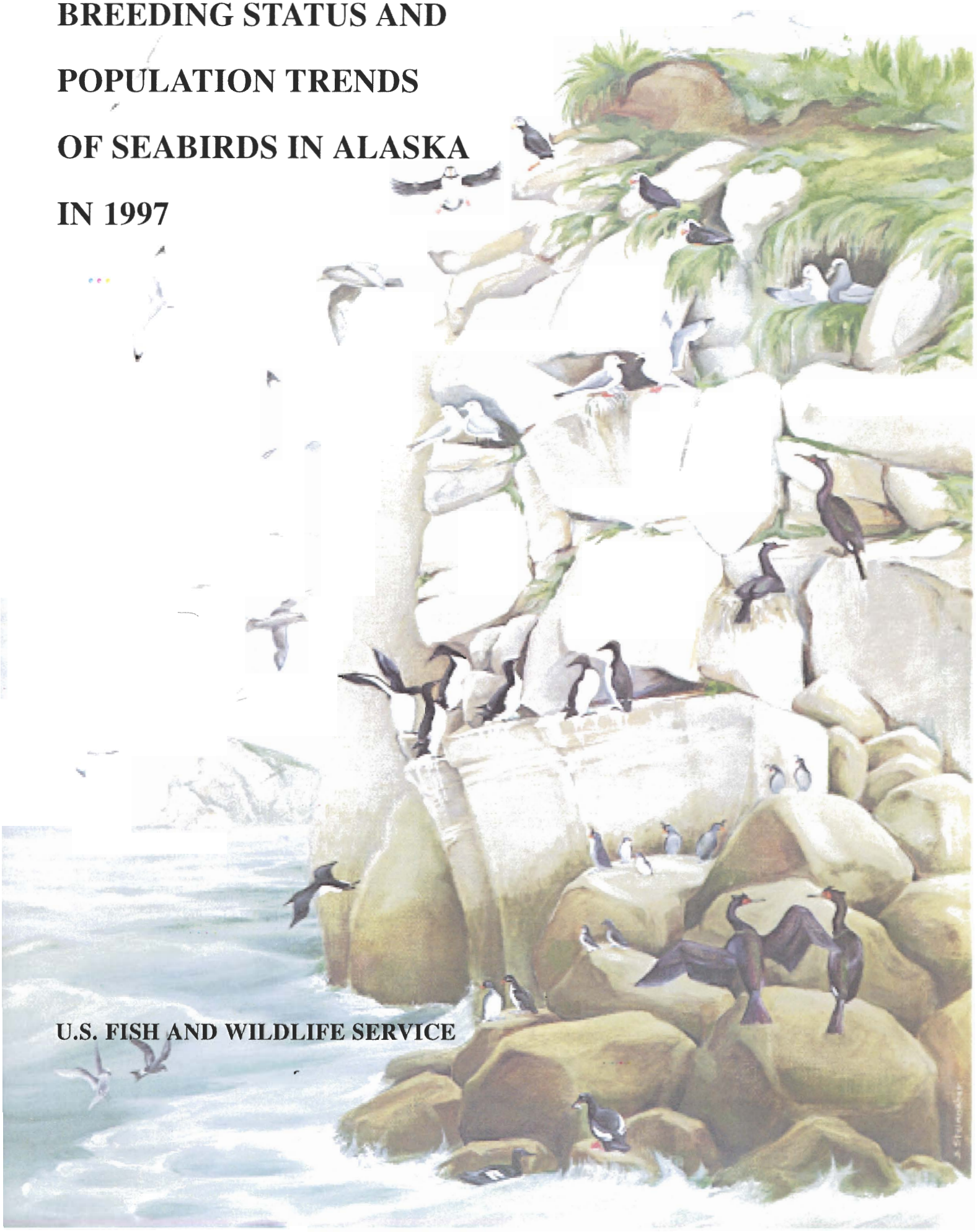
BREEDING STATUS AND POPULATION TRENDS OF SEABIRDS IN ALASKA IN 1997



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BREEDING STATUS AND POPULATION TRENDS OF SEABIRDS IN ALASKA IN 1997

Compiled By:

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EXECUTIVE SUMMARY

Data are being collected annually for selected species of marine birds at breeding colonies on the far-flung Alaska Maritime 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 Fish and Wildlife Service. The strategy for colony monitoring includes estimating timing of nesting events, rates of reproductive success (e.g., chicks per nest), and population trends of representative species of various foraging guilds (e.g., off-shore diving fish-feeders, offshore surface-feeding fish-feeders, diving plankton-eaters) at geographically-dispersed breeding sites. This information enables managers to better understand ecosystem processes and respond appropriately to resource issues and 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 1997 data were gathered on fulmars, cormorants, gulls, kittiwakes, murres, auklets, and/or puffins at 9 annual monitoring sites on the Alaska Maritime NWR and 1 annual monitoring site on Togiak NWR. In addition, data were gathered at 10 other locations which are visited intermittently or are currently part of an intensive research program off refuges (e.g., Exxon Valdez Trustee Council-sponsored research in Prince William Sound).

Most species we monitored hatched eggs at about average dates in most regions in 1997, but in the southeastern Bering Sea (the Pribilof Is. and Aiktak I.), eggs of diving fish feeders (cormorants, murres and puffins) hatched later than average, and surface plankton feeders (storm-petrels) also had delayed hatching in the eastern Aleutians. Possibly these delays were responses to relatively-warm water reported in the region.

Generally, plankton feeders (storm-petrels and auklets) had average rates of reproductive success everywhere we monitored them in 1997. Surface fish feeders (gulls and kittiwakes) also mostly had average or higher success; except in 4 of 19 cases (one in each region) black-legged kittiwakes had lower than normal success in 1997. All species of diving fish feeders had average or higher rates of productivity in the N. Bering and Chukchi and Southeast regions, and species in this group also had average or higher success at most sites (6 of 8 cases) in the SW Bering region. In contrast, success was lower than average in 8 of 11 cases in 1997 in the SE Bering Region, the same region where hatching dates were later then normal at several locations. Productivity of diving fish feeders was mixed in the Gulf of Alaska; average or above in 5 of 8 cases.

Population trends are presented only for sites and species for which surveys were conducted in 1997. For species with data from more than one site, it appears that storm-petrel populations (surface plankton feeders) are increasing at most sites. Patterns across species and regions were not so clear cut for other foraging guilds. Generally most species monitored in the N. Bering and Chukchi, SW Bering, and Southeast regions were stable or increasing. In contrast, in the SE Bering and Gulf of Alaska regions, cormorant population indices were down in 5 of 6 cases, kittiwakes had declined in 4 of 8 cases, and murre counts were recently down in 3 of 8 cases. In these regions gull and tufted puffin counts suggested no recent trends.

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INTRODUCTION

This report is the second 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. This report series is patterned after the publications of the Joint Nature Conservation Committee in Britain (e.g., Thompson et al. 1997). Like the British seabird monitoring program, the one in Alaska is designed to keep track of selected species of seabirds that indicate changes in the marine 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" (Alaska National Interests Land Conservation Act of 1982), and the monitoring program is an integral part of the management of this refuge. 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, and population trends of representative species of various foraging guilds (e.g., murres are off-shore diving fish-eaters, kittiwakes are offshore surface-feeding fish-eaters, auklets are diving plankton-feeders, etc.) at geographically dispersed breeding sites along the entire coastline of Alaska. A total of 12 sites (Fig. 1), located roughly 300-500 km apart, are scheduled for annual surveys, but data were available for only 10 of these in 1997. In addition, colonies near the annual sites are identified for less frequent surveys to "calibrate" the information at the annual sites. Furthermore, other research projects (e.g., those associated with evaluating the impacts of oil spills on marine birds) supplement the monitoring database.

