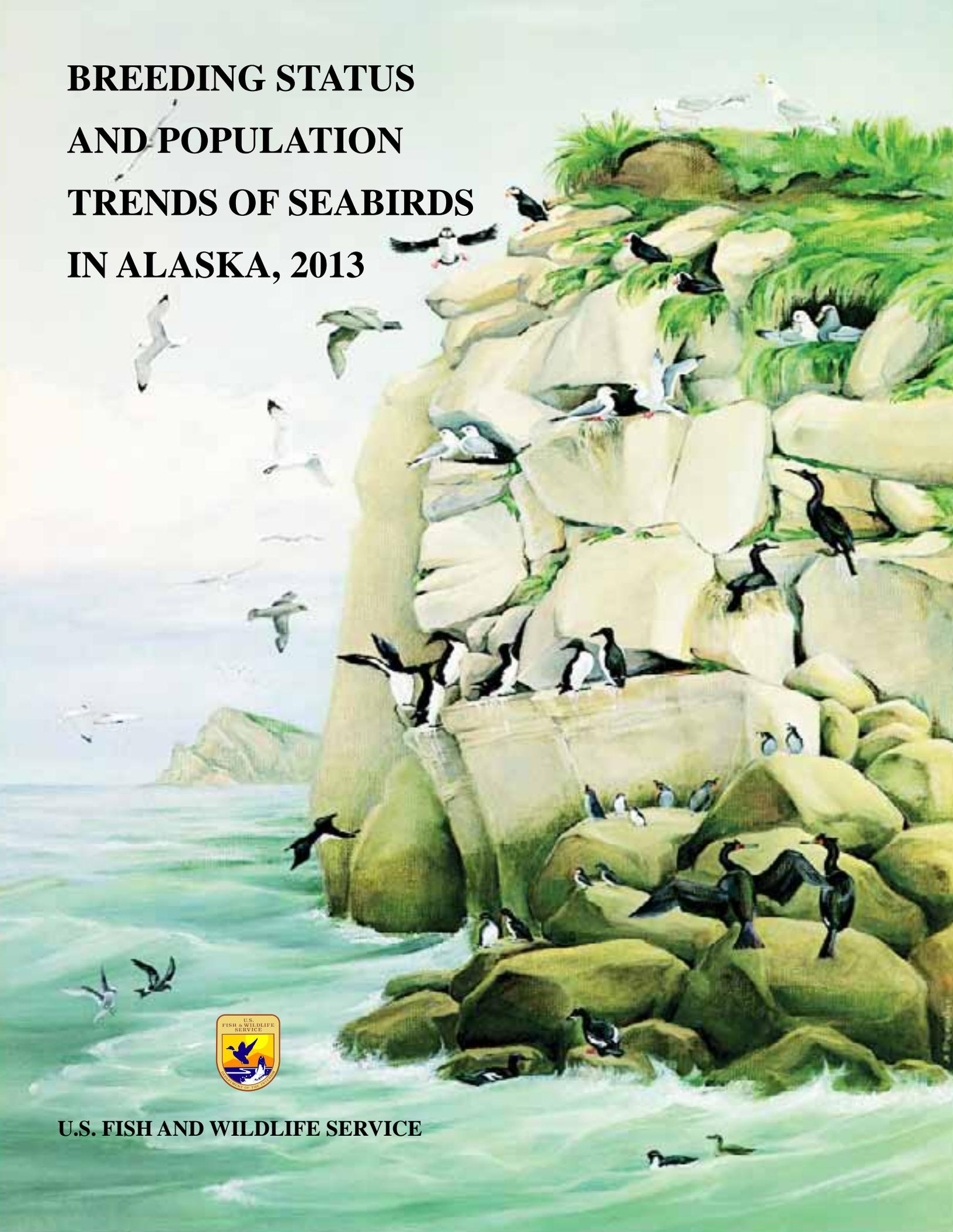


**BREEDING STATUS
AND POPULATION
TRENDS OF SEABIRDS
IN ALASKA, 2013**



U.S. FISH AND WILDLIFE SERVICE

BREEDING STATUS AND POPULATION TRENDS OF SEABIRDS IN ALASKA, 2013

Compiled By:

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Key words: *Aethia*, Alaska, Aleutian Islands, ancient murrelet, Bering Sea, black-legged kittiwake, *Cepphus*, *Cerorhinca*, Chukchi Sea, common murre, crested auklet, 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, 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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The findings and conclusions in this report are those of the author(s) and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

Executive Summary

Data are 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 and population trends of representative species of various foraging guilds (e.g., offshore diving 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 2013 data were gathered on northern fulmars, storm-petrels, cormorants, kittiwakes, glaucous-winged gulls, murres, ancient murrelets, auklets and/or puffins at eight annual monitoring sites on the Alaska Maritime NWR. In addition, data were gathered at other locations which are visited intermittently or were part of a research or monitoring program off refuges.

Timing of breeding (Table A)

- Statewide, the mean hatch date was early for 33% of species, average for 54% and late for 13%.
- Storm-petrels hatched early in Alaska in 2013, whereas least auklets hatched later than normal.

Table A. Regional and statewide seabird breeding chronology^a compared to averages for past years within regions and the state of Alaska as a whole. Only regions for which there were data from 2013 are included.

Region	FTSP ^b	LHSP	RFCO	BLKI	RLKI	GWGU	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	HOPU	TUPU
SE Bering	E	E	A	E	E	L	E	E	E		L			A	E
SW Bering				L	A	L		A		A	L	A	E	A	A
N. Gulf of Alaska				A		E	L	A		E				A	A
Alaska	E	E	A	A	E	L	A	A	E	A	L	A	E	A	A

^a Codes:

“E” and red cell color indicate hatching chronology was > 3 days earlier than the average for sites in this region.

“A” and yellow cell color indicate hatching chronology was within 3 days of average.

“L” and green cell color indicate hatching chronology was > 3 days later than the average for sites in this region.

^bFTSP=fork-tailed storm-petrel, LHSP=Leach’s storm-petrel, RFCO=red-faced cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake, GWGU=glaucous-winged gull, COMU=common murre, TBMU=thick-billed murre, ANMU=ancient murrelet, PAAU=parakeet auklet, LEAU=least auklet, WHAU=whiskered auklet, CRAU=crested auklet, HOPU=horned puffin, TUPU=tufted puffin.

Productivity (Table B)

- Statewide, productivity was below average in 25% of species, average in 69% and above average in 6% of species in 2013.
- Statewide, pelagic cormorants had high productivity, whereas glaucous-winged gull, thick-billed murre, parakeet auklet and crested auklet success was low in 2013.

Table B. Regional and statewide seabird breeding productivity levels^a compared to averages for past years within regions and the state of Alaska as a whole. Only regions for which there were data from 2013 are included.

Region	FTSP ^b	LHSP	RFCO	PECO	BLKI	RLKI	GWGU	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	HOPU	TUPU
N. Bering/Chukchi					↓											
SE Bering	↔	↔	↑	↔	↔	↔	↓	↔	↓	↔		↔			↔	↑
SW Bering	↓	↔	↓	↔	↓	↓	↔	↓	↔		↓	↔	↔	↓	↔	↑
Gulf of Alaska			↓	↑	↔		↔	↔	↓		↔				↓	↔
Alaska	↔	↔	↔	↑	↔	↔	↓	↔	↓	↔	↓	↔	↔	↓	↔	↔

^a Codes:

- ↓ and red cell color indicate productivity was > 20% below the average for the region.
- ↔ and yellow cell color indicate productivity was within 20% of average.
- ↑ and green cell color indicate productivity was > 20% above the average for the region.

^b FTSP=fork-tailed storm-petrel, LHSP=Leach's storm-petrel, RFCO=red-faced cormorant, PECO=pelagic cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake, GWGU=glaucous-winged gull, COMU=common murre, TBMU=thick-billed murre, ANMU=ancient murrelet, PAAU=parakeet auklet, LEAU=least auklet, WHAU=whiskered auklet, CRAU=crested auklet, HOPU=horned puffin, TUPU=tufted puffin.

Recent population trends (Table C)

- Statewide, 12% of species showed declining trends, 69% were stable and 19% increased between 2004 and 2013.
- Between 2004 and 2013, northern fulmars declined in all regions where they were monitored.

Table C. Regional and statewide seabird population trends^a between 2004 and 2013 within regions and the state of Alaska as a whole. Only sites for which there were data from at least two years (at least 5 years apart) within the target decade are included.

Region	NOFU ^b	FTSP	STPE	RFCO	PECO	UNCO	BLKI	RLKI	GWGU	COMU	TBMU	UNMU	PIGU	LEAU	RHAU	TUPU
N. Bering/Chukchi	↓				↓		↓			↔	↑	↔				
SE Bering	↓		↔	↔	↑	↑	↔	↔	↔	↔	↔	↓		↑		↔
SW Bering						↓	↑	↑				↔				
Gulf of Alaska	↓	↔			↑		↑		↔			↔	↔			↔
Southeast			↔		↔				↔			↔	↓		↑	↓
Alaska	↓	↔	↔	↔	↑	↓	↔	↔	↔	↔	↔	↔	↔	↑	↑	↔

^a Codes:

- ↓ and red cell color indicate a negative population trend of ≥3% per annum for this site or region.
- ↔ and yellow cell color indicate no population trend.
- ↑ and green cell color indicate a positive population trend of ≥3% per annum for this site or region.

^b NOFU=northern fulmar, FTSP=fork-tailed storm-petrel, STPE=unspecified storm-petrel, RFCO=red-faced cormorant, PECO=pelagic cormorant, UNCO=unspecified cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake, GWGU=glaucous-winged gull, COMU=common murre, TBMU=thick-billed murre, UNMU=unspecified murre, PIGU=pigeon guillemot, LEAU=least auklet, RHAU=rhinoceros auklet, TUPU=tufted puffin.

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Introduction

This report is the latest in a series of annual reports summarizing the results of seabird monitoring efforts at breeding colonies on the Alaska Maritime National Wildlife Refuge (NWR) and elsewhere in Alaska (see Byrd and Dragoo 1997, Byrd et al. 1998 and 1999, Dragoo et al. 2000, 2001, 2003, 2004 and 2006-2013 for compilations of previous years' data). 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 and provides data that can be used to define "normal" variability in demographic parameters and identify patterns that fall outside norms and thereby constitute potential 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 (e.g., 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., murre 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 (Figure 1). A total of nine sites on the Alaska Maritime NWR, located roughly 300-500 km apart, are scheduled for annual surveys (Byrd 2007), and at least some data were available from most of these in 2013. Furthermore, data are recorded annually or semiannually at other sites in Alaska (e.g., Cape Peirce, Togiak NWR). In addition, colonies near the annual sites are identified for less frequent surveys to "calibrate" the information at the annual sites. Data provided from other research projects (e.g., those associated with evaluating the impacts of invasive rodents on marine birds) also supplement the monitoring database.

In this report, we summarize information from 2013 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 reproductive success at various sites. In addition, historical patterns of hatching chronology and productivity are illustrated for those sites for which we have sufficient data. Population trend information is included for sites where adequate data have been gathered.

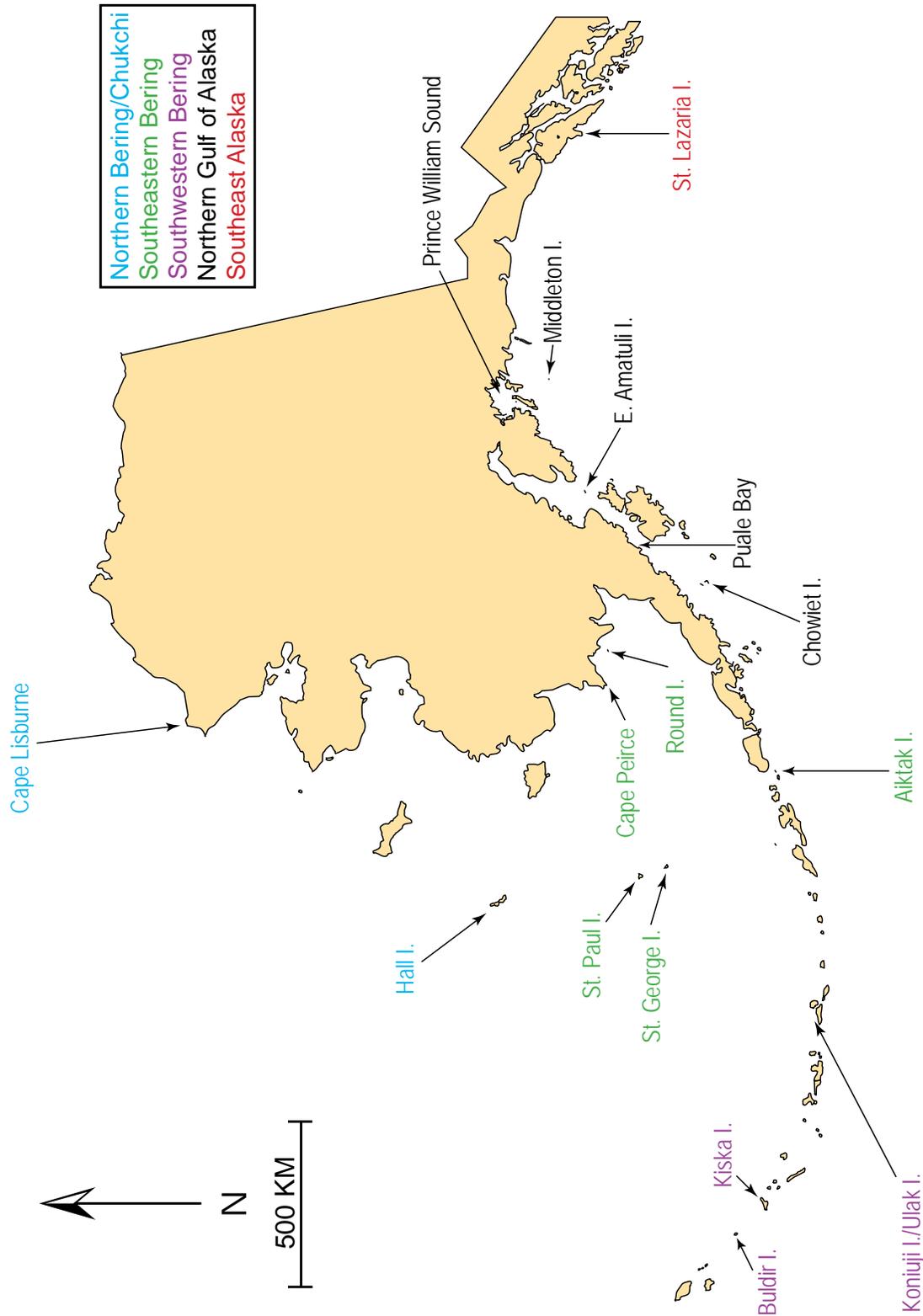


Figure 1. Map of Alaska showing the locations of seabird monitoring sites summarized in this report. Text color indicates geographic regions.

Methods

Data collection methods generally followed standardized protocols (e.g., USFWS 2013). 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 were used to describe nesting chronology. Productivity typically was expressed as chicks fledged per egg, but occasionally other variables were used (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)
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	Chicks Fledged/Egg (Total chicks fledged/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 2013, and compares 2013 results with previous years. For sites with at least two years of data prior to 2013, site averages were used for comparisons. For chronology, we considered dates within 3 days of the long-term average to be “normal”; larger deviations represented relatively early or late dates. For productivity, we defined significant deviations from “normal” as any that differed by more than 20% from the site or regional average. Population trends were analyzed using linear regression models on log-transformed data (ln) to calculate the slope of the line. The resultant slope is equivalent to the annual rate of population change. A trend was defined as any change greater than or equal to a three percent per annum increase or decline ($\geq 3\%$ p.a.). Population counts were analyzed using two time frames: 1) data from all available years, and 2) data from the last decade (2004-2013 for this report). A percent per annum change was calculated for each data set during both time periods, if sufficient data were available. We also summarized seabird phenology and productivity, as well as population trends (from 2004-2013), by region and for the entire state.

Chronology was calculated for each species in a region using data from all colonies. Each colony was weighted equally within each region. The chronology was averaged for all sites within each region resulting in a value for each species, thus producing one statewide value for each species.

Productivity was calculated for each species in a region using data from all colonies. Each colony was weighted equally within each region. The productivity was averaged for all sites within each region resulting in a value for each species. Species productivities were then

averaged to calculate a statewide value for each species.

Population trends were calculated for each species in a region using data from all colonies. Each colony was weighted equally within each region. Trends (line slopes) were averaged for all sites within each region resulting in a regional value for each species. Only sites for which there were data from at least two years (at least 5 years apart) between 2004 and 2013 were included.

Results



Northern fulmar (*Fulmarus glacialis*)

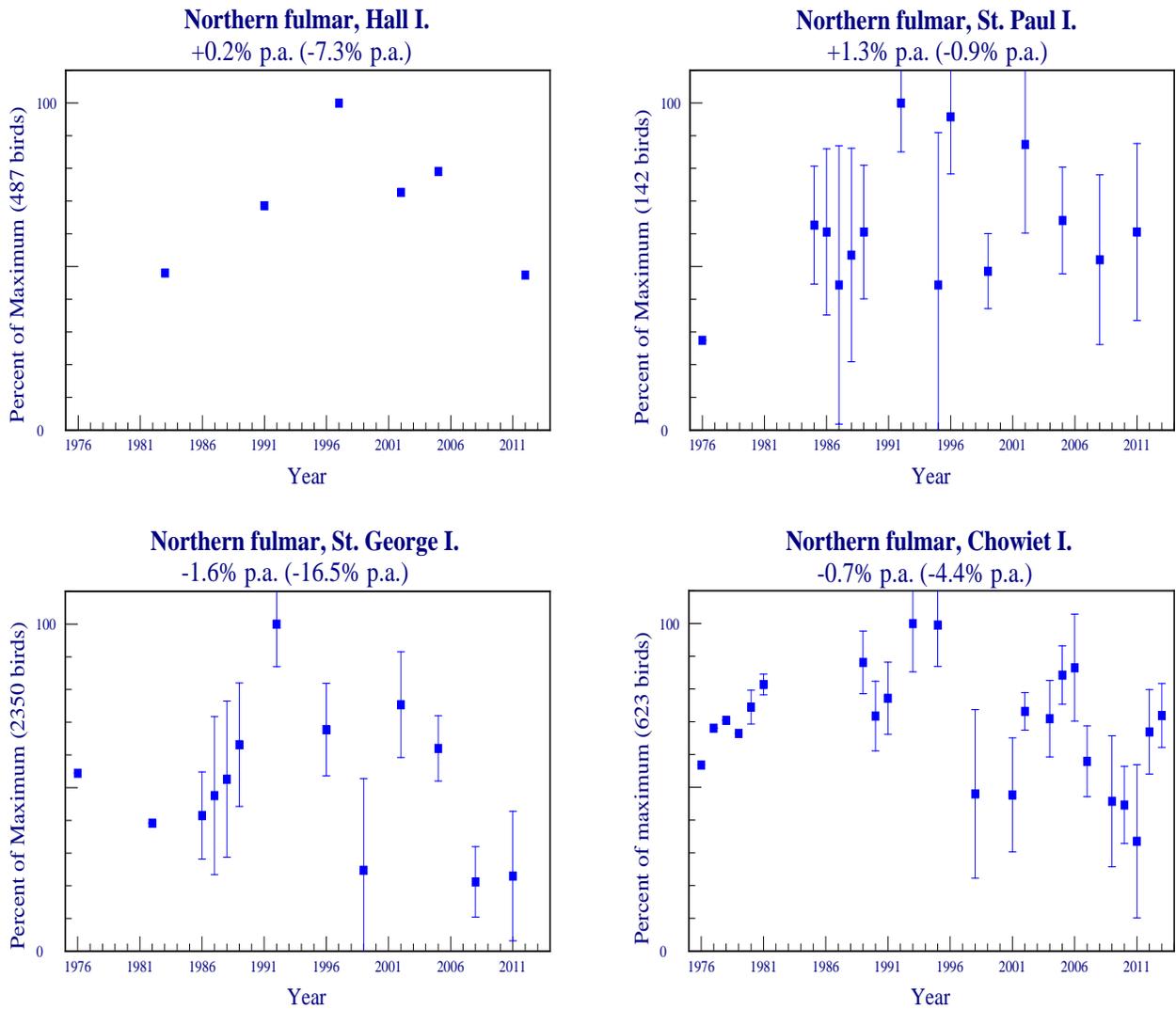


Figure 2. Trends in populations of northern fulmars at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).



Fork-tailed storm-petrel (*Oceanodroma furcata*)

Table 2. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Aiktak I.	16 Jul (18) ^a	16 Jul (16) ^a	Howie et al. 2014

^aSample 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.

Table 3. Reproductive performance of fork-tailed storm-petrels at Alaskan sites monitored in 2013.

Site	Chicks Fledged ^a /Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.55	5 (44) ^b	0.73 (26) ^b	Kohley and Herman 2014
Aiktak I.	0.82	14 (68)	0.81 (13)	Howie et al. 2014

^aFledged chick defined as being alive at last check in August or September.

