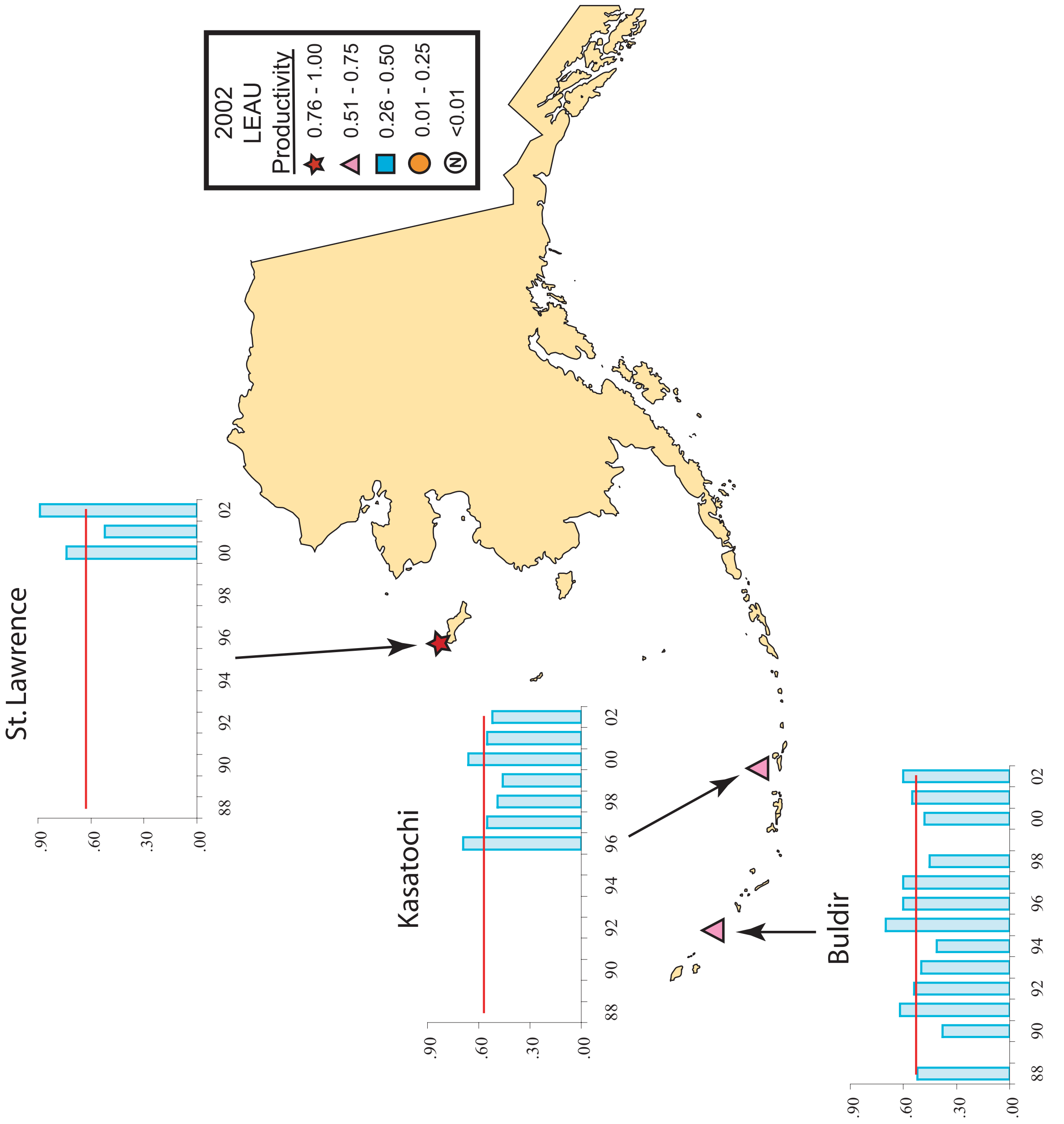


Figure 40. Productivity of least auklets (chicks fledged/nest site) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

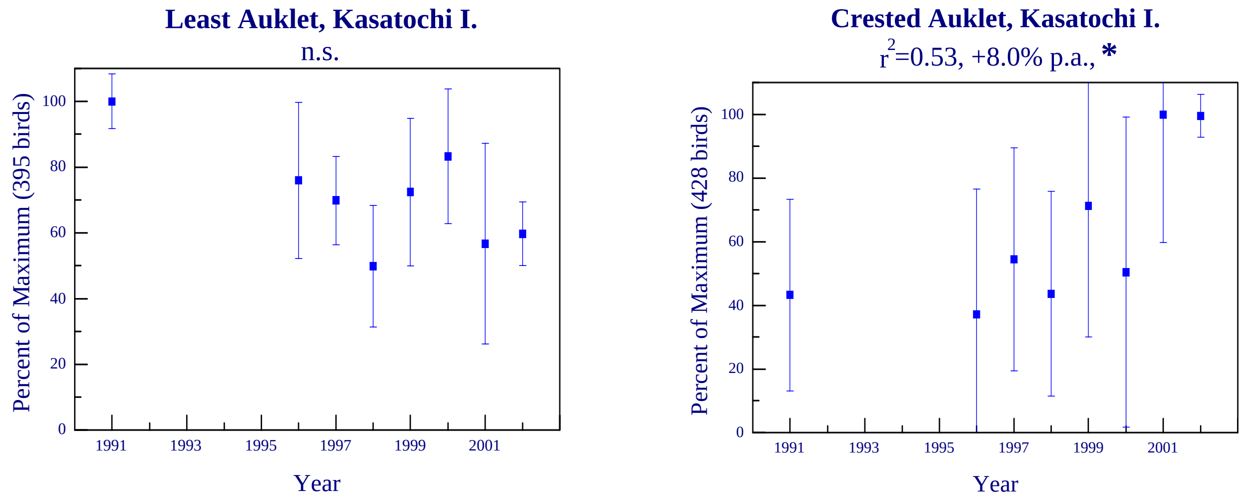


Figure 41. Trends in populations of least and crested auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

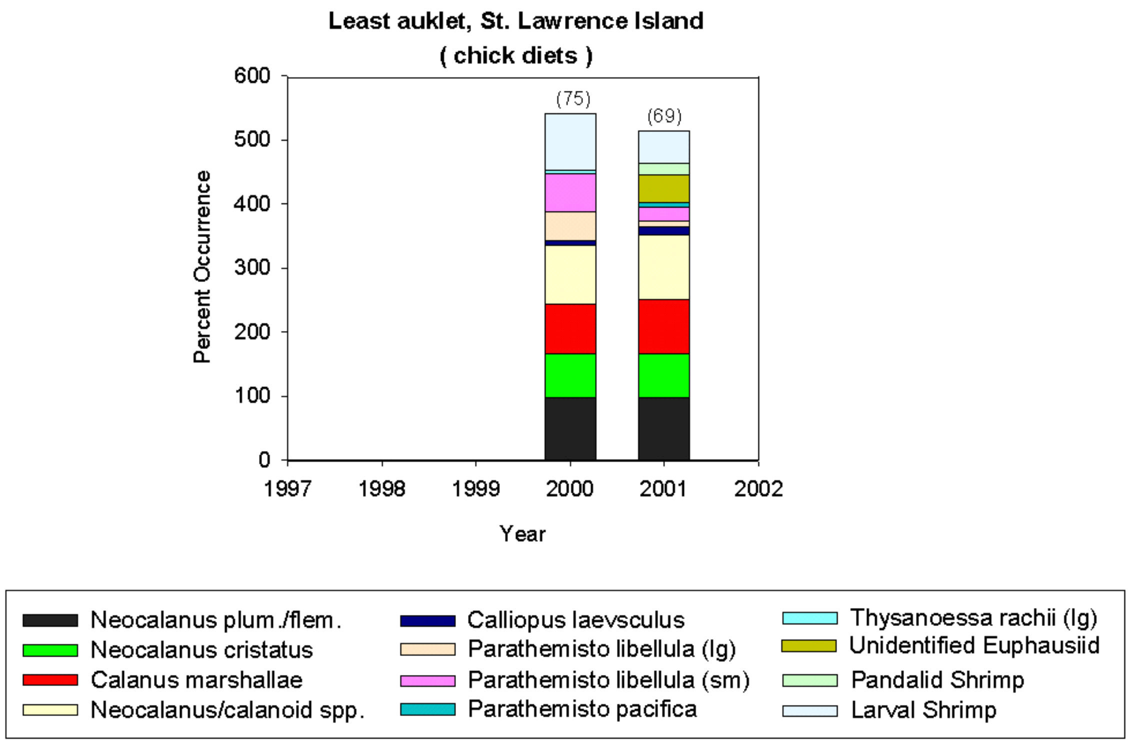


Figure 42. Diets of least auklets at St. Lawrence Island. Sample sizes are indicated by the number above the stacked bars. Samples represent adult gular pouch contents. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