In this report, we summarize information from 1997 for each species; i.e., tables with estimates of average hatch dates and reproductive success and maps with symbols indicating the relative success at various sites. In addition, historical patterns of productivity are illustrated for most annual monitoring sites (those where we have information). Population trend information also is included for sites where data were gathered in 1997.

METHODS

Generally methods were used like those specified in "Standard Operating Procedures for Population Inventories" (USFWS 1997*a, b, c*). Investigators calculated different point estimates for the timing of nesting events, but it appears median and mean hatch dates are similar, so we discuss them together (referred to as "average"). Average hatch dates from previous years were used to put 1997 into perspective. At most annual sites, estimates of reproductive success were based on periodic checks of a sample of nests (usually in plots) throughout the breeding season. A few of the estimates were based on single visits to colonies late in the breeding season to record chicks per nest. We expressed productivity in terms of chick fledged per nest or chick fledged per egg when this variable was available, but occasionally other variables (e.g., chicks hatched per egg) were compared. Population surveys were conducted for ledge-nesting species at times of the day and breeding season when variability in attendance was reduced.

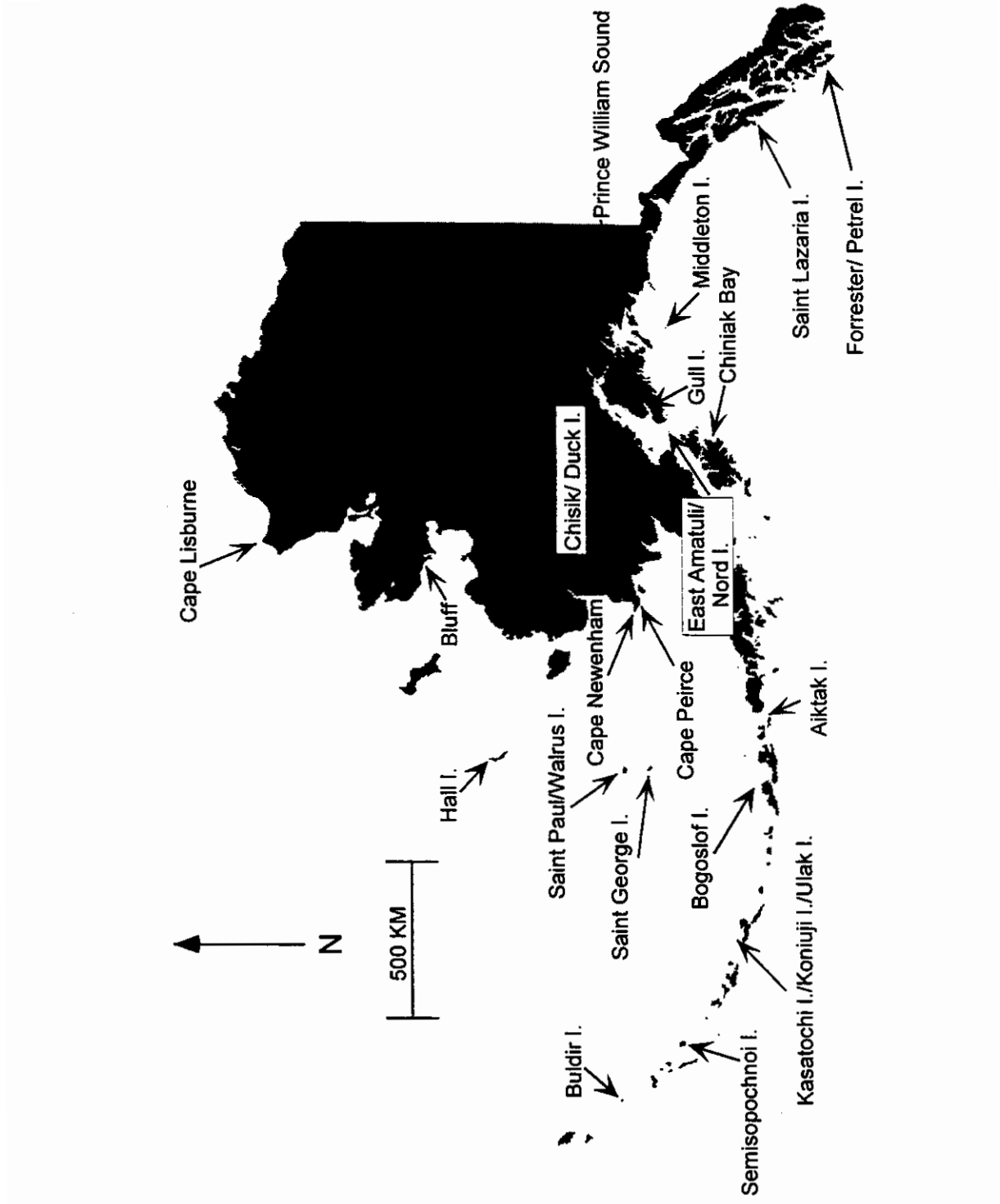

Figure 1. Map of Alaska showing the locations of seabird monitoring sites summarized in this report.

RESULTS

Northern Fulmar (*Fulmarus glacialis*)

Breeding Chronology.--No information was obtained on breeding chronology of northern fulmars in 1997.

Productivity.--No information was obtained on productivity of northern fulmars in 1997.

Populations.--We counted fulmars at Hall Island, one of the sites in the Bering Sea visited periodically. The 1997 count on selected plots averaged 421 birds, up from 271 birds in 1991, the last year counts were made (A. Sowls, unpubl. data). Counts of northern fulmars are scheduled for Chowiet Island in 1998 and for the Pribilof Islands in 1999.

Fork-tailed (*Oceanodroma furcata)* and Leach's (*O. leucorhoa*) Storm-Petrels

Breeding Chronology.--Typically, fork-tailed storm-petrels begin nesting earlier than Leach's storm-petrels, and that was true at Aiktak Island in 1997 (Table 1). In contrast, fork-tails were delayed at St. Lazaria Island in 1997 so that their eggs hatched only a few days earlier than those of Leach's. Timing of hatching was identical for Leach's storm-petrels at Aiktak Island and St. Lazaria Island in 1997. Hatching chronology was later at Aiktak Island in 1997 than in 1996 for both species of storm-petrel (Table 1).

Table 1. Hatching chronology of storm-petrels at Alaskan sites monitored in 1997.

Site/Species	Median	Mean	Long-term Average	Reference
Fork-tailed				
Aiktak I.	20 Jul	21 Jul (16)[a]	16 Jul (2)[a]	Woodward 1998
Saint Lazaria I.		2 Aug (23)	20 Jul (3)	Slater et al. 1998
Leach's				
Aiktak I.	5 Aug	5 Aug (63)	1 Aug (2)	Woodward 1998
Saint Lazaria I.		5 Aug (41)	2 Aug (3)	Slater et al. 1998

[a]Sample size in parentheses represent 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.