^bSample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

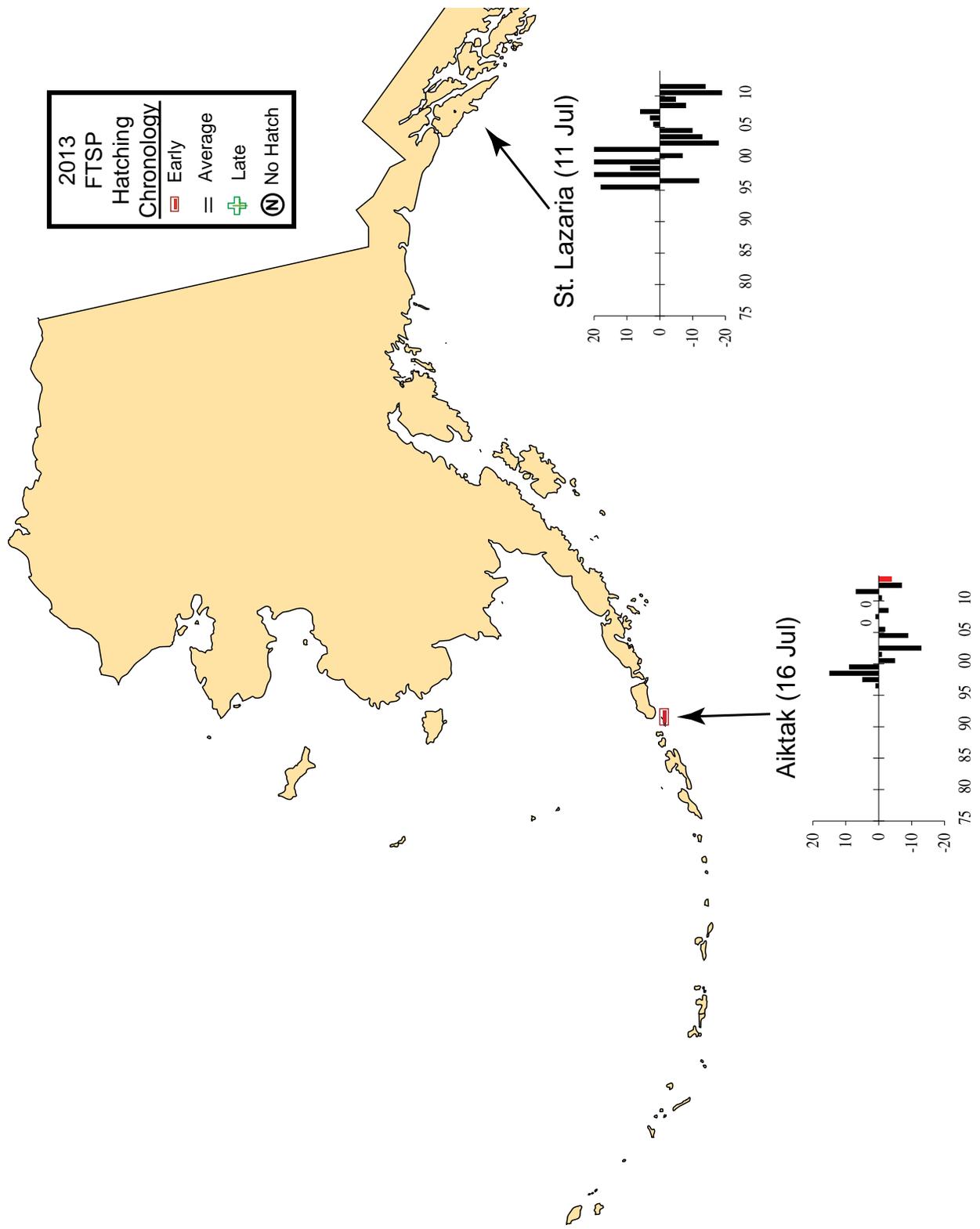


Figure 3. Hatching chronology of fork-tailed storm-petrels at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

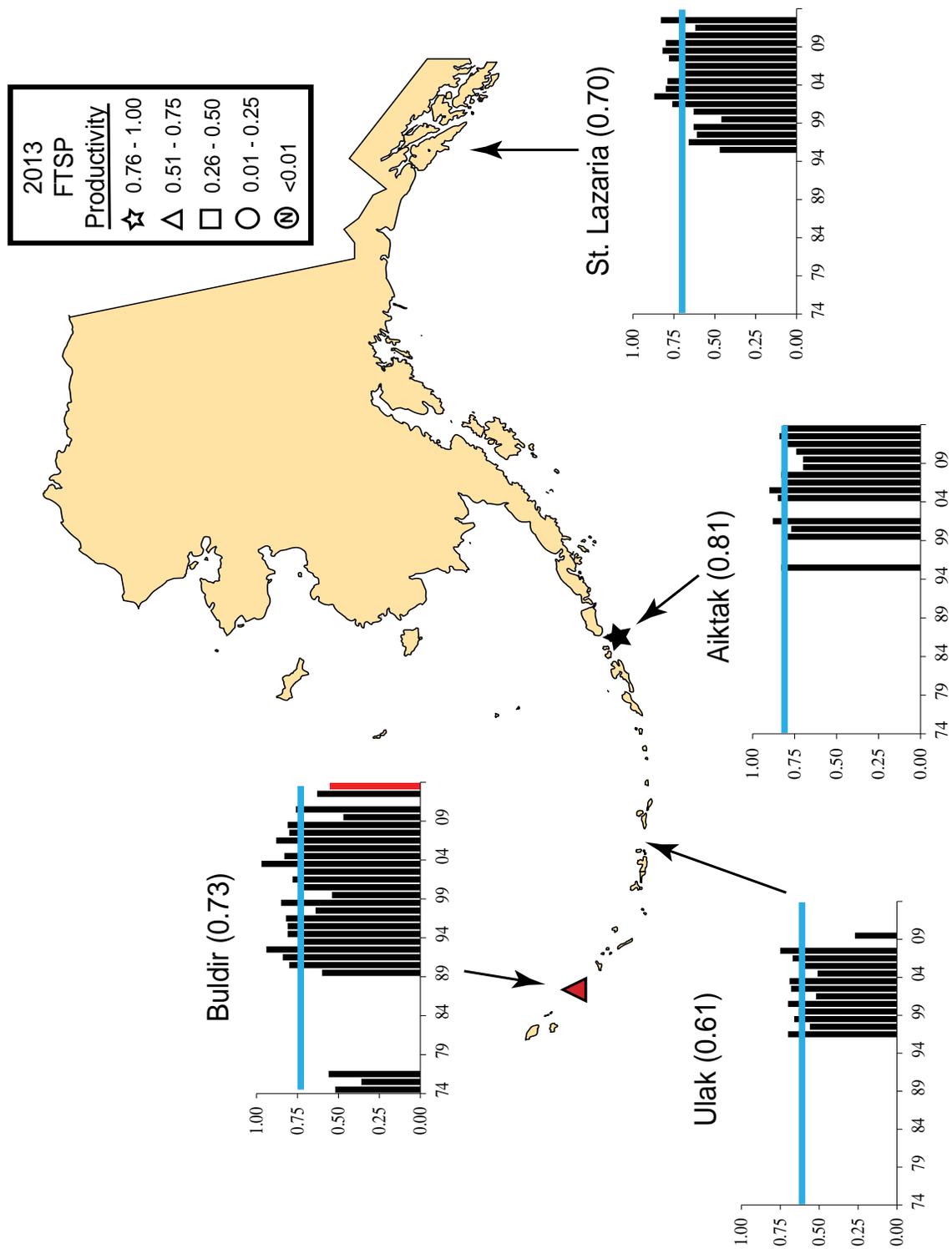


Figure 4. Productivity of fork-tailed storm-petrels (chicks fledged/egg) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

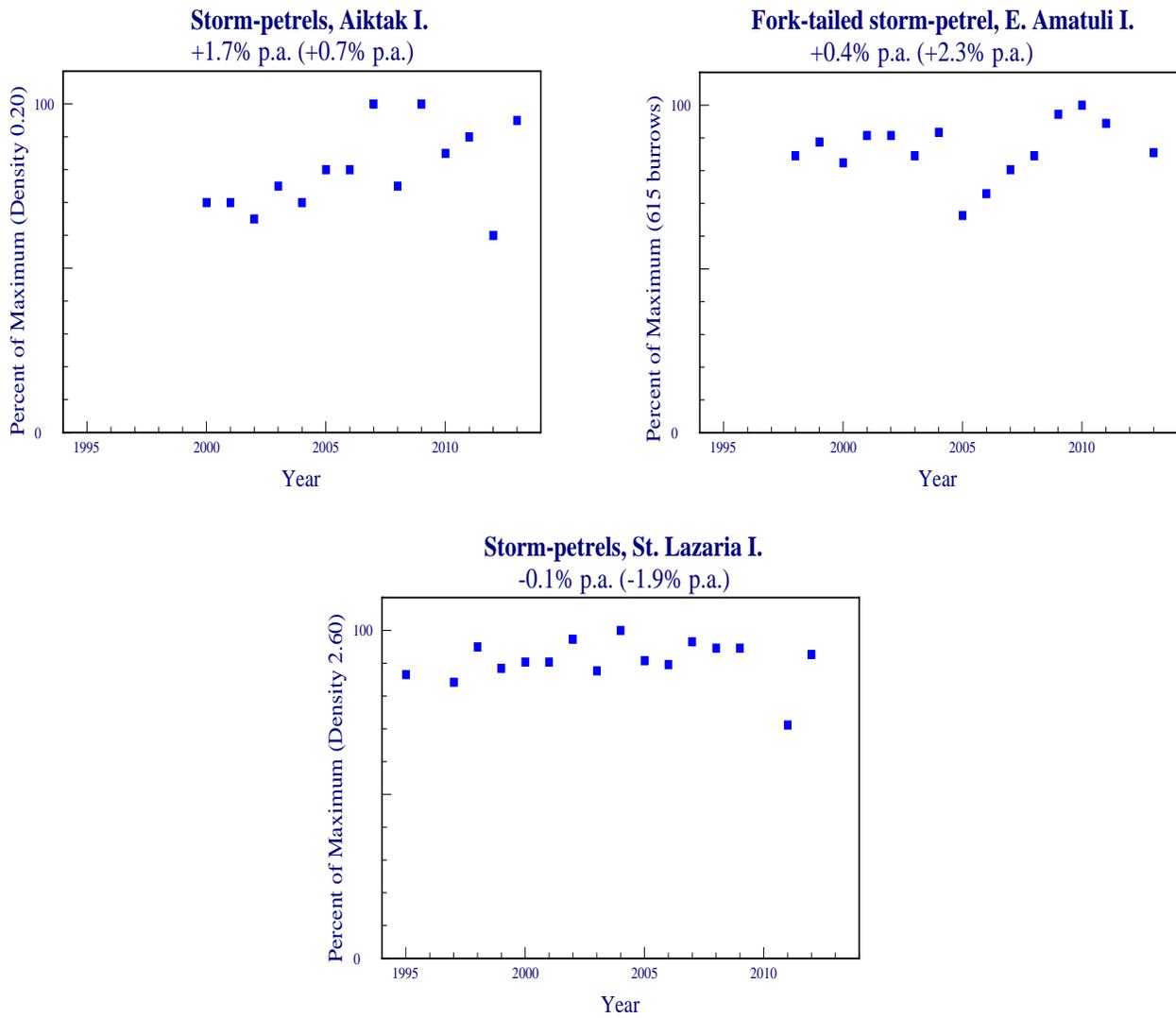


Figure 5. Trends in populations of storm-petrels at Alaskan sites. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).



Leach's storm-petrel (*Oceanodroma leucorhoa*)

Table 4. Hatching chronology of Leach's storm-petrels at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Aiktak I.	17 Jul (5) ^a	1 Aug (16) ^a	Howie et al. 2014

^aSample 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.

Table 5. Reproductive performance of Leach's storm-petrels at Alaskan sites monitored in 2013.

Site	Chicks Fledged ^a /Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.61	5 (69) ^b	0.73 (26) ^b	Kohley and Herman 2014
Aiktak I.	0.82	14 (83)	0.84 (13)	Howie et al. 2014

^aFledged chick defined as being alive at last check in August or September.

^bSample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

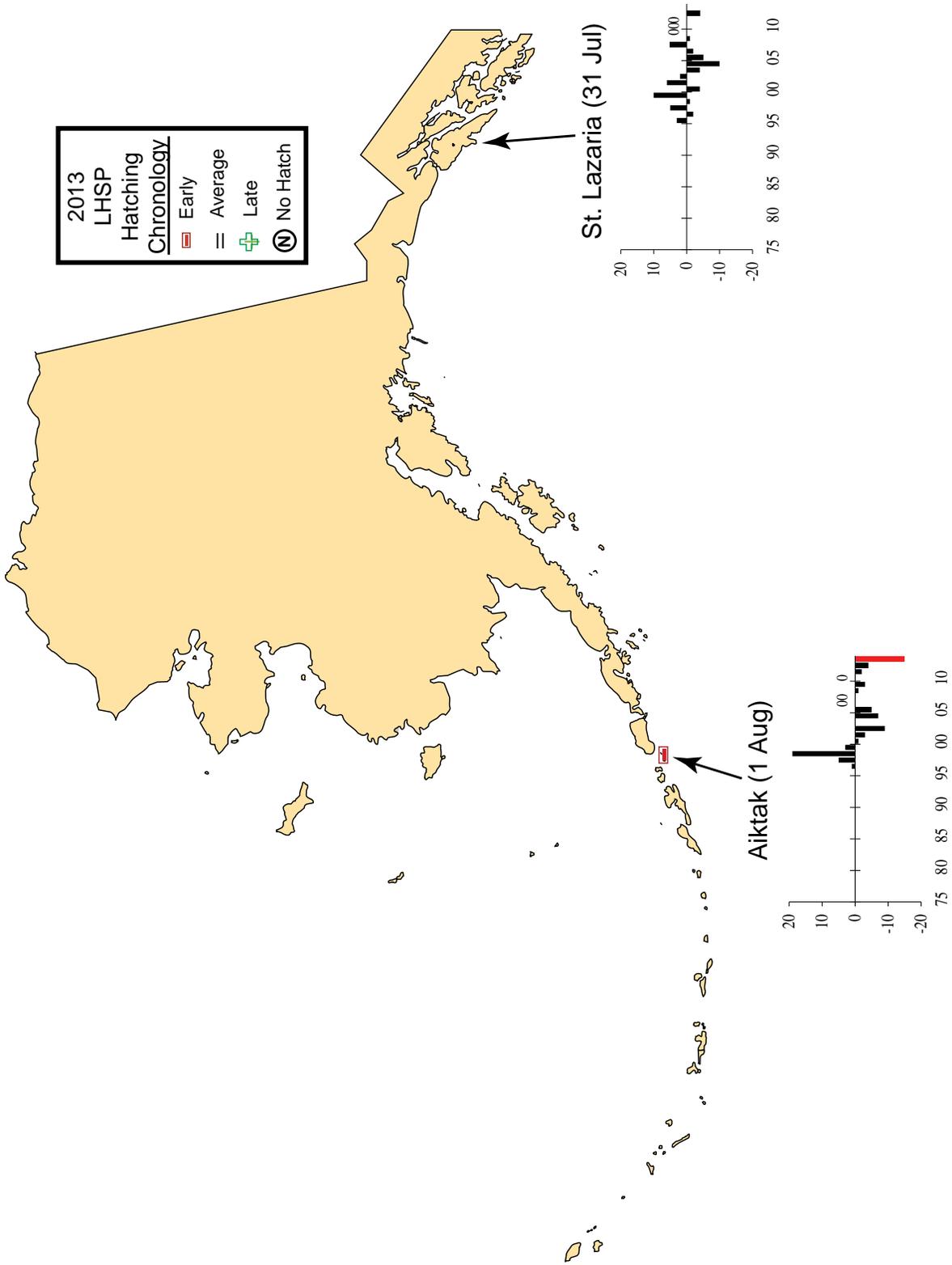


Figure 6. Hatching chronology of Leach’s storm-petrels at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

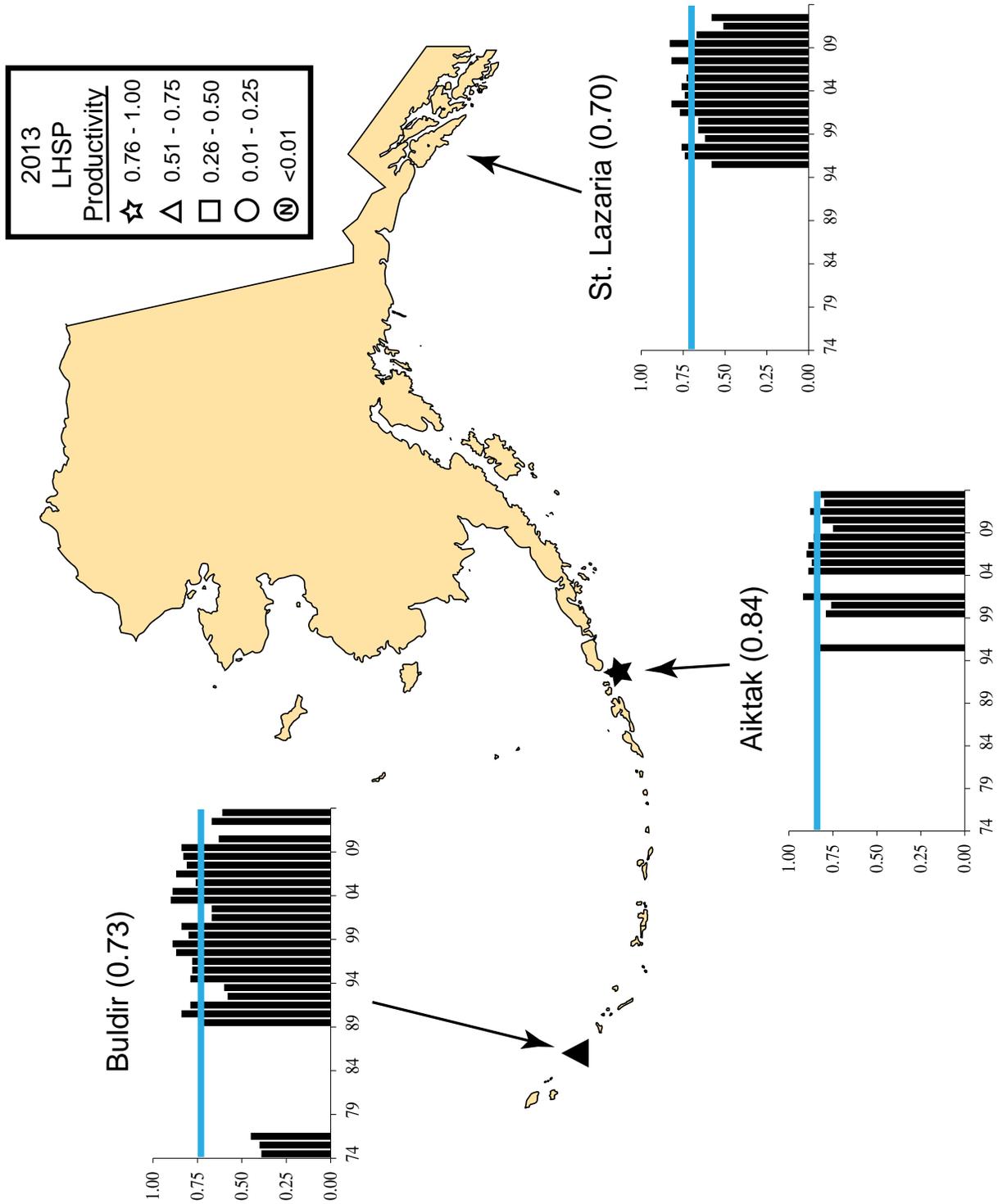


Figure 7. Productivity of Leach’s storm-petrels (chicks fledged/egg) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year’s success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Red-faced cormorant (*Phalacrocorax urile*)

Table 6. Hatching chronology of red-faced cormorants at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. Paul I.	27 Jun (16) ^a	30 Jun (23) ^a	Thomson and Romano 2013

^aSample 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.

Table 7. Reproductive performance of red-faced cormorants at Alaskan sites monitored in 2013.

Site	Chicks Fledged/Nest	No. of Plots	Long-term Average	Reference
St. Paul I.	1.92	2 (24) ^a	1.28 (28) ^a	Thomson and Romano 2013
St. George I.	1.29	4 (52)	1.21 (16)	Klostermann et al. 2013
Buldir I.	0.57	NA ^b (7)	1.50 (8)	Kohley and Herman 2014
Aiktak I.	1.33	NA (9)	0.75 (8)	Howie et al. 2014
Chowiet I.	0.13	3 (125)	1.33 (3)	Henschen et al. 2013

^aSample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

^bNot applicable or not reported.

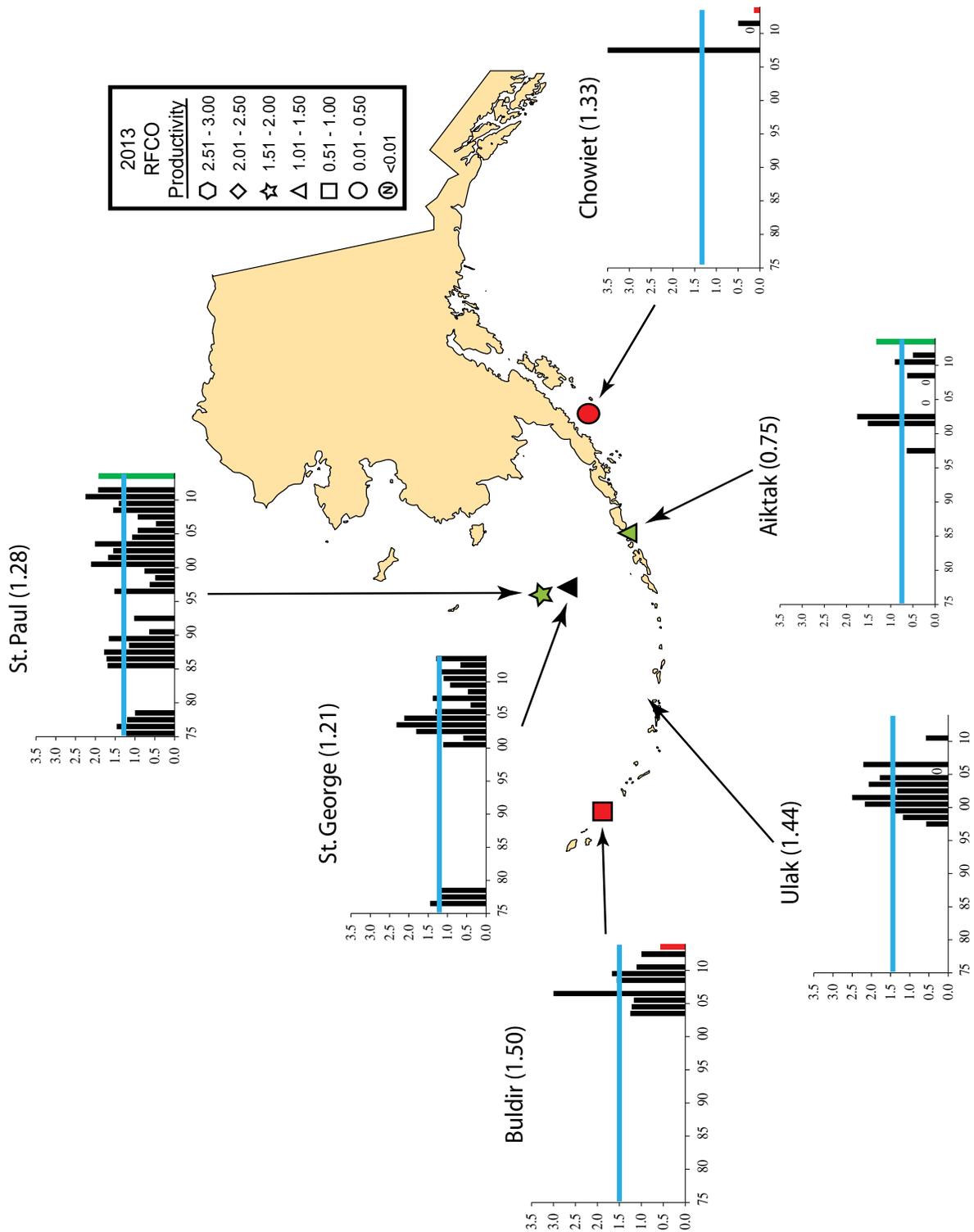


Figure 8. Productivity of red-faced cormorants (chicks fledged/nest) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