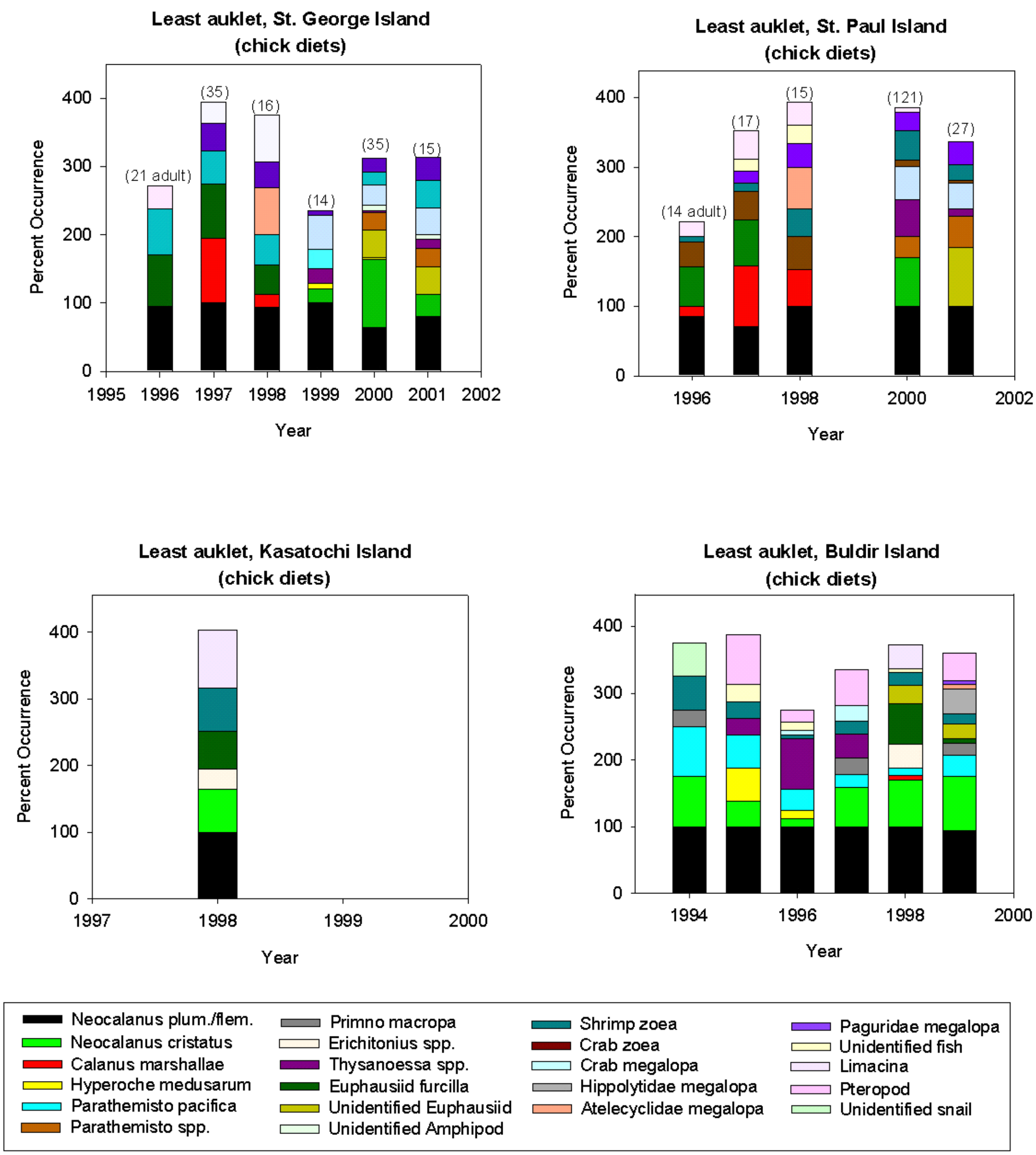


Figure 43. Diets of least auklets at southeastern Bering Sea and Aleutian Island sites. Sample sizes are indicated by the number above the stacked bars. Samples represent adult gular pouch contents. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Whiskered Auklet (*Aethia pygmaea*)

Breeding Chronology.–The mean hatching date for whiskered auklets at Buldir Island in 2002 was about average (Table 27).

Table 27. Hatching chronology of whiskered auklets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	21 Jun (36)[a]	24 Jun (36)	22 Jun[b] (12)[a]	Williams et al. 2002

[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 2002 (Table 28).

Table 28. Reproductive performance of whiskered auklets at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
Buldir I.	0.48	100	Williams et al. 2002

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

Populations.–No data.

Diet.–Whiskered auklet diets were only examined at Buldir Island. Their diet consisted of a wide range of prey species predominantly made up of copepods and euphausiids (Fig. 44).

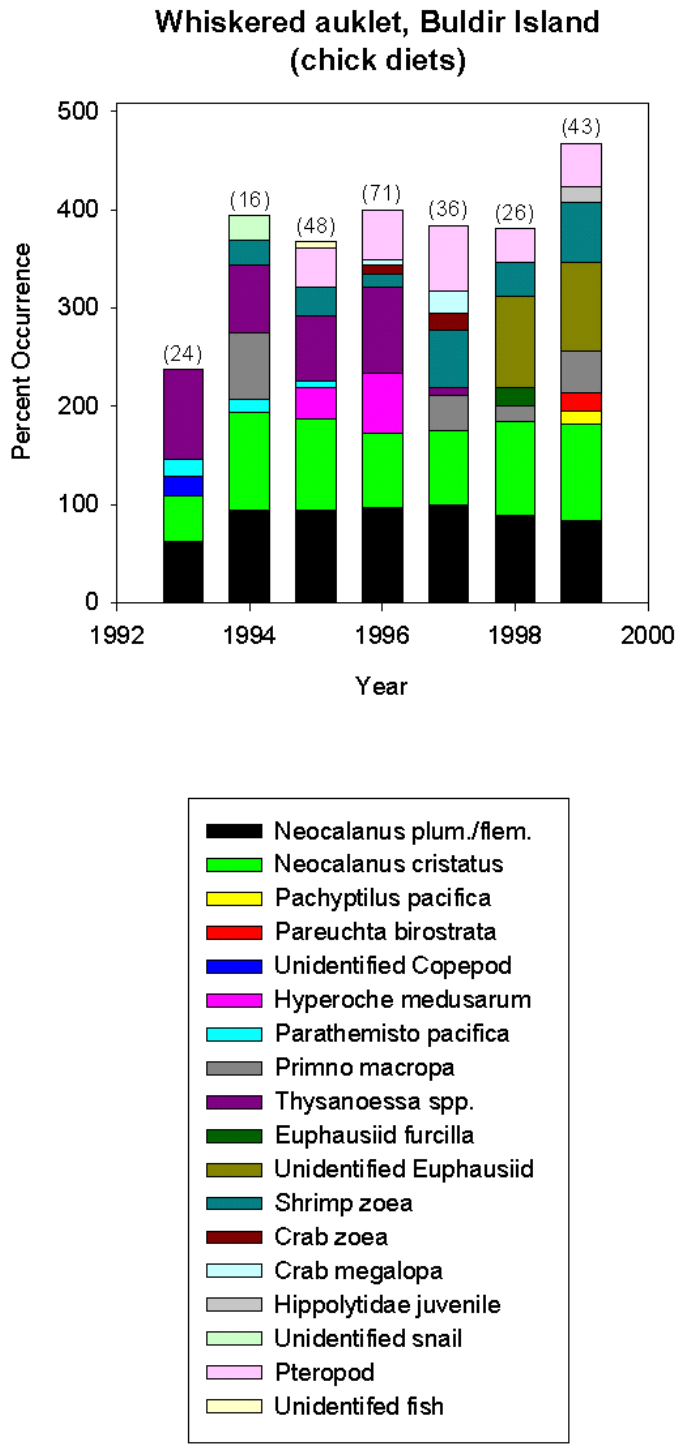
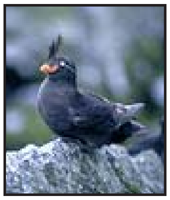


Figure 44. Diets of whiskered auklets at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Samples represent adult gular pouch contents. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.



Crested Auklet (*Aethia cristatella*)

Breeding Chronology.–The mean date of hatching for crested auklets in 2002 was about average at Buldir and Kasatochi islands and early at St. Lawrence Island (Table 29, Fig. 45).

Table 29. Hatching chronology of crested auklets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
St. Lawrence I.	—	23 July (92)[a]	4 Aug[b] (3)[a]	Gall et al. 2003
Buldir I.	25 Jun (26)	25 Jun (26)	28 Jun[b] (12)	Williams et al. 2002
Kasatochi I.	27 Jun (70)	28 Jun (70)	1 Jul[b] (6)	Syria 2002

[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.–Crested auklets had about average rates of success at Buldir and Kasatochi islands and above average productivity at St. Lawrence Island in 2002 (Table 30, Fig. 46).

Table 30. Reproductive performance of crested auklets at Alaskan sites monitored in 2002.

Site	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
St. Lawrence I.	0.83	105	Gall et al. 2003
Buldir I.	0.60	81	Williams et al. 2002
Kasatochi I.	0.59	109	Syria 2002

[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 (+8.0% per annum, Fig. 41).

Diet.–Crested auklets at Kasatochi, Buldir and St. Lawrence islands ate a wide range of prey species consisting predominately of copepods and euphausiids with lesser amounts of amphipods (Fig. 47).