Productivity.--In 1997, productivity of fork-tailed and Leach's storm-petrels ranged from over 85% at Buldir Island to only 35% at Ulak Island (Table 2, Figs. 2 and 3). At all three sites where both species occurred (Buldir Island, Aiktak Island, and St. Lazaria Island), Leach's storm-petrels had slightly higher rates of success than fork-tailed storm-petrels. In every case, except for Leach's storm-petrels at Buldir Island, estimates of chick fledged per egg were lower in 1997 than in 1996. Fork-tailed storm-petrels had lower success at Ulak Island, than elsewhere in 1997. We only recently began recording productivity of storm-petrels at most sites, so there are few data for long-term comparison. Nevertheless, at Buldir Island we were able to compare reproductive success over an extended period; 1997 was about average for fork-tailed storm-petrels but above average for Leach's storm-petrels (Figs. 2 and 3).

Populations.--In 1997, counts of burrow entrances were made in monitoring plots at St. Lazaria Island, East Amatuli Island (fork-tailed only), Aiktak Island, Ulak Island, and Buldir Island (all annual sites), and Petrel Island (an intermittent site). Trends could be estimated for St. Lazaria, Aiktak, and Buldir islands and it appears populations have increased at all three sites (Fig. 4). Density also increased at Ulak Island between 1996 and 1997, and was higher at Petrel Island in 1997 than in 1994 when the previous count was made (L. Slater, pers. comm).

Table 2. Reproductive performance of storm-petrels at Alaskan sites monitored in 1997.

Site/Species	Chicks Fledged[a]/egg	No. of Plots	No. of Eggs	Reference
Fork-tailed				
Buldir I.	0.74	6	68	Williams et al. 1998
Ulak I.	0.35	1	40	Scharf and Williams 1997
Aiktak I.	0.57 (0.08)[b]	12	30	Woodward 1998
Saint Lazaria I.	0.61 (0.23)	10	150	Slater et al. 1998
Leach's				
Buldir I.	0.87	6	77	Williams et al. 1998
Aiktak I.	0.55 (0.05)	16	104	Woodward 1998
Saint Lazaria I.	0.79 (0.13)	10	126	Slater et al. 1998

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

Figure 2. Productivity of fork-tailed storm-petrels (chicks/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

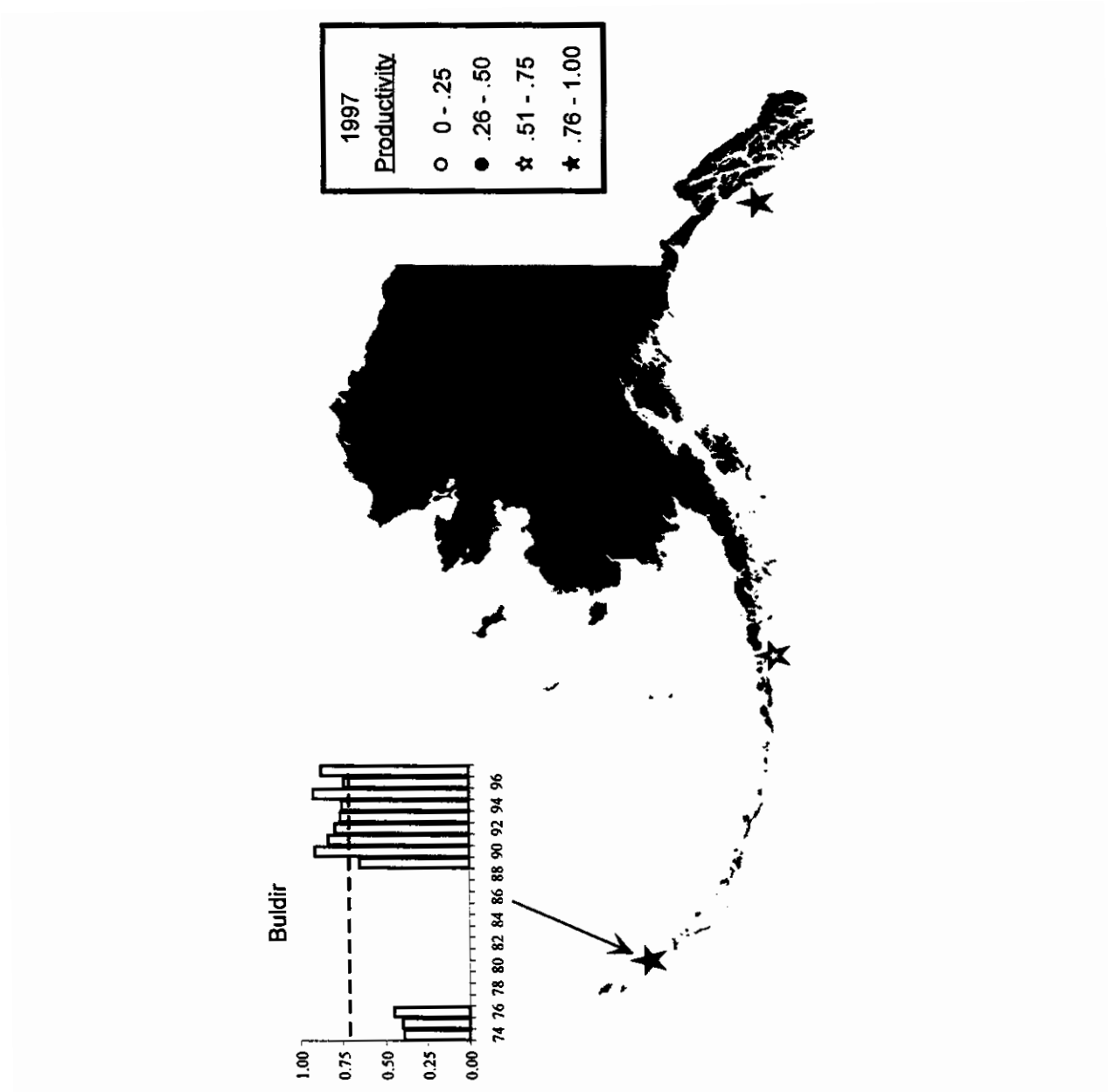

Figure 3. Productivity of Leach's storm-petrels (chicks/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