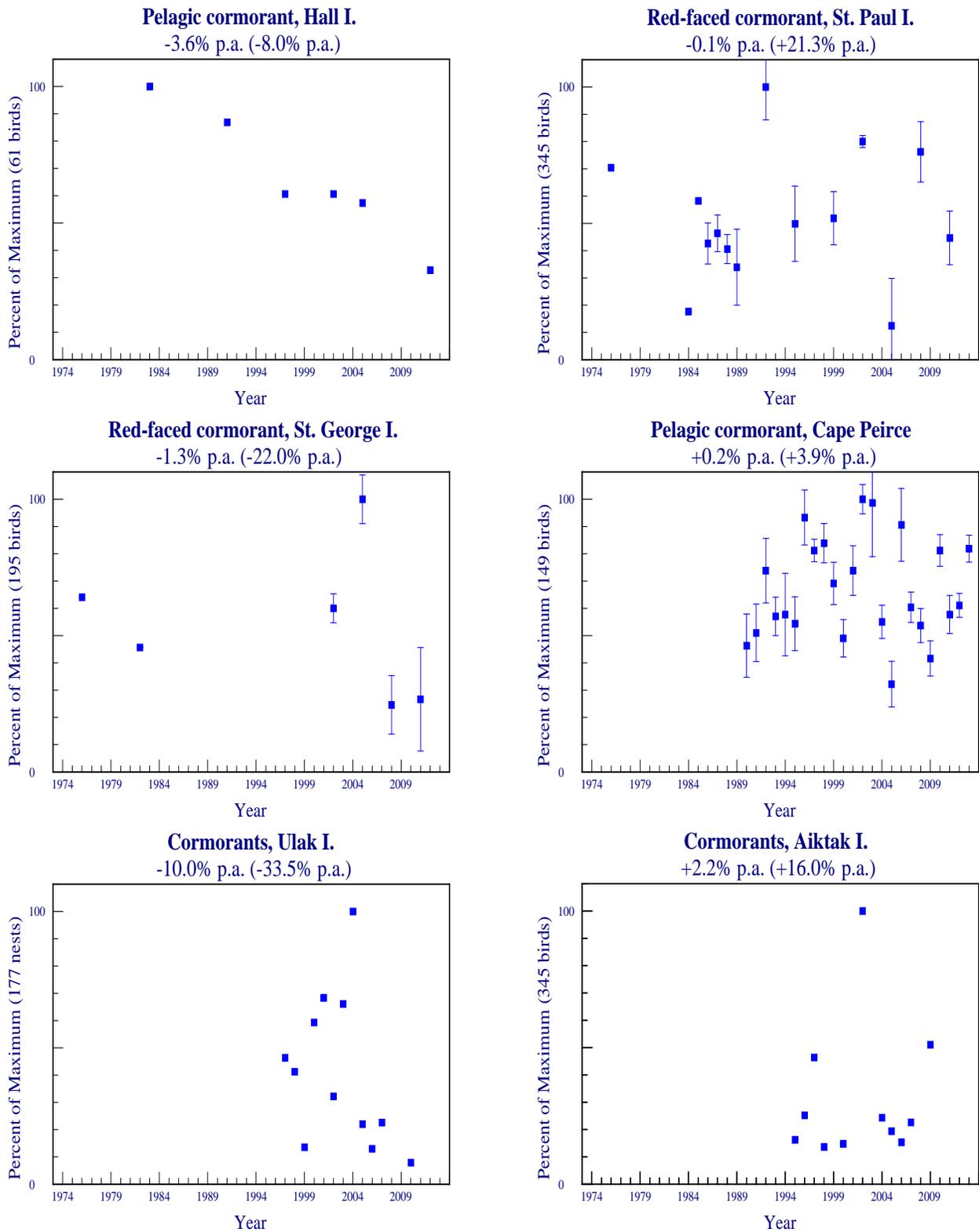


Figure 9. Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

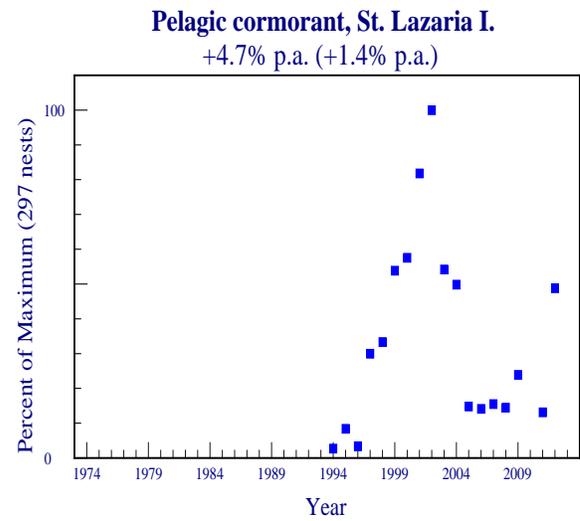
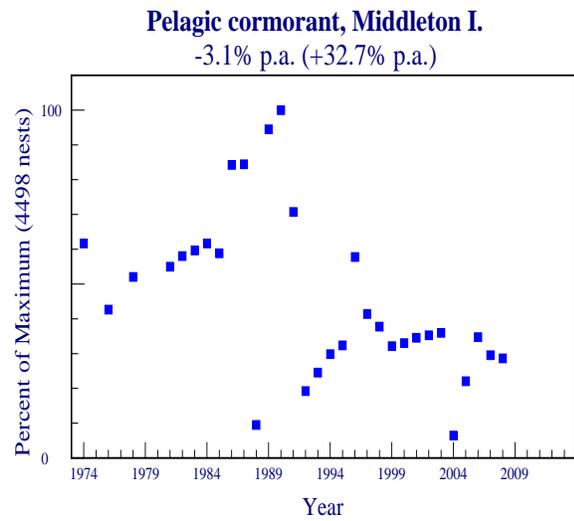


Figure 9 (continued). Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).



Pelagic cormorant (*Phalacrocorax pelagicus*)

Table 8. Reproductive performance of pelagic cormorants at Alaskan sites monitored in 2013.

Site	Chicks Fledged/Nest	No. of Plots	Long-term Average	Reference
Cape Peirce	1.60	11 (72) ^a	1.16 (27) ^a	M. Swaim Unpubl. Data
Round I.	1.33	2 (42)	1.42 (12)	E. Weiss Unpubl. Data
Buldir I.	1.15	NA ^b (34)	0.99 (23)	Kohley and Herman 2014
Aiktak I.	1.20	NA (15)	0.97 (11)	Howie et al. 2014
Chowiet I.	1.33	NA (24)	0.51 (2)	Henschen et al. 2013

^aSample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

^bNot applicable or not reported.

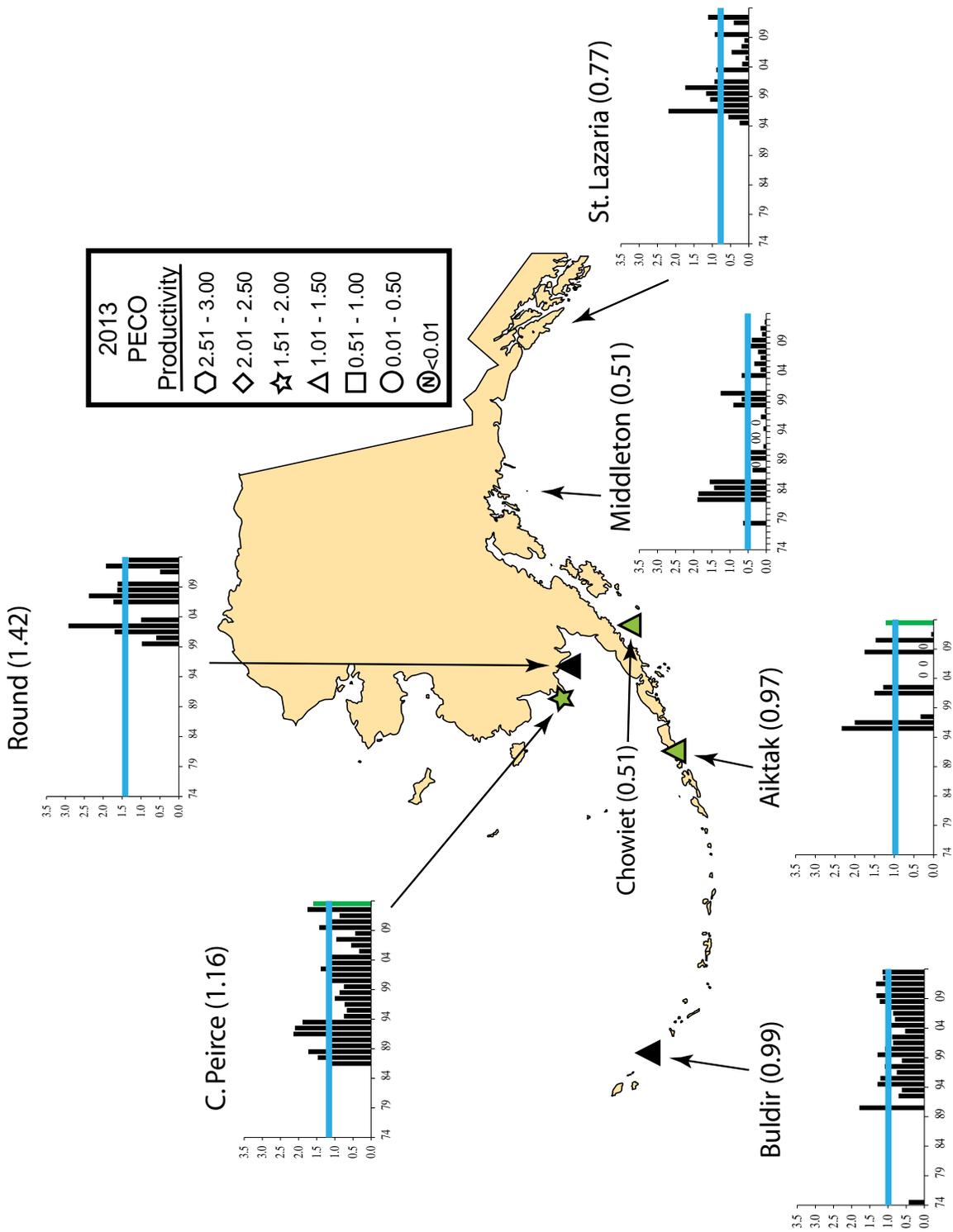


Figure 10. Productivity of pelagic cormorants (chicks fledged/nest) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Black-legged kittiwake (*Rissa tridactyla*)

Table 9. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. Paul I.	9 Jul (38) ^a	17 Jul (29) ^a	Thomson and Romano 2013
St. George I.	9 Jul (24)	16 Jul (28)	Klostermann et al. 2013
Buldir I.	15 Jul (32)	7 Jul (25)	Kohley and Herman 2014
Chowiet I.	16 Jul (96)	17 Jul (17)	Henschen et al. 2013
E. Amatuli I.	14 Jul (238)	12 Jul (15)	A. Kettle Unpubl. Data

^aSample 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.

Table 10. Reproductive performance of black-legged kittiwakes at Alaskan sites monitored in 2013.

Site	Chicks Fledged ^a /Nest	No. of Plots	Long-term Average	Reference
C. Lisburne	0.04 ^b	2 (93) ^c	0.61 (31) ^c	Dragoo et al. 2013
St. Paul I.	0.06	17 (370)	0.27 (33)	Thomson and Romano 2013
St. George I.	0.12	5 (179)	0.20 (37)	Klostermann et al. 2013
Cape Peirce	0.33	14 (457)	0.19 (30)	M. Swaim Unpubl. Data
Round I.	0.18	2 (50)	0.22 (14)	E. Weiss Unpubl. Data
Buldir I.	0.07	7 (208)	0.16 (25)	Kohley and Herman 2014
Chowiet I.	0.01	11 (334)	0.20 (19)	Henschen et al. 2013
E. Amatuli I.	0.50	11 (556)	.35 (25)	A. Kettle Unpubl. Data
Pr. Will. Snd.	0.44 ^b	NA ^d (28,111)	0.22 (28)	D. Irons Unpubl. Data

^aTotal chicks fledged/Total nests.

^bShort visit.

^cSample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

^dNot applicable or not reported.

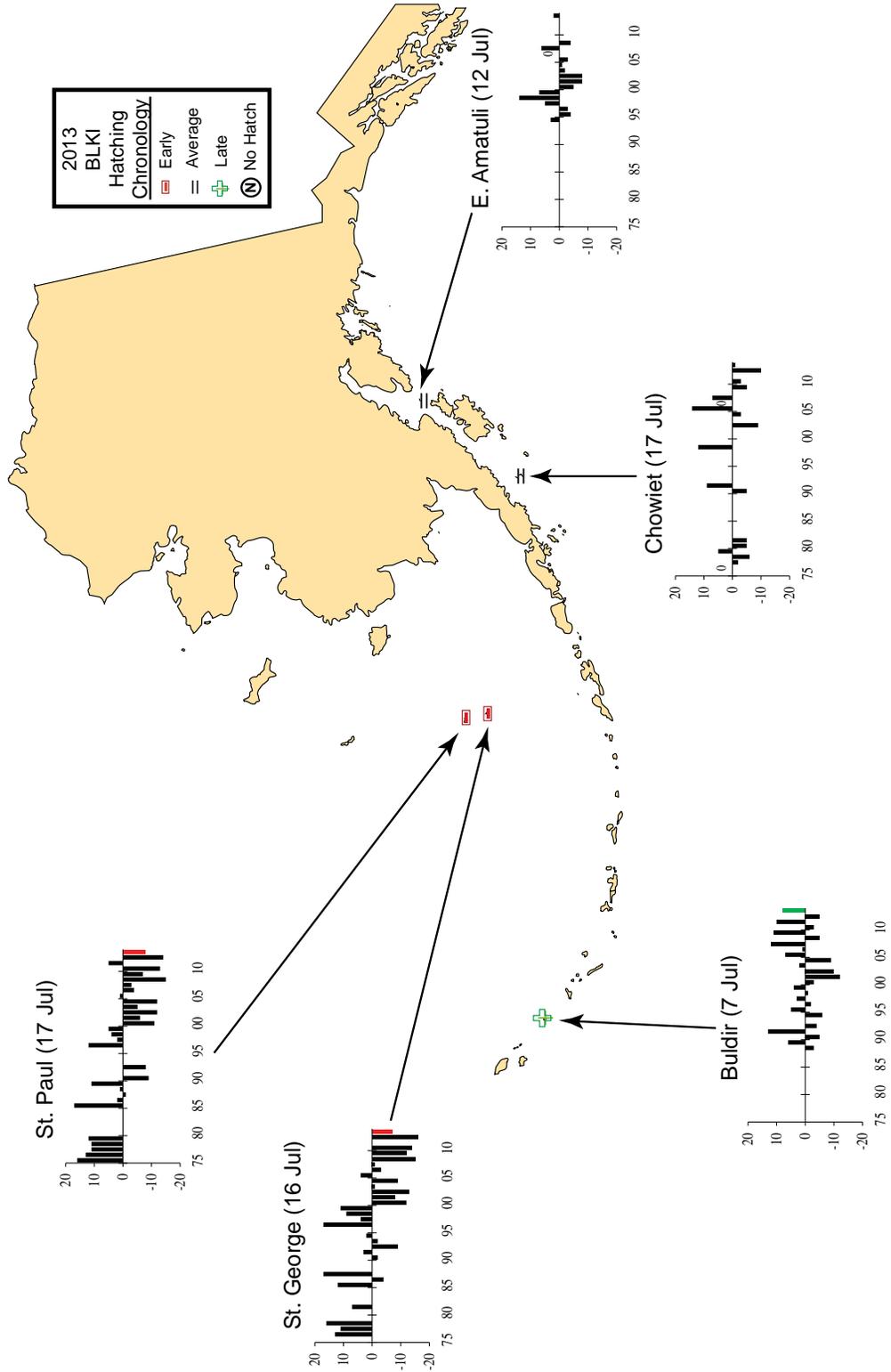


Figure 11. Hatching chronology of black-legged kittiwakes at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

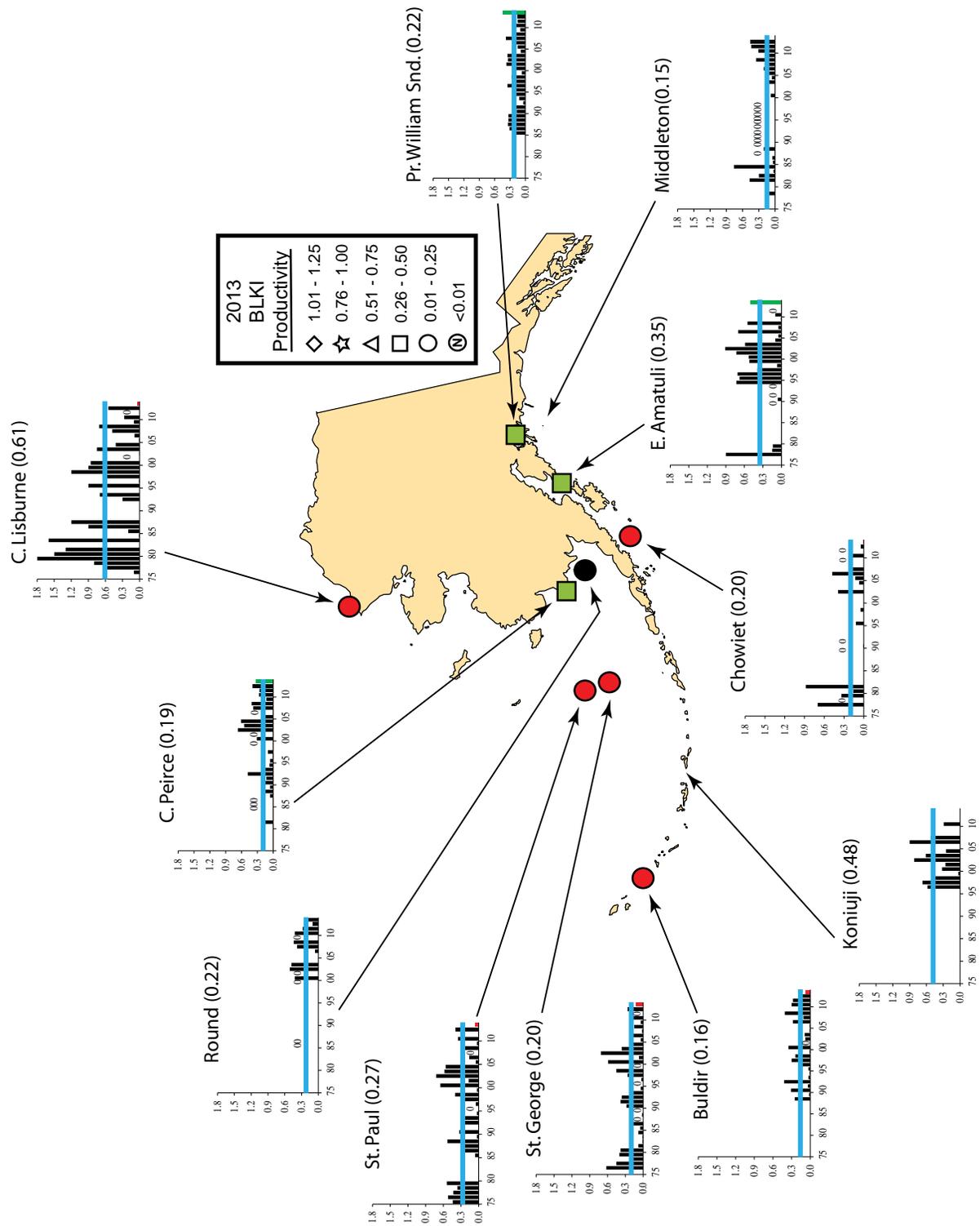


Figure 12. Productivity of black-legged kittiwakes (chicks fledged/nest) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