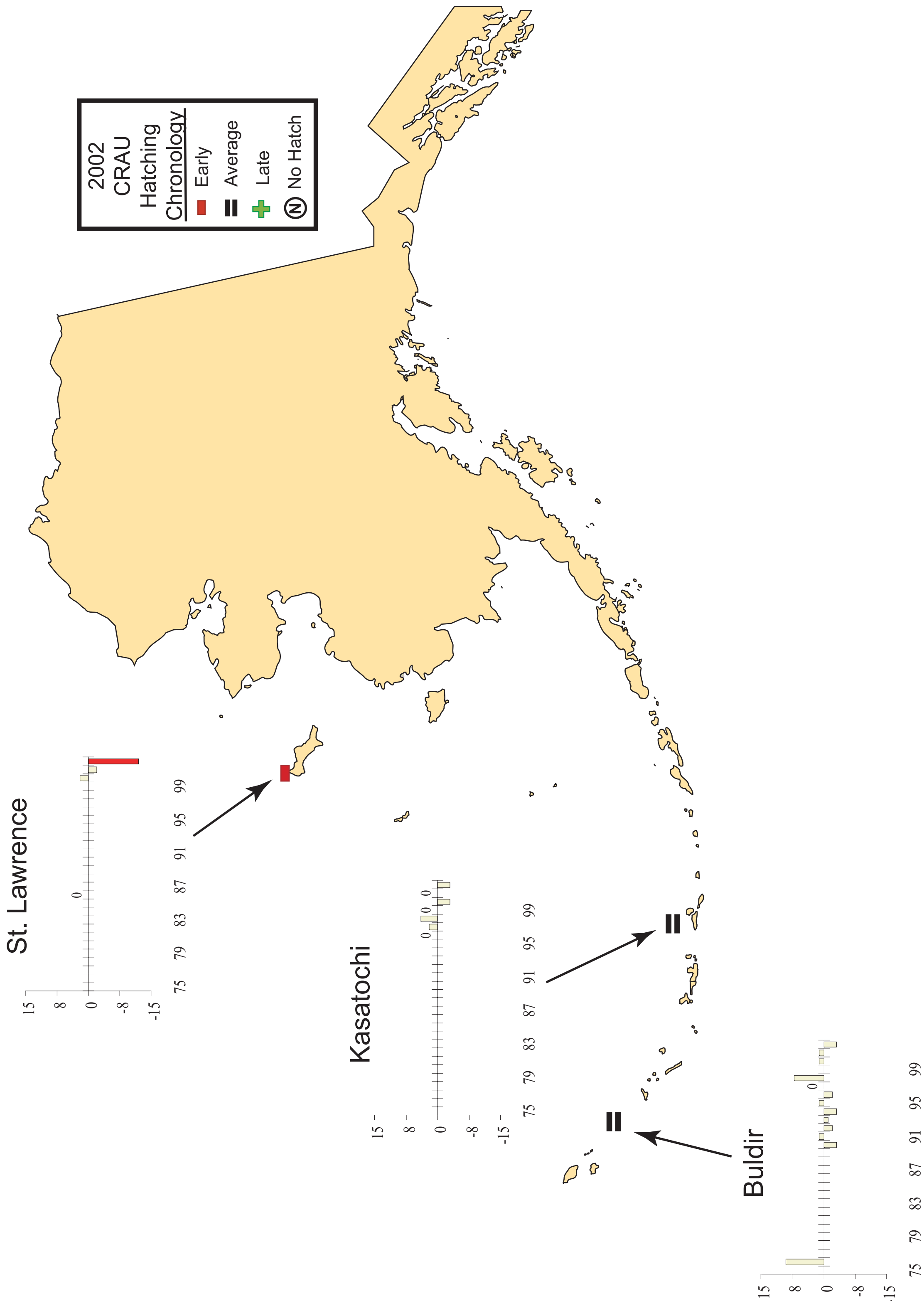


Figure 45. Hatching chronology of crested auklets at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

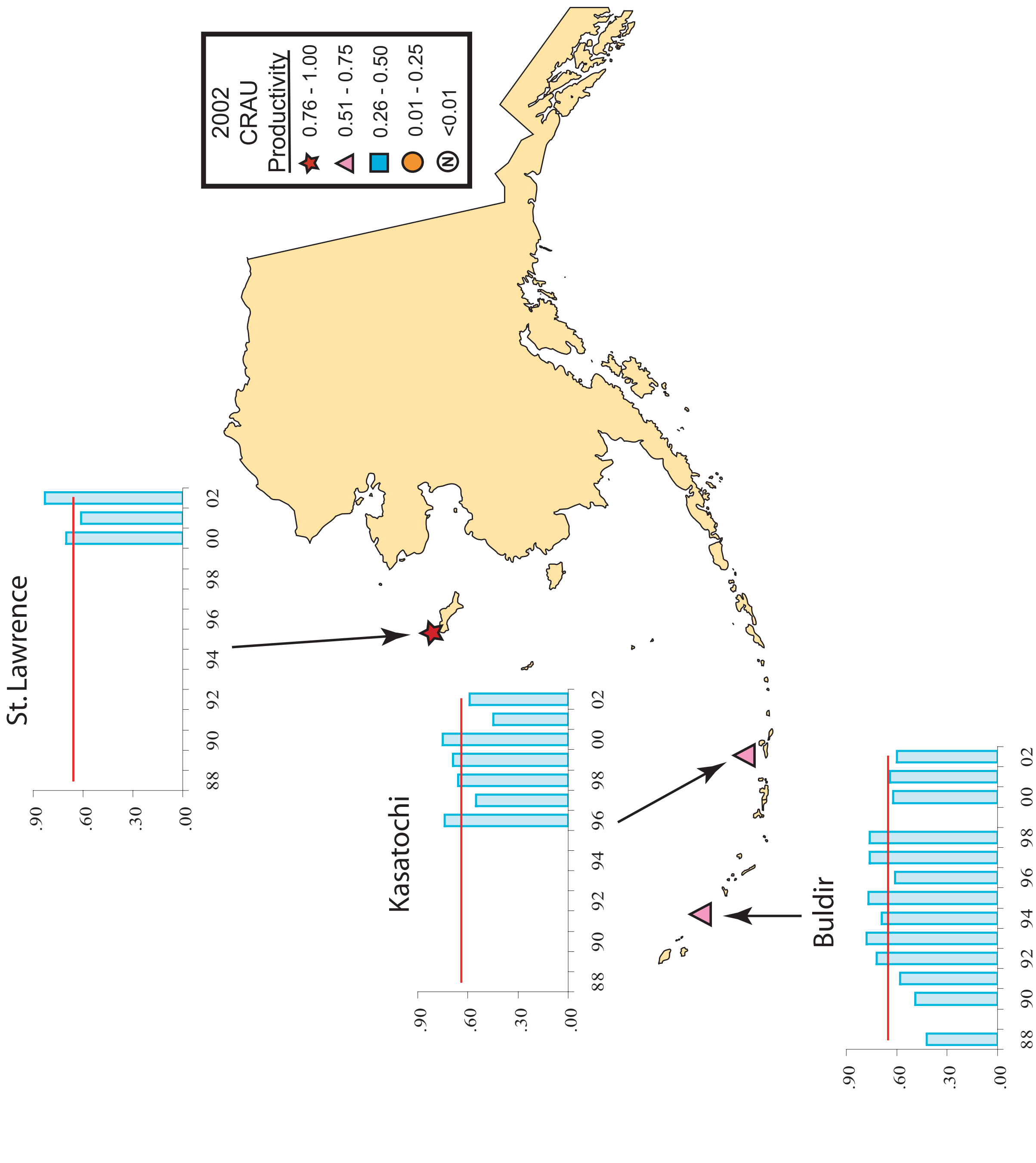


Figure 46. Productivity of crested auklets (chicks fledged/nest site) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