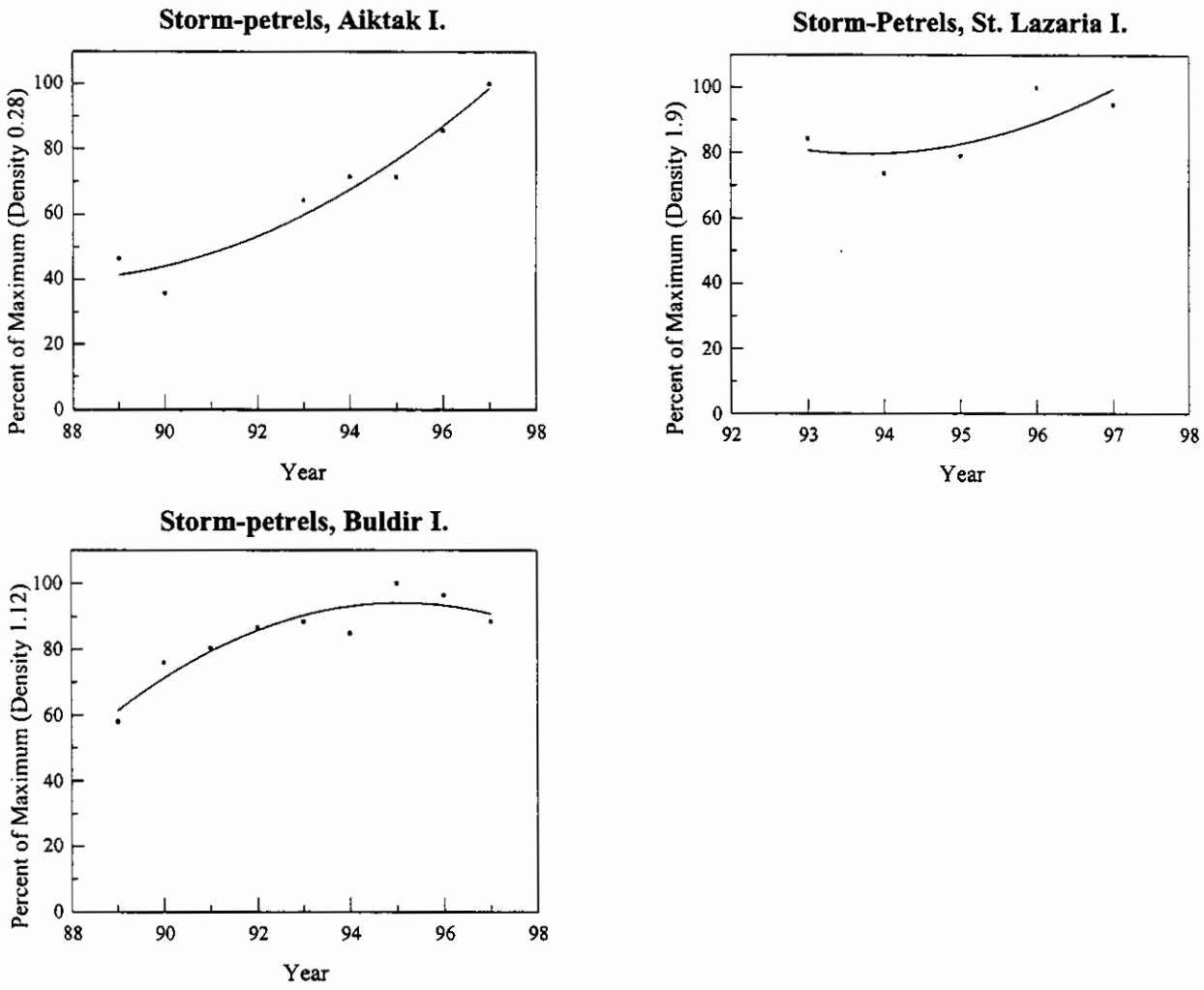

Figure 4. Trends in populations of storm-petrels at Alaskan sites monitored in 1997.

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Breeding Chronology.--Information on breeding chronology of pelagic cormorants was obtained only at Cape Peirce in 1997 (Haggblom 1997). The mean hatch date in 1997 was 13 June, 5 days earlier than the long-term average (18 June, n=6 years).

Productivity.--Generally, the index to productivity for cormorants is obtained by single visits to nesting colonies late in the chick-rearing period when chicks are clearly visible. The parameter, "large chick per nest" is used to describe productivity rates. Productivity varied substantially among sites in 1997 ranging from a low of 0.22 chicks per nest at Chiniak Bay to highs of 2.10 at Kasatochi Island and 2.90 at Bluff (Table 3, Fig. 5). Productivity at most sites in the Bering Sea, where observations were available in both years, was higher in 1997 than in 1996, but Cape Peirce was an exception. In the Gulf of Alaska, pelagic cormorants had lower success in 1997 than in 1996 at all sites. Extended time-series data for three sites indicated 1997 was nearly average at Buldir Island but below average at Cape Peirce and Chiniak Bay (Fig. 5).

Table 3. Reproductive performance of pelagic cormorants at Alaskan sites monitored in 1997.

Site	Chicks/Nest	No. of Plots	No. of Nests	Reference
Bluff	2.90[a] (1.0)[b]	1	21	Murphy 1997
Hall I.	1.68[a]	2	52	Sowls Pers. Com.[c]
Cape Peirce	1.07	12	94	Haggblom 1997
Buldir I.	1.10	1	22	Williams et al. 1998
Kasatochi I.	2.10[d]	1	27	Scharf and Williams 1997
Chiniak Bay	0.22[a]	1	31	D. Irons Pers. Com.[e]
Gull I.	1.23 (1.23)	13	20	S. Zador Pers. Com.[f]
Saint Lazaria I.	1.02 (0.15)	3	90	Slater et al. 1998

[a]Value obtained during a short visit to the colony in the late incubation/ early chick-rearing period, or late in chick-rearing period, and so should be considered a maximum estimate of productivity.
[b]Standard deviation in parentheses
[c]Sowls, A.L., U.S. Fish and Wildlife Service, Personal Communication, 1998
[d]Based on 3 visits to the colony late July to late August.
[e]Irons, D. B., U. S. Fish and Wildlife Service, Personal Communication, 1998
[f]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Populations.--Cormorants are notorious for shifting nesting locations between years, so it is difficult to confidently interpret changes in counts. Nevertheless, numbers of pelagic