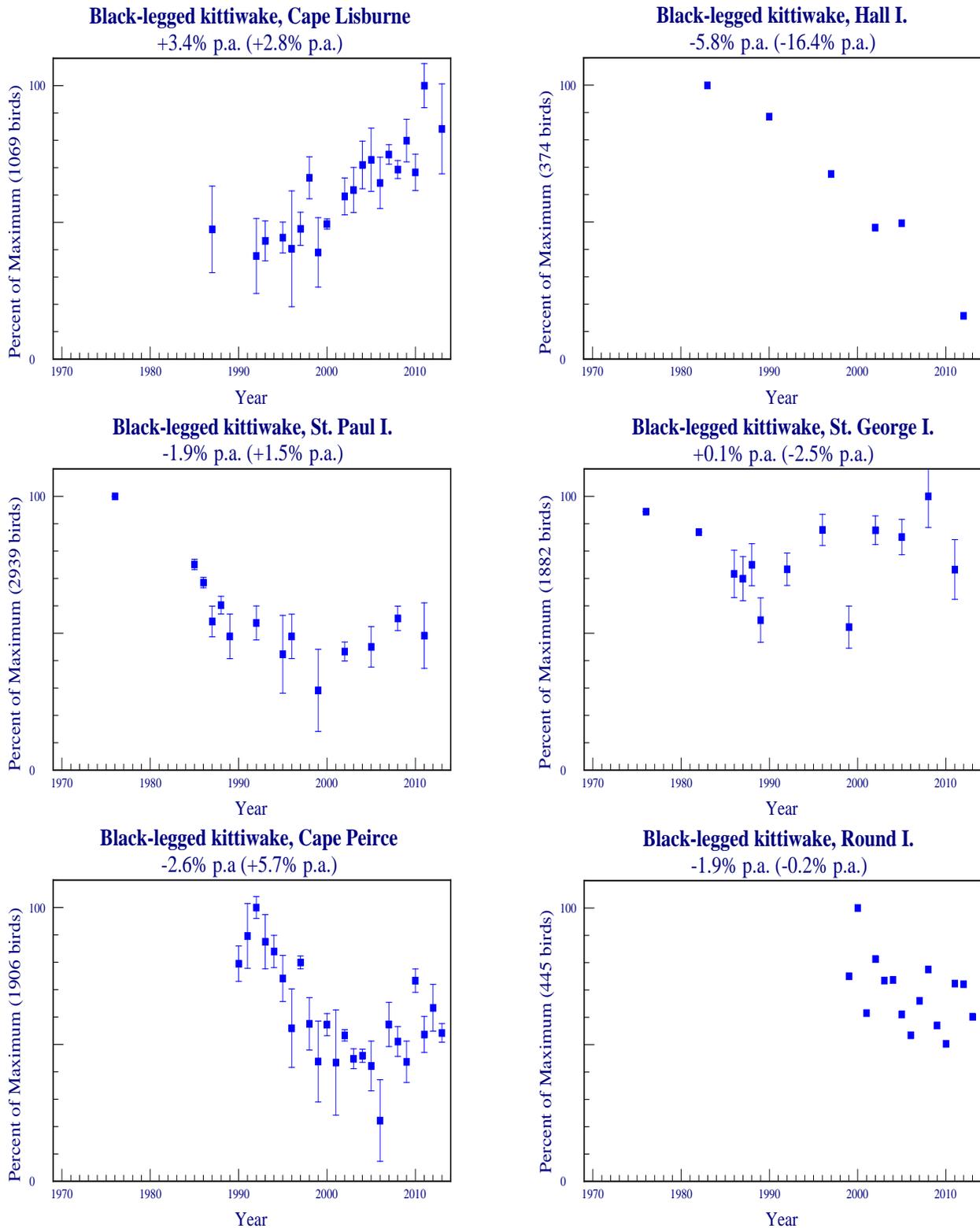


Figure 13. Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

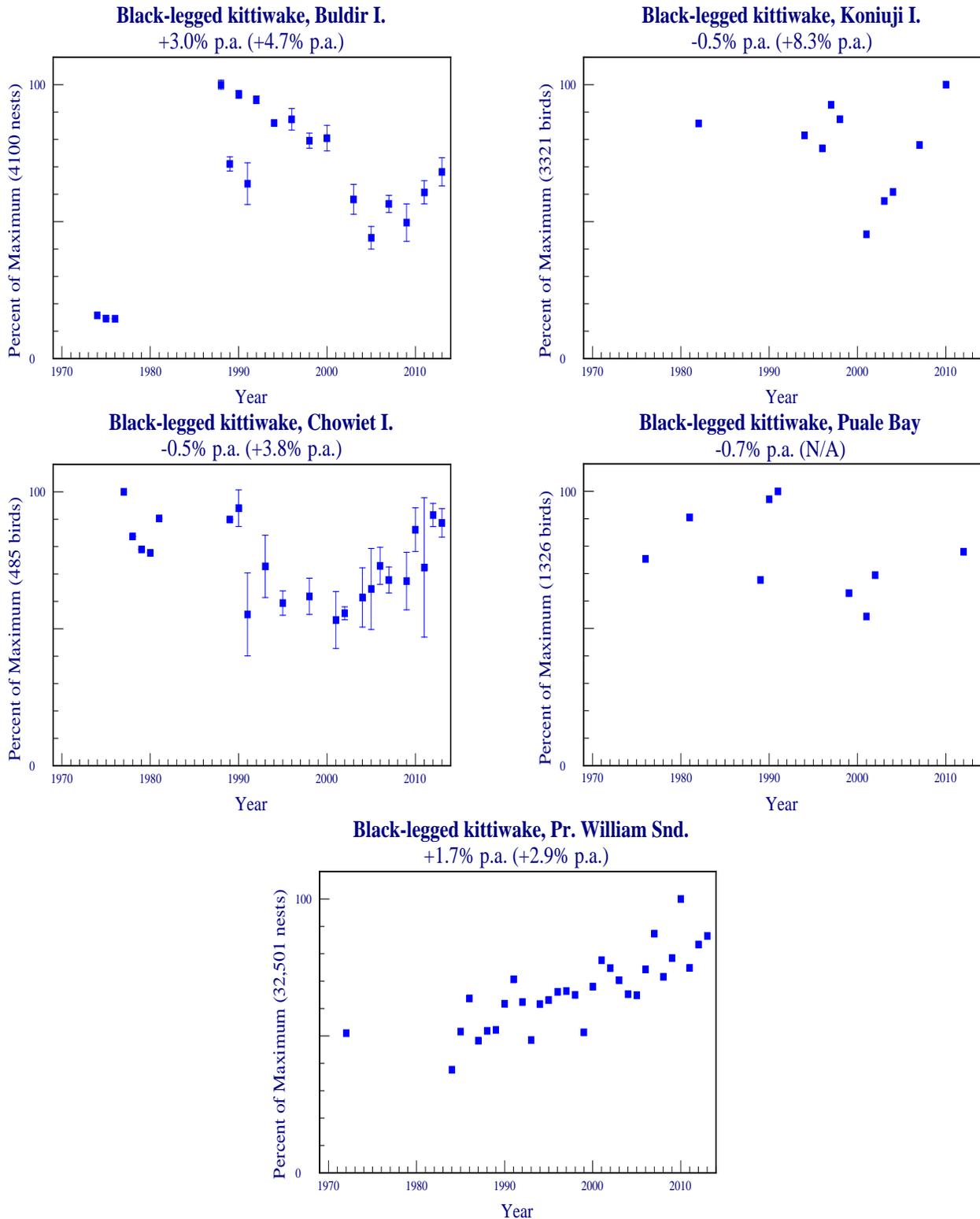


Figure 13 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses). “NA” indicates that insufficient data were available.



Red-legged kittiwake (*Rissa brevirostris*)

Table 11. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. George I.	6 Jul (89) ^a	16 Jul (32) ^a	Klostermann et al. 2013
Buldir I.	10 Jul (4)	11 Jul (22)	Kohley and Herman 2014

^aSample 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.

Table 12. Reproductive performance of red-legged kittiwakes at Alaskan sites monitored in 2013.

Site	Chicks Fledged ^a /Nest	No. of Plots	Long-term Average	Reference
St. Paul I.	0.16	5 (19) ^b	0.25 (33) ^b	Thomson and Romano 2013
St. George I.	0.25	8 (310)	0.24 (37)	Klostermann et al. 2013
Buldir I.	0.15	2 (27)	0.19 (25)	Kohley and Herman 2014

^aTotal chicks fledged/Total nests.

^bSample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

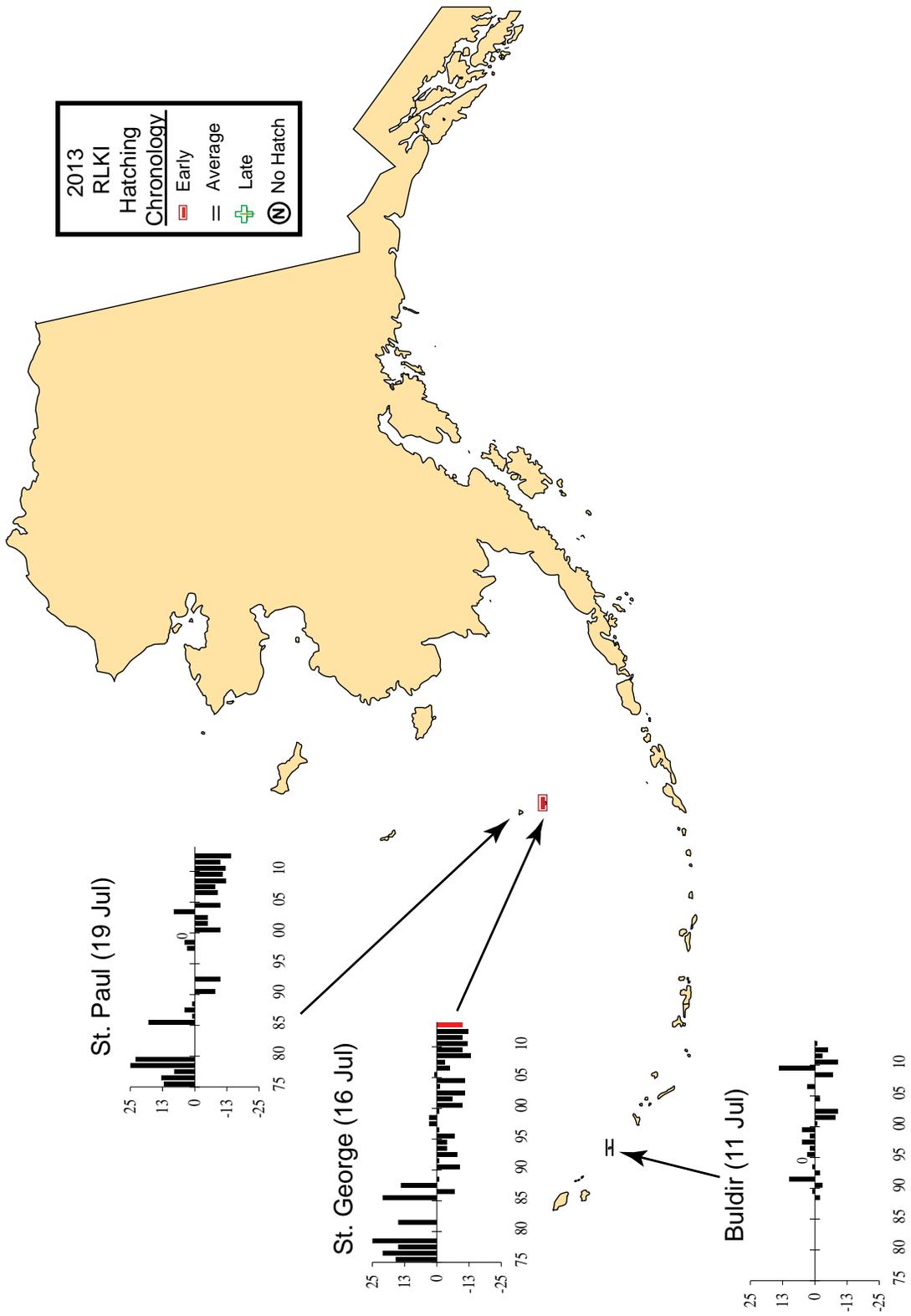


Figure 14. Hatching chronology of red-legged kittiwakes at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

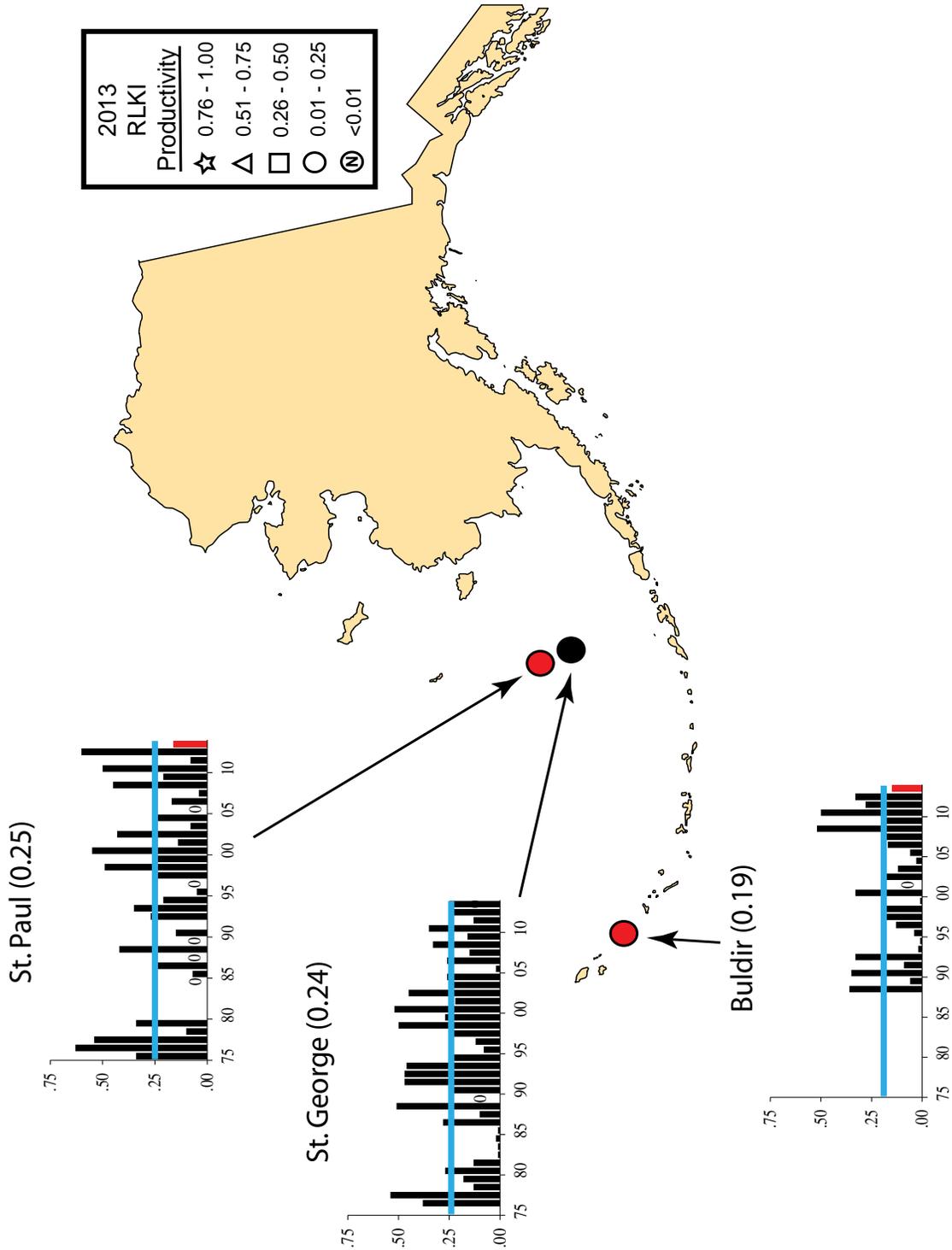


Figure 15. Productivity of red-legged kittiwakes (chicks fledged/nest) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

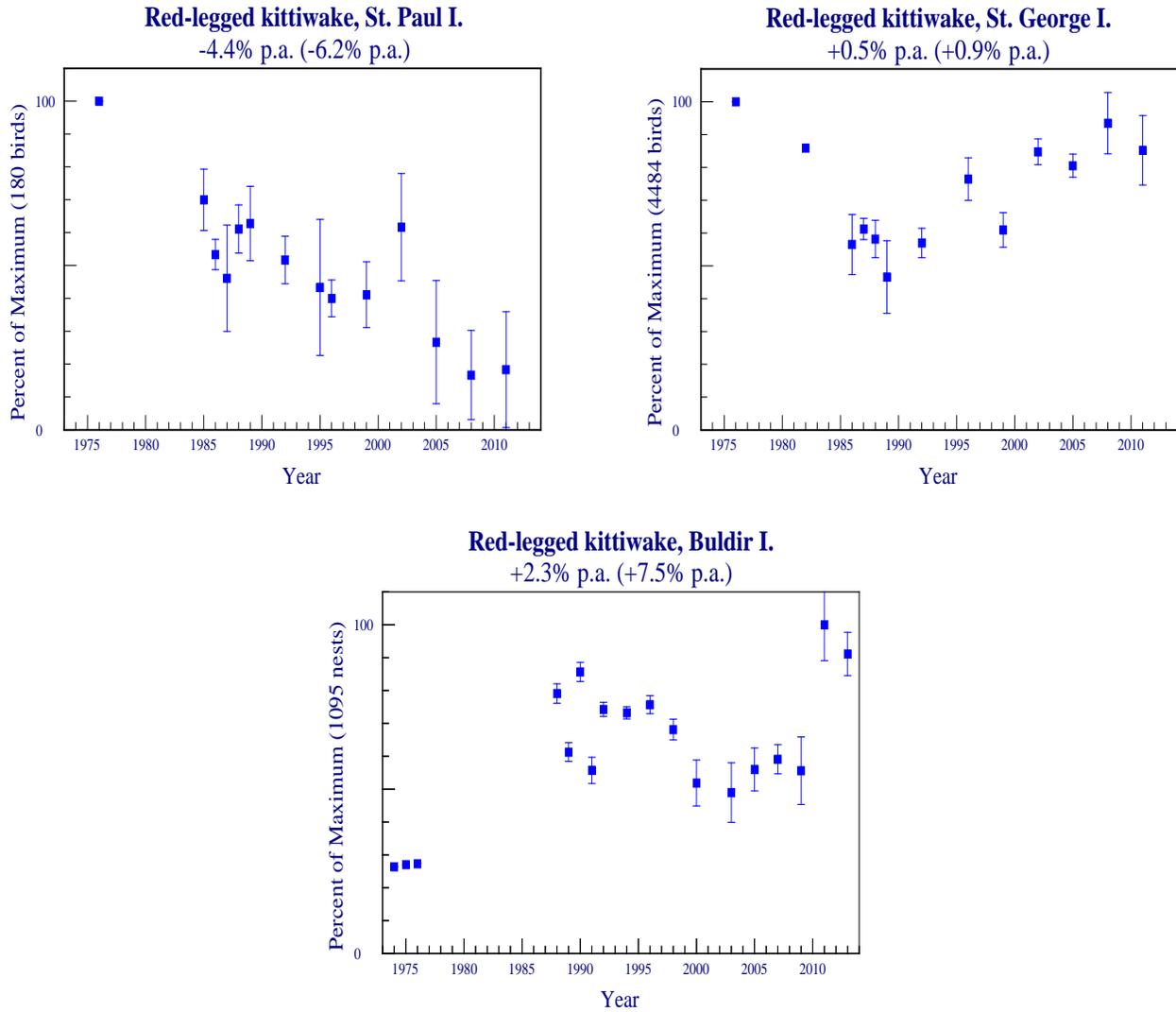


Figure 16. Trends in populations of red-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).



Glaucous-winged gull (*Larus glaucescens*)

Table 13. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	1 Jul (5) ^a	24 Jun (13) ^a	Kohley and Herman 2014
Aiktak I.	19 Jul (5)	11 Jul ^b (18)	Howie et al. 2014
Chowiet I.	30 Jun (30)	4 Jul ^b (7)	Henschen et al. 2013

^aSample 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.

Table 14. Reproductive performance of glaucous-winged gulls at Alaskan sites monitored in 2013.

Site	Hatching Success ^a	No. of Plots	Long-term Average	Reference
Buldir I.	0.43	NA ^b (45) ^c	0.45 (15) ^c	Kohley and Herman 2014
Aiktak I.	0.02	4 (327)	0.53 (18)	Howie et al. 2014
Chowiet I.	0.54	3 (81)	0.55 (6)	Henschen et al. 2013

^aTotal chicks/Total eggs.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of eggs used to calculate hatching success and the number of years used to calculate the long-term average. Current year not used in long-term average.

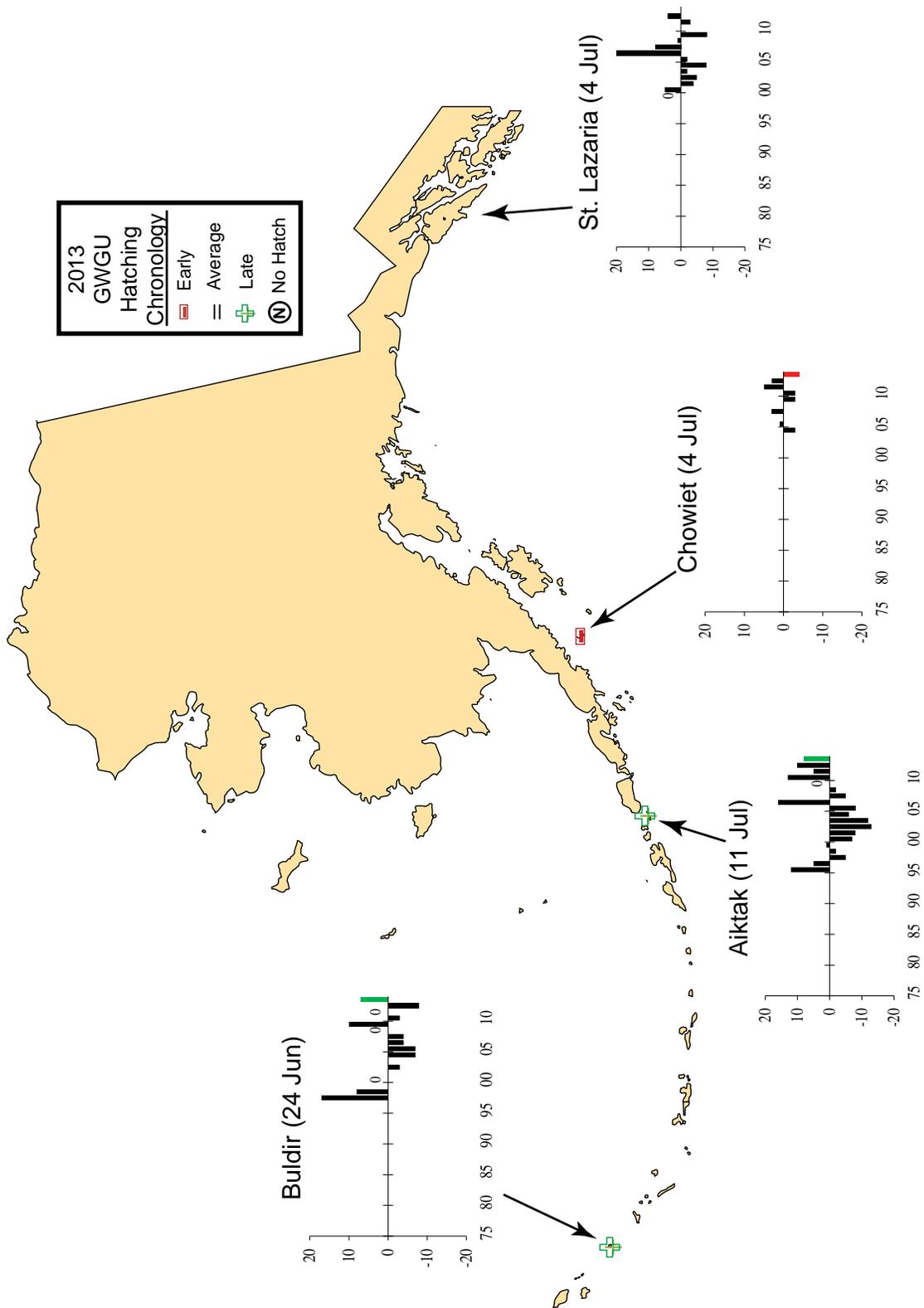


Figure 17. Hatching chronology of glaucous-winged gulls at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