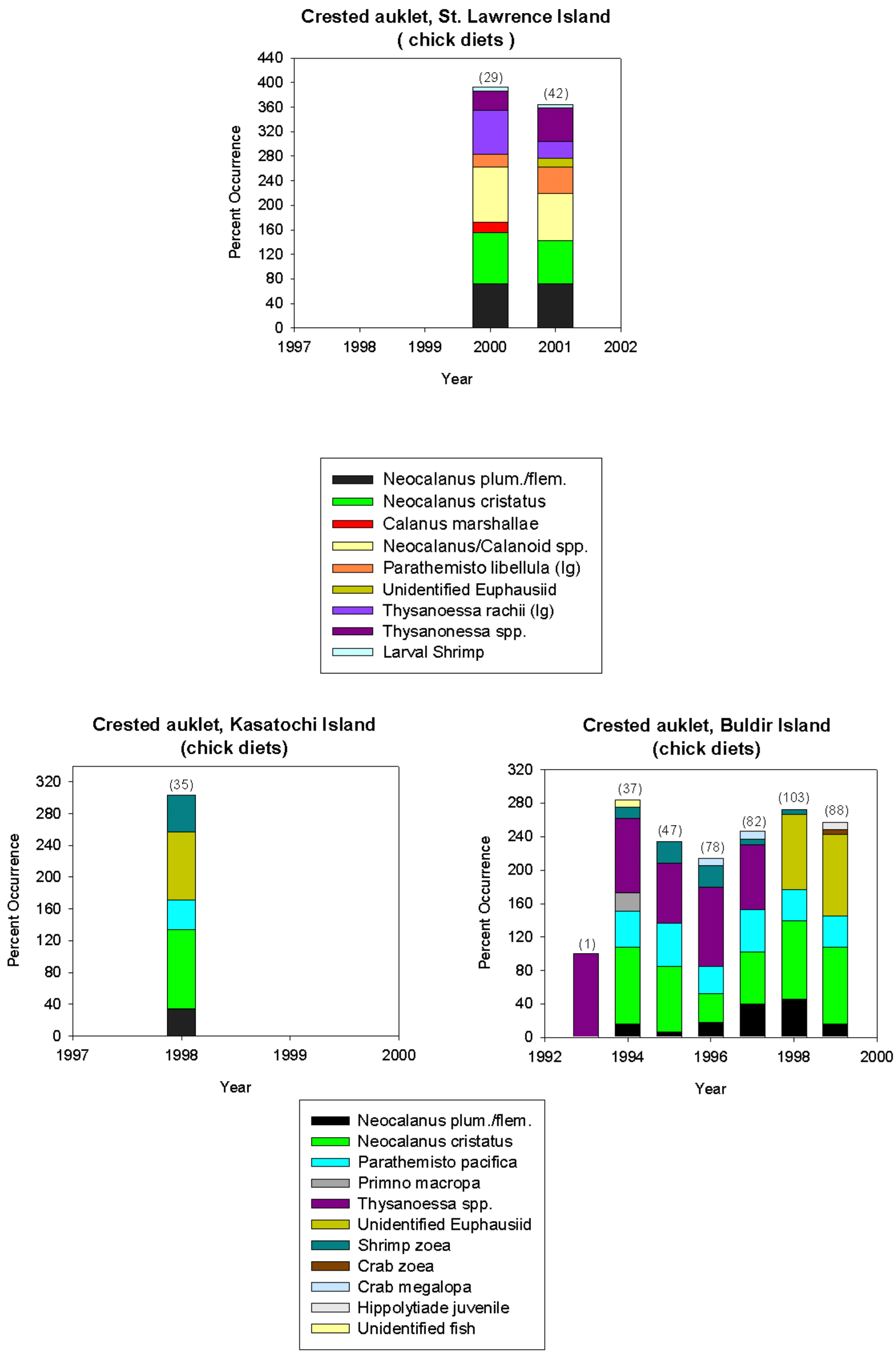


Figure 47. Diets of crested auklets at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Samples represent adult gular pouch contents. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more than100% because birds ate more than one prey type per foraging trip.

Rhinoceros Auklet (*Cerorhinca monocerata*)

Breeding Chronology.–In 2002, the mean hatch date of rhinoceros auklets at Chowiet Island was 25 June (Table 31).

Table 31. Hatching chronology of rhinoceros auklets at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Chowiet I.	24 Jun (14)[a]	25 Jun (14)	N/A[b]	Wang 2002

[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]Not applicable or not reported.

Productivity.–Rhinoceros auklet productivity was below average at Chowiet Island in 2002 (Table 32).

Table 32. Reproductive performance of rhinoceros auklets at Alaskan sites monitored in 2002.

Site	Chicks Fledged/Egg	No. of Eggs	Reference
Chowiet I.	0.04	28	Wang 2002

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).

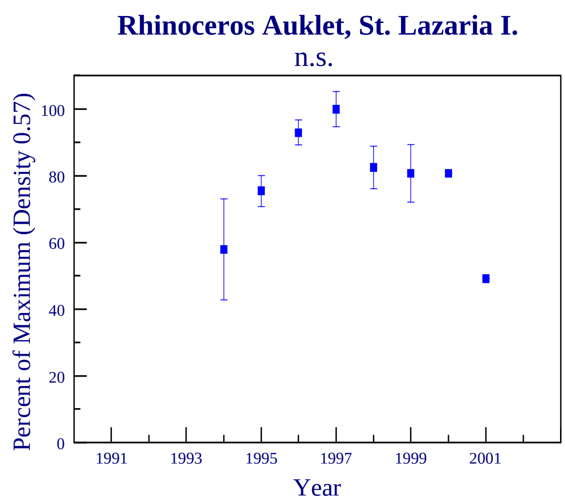


Figure 48. Trends in populations of rhinoceros auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as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

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

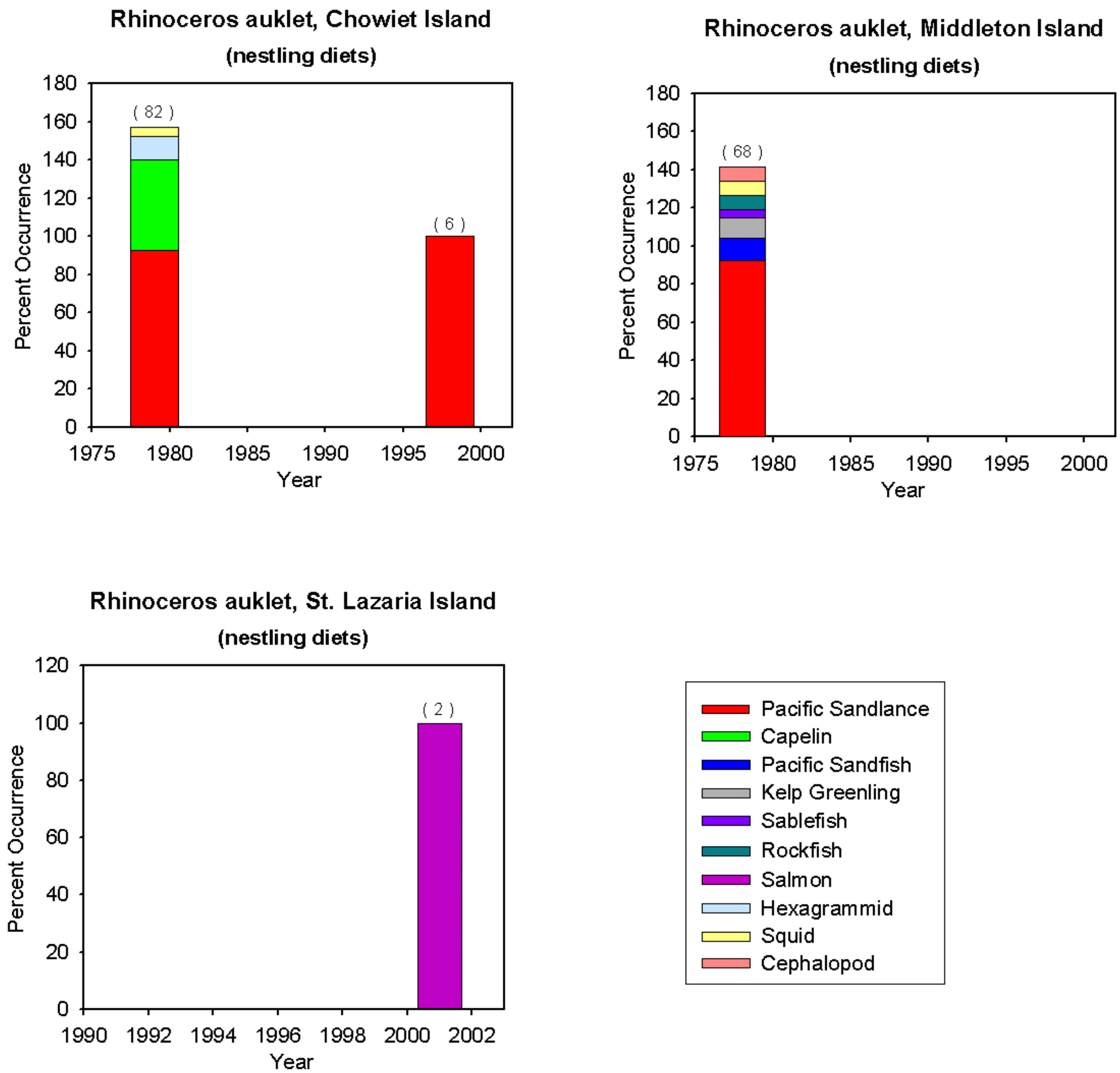
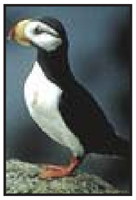


Figure 49. Diets of rhinoceros auklets at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds 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 2002 (Table 33).

Table 33. Hatching chronology of horned puffins at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	19 Jul (42)[a]	20 Jul (42)	23 Jul[b] (14)[a]	Williams et al. 2002

[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 below average productivity at Buldir Island in 2002 (Table 34, Fig. 50).

Table 34. Reproductive performance of horned puffins at Alaskan sites monitored in 2002.

Site	Chicks Fledged/Egg	No. of Eggs	Reference
Buldir I.	0.32	91	Williams et al. 2002

Populations.–No data.