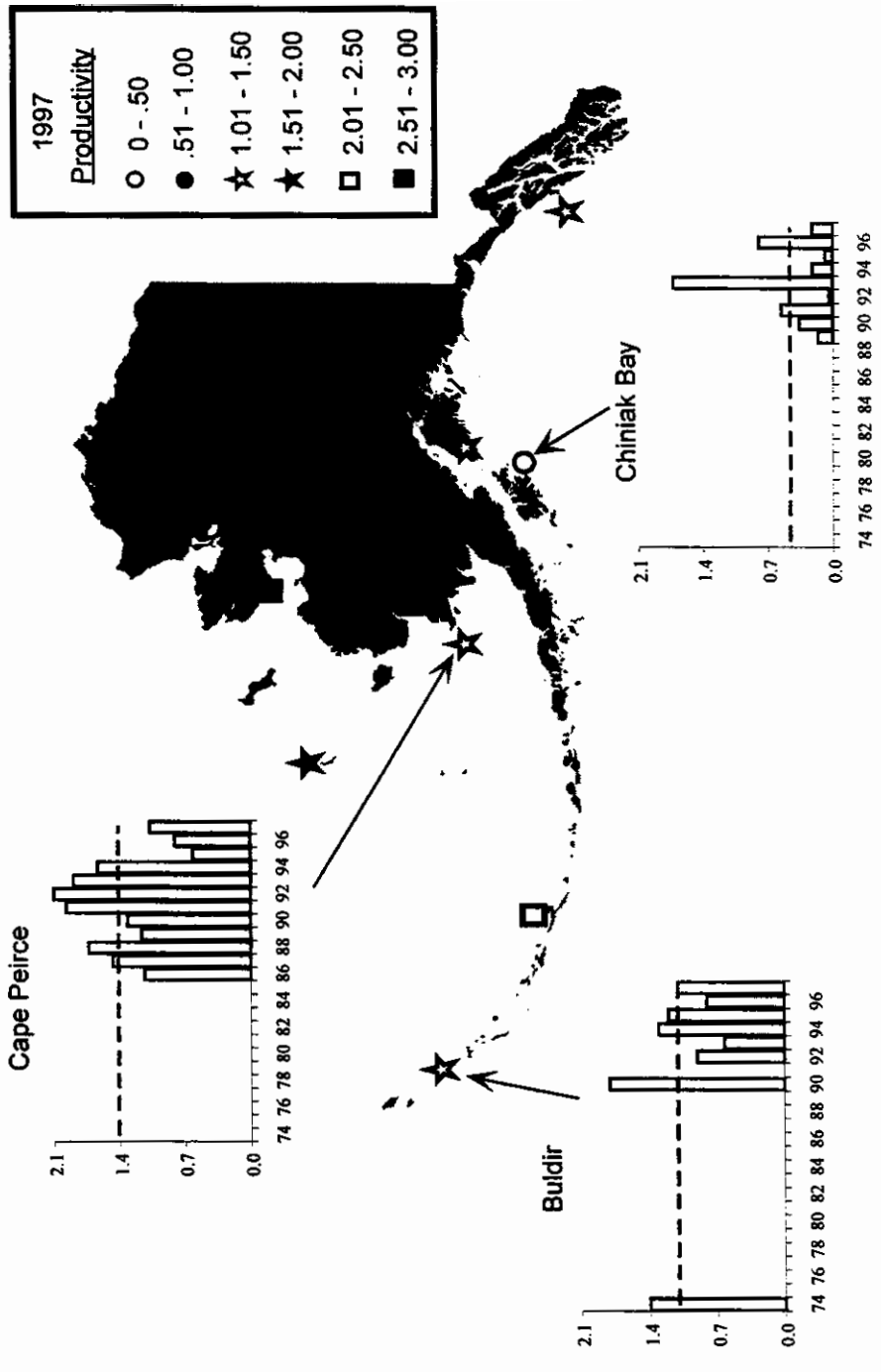

Figure 5. Productivity of pelagic cormorants (large chicks/nest) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

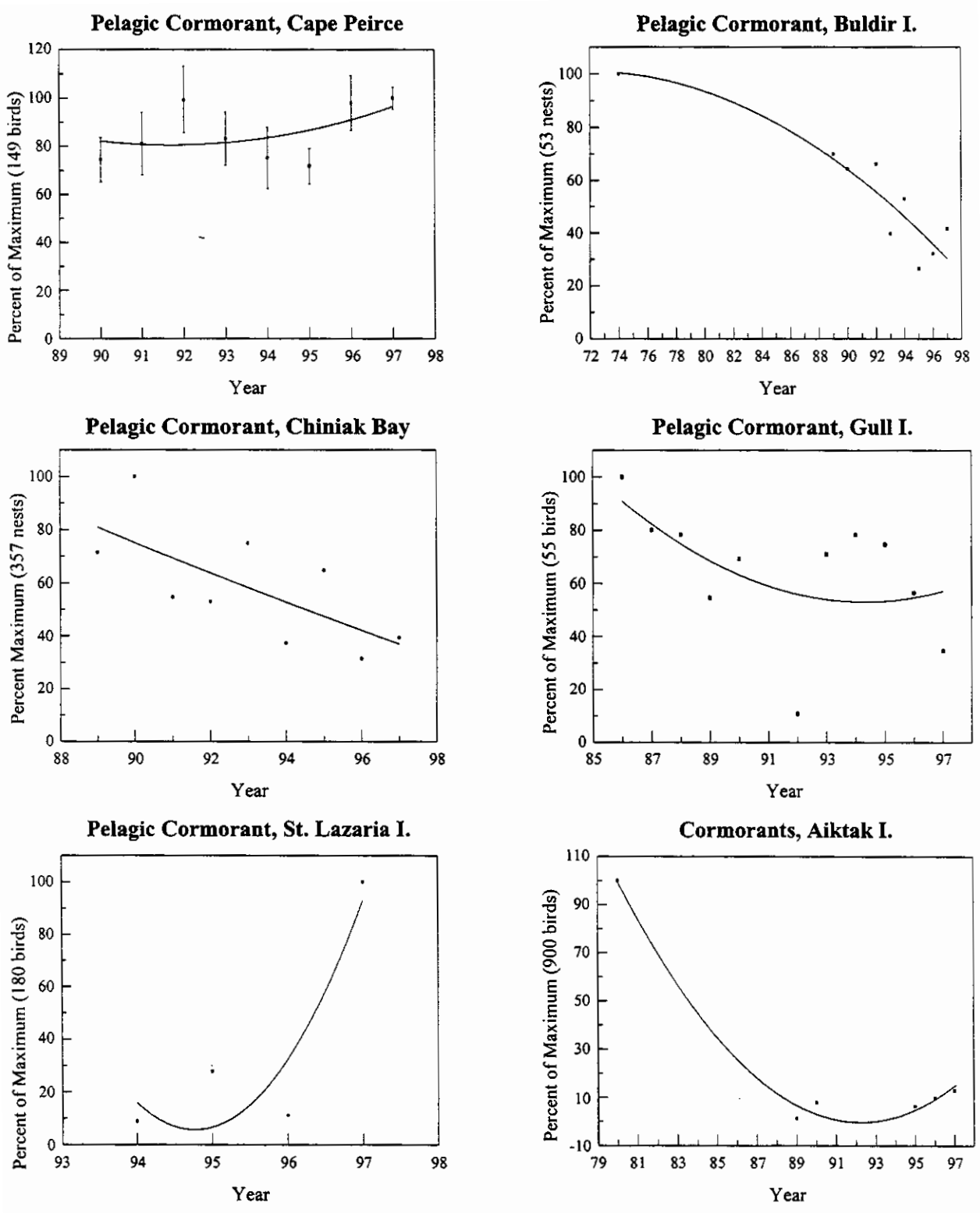

Figure 6. Trends in populations of cormorants at Alaskan sites monitored in 1997. Error bars (90% confidence intervals) are shown for years with multiple counts.

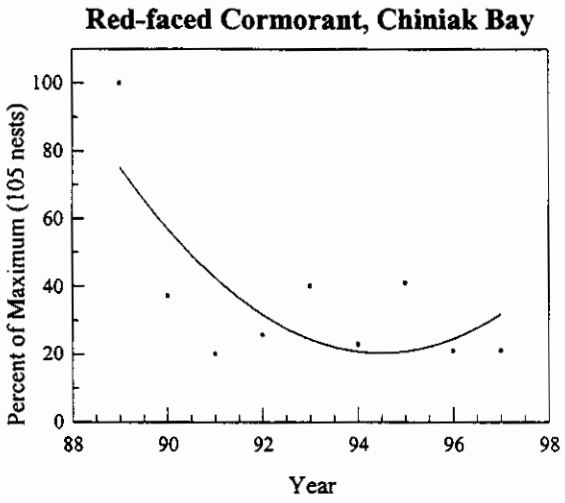

Figure 6. Trends in populations of cormorants at Alaskan sites monitored in 1997 (continued).

cormorants or nests (the index that has been used at some sites) have declined at sites in the western Gulf of Alaska (Chiniak Bay, Gull Island) and Aleutians (Buldir Island and Aiktak Island where counts include pelagic and red-faced cormorants), but increased substantially at St. Lazaria Island in Southeastern Alaska and slightly at Cape Peirce in the Bering Sea (Fig. 6). At sites with few prior counts for comparison, we found higher numbers at Kasatochi in 1997 than in 1996 (Scharf and Williams 1997), and numbers of pelagic cormorants at Forrester Island in Southeastern Alaska in 1997 were similar to prior counts in 1994 (L. Slater pers. comm.).

Red-faced Cormorant (*Phalacrocorax urile*)

Breeding Chronology.--Average hatching dates for red-faced cormorant eggs were similar, 6-9 July, in the Pribilofs (St. Paul Island) and in the eastern Aleutians (Aiktak Island) in 1997 (Table 4). Hatching was a week later in 1997 at St. Paul Island than the long-term average.

Table 4. Hatching chronology of red-faced cormorants at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Saint Paul I.	5 Jul	9 Jul (31)[a]	1 Jul (8)[a]	Carten and Cavin 1997
Aiktak I.	6 Jul	6 Jul (14)		Woodward 1998

[a]Sample size in parentheses represent 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.