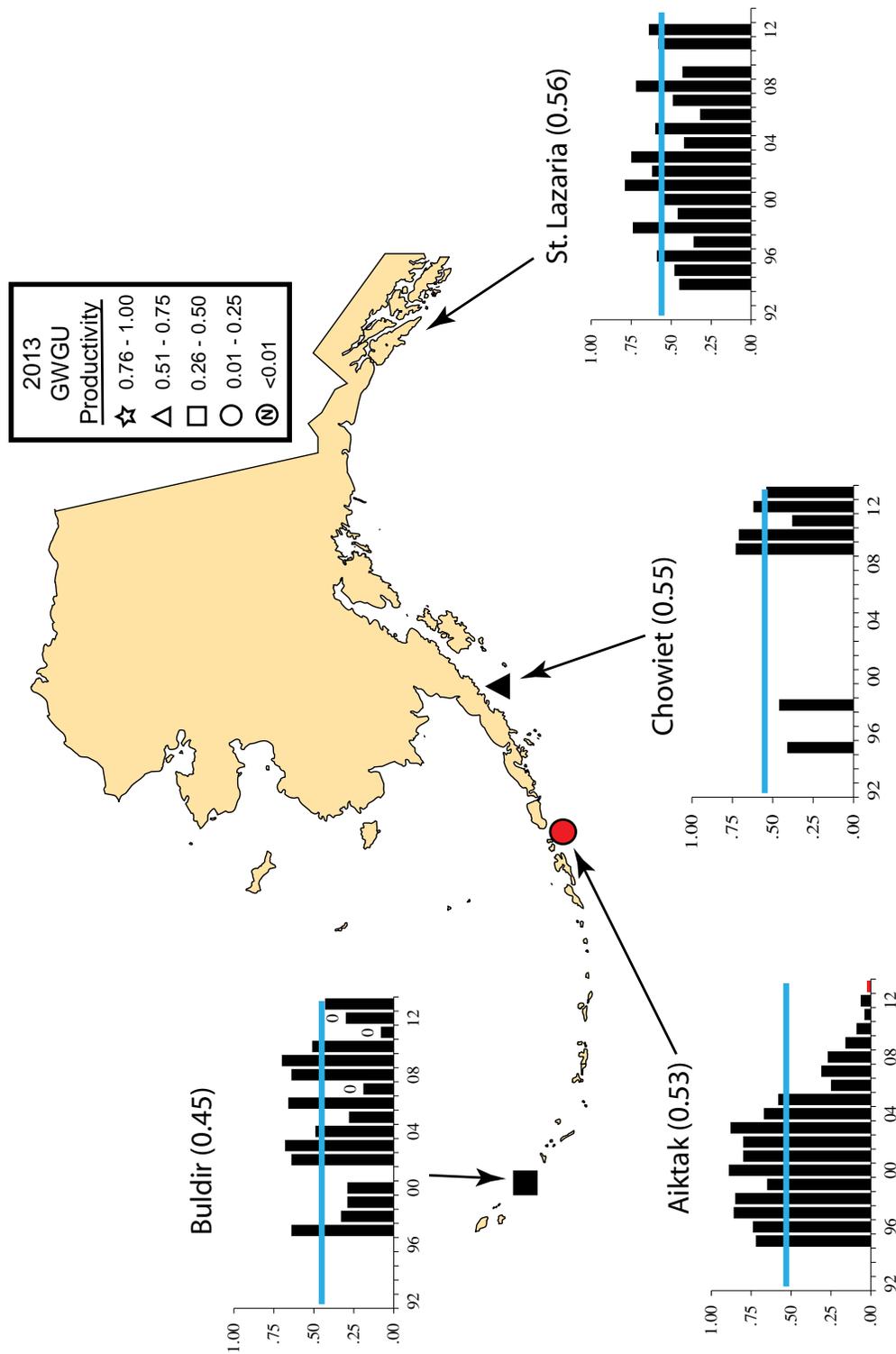


Figure 18. Productivity of glaucous-winged gulls (hatching success) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

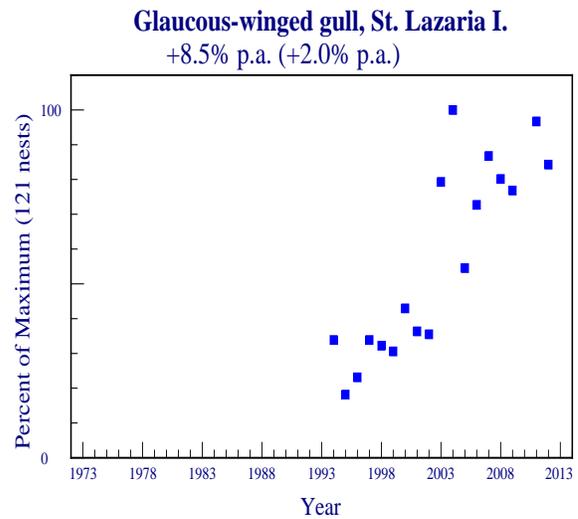
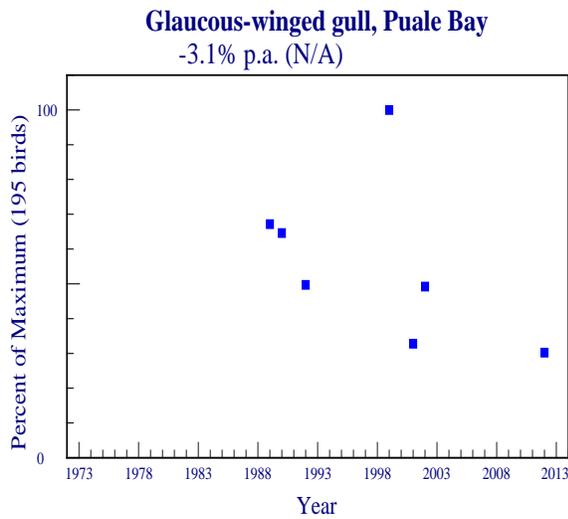
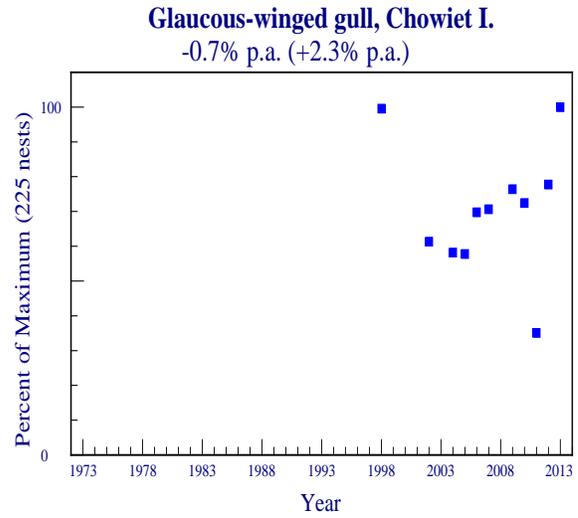
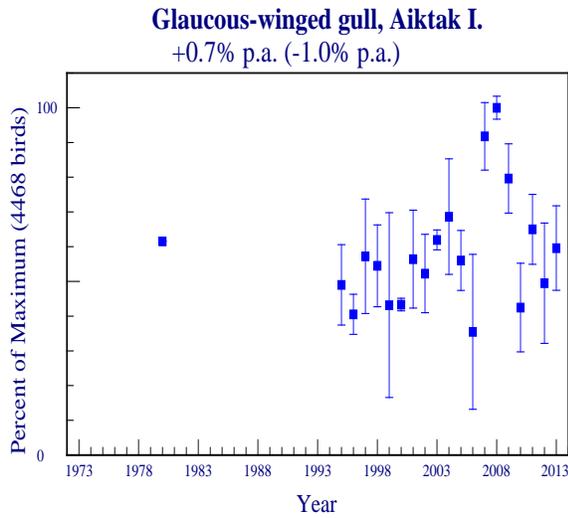


Figure 19. Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses). “N/A” indicates that insufficient data were available.



Common murre (*Uria aalge*)

Table 15. Hatching chronology of common murres at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. Paul I.	29 Jul (33) ^a	4 Aug (26) ^a	Thomson and Romano 2013
St. George I.	30 Jul (78)	4 Aug (29)	Klostermann et al. 2013
Chowiet I.	25 Jul (143)	22 Jul (17)	Henschen et al. 2013
E. Amatuli I.	21 Aug (197)	11 Aug (19)	A. Kettle Unpubl. Data

^aSample 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.

Table 16. Reproductive performance of common murres at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
St. Paul I.	0.64	3 (129) ^b	0.50 (26) ^b	Thomson and Romano 2013
St. George I.	0.62	5 (177)	0.50 (29)	Klostermann et al. 2013
Round I.	0.27	3 (70)	0.19 (12)	E. Weiss Unpubl. Data
Buldir I.	0.00	1 (4)	0.45 (16)	Kohley and Herman 2014
Aiktak I.	0.00	1 (23)	0.21 (17)	Howie et al. 2014
Chowiet I.	0.45	9 (254)	0.51 (19)	Henschen et al. 2013

^aSince murres do not build nests, nest sites were defined as sites where eggs were laid.

^bSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

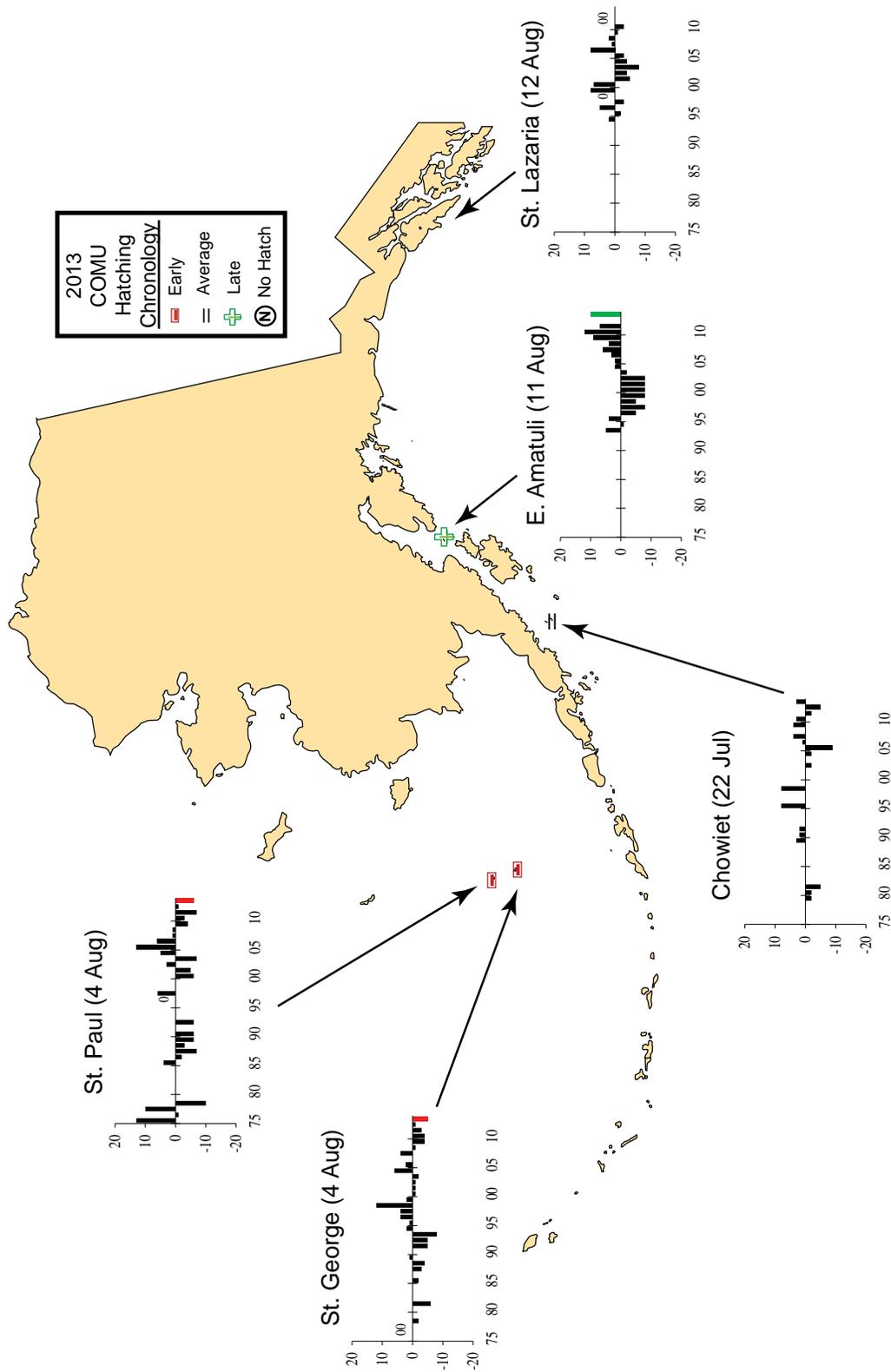


Figure 20. Hatching chronology of common murre at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

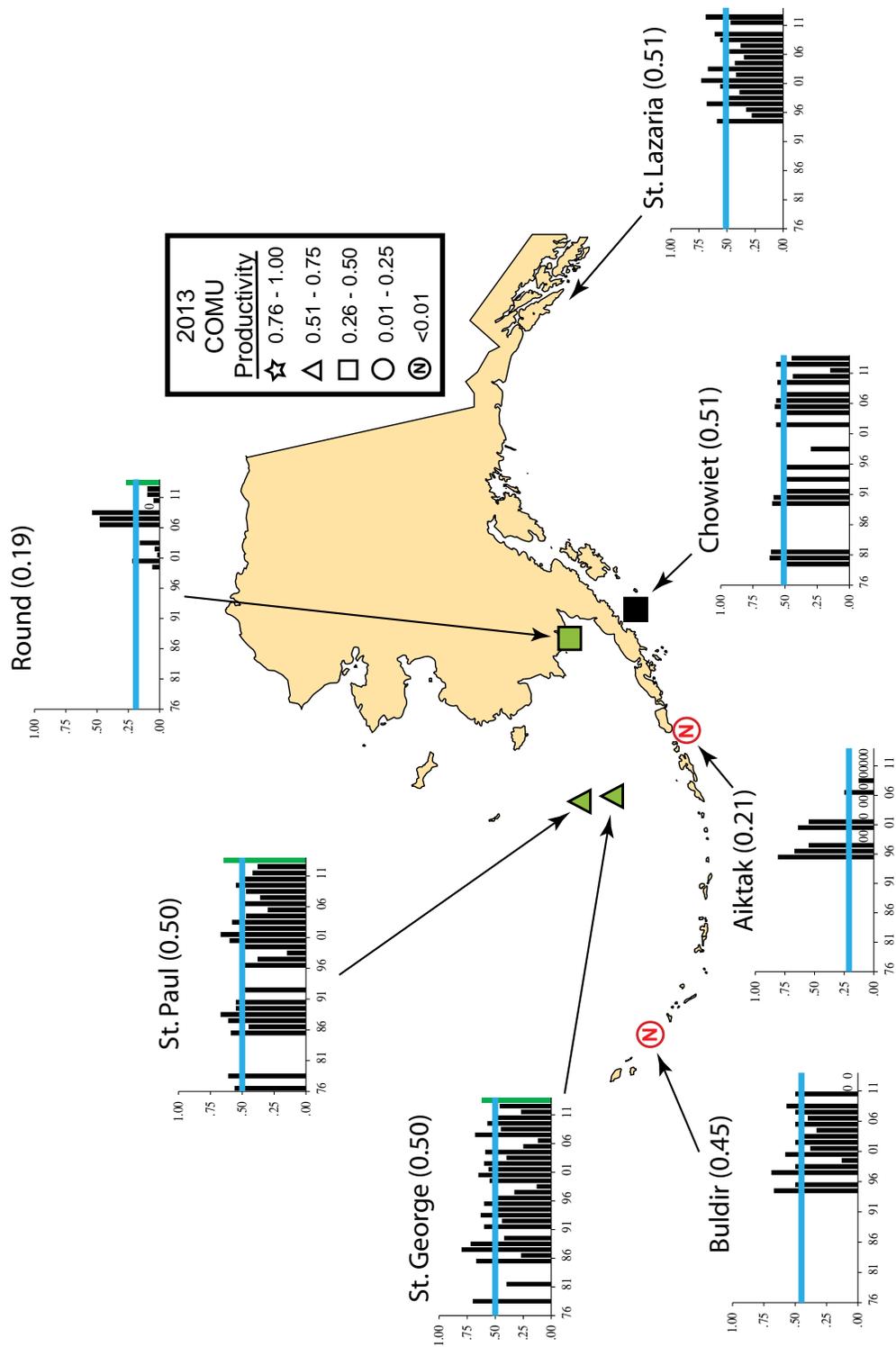


Figure 21. Productivity of common murre (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

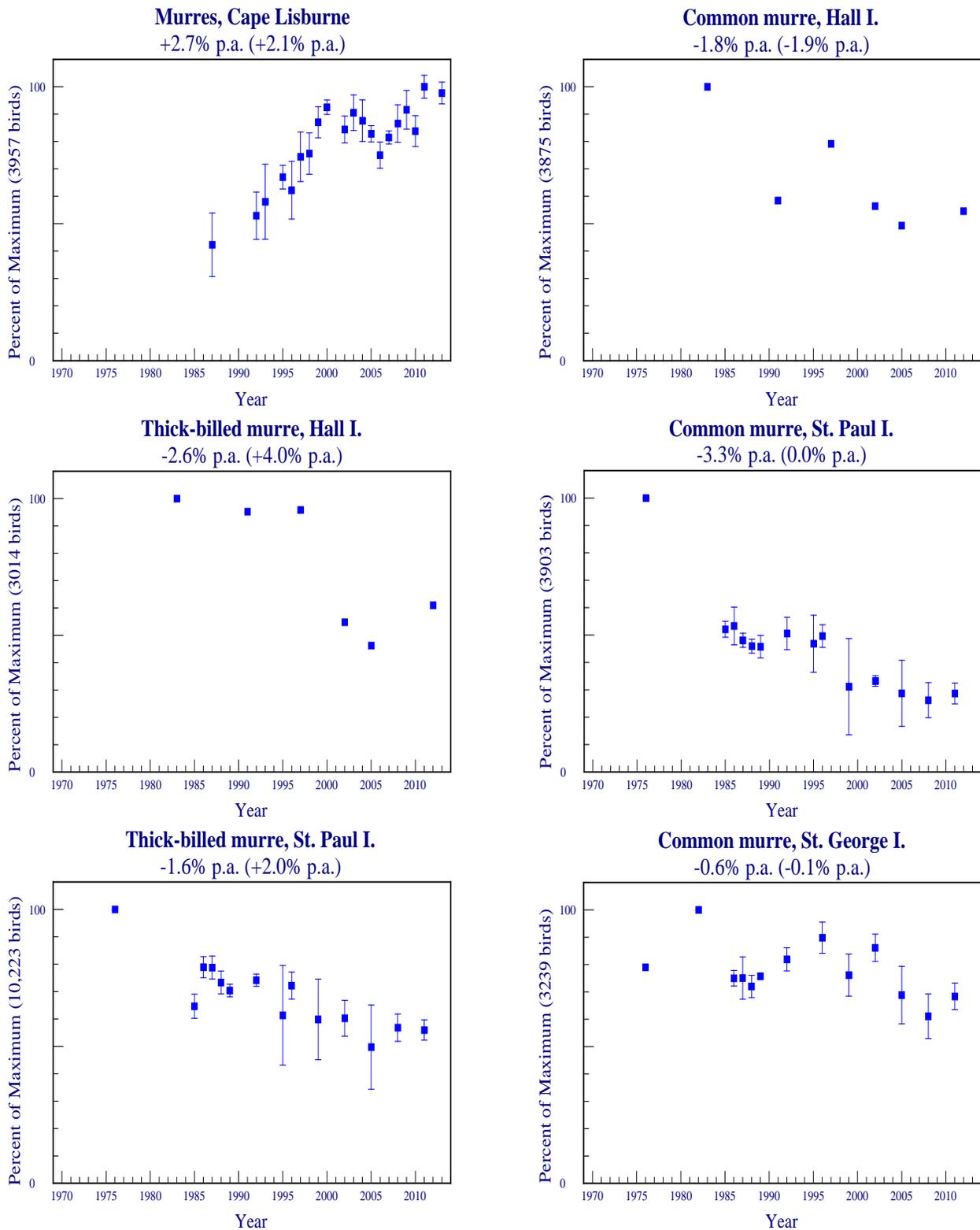


Figure 22. Trends in populations of murrens at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

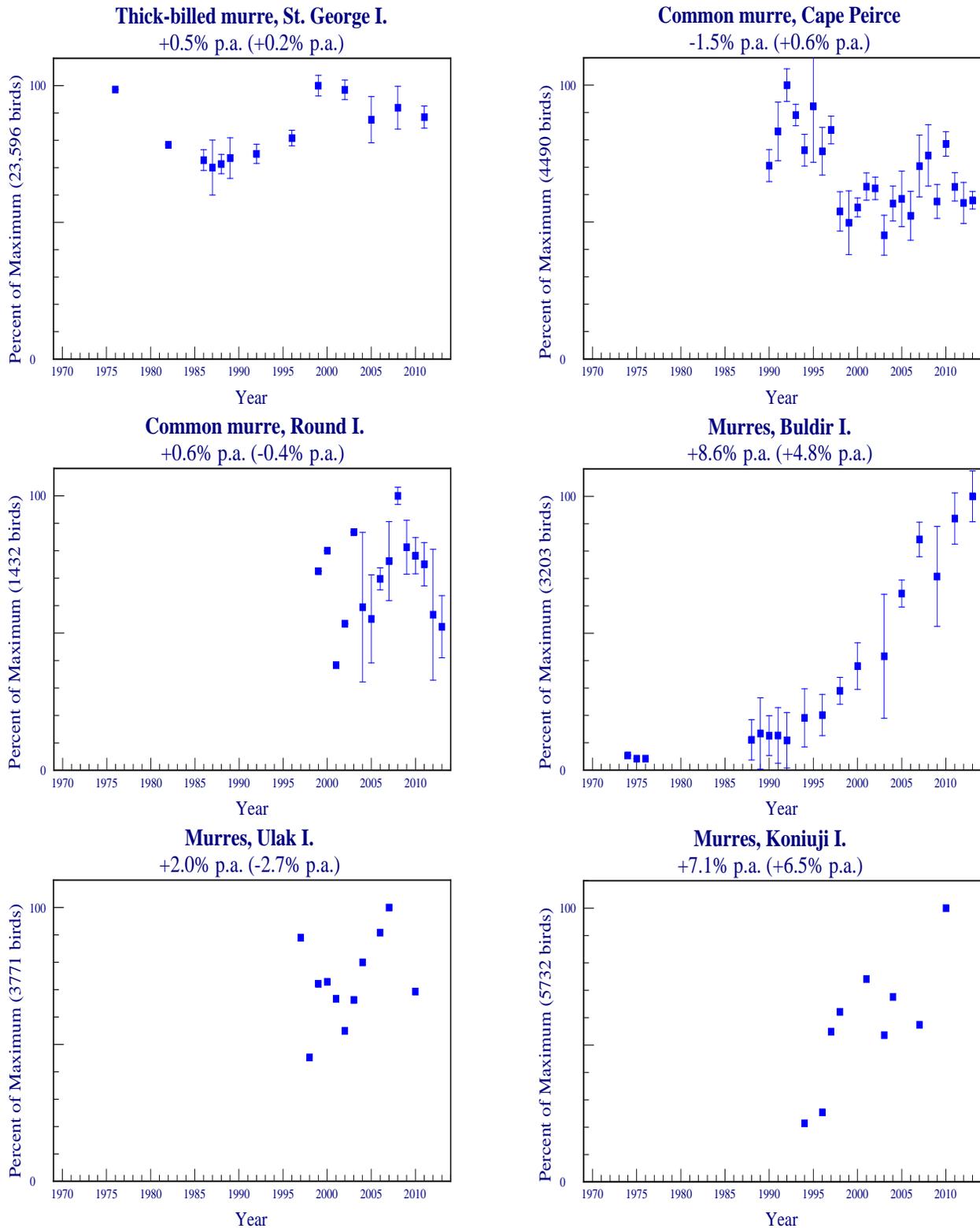


Figure 22 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

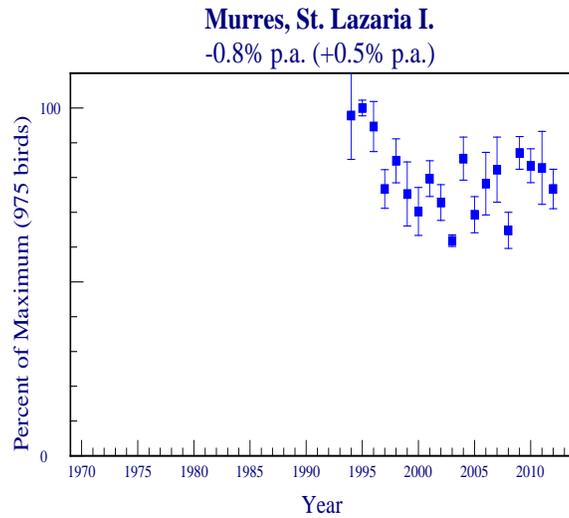
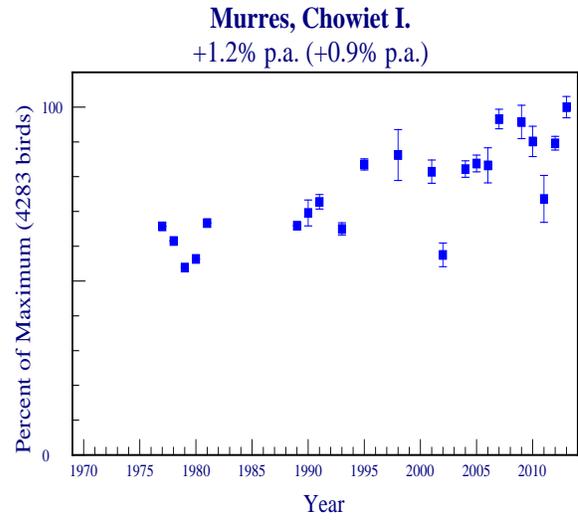
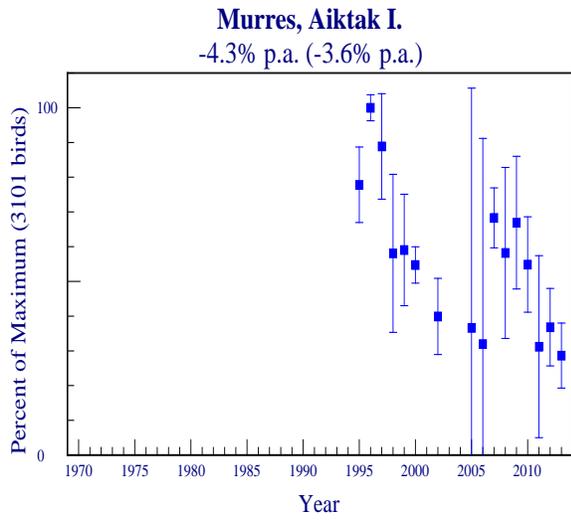


Figure 22 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).