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

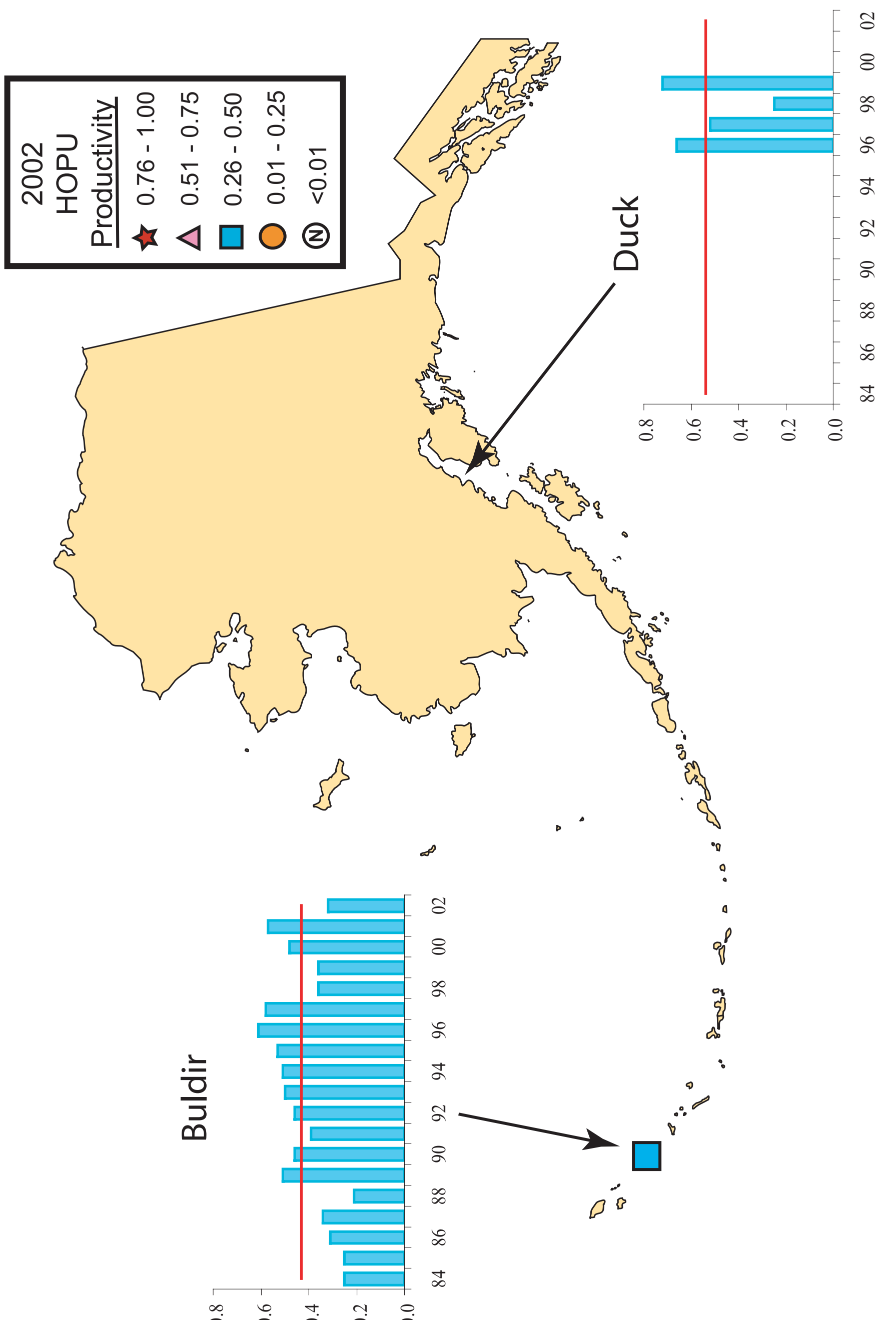


Figure 50. Productivity of horned puffins (chicks fledged/egg) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

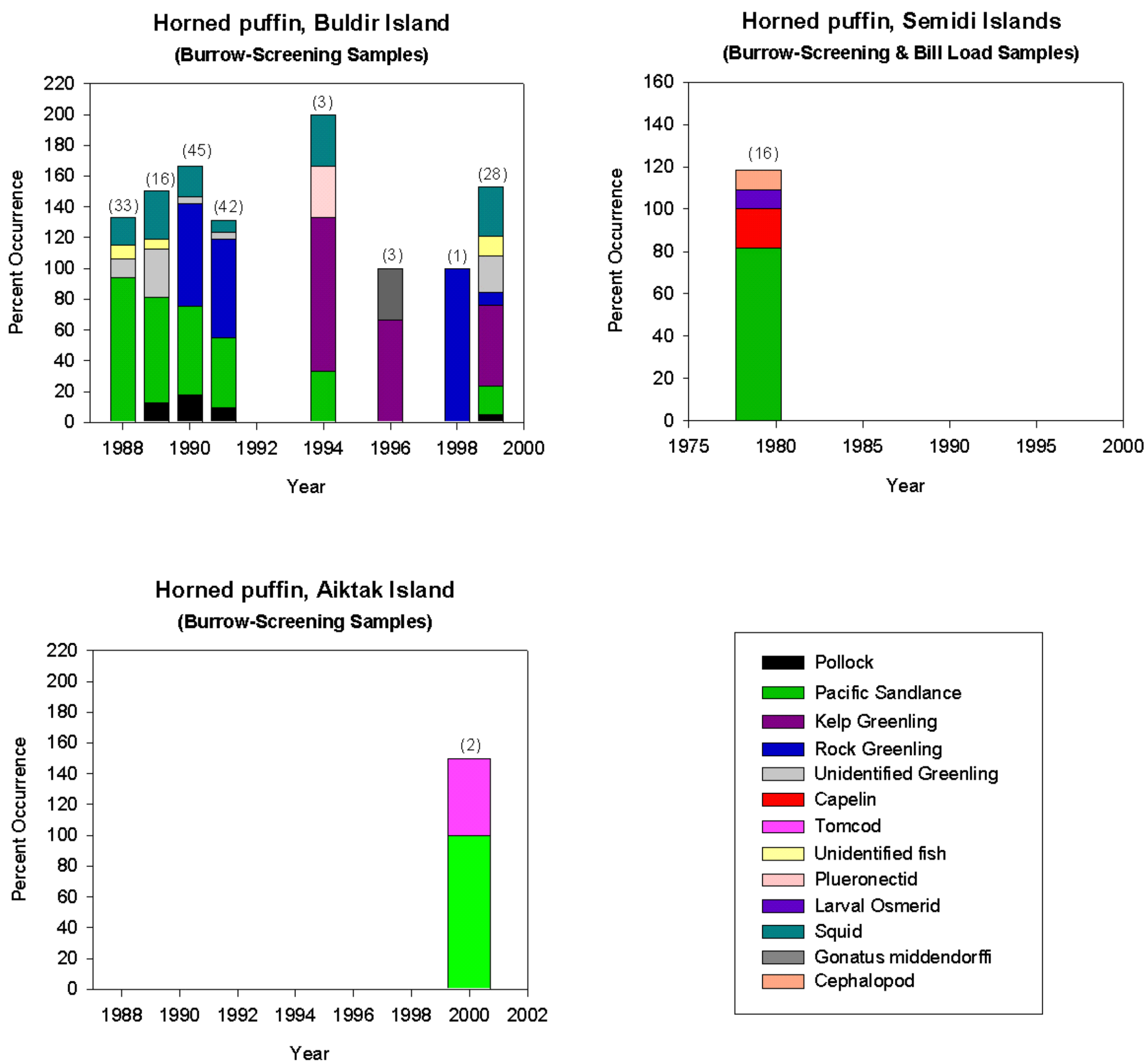


Figure 51. Diets of horned puffins at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more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

Tufted Puffin (*Fratercula cirrhata*)

Breeding Chronology.–Hatch dates for tufted puffins were about average at Aiktak Island and earlier than normal at Buldir Island in 2002 (Table 35, Fig. 52).

Table 35. Hatching chronology of tufted puffins at Alaskan sites monitored in 2002.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	10 Jul (12)[a]	10 Jul (12)	14 Jul[b] (13)[a]	Williams et al. 2002
Aiktak I.	26 Jul (34)	25 Jul (34)	28 Jul[b](6)	Dykstra and Wynn 2002

[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 below average in 2002 at Buldir Island and above average at Aiktak Island (Table 36, Fig. 53).

Table 36. Reproductive performance of tufted puffins at Alaskan sites monitored in 2002.

Site	Chicks Fledged[a]/Egg	No. of Eggs	Reference
Buldir I.	0.17	35	Williams et al. 2002
Aiktak I.	0.75	39	Dykstra and Wynn 2002

[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).