Productivity.--In 1997, productivity of red-faced cormorants ranged from near failure at Semisopochnoi Island and Chiniak Bay to a high rate of success at Kasatochi Island (Table 5 Fig. 7). Red-faced cormorants in the Pribilof Islands (i.e., St. Paul Island and Walrus Island) had moderately high rates of productivity, but cormorants had relatively low success at Ulak Island and Aiktak Island (Table 5, Fig. 7). Only three sites were comparable between 1996 and 1997. Cormorants at St. Paul Island and Chiniak Bay had slightly and substantially lower success, respectively, in 1997 than in 1996, whereras success rates were higher in 1997 than in 1996 at Kasatochi Island. At the two sites with relatively lengthy time series, 1997 was nearly average at St. Paul Island and below average at Chiniak Bay.

Populations.--As with pelagic cormorants, shifting among sites occurs in red-faced cormorants. In 1997 red-faced cormorants were counted at Chiniak Bay, and this species was included in the survey of both species combined at Aiktak Island. Apparently numbers are declining at both sites (Fig. 6). In contrast, more red-faced cormorants were counted at Kasatochi in 1997 than in 1996 (Scharf and Williams 1997). Fewer red-faced cormorants were counted at Walrus Island, Pribilofs in 1997 than a decade earlier (Byrd 1997).

Table 5. Reproductive performance of red-faced cormorants at Alaskan sites monitored in 1997.

Site	Chicks/Nest	No. of Plots	No. of Nests	Reference
Saint Paul I.	1.44 (0.62)[a]	5	91	Carten and Cavin 1997
Walrus I.	1.63[b]	1	16	Byrd 1997
Semisopochnoi I.	0.01[b]	1	120	Thomson 1997
Kasatochi I.	2.20[c]	1	20	Scharf and Williams 1997
Ulak I.	0.60[b]	1	76	Scharf and Williams 1997
Aiktak I.	0.19 (0.05)	1	53	Woodward 1998
Chiniak Bay	0.05[b]	1	22	D. Irons Pers. Com.[d]

[a]Standard deviation in parentheses

[b]Value obtained during a short visit to the colony in the late incubation/ early chick-rearing period, or late in chick-rearing period, and so should be considered a maximum estimate of productivity.

[c]Based on 3 visits to the colony late July to late August.

[d]Irons, D. B., U. S. Fish and Wildlife Service, Personal Communication, 1998

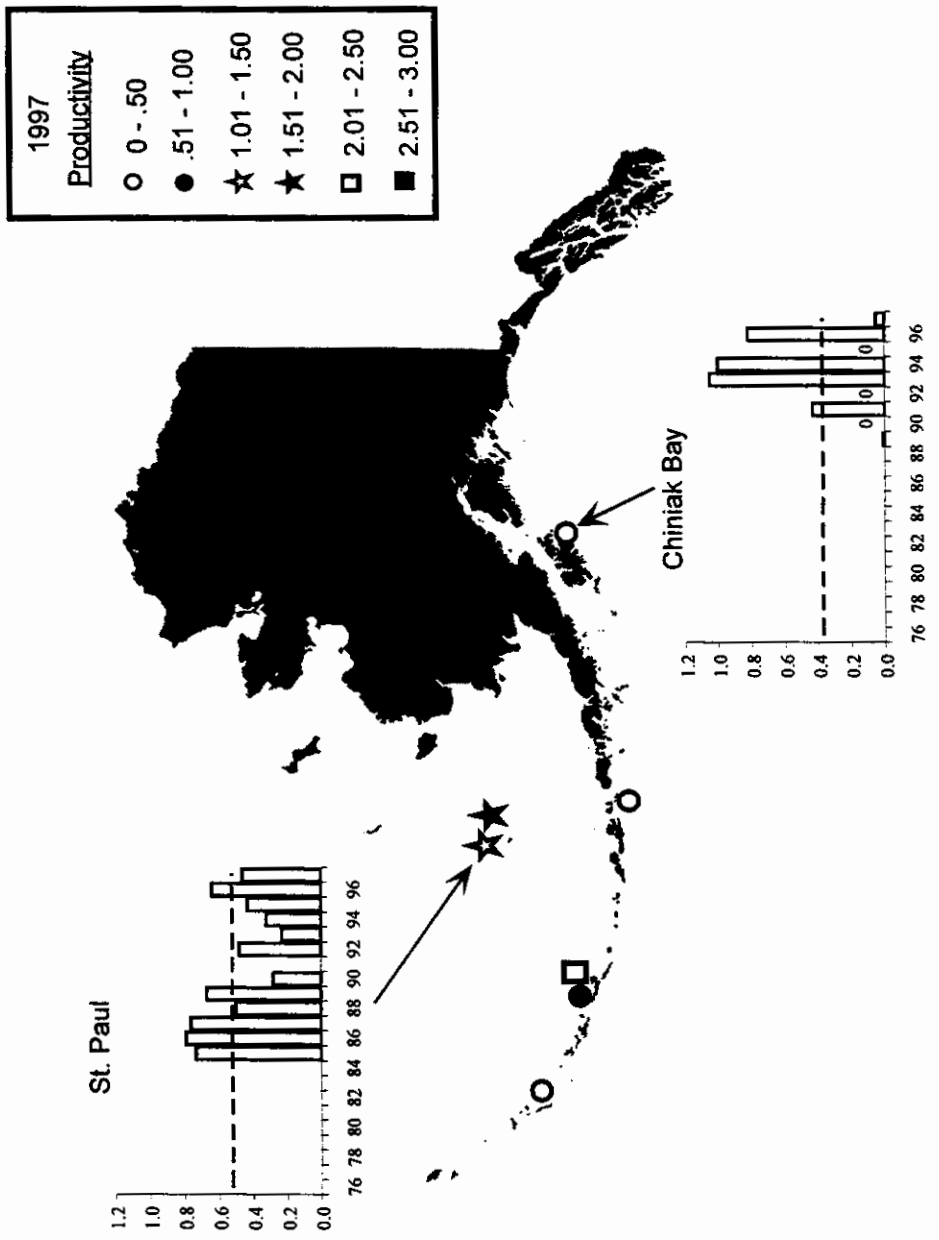

Figure 7. Productivity of red-faced cormorants (large chicks/nest) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Glaucous-winged Gull *(Larus glaucescens)*

Breeding Chronology.--Median hatch dates for gulls were in late June and early July in 1997 (Table 6). Apparently gulls nested slightly earlier in Cook Inlet (Gull Island and Chisik/Duck Islands) than in the eastern Aleutians (Aiktak Island). Hatching occurred more than a week earlier in 1997 at Aiktak Island than in the previous two years, but at Gull Island the median hatch date was similar to 1996.

Table 6. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	5 Jul (93)[a]	5 Jul	14 Jul (3)[a]	Woodward 1998
Gull I.	1 Jul (60)		2 Jul (2)	S. Zador Pers. Com.[b]
Chisik I./Duck I.	27 Jun (24)			S. Zador Pers. Com.[b]

[a]Sample size in parentheses represent 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.
[b]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Productivity.--Approximately 60% to 70% of the gull eggs hatched at five of the six colonies we monitored (Table 7, Fig. 8). The exception was Aiktak Island where 85% of the eggs hatched in 1997. At the four sites where comparisons could be made between 1996 and 1997 (Buldir Island, Aiktak Island, Gull Island, and Chisik Island), two each had higher and lower success in 1997.