Thick-billed murre (*Uria lomvia*)

Table 17. Hatching chronology of thick-billed murres at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. Paul I.	31 Jul (98) ^a	5 Aug (28) ^a	Thomson and Romano 2013
St. George I.	27 Jul (109)	1 Aug (32)	Klostermann et al. 2013
Buldir I.	17 Jul (18)	18 Jul (25)	Kohley and Herman 2014
Chowiet I.	21 Jul (59)	20 Jul (16)	Henschen et al. 2013

^aSample 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.

Table 18. Reproductive performance of thick-billed murres at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
St. Paul I.	0.52	15 (348) ^b	0.45 (28) ^b	Thomson and Romano 2013
St. George I.	0.58	10 (308)	0.52 (32)	Klostermann et al. 2013
Buldir I.	0.58	8 (199)	0.68 (25)	Kohley and Herman 2014
Aiktak I.	0.00	4 (9)	0.27 (12)	Howie et al. 2014
Chowiet I.	0.32	6 (148)	0.42 (18)	Henschen et al. 2013

^aSince murres do not build nests, nest sites were defined as sites where eggs were laid.

^bSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

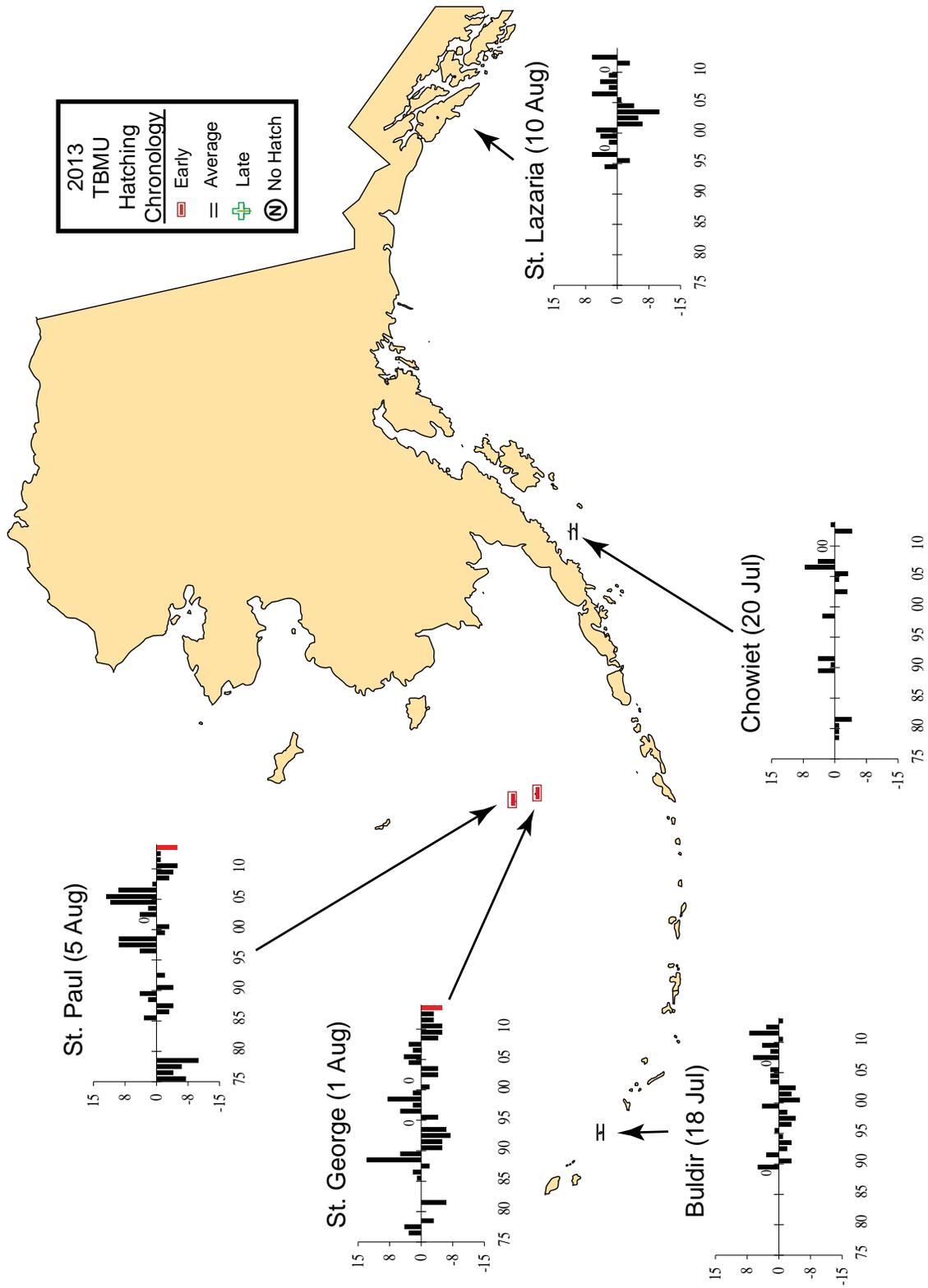


Figure 23. Hatching chronology of thick-billed murres at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

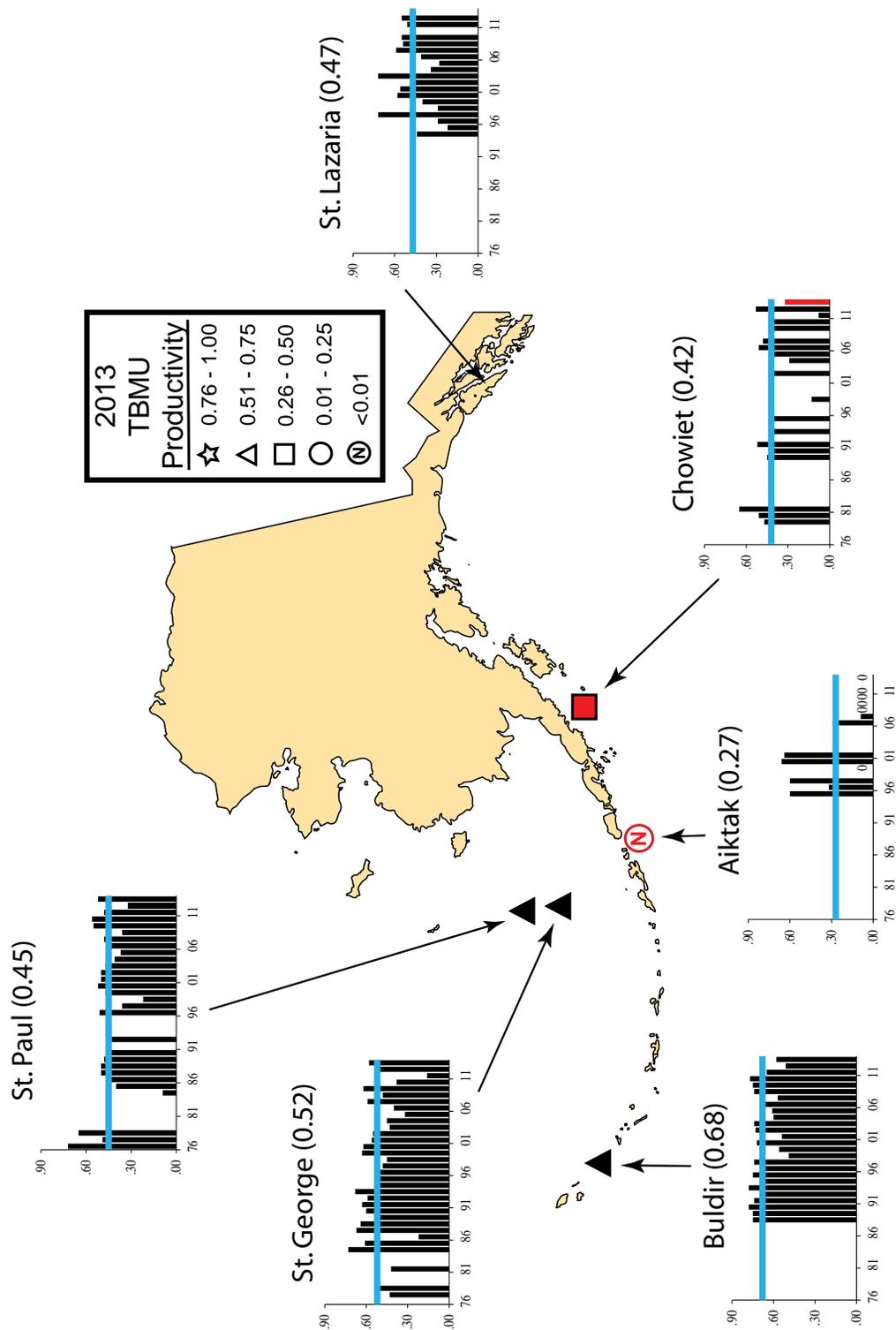


Figure 24. Productivity of thick-billed murres (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Pigeon guillemot (*Cepphus columba*)

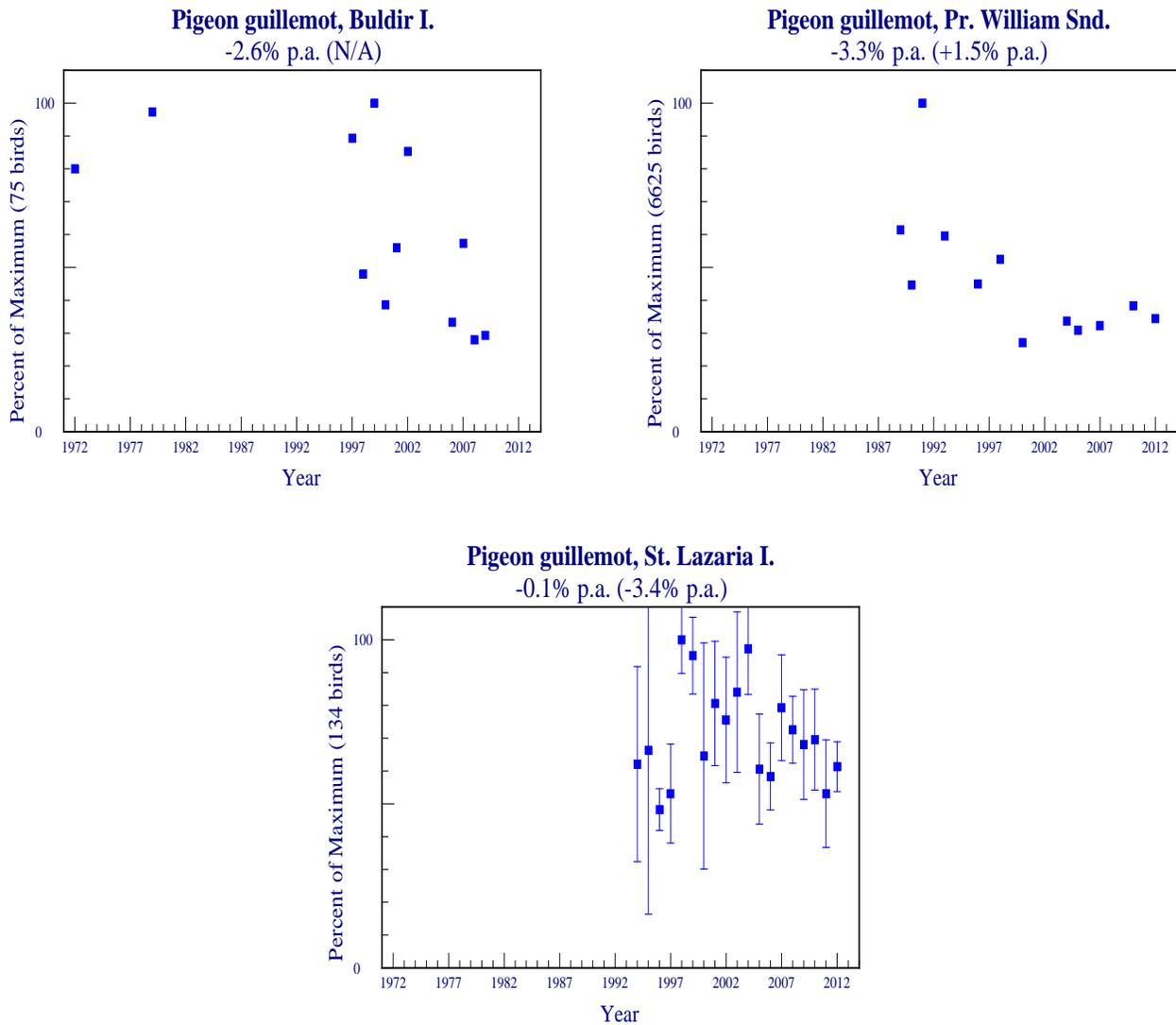


Figure 25. Trends in populations of pigeon guillemots at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses). “NA” indicates that insufficient data were available.



Ancient murrelet (*Synthliboramphus antiquus*)

Table 19. Hatching chronology of ancient murrelets at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Aiktak I.	30 Jun (36) ^a	4 Jul (16) ^a	Howie et al. 2014

^aSample 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.

Table 20. Reproductive performance of ancient murrelets at Alaskan sites monitored in 2013.

Site	Chicks Fledged/Egg ^a	No. of Plots	Long-term Average	Reference
Aiktak I.	0.77	NA ^b (202) ^c	0.78 (16) ^c	Howie et al. 2014

^aTotal chicks fledged/Total eggs.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.



Parakeet auklet (*Aethia psittacula*)

Table 21. Hatching chronology of parakeet auklets at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	3 Jul (12) ^a	4 Jul (21) ^a	Kohley and Herman 2014
Chowiet I.	1 Jul (13)	5 Jul (8)	Henschen et al. 2013

^aSample 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.

Table 22. Reproductive performance of parakeet auklets at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
Buldir I.	0.36	NA ^b (50) ^c	0.54 (21) ^c	Kohley and Herman 2014
Chowiet I.	0.33	NA (55)	0.37 (8)	Henschen et al. 2013

^aNest site is defined as a site where an egg was laid.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

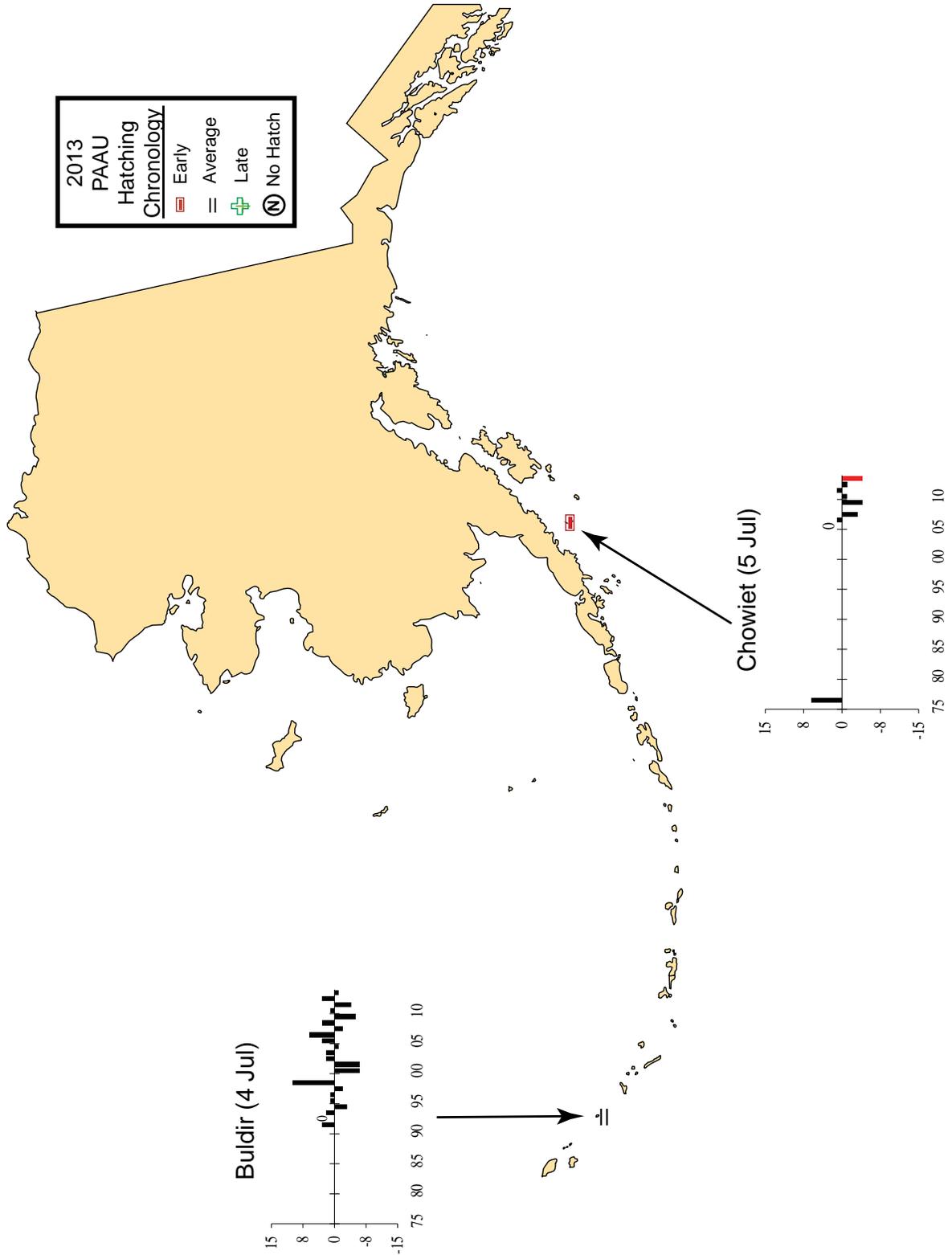


Figure 26. Hatching chronology of parakeet auklets at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

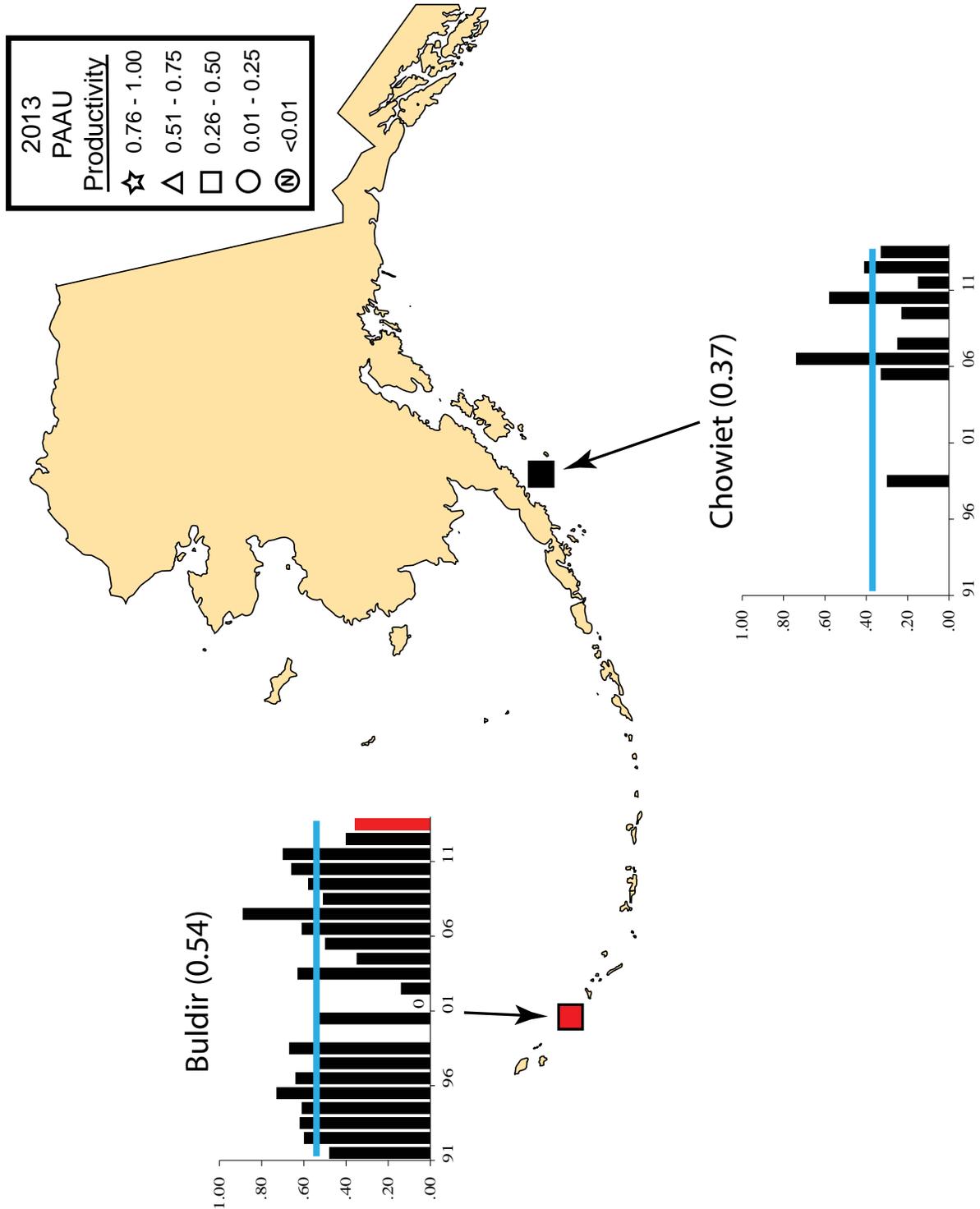


Figure 27. Productivity of parakeet auklets (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Least auklet (*Aethia pusilla*)

Table 23. Hatching chronology of least auklets at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
St. George I.	24 Jul (12) ^a	16 Jul (5) ^a	Klostermann et al. 2013
Buldir I.	1 Jul (26)	27 Jun (23)	Kohley and Herman 2014

^aSample 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.