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

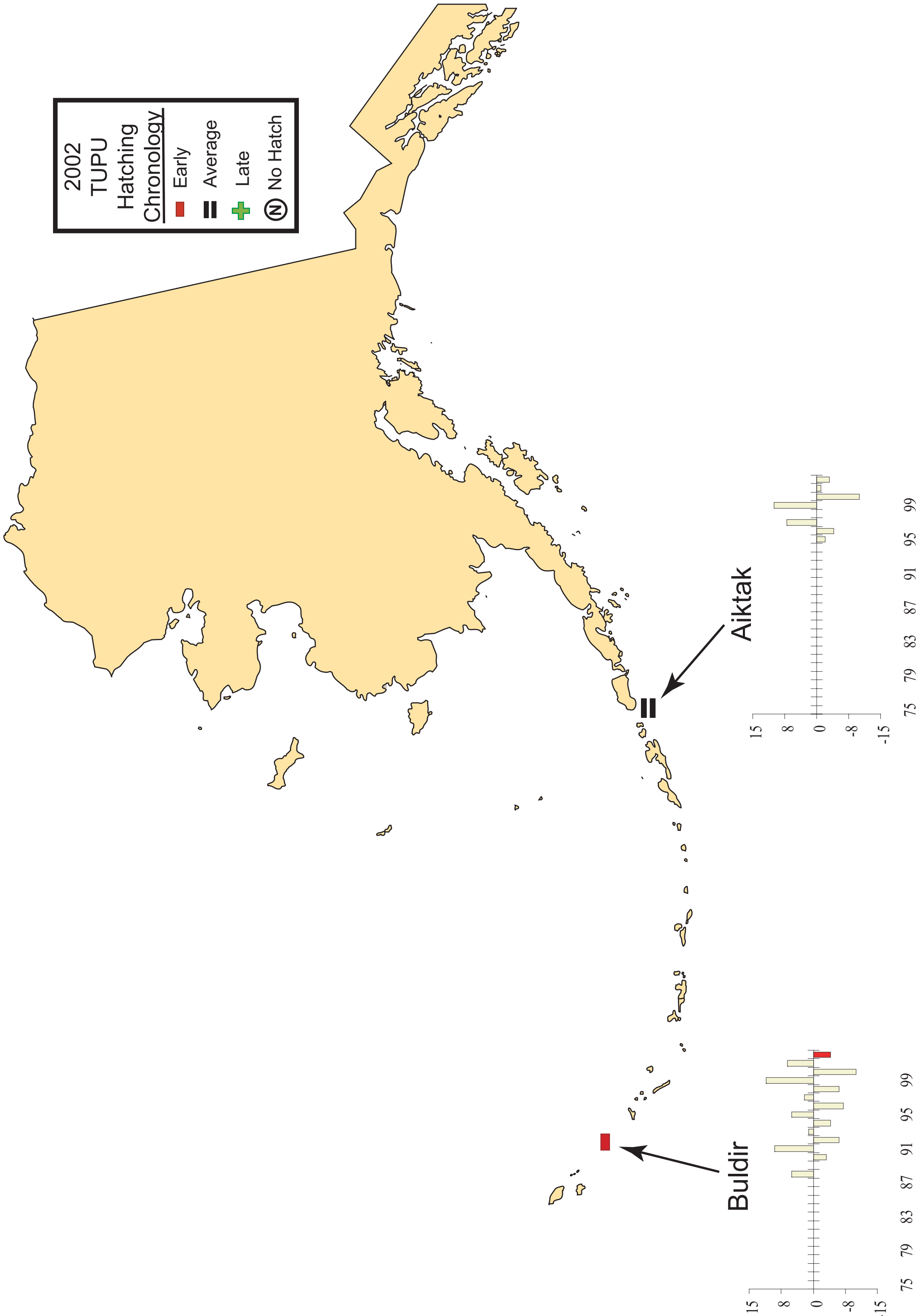


Figure 52. Hatching chronology of tufted puffins at Alaskan sites monitored in 2002. Graphs indicate the departure (if any), in days, from the site mean (current year not included).

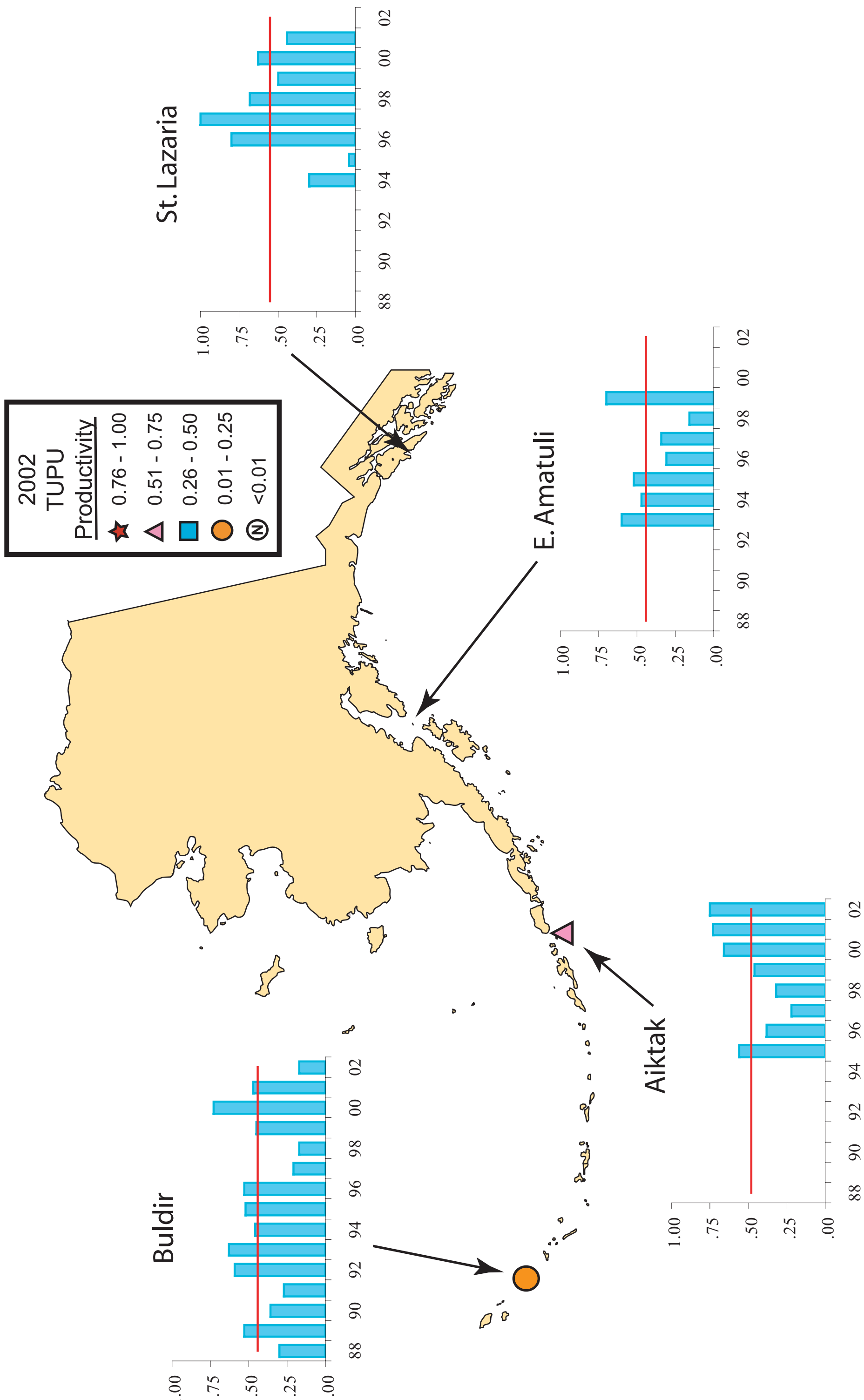


Figure 53. Productivity of tufted puffins (chicks fledged/egg) at Alaskan sites monitored in 2002. Lack of bars on graphs indicates that no data were gathered in those years. Red line is the mean productivity at the site in all years for which there are data (current year not included).