Populations.--Gulls were counted in plots at St. Lazaria Island, East Amatuli Island, Aiktak Island, Buldir Island, and Cape Lisburne in 1997. Data were adequate to plot trends at all but Cape Lisburne. It appears numbers are declining in the study plots at Buldir Island. In contrast, numbers have increased at St. Lazaria Island, and no trends were evident at Aiktak Island or East Amatuli Island (Fig. 9).

Table 7. Reproductive performance of glaucous-winged gulls at Alaskan sites monitored in 1997.

Site	Hatching Success[a]	No. of Plots	No. of Nests	Reference
Buldir I.	0.53	1	88	Williams et al. 1998
Aiktak I.	0.85 (0.04)[b]	5	106	Woodward 1998
East Amatuli I.	0.70	1	49	A. Kettle Pers. Com.[c]
Gull I.	0.61 (0.03)	5	60	S. Zador Pers. Com[d]
Chisik I./Duck I.	0.60 (0.16)	3	24	S. Zador Pers. Com[d]
Saint Lazaria I.	0.64	4	53	Slater et al. 1998

[a]Total chicks/Total eggs
[b]Standard deviation in parentheses
[c]Kettle, A., Alaska Maritime NWR, USFWS. Personal Communication, 1998.
[d]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Figure 8. Productivity of glaucous-winged gulls (hatching success) at Alaskan sites monitored in 1997.

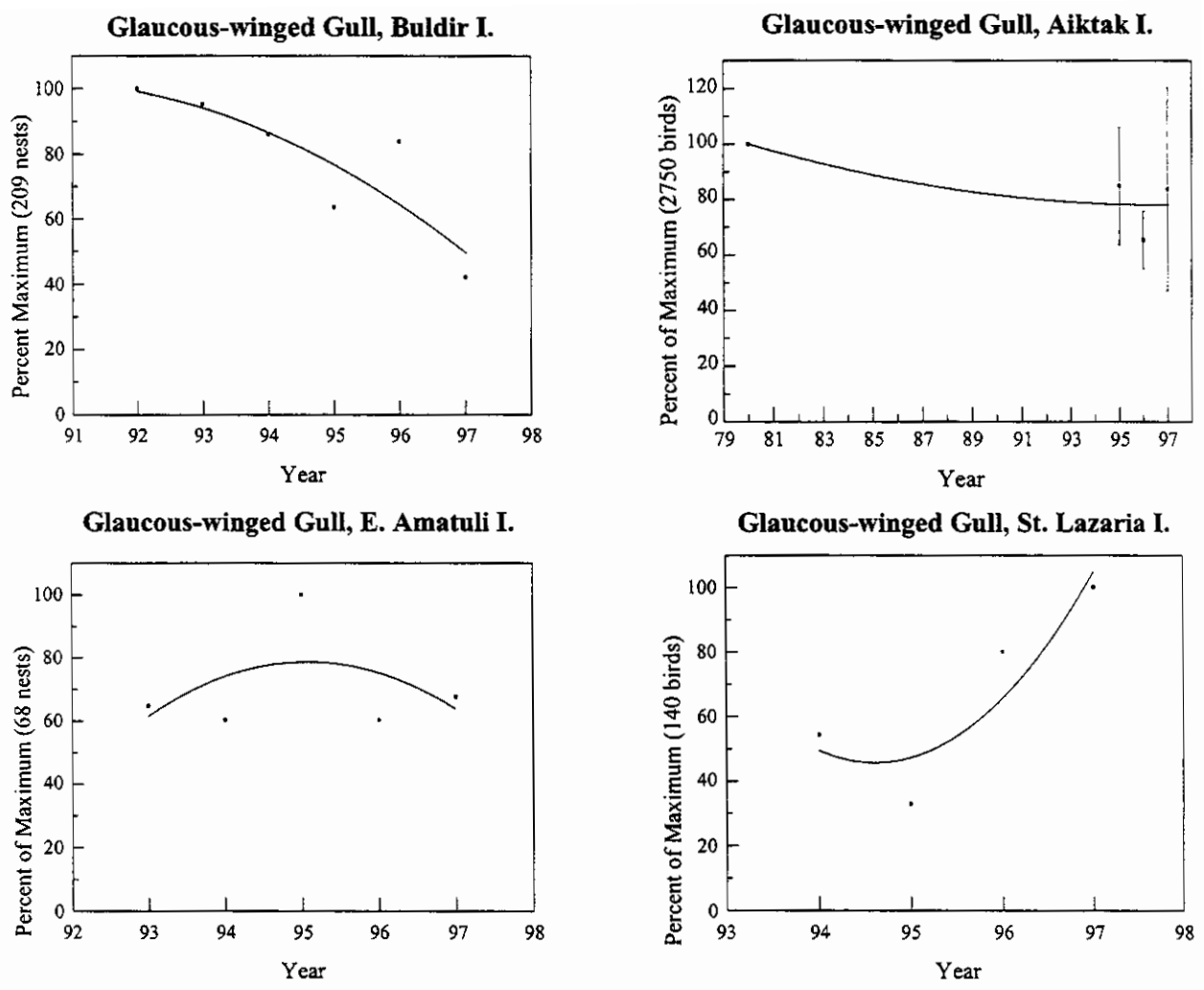

Figure 9. Trends in populations of glaucous-winged gulls at Alaskan sites monitored in 1997. Error bars (90% confidence intervals) are shown for years with multiple counts.

Black-legged Kittiwake (*Rissa tridactyla*)

Breeding Chronology.--At Buldir Island. in the western Aleutians and in Cook Inlet (Gull Island and Chisik/Duck Islands), average hatch was about 8-9 July (Table 8). Elsewhere it was 13-20 July in 1997. Average hatch dates in 1997 were earlier than the long-term mean at St. Paul Island, whereas 1997 was later at Cape Newenham and East Amatuli Island. Hatching chronology in 1997 was similar to the long-term averages at all other sites (Table 8).

Table 8. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Cape Lisburne	25 Jul (80)[a]		26 Jul (5)[a]	D. Roseneau Pers. Com.[b]
Saint Paul I.		19 Jul (133)	24 Jul (14)	Cartin and Cavin 1997
Saint George I.		20 Jul (38)	21 Jul (13)	Schindler 1997
Cape Newenham		13 Jul (82)	6 Jul (2)	Haggblom 1997
Cape Peirce		13 Jul (82)	13 Jul (3)	Haggblom 1997
Buldir I.	9 Jul	9 Jul (276)	8 Jul (10)	Williams et al. 1998
East Amatuli I.	17 Jul (134)		11 Jul (4)	A. Kettle Pers. Com.[c]
Gull I.	8 Jul (300)		9 Jul (2)	S. Zador Pers. Com.[d]
Chisik I./Duck I.	8 Jul (140)		6 Jul (2)	S. Zador Pers. Com.[d]

[a]Sample size in parentheses represent 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.
[b]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.
[c]Kettle, A., Alaska Maritime NWR, USFWS. Personal Communication, 1998.
[d]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Productivity.--Data were gathered at 16 sites in 1997 (Table 9, Fig. 10). Surprisingly, no complete reproductive failures were recorded, nevertheless success rates were not particularly high anywhere. Rates exceeded 0.6 fledglings per nest at only one site in 1997 compared to 4 sites in 1996. Nevertheless, in 1997, reproductive success was higher than or equal to 1996 at all sites in the Bering Sea and Chuckchi Sea regions. In the Gulf of Alaska, rates were similar at Chiniak Bay between years, but in the Barren Islands, success was lower in 1997 than in 1996. For eight sites with at least five years of historic data, our indices of productivity were average at all but Cape Lisburne, where success was below average in 1997 (Fig. 10).