Table 24. Reproductive performance of least auklets at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
St. George I.	0.64	NA ^b (64) ^c	0.71 (5) ^c	Klostermann et al. 2013
Buldir I.	0.59	NA (76)	0.59 (24)	Kohley and Herman 2014

^aNest site is defined as a site where an egg was laid.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

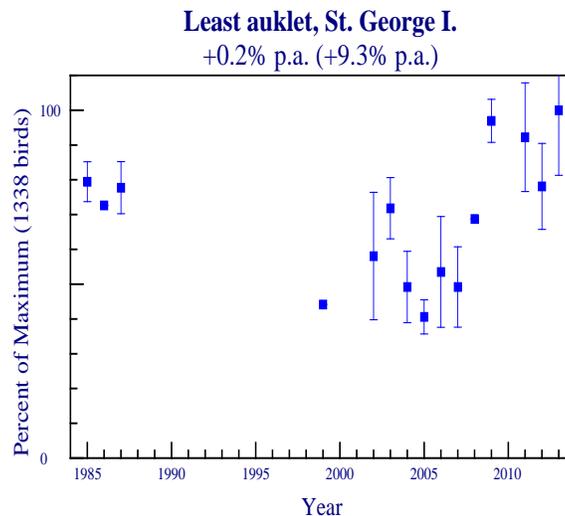


Figure 28. Trends in populations of least auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

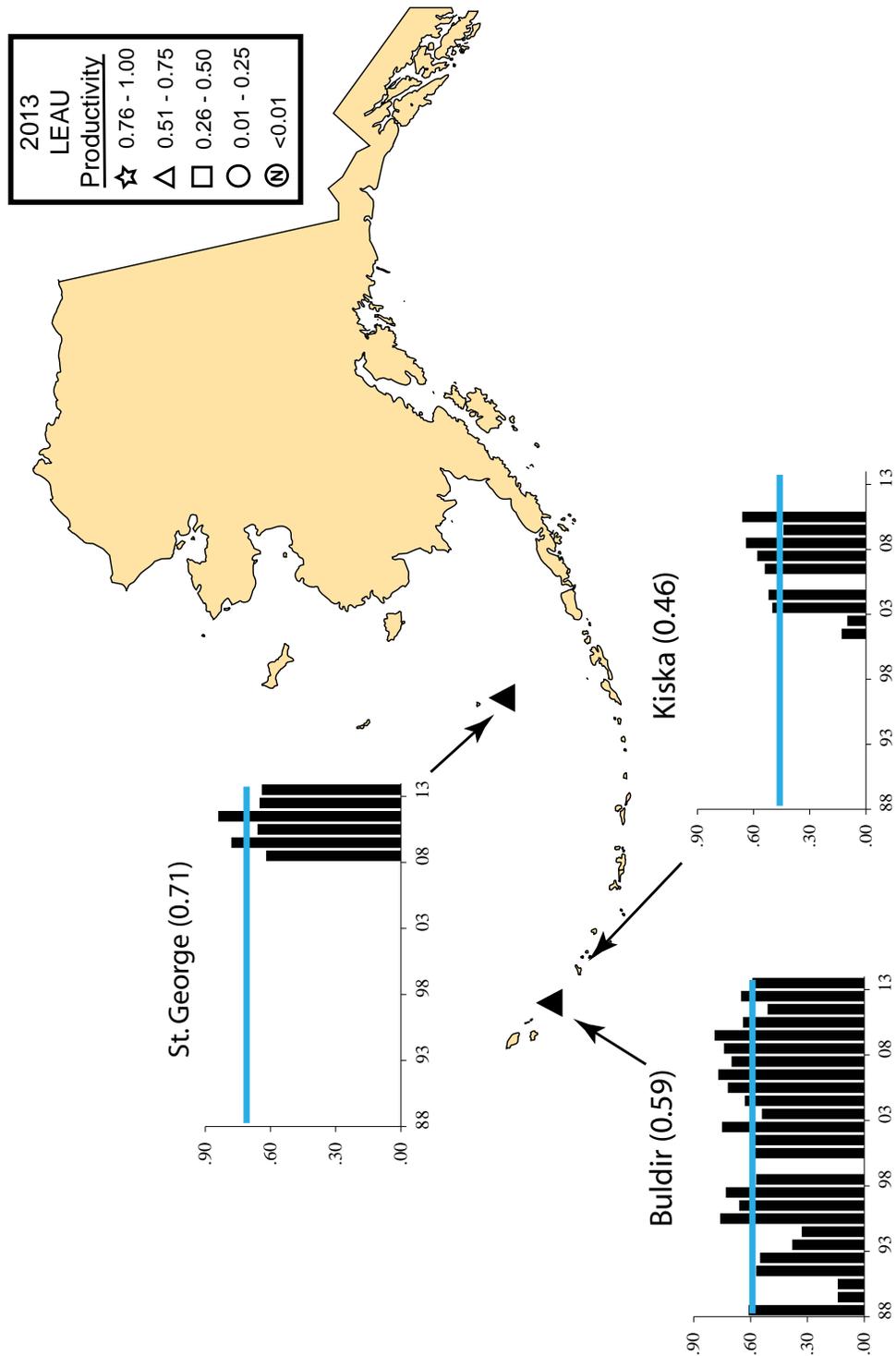


Figure 30. Productivity of least auklets (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Whiskered auklet (*Aethia pygmaea*)

Table 25. Hatching chronology of whiskered auklets at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	21 Jun (30) ^a	22 Jun (22) ^a	Kohley and Herman 2014

^aSample 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.

Table 26. Reproductive performance of whiskered auklets at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
Buldir I.	0.64	NA ^b (73) ^c	0.66 (22) ^c	Kohley and Herman 2014

^aNest site is defined as a site where an egg was laid.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.



Crested auklet (*Aethia cristatella*)

Table 27. Hatching chronology of crested auklets at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	23 Jun (13) ^a	29 Jun (23) ^a	Kohley and Herman 2014

^aSample 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.

Table 28. Reproductive performance of crested auklets at Alaskan sites monitored in 2013.

Site	Chicks Fledged/ Nest Site ^a	No. of Plots	Long-term Average	Reference
Buldir I.	0.50	NA ^b (94) ^c	0.66 (24) ^c	Kohley and Herman 2014

^aNest site is defined as a site where an egg was laid.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

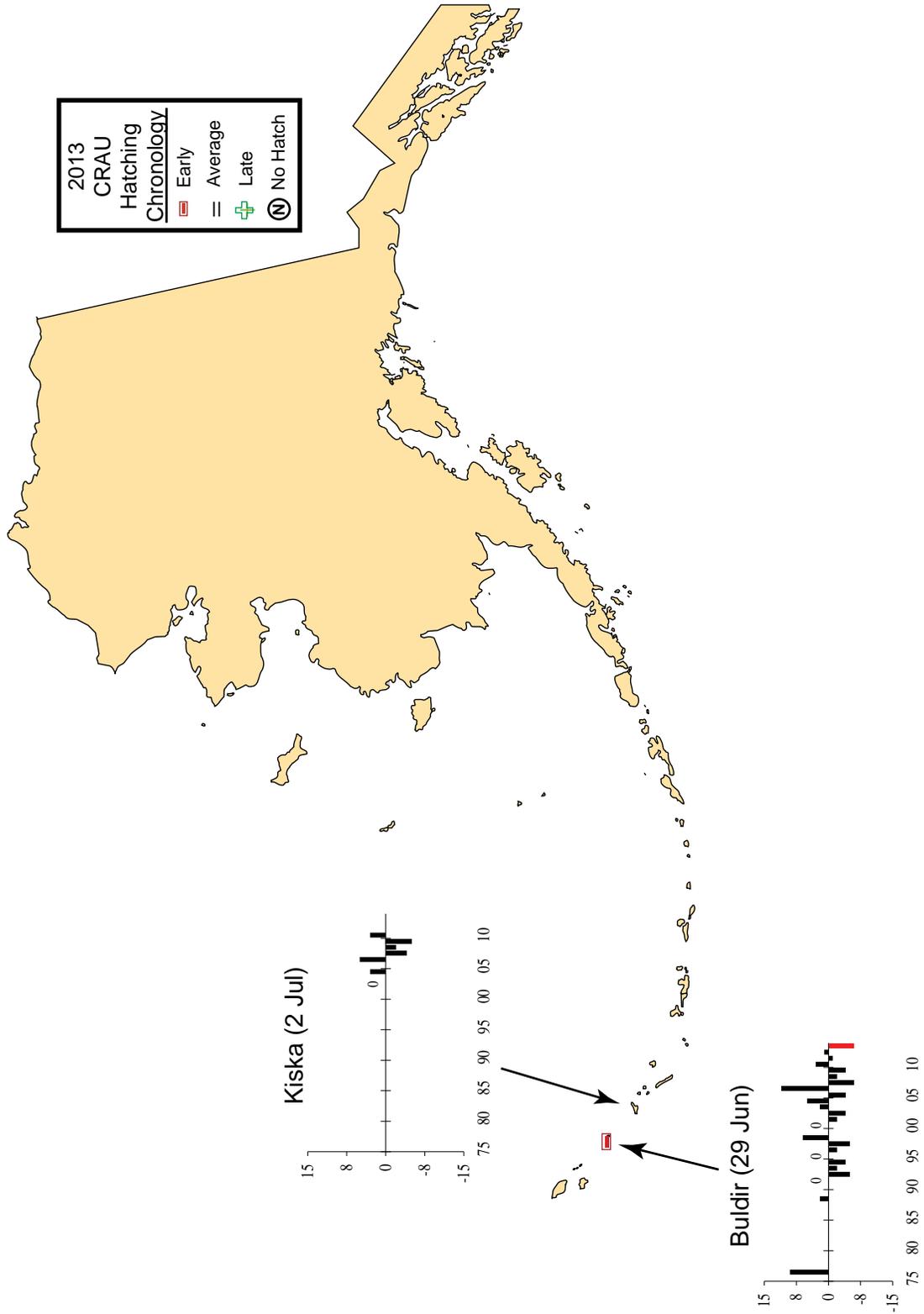


Figure 31. Hatching chronology of crested auklets at Alaskan. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

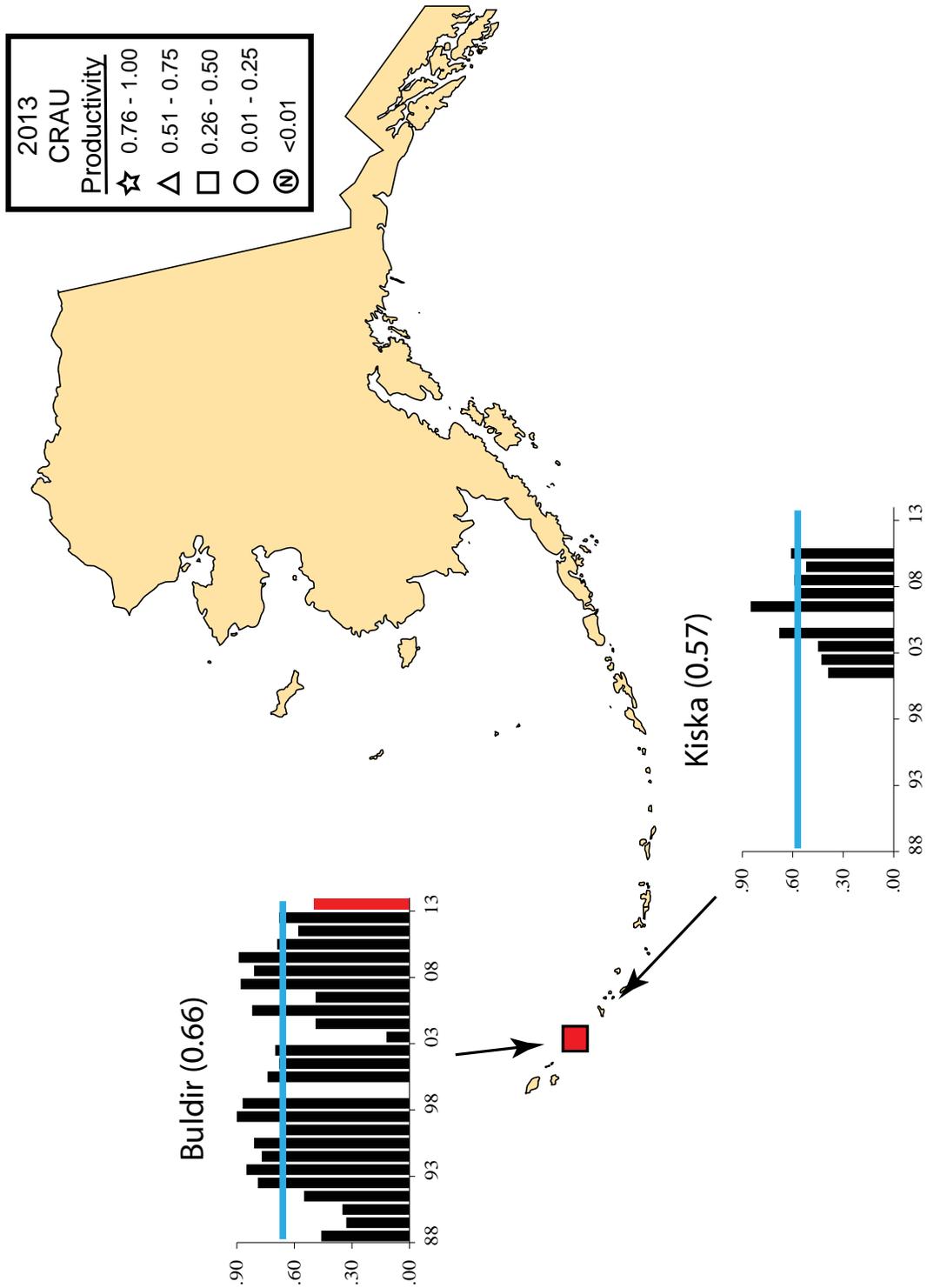


Figure 32. Productivity of crested auklets (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Rhinoceros auklet (*Cerorhinca monocerata*)

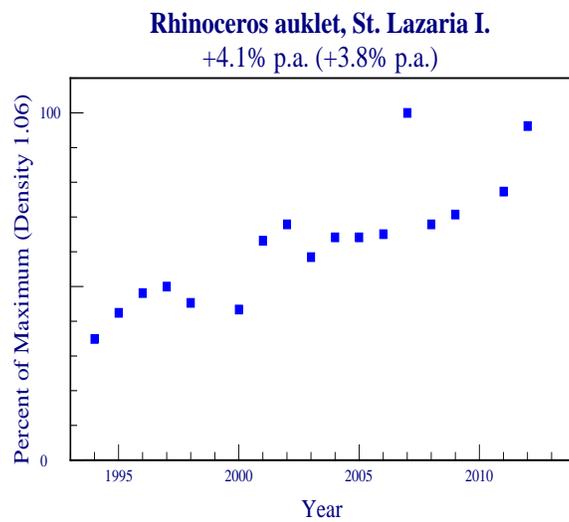


Figure 33. Trends in populations of rhinoceros auklets at Alaskan sites. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

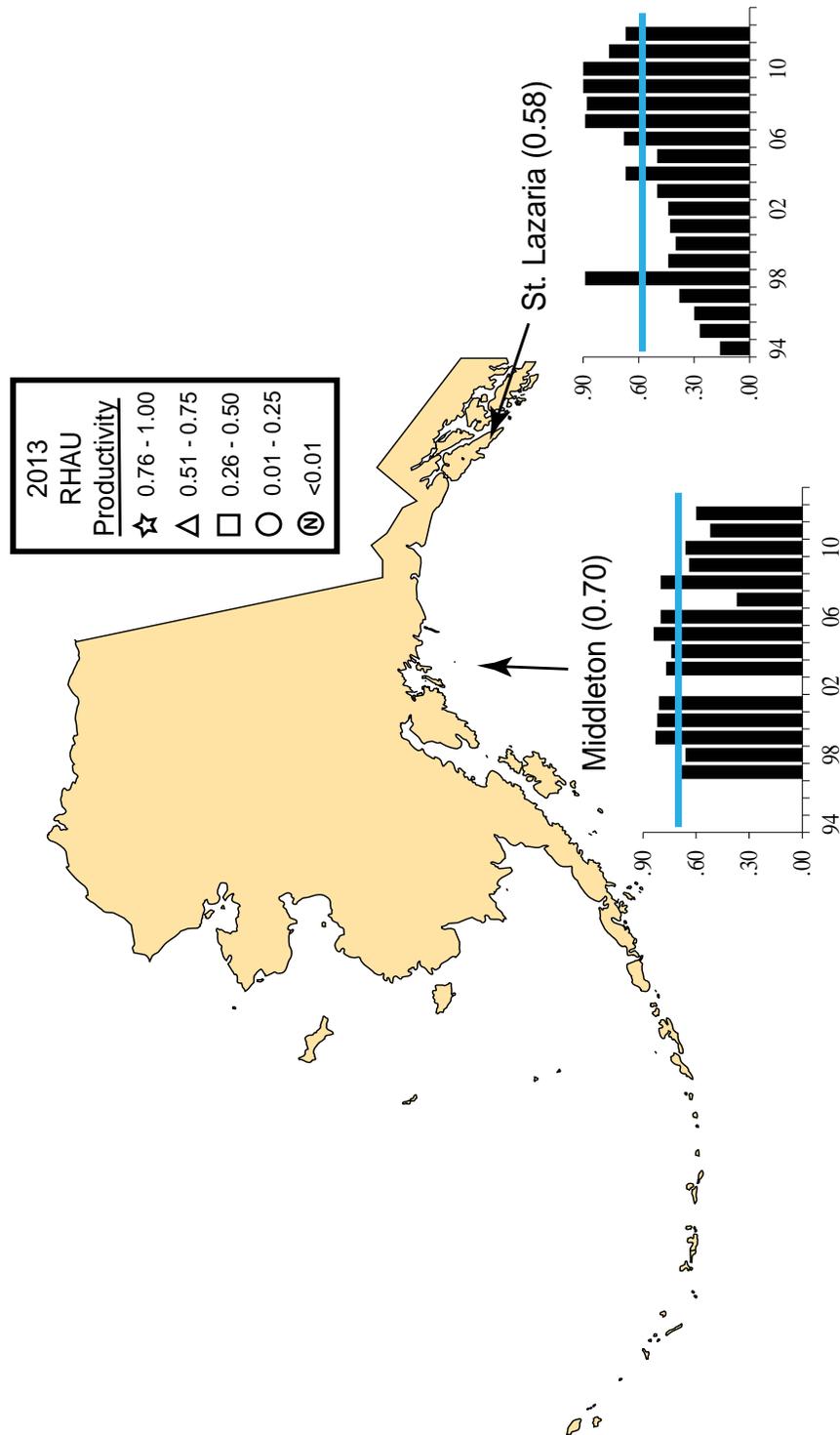


Figure 34. Productivity of rhinoceros auklets (chicks fledged/nest site) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Horned puffin (*Fratercula corniculata*)

Table 29. Hatching chronology of horned puffins at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	27 Jul (29) ^a	24 Jul (23) ^a	Kohley and Herman 2014
Aiktak I.	4 Aug (6)	1 Aug (8)	Howie et al. 2014
Chowiet I.	3 Aug (42)	1 Aug (9)	Henschen et al. 2013

^aSample 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.

Table 30. Reproductive performance of horned puffins at Alaskan sites monitored in 2013.

Site	Chicks Fledged/Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.51	NA ^a (50) ^b	0.45 (25) ^b	Kohley and Herman 2014
Aiktak I.	0.58	NA (11)	0.59 (11)	Howie et al. 2014
Chowiet I.	0.16	NA (70)	0.38 (8)	Henschen et al. 2013

^aNot applicable or not reported.