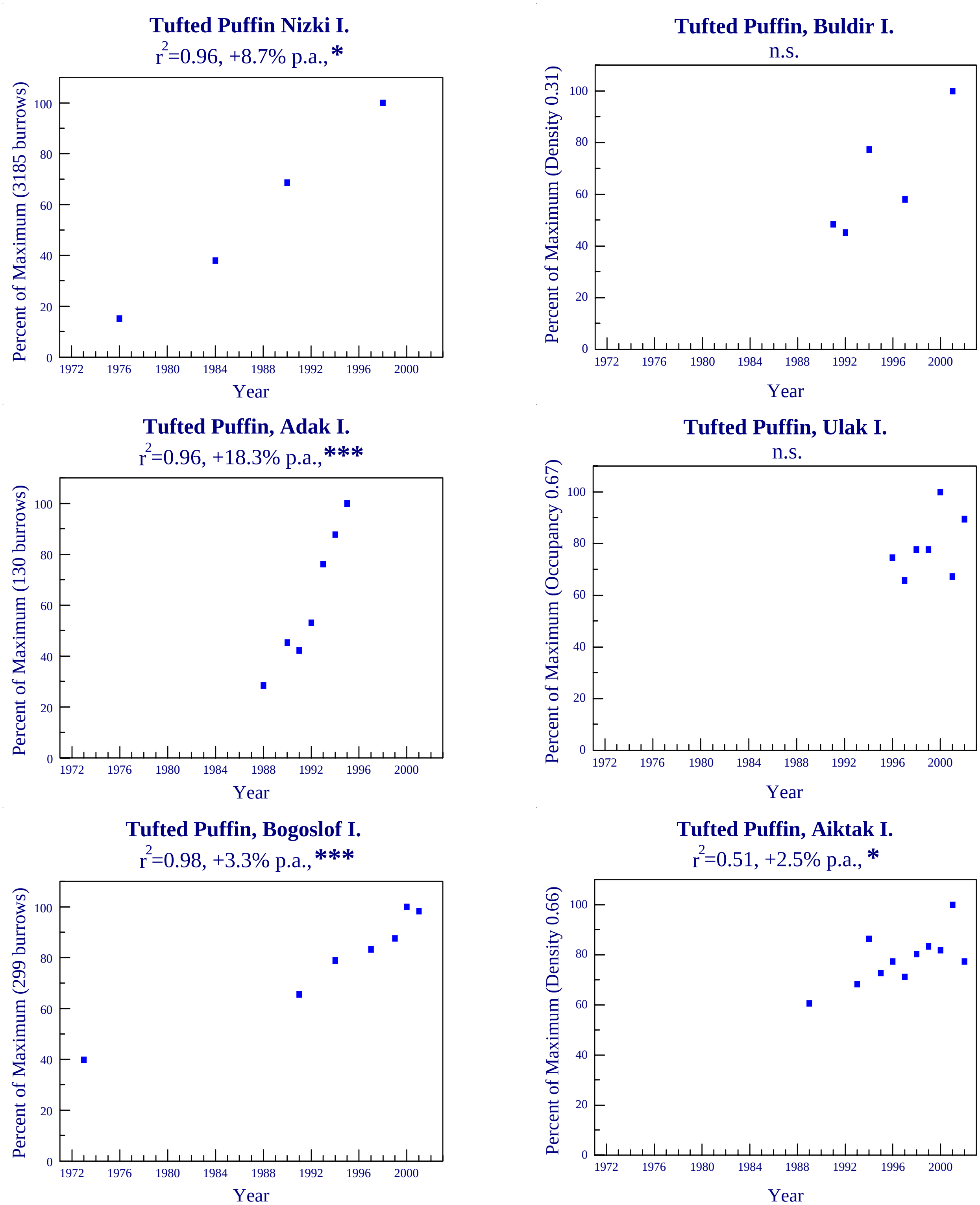
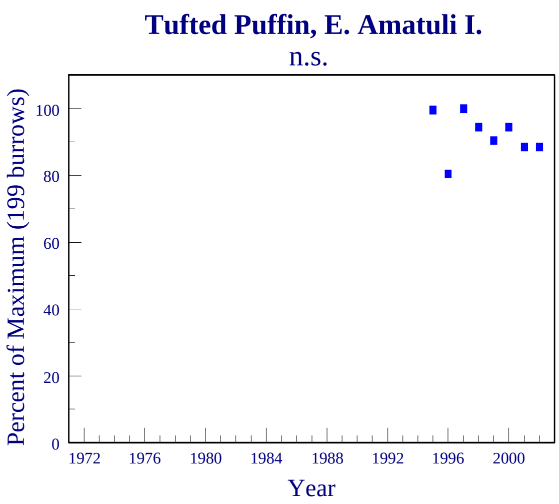


Figure 54. Trends in populations of tufted puffins at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent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



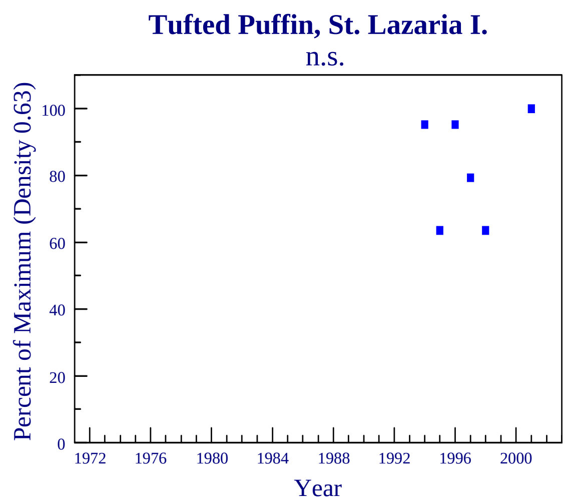


Figure 54 (continued). Trends in populations of tufted puffins at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported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

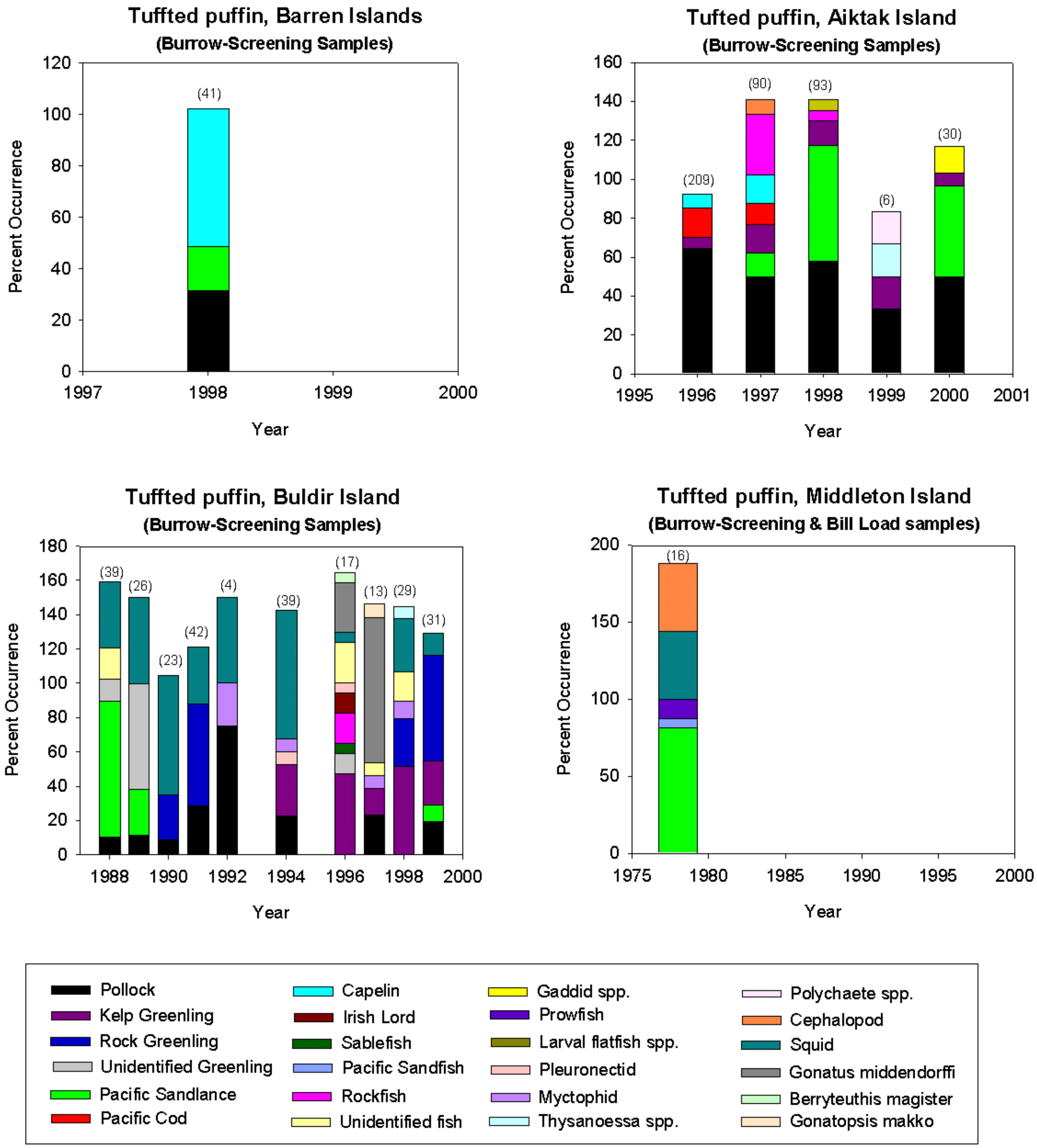


Figure 55. Diets of tufted puffins at Alaskan sites. Sample sizes are indicated by the number above the stacked bars. Source of samples (adult or chick) is indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Cumulative percent occurrence generally adds to more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

SUMMARY

Species Differences

Surface Plankton-Feeders.–In 2002, the timing of hatching for both fork-tailed (FTSP) and Leach's (LHSP) storm-petrels was early at Aiktak Island (Table 37). Fork-tailed storm-petrels had average reproductive success at Aiktak Island (Table 38). Leach's storm-petrel productivity was below average at that colony. Both species of storm-petrels had average productivity at Buldir Island. Fork-tailed storm-petrels also had about average success at Ulak Island. Storm-petrel (STPE) burrow densities (both species combined) have increased or remained stable in recent years (Table 39).

Surface Fish-Feeders.–We found no significant trends for northern fulmar (NOFU) populations at the Pribilof Islands or at Chowiet Island (Table 39).

Glaucous-winged gulls (GWGU) are treated here, although they are opportunistic feeders taking other birds as well as fish for prey. In 2002, gull eggs hatched earlier than normal at both Aiktak and St. Lazaria islands, and at about the average date at Puale Bay (Table 37). Gulls had average success at Aiktak Island and Puale Bay and above average reproduction at Buldir, Chowiet and St. Lazaria islands in 2002 (Table 38). Gull populations showed positive or stable trends at all but one colony (Table 39). Numbers of this species have declined significantly at Buldir Island.

Black-legged kittiwakes (BLKI) had earlier than normal hatch dates at all eight sites monitored in 2002 (Table 37). Black-legged kittiwake productivity was below average at two of the three colonies in the northern Bering/Chukchi, and above average at one site in 2002 (Table 38). Above average success occurred at most sites in the Bering Sea and Aleutian Islands, with only one of six colonies in these regions experiencing below average success. This species had above average productivity at all four monitored colonies in the Gulf of Alaska. Black-legged kittiwake populations exhibited stable trends at 12 sites, significant declines at four colonies and significant positive trends at two locations (Table 39).

Red-legged kittiwake (RLKI) eggs hatched earlier than normal in 2002 at the Pribilof Islands (St. Paul and St. George islands), and at Buldir Island (Table 37). Reproductive success was higher than average at the Pribilof Islands and about average at Buldir and Bogoslof islands in 2002 (Table 38). This species exhibited a significant negative population trend at St. Paul Island, no trend at either St. George Island or Koniuji Island and a significant increase at Buldir Island (Table 39).

Diving Fish-Feeders (nearshore).–Timing of hatching was relatively early for red-faced cormorants (RFCO) at Puale Bay and about average for pelagic cormorants (PECO) at Cape Peirce in 2002 (Table 37). Red-faced cormorants (RFCO) had above average reproductive success at four of the six monitored sites in 2002 (Table 38). Red-faced cormorant productivity was below average at Aiktak and Ulak islands. Pelagic cormorants exhibited average or above average success at most monitored colonies, the exceptions being below average productivity at Aiktak, Ulak and St. Lazaria islands. We found significant declines of red-faced cormorants at the Semidi Islands and Chiniak Bay (Table 39). 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 two of the three monitored colonies and increasing significantly at Kasatochi Island.

Table 37. Seabird relative breeding chronology compared to averages for past years within regions[a]. Only sites for which there were data from 2002 are included.

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

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

Table 38. Seabird relative productivity levels compared to averages for past years within regions[a]. Only sites for which there were data from 2002 are included.

Region	Site	FTSP	LHSP	RFCO	PECO	GWGU	BLKI	RLKI	COMU	TBMU	ANMU	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.				+		+		–									
	Bogoslof I.						+	=										
	Aiktak I.	=	–	–	–	=			–	–	=							+
SW Bering	Buldir I.	=	=		=	+	–	=	=	=		–	=	=	=		–	–
	Ulak I.	=		–	–													
	Kasatochi I.			+	=				–	–			=		=			
	Koniuji I.						+											
Gulf of Alaska	Chowiet I.					+	+		=	=						–		
	Puale Bay			+		=			+	+								
	Chiniak Bay			+	+		+											
	E. Amatuli I.						+											
	Pr. Will. Snd.						+											
Southeast	St. Lazaria I.				–	+			–	=								

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

Table 39. 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	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	Nizki 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.

Pigeon guillemot (PIGU) numbers showed a significant decline at Aiktak Island but no trends at Buldir, Kasatochi or St. Lazaria islands (Table 39).

Diving Fish-Feeders (offshore).–Timing of common murre (COMU) hatching in 2002 was early at eight of ten monitored sites and average at the Pribilof Islands (Table 37). Thick-billed murre (TBMU) chronology was earlier than average at Puale Bay and St. Lazaria Island and average elsewhere.

Common murres exhibited average or below average reproductive success at all sites except St. Paul Island, Cape Peirce and Puale Bay where success was above normal. This species again failed completely at Kasatochi Island in 2002 (Table 38). Thick-billed murres also failed at Kasatochi Island and had below average success at St. Lawrence and Aiktak islands as well in 2002 . 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 eight locations (Table 39). Thick-billed murre populations exhibited significant declining trends at two sites, increases at one colony and stable numbers at one location. At colonies where murres were not identified to species during counts (UNMU), numbers significantly increased or remained stable at six sites and showed significant negative trends at three locations.

Ancient murrelet (ANMU) hatching chronology was early and productivity was about average at Aiktak Island in 2002 (Tables 37 and 38).

Rhinoceros auklets (RHAU) exhibited below average productivity in 2002 at Chowiet Island (Table 38).

Horned puffins (HOPU) exhibited approximately normal hatching chronology and below average productivity at Buldir Island in 2002 (Tables 37 and 38).

Tufted puffin (TUPU) eggs hatched at about the average time at Aiktak Island and earlier than average at Buldir Island in 2002 (Table 37). Reproductive success for tufted puffins was above average at Aiktak Island and below average at Buldir Island in 2002 (Table 38). Significant positive population trends were found for tufted puffins at four colonies but we found no significant trends for this species elsewhere (Table 39).

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 2002 (Table 37). Timing was early for both least and crested auklets at St. Lawrence Island in 2002. Productivity was below average for parakeet auklets at Buldir Island in 2002 (Table 38). Least, whiskered and crested auklets had average success at most monitored sites. Productivity was above average for both least and crested auklets at St. Lawrence Island in 2002. Populations of least auklets showed no trend at Kasatochi Island whereas crested auklet numbers increased significantly there (Table 39).

Regional Differences

Northern Bering/Chukchi.–Black-legged kittiwakes and common murres hatched earlier than normal at St. Lawrence Island and Bluff in 2002 (Table 37). Thick-billed murre timing was approximately average at St. Lawrence Island whereas hatch was relatively early for both least and crested auklets at this colony. Reproductive success was below average for black-legged kittiwakes at Cape Lisburne and St. Lawrence Island but above average at Bluff in 2002 (Table 38). Murre productivity was below normal at St. Lawrence Island whereas least and crested auklets exhibited higher than 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 39). Common murre populations exhibited no trend at Bluff or Hall Island. Thick-billed murre populations declined significantly at Hall Island. Unspecified murres showed no trend at Cape Thompson but increased significantly at Cape Lisburne.

Southeastern Bering.–Hatch dates for fork-tailed and Leach's storm-petrels at Aiktak Island were earlier than average in 2002 (Table 37). All species of fish-feeders exhibited early or normal timing in this region, with eight of 14 cases having an earlier than average breeding chronology.

Storm-petrels had average or below average reproduction in 2002 (Table 38). Cormorants experienced above average productivity in this region with the exception of below average success of both red-faced and pelagic cormorants at Aiktak Island. Glaucous-winged gulls had about average productivity at the only site monitored in the Southeastern Bering Sea area in 2002. Kittiwakes exhibited normal or higher than normal productivity in all instances in this region in 2002. Murre productivity was average or above average in five of the eight instances in this region in 2002. Common murres had lower than normal success at Round Island and both species of murre failed entirely at Aiktak Island. Ancient murrelets exhibited average reproductive success at Aiktak Island and tufted puffins had better than average success there in 2002.

Northern fulmar numbers appeared to be stable at both monitored colonies in this region. (Table 39). 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 earlier than usual or about average in 2002 (Table 37). Plankton-feeders (auklets) also exhibited normal breeding chronology in this region. Tufted puffins exhibited later than normal hatching chronology at Buldir Island and about average timing at Aiktak Island. Horned puffin chronology was about average at Buldir Island in 2002.

Both species of storm-petrel had average productivity in this region in 2002 (Table 38). Cormorant success was average or above at three of the five sites monitored. Both red-faced and pelagic cormorants had low productivity at Ulak Island. Glaucous-winged gull productivity was above average at Buldir Island. Black-legged kittiwakes showed below average production at Buldir Island and above average success at Koniuji Island in 2002. Red-legged kittiwakes had 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 fifth year in a row. Auklets exhibited average or below average productivity at southwestern Bering Sea colonies monitored in 2002. Both horned and tufted puffins had lower than average productivity at Buldir Island.

Storm-petrel populations at Buldir and Ulak islands were stable (Table 39). We found no significant trends in cormorant populations at either Buldir Island or Ulak Island but cormorants significantly increased at Kasatochi 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 no trends were evident for either species at Koniuji Island. Murres were either stable or increasing in this region and pigeon guillemots exhibited no trends. Least auklet numbers were stable at Kasatochi Island but crested auklet populations at the same colony showed a significant positive trend. Tufted puffins also 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 earlier than normal in seven of nine instances for birds breeding in this region in 2002 (Table 37).

Productivity was normal or above normal for all of the species we monitored in this region in 2002, with the exception of below average success for rhinoceros auklets at Chowiet Island (Table 38).

Northern fulmars showed no trend in populations at Chowiet Island (Table 39). 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 for red-faced cormorants at the Semidi Islands and a decline for 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 a significant positive trend for murre populations at Gull Island, a significant decline at Chisik/Duck islands and stable populations at three other colonies in this region. Tufted puffin numbers showed no trends at East Amatuli Island.

Southeast Alaska.–Gull and murre eggs hatched early at St. Lazaria Island, the only site monitored in this region in 2002 (Table 37).

Reproductive success was below average for pelagic cormorants and common murres, average for thick-billed murres and above average for glaucous-winged gulls at St. Lazaria Island in 2002 (Table 38).

Storm-petrel and pelagic cormorant numbers increased significantly at St. Lazaria Island (Table 39). 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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