^bSample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

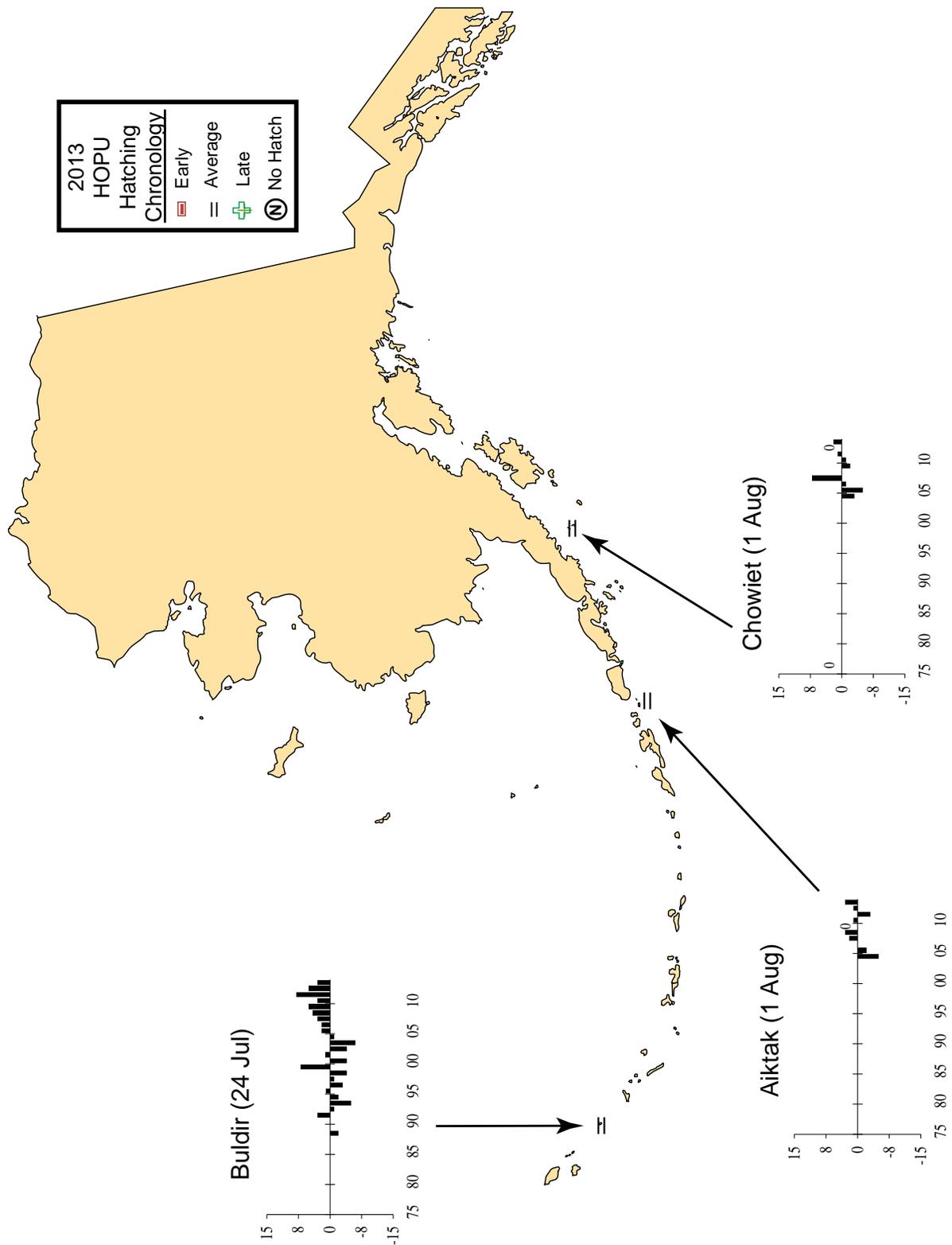


Figure 35. Hatching chronology of horned puffins at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

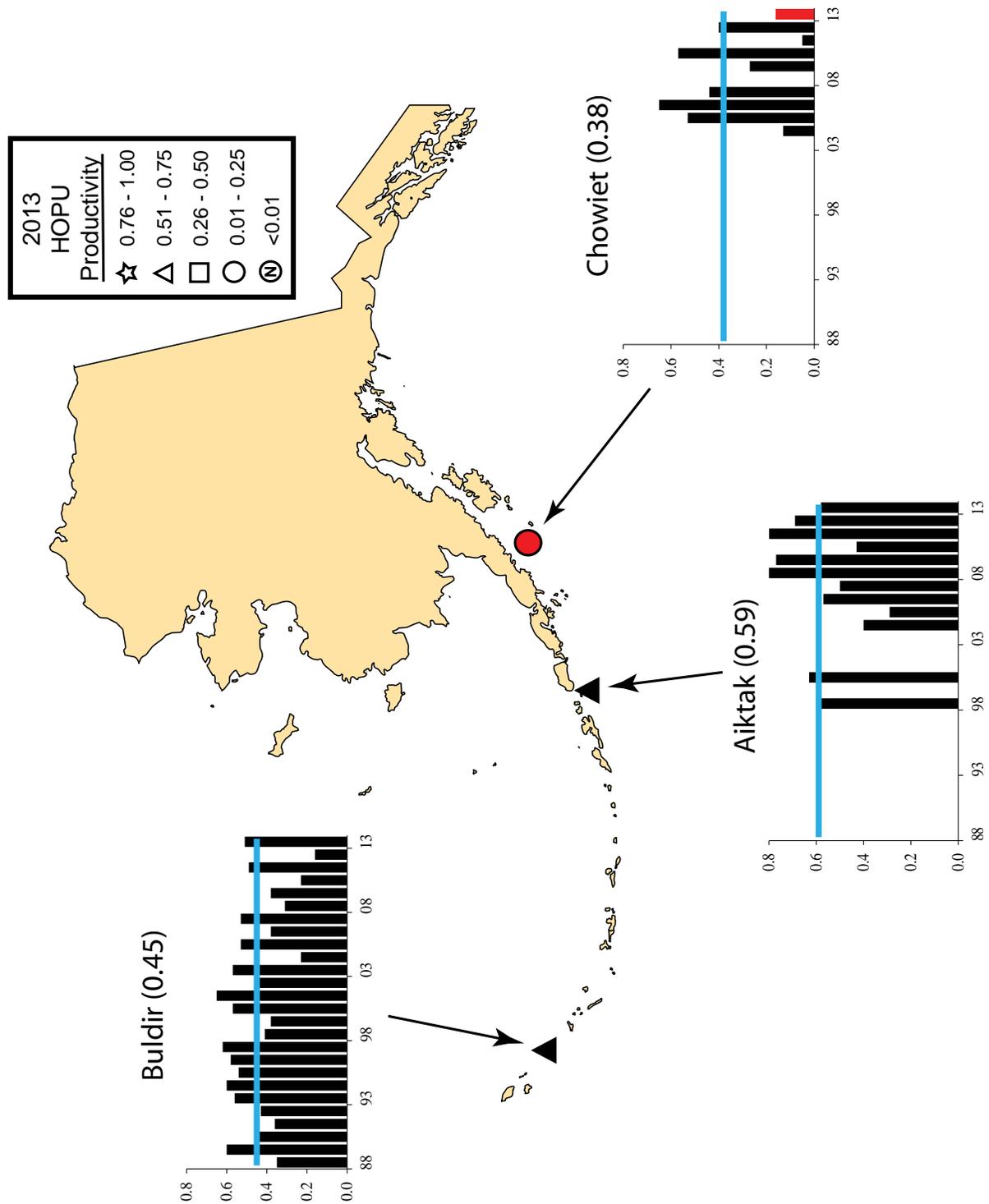


Figure 36. Productivity of horned puffins (chicks fledged/egg) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).



Tufted puffin (*Fratercula cirrhata*)

Table 31. Hatching chronology of tufted puffins at Alaskan sites monitored in 2013.

Site	Mean	Long-term Average	Reference
Buldir I.	16 Jul (6) ^a	13 Jul (18) ^a	Kohley and Herman 2014
Aiktak I.	27 Jul (23)	1 Aug (16)	Howie et al. 2014
Chowiet I.	27 Jul (24)	25 Jul (8)	Henschen et al. 2013

^aSample 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.

Table 32. Reproductive performance of tufted puffins at Alaskan sites monitored in 2013.

Site	Chicks Fledged ^a /Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.50	NA ^b (11) ^c	0.39 (25) ^c	Kohley and Herman 2014
Aiktak I.	0.73	NA (76)	0.54 (17)	Howie et al. 2014
Chowiet I.	0.29	NA (49)	0.32 (7)	Henschen et al. 2013

^aFledged chick defined as being still alive at last check in August or September.

^bNot applicable or not reported.

^cSample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

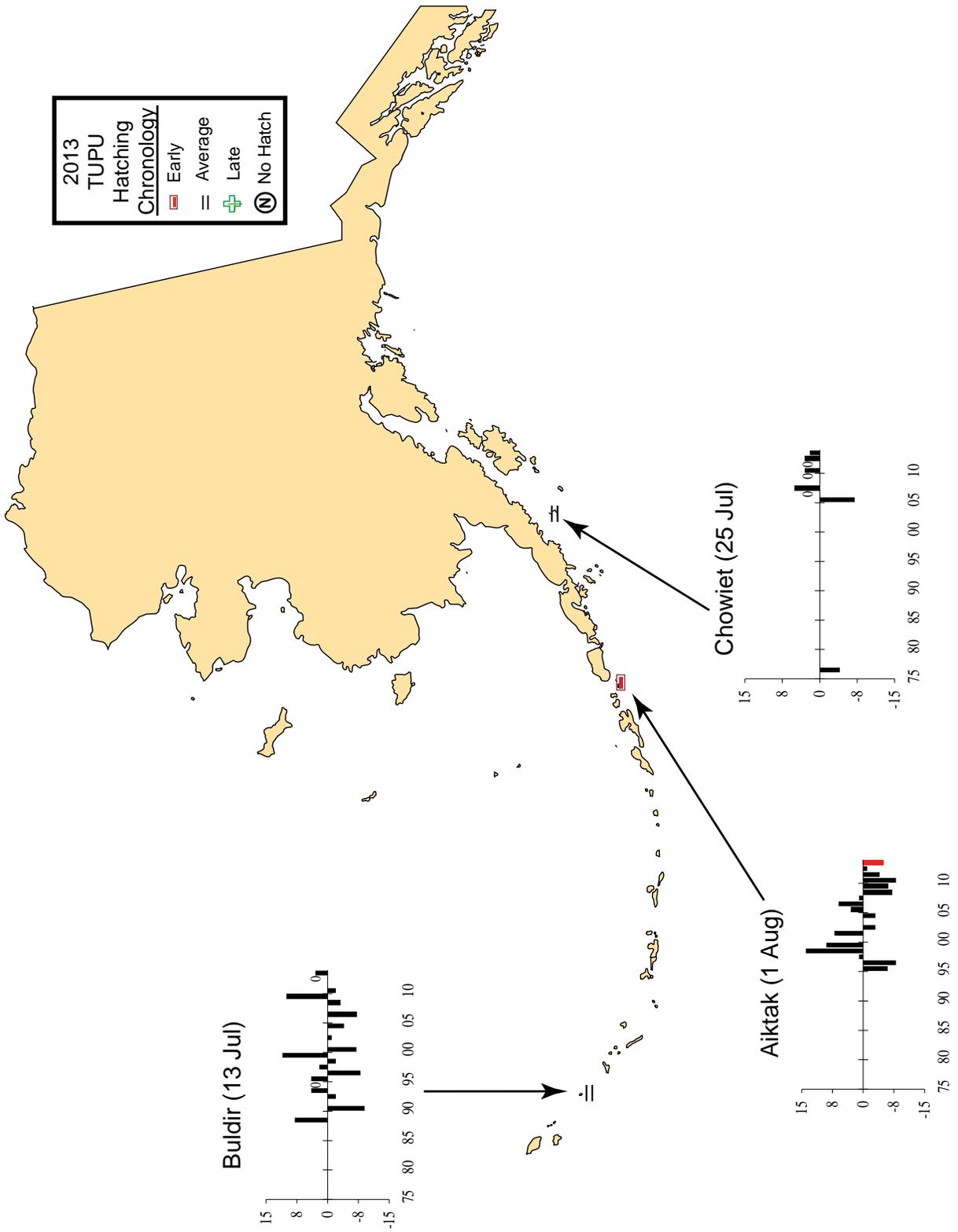


Figure 37. Hatching chronology of tufted puffins at Alaskan sites. Graphs indicate the departure in days (if any) from the site mean (in parentheses; current year not included).

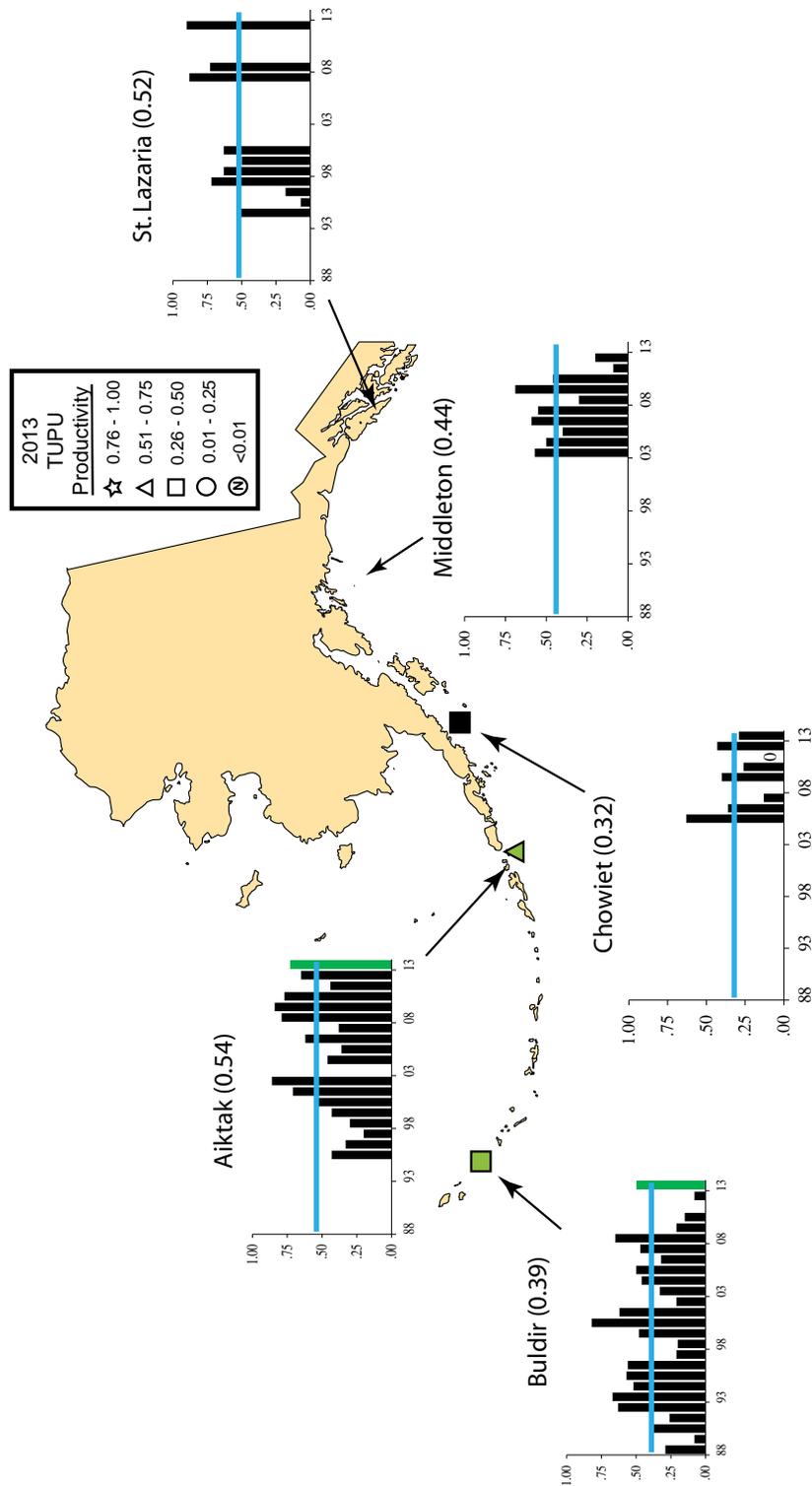


Figure 38. Productivity of tufted puffins (chicks fledged/egg) at Alaskan sites. Lack of bars indicates that no data were gathered in those years. Blue line is the mean productivity at the site (in parentheses; current year not included). Color of symbol indicates how current year's success compared to the site mean (red is >20% below, black is within 20% and green is >20% above site mean).

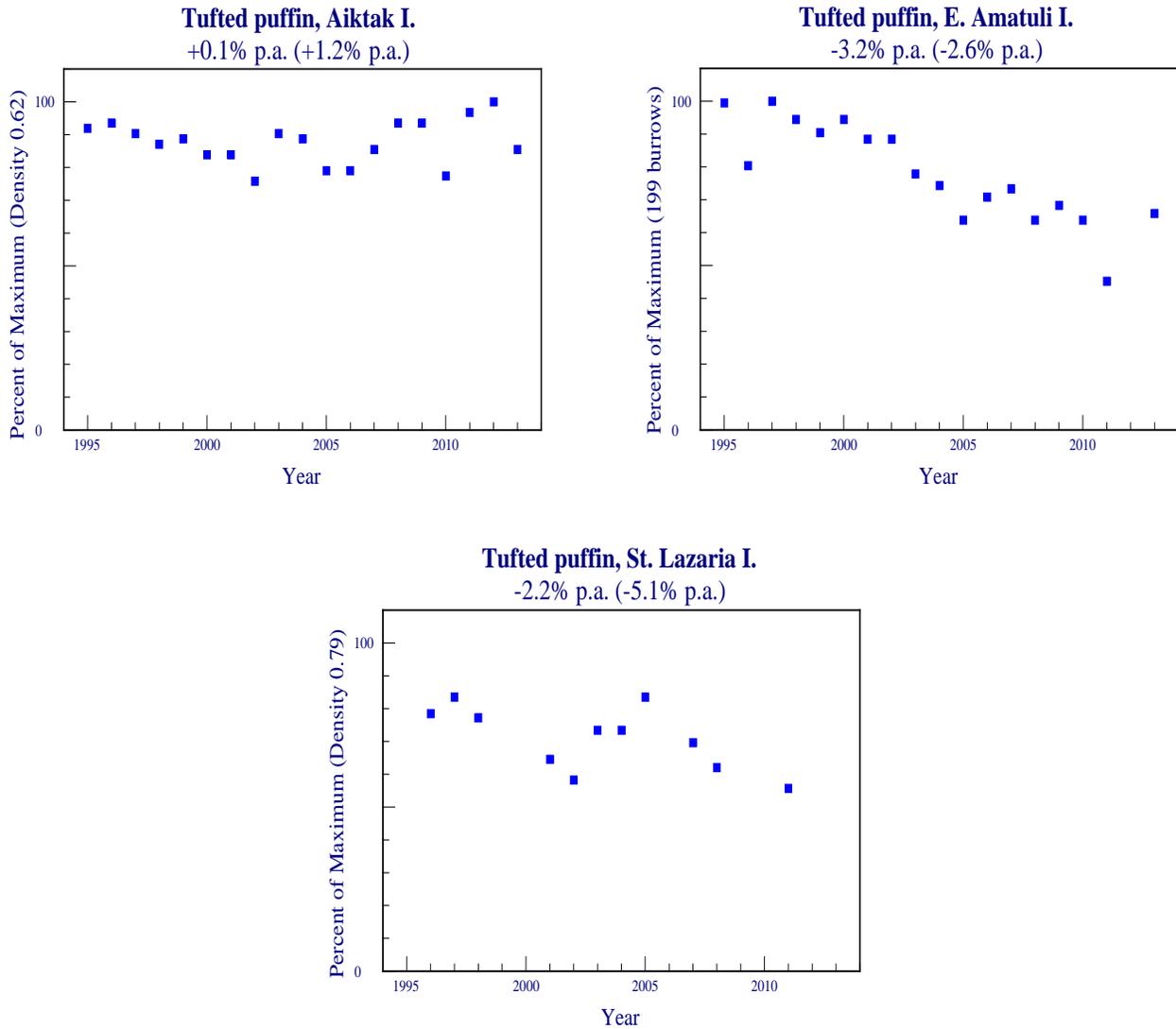


Figure 39. Trends in populations of tufted puffins at Alaskan sites. Percent per annum (p.a.) changes are indicated for all years and for just the last decade (2004-2013, in parentheses).

Table 33. Seabird relative breeding chronology^a compared to averages for past years. Only sites for which there were data from 2013 are included.

Region	Site	FTSP ^b	LHSP	RFCO	BLKI	RLKI	GWGU	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	HOPU	TUPU
SE Bering	St. Paul I.			A	E			E	E							
	St. George I.				E	E		E	E			L				
	Aiktak I.	E	E				L			E					A	E
SW Bering	Buldir I.			L	A	L		A		A	L	A	E	A	A	
Gulf of Alaska	Chowiet I.				A		E	A	A		E				A	A
	E. Amatuli I.				A			L								

^a Codes:

“E” and red cell color indicate hatching chronology was > 3 days earlier than the average for this site.

“A” and yellow cell color indicate hatching chronology was within 3 days of average.

“L” and green cell color indicate hatching chronology was > 3 days later than the average for this site.

^bFTSP=fork-tailed storm-petrel, LHSP=Leach’s storm-petrel, RFCO=red-faced cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake,

GWGU=glaucous-winged gull, COMU=common murre, TBMU=thick-billed murre, ANMU=ancient murrelet, PAAU=parakeet auklet, LEAU=least auklet,

WHAU=whiskered auklet, CRAU=crested auklet, HOPU=horned puffin, TUPU=tufted puffin.

Table 34. Seabird relative productivity levels^a compared to averages for past years. Only sites for which there were data from 2013 are included.

Region	Site	FTSP ^b	LHSP	RFCO	PECO	BLKI	RLKI	GWGU	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	HOPU	TUPU
N Bering/ Chukchi	C. Lisburne					↓											
	St. Paul I.			↑		↓	↓		↑	↔							
	St. George I.			↔		↓	↔		↑	↔			↔				
SE Bering	C. Peirce				↑	↑											
	Round I.				↔	↔			↑								
	Aiktak I.	↔	↔	↑	↑			↓	↓	↓	↔					↔	↑
SW Bering	Buldir I.	↓	↔	↓	↔	↓	↓	↔	↓	↔		↓	↔	↔	↓	↔	↑
	Chowiet I.			↓	↑	↓		↔	↔	↓		↔				↓	↔
Gulf of Alaska	E. Amatuli I.					↑											
	Pr. Will. Snd.					↑											

^a Codes:

↓ and red cell color indicate productivity was > 20% below the average for this site.

↔ and yellow cell color indicate productivity was within 20% of average.

↑ and green cell color indicate productivity was > 20% above the average for this site.

^b FTSP=fork-tailed storm-petrel, LHSP=Leach's storm-petrel, RFCO=red-faced cormorant, PECO=pelagic cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake, GWGU=glaucous-winged gull, COMU=common murre, TBMU=horned auklet, HOPU=whiskered auklet, CRAU=least auklet, LEAU=parakeet auklet, WHAU=whiskered auklet, HOPU=horned puffin, TUPU=tufted puffin.

Table 35. Seabird population trends^a for all available years (“A” columns), and the past decade (2004-2013, “D” columns).

Region	Site	NOFU ^b		FTSP		STPE		RFCO		PECO		UNCO		BLKI		RLKI		GWGU		COMU		TBMU		UNMU		PIGU		LEAU		RHAU		TUPU					
		A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D	A	D						
N. Bering/ Chukchi	C. Lisburne																																				
	Hall I.																																				
	St. Paul I.																																				
SE Bering	St. George I.																																				
	C. Peirce																																				
	Round I.																																				
	Aiktak I.																																				
SW Bering	Buldir I.																																				
	Ulak I.																																				
	Koniujj I.																																				
	Chowiet I.																																				
Gulf of Alaska	Puale Bay																																				
	E. Amatuli I.																																				
	P. William Snd.																																				
	Middleton I.																																				
Southeast	St. Lazaria I.																																				

^a Codes:

↓ and red cell color indicate a negative population trend of $\geq 3\%$ per annum for this site.

↔ and yellow cell color indicate no population trend.

↑ and green cell color indicate a positive population trend of $\geq 3\%$ per annum for this site.

“NA” indicates that there were insufficient data to determine a trend (see Methods).

^bNOFU=northern fulmar, FTSP=fork-tailed storm-petrel, STPE=unspecified storm-petrel, RFCO=red-faced cormorant, PECO=pelagic cormorant, UNCO=unspecified cormorant, BLKI=black-legged kittiwake, RLKI=red-legged kittiwake, GWGU=glaucous-winged gull, COMU=common murre, TBMU=thick-billed murre, UNMU=unspecified murre, PIGU=pigeon guillemot, LEAU=least auklet, RHAU=rhinoceros auklet, TUPU=tufted puffin.

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

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