Table 9. Reproductive performance of black-legged kittiwakes at Alaskan sites monitored in 1997.

Site	Chicks Fledged/Nest[a]	No. of Plots	No. of Nests	Reference
Cape Lisburne	0.42 (0.10)[b]	8	192	D. Roseneau Pers. Com.[c]
Bluff	0.54 (0.10)	5	183	Murphy 1997
Hall I.	0.65[d]	2	88	Sowls Pers. Com[e]
Saint Paul I.	0.29 (0.15)	12	301	Carten and Cavin 1997
Walrus I.	0.68[d]		25	Byrd 1997
Saint George I.	0.27 (0.22)	4	105	Schindler 1997
Cape Newenham	0.19 (0.25)	4	103	Haggblom 1997
Cape Peirce	0.10 (0.12)	13	204	Haggblom 1997
Buldir I.	0.30 (0.05)	19	493	Williams et al. 1998
Koniuji I.	0.55[d] (0.08)	10	674	Scharf and Williams 1997
Bogoslof I.	0.90[d]	1	80	Byrd and Williams 1997
Chiniak Bay	0.29[d]	1	3926	D. Irons Pers. Com.[f]
East Amatuli I.	0.30 (0.13)	11	304	Roseneau et al. 1998*a*
Gull I.	0.64 (0.36)	11	300	S. Zador Pers. Com.[g]
Chisik I./Duck I.	0.02 (0.03)	10	140	S. Zador Pers. Com.[g]
Prince William Sound	0.24[h]		21,487	D. Irons Pers. Com.[f]

[a]Nests with fledged chick/Total nests
[b]Standard deviation in parentheses
[c]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.
[d]Value obtained during a short visit to the colony early in the chick-rearing period and so should be considered a maximum estimate of productivity.
[e]Sowls, A.L., U.S. Fish and Wildlife Service, Personal Communication, 1998
[f]Irons, D. B., U. S. Fish and Wildlife Service, Personal Communication, 1998
[g]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.
[h]Value obtained during two short visits: one early in the season and one late in the chick-rearing period.

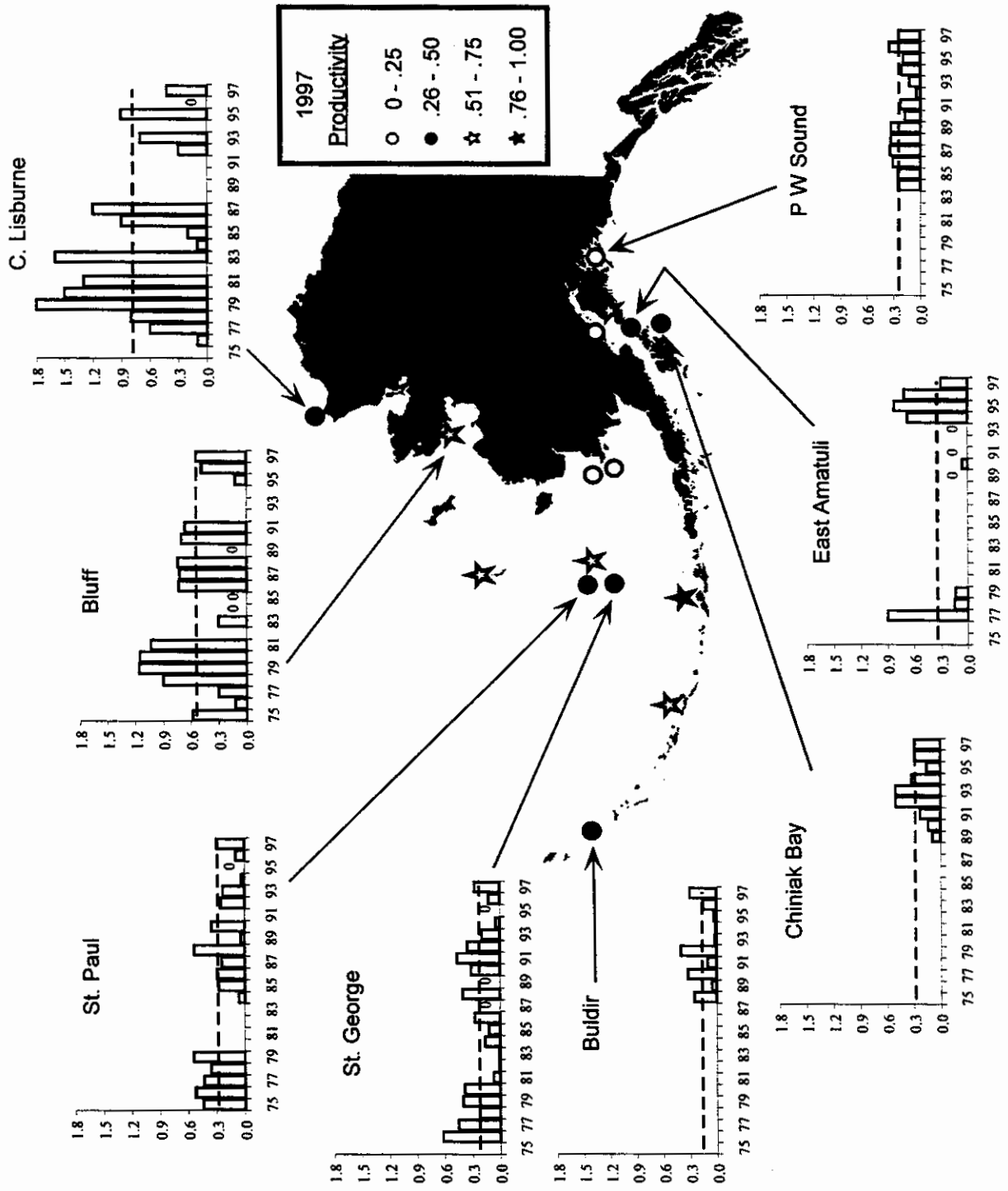

Figure 10. Productivity of black-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Populations.--In 1997 black-legged kittiwakes were counted on monitoring plots in the Chukchi Sea (Cape Lisburne), the eastern Bering Sea (Bluff, Walrus Island in the Pribilofs, and Capes Peirce and Newenham), the Aleutians (Koniuji Island), and the northern Gulf of Alaska (Chisik Island, Gull Island, E. Amatuli Island, Prince William Sound, and Chiniak Bay). We were able to describe trends at most of these sites (Fig. 11). At Cape Lisburne in the Chukchi Sea, kittiwake populations have not demonstrated a definite trend over the past 20 years. In the eastern Bering Sea, numbers of kittiwakes apparently are increasing at Bluff and they exhibited no trend at Cape Newenham. In contrast, numbers have declined at Cape Peirce in the past 10 years, and fewer birds were counted at Walrus Island in 1997 then a decade earlier (Byrd 1997). At the only site where kittiwakes were surveyed in the Aleutians in 1997, Koniuji Island, numbers counted in recent years were similar to counts in 1982 (Fig. 11). Kittwake counts at colonies in the Gulf of Alaska indicated stable populations at E. Amatuli Island and Gull Island but fewer birds were present at Chiniak Bay and Chisik Island in 1997 than in previous years. Furthermore, an increase is occuring in Prince William Sound (Fig. 11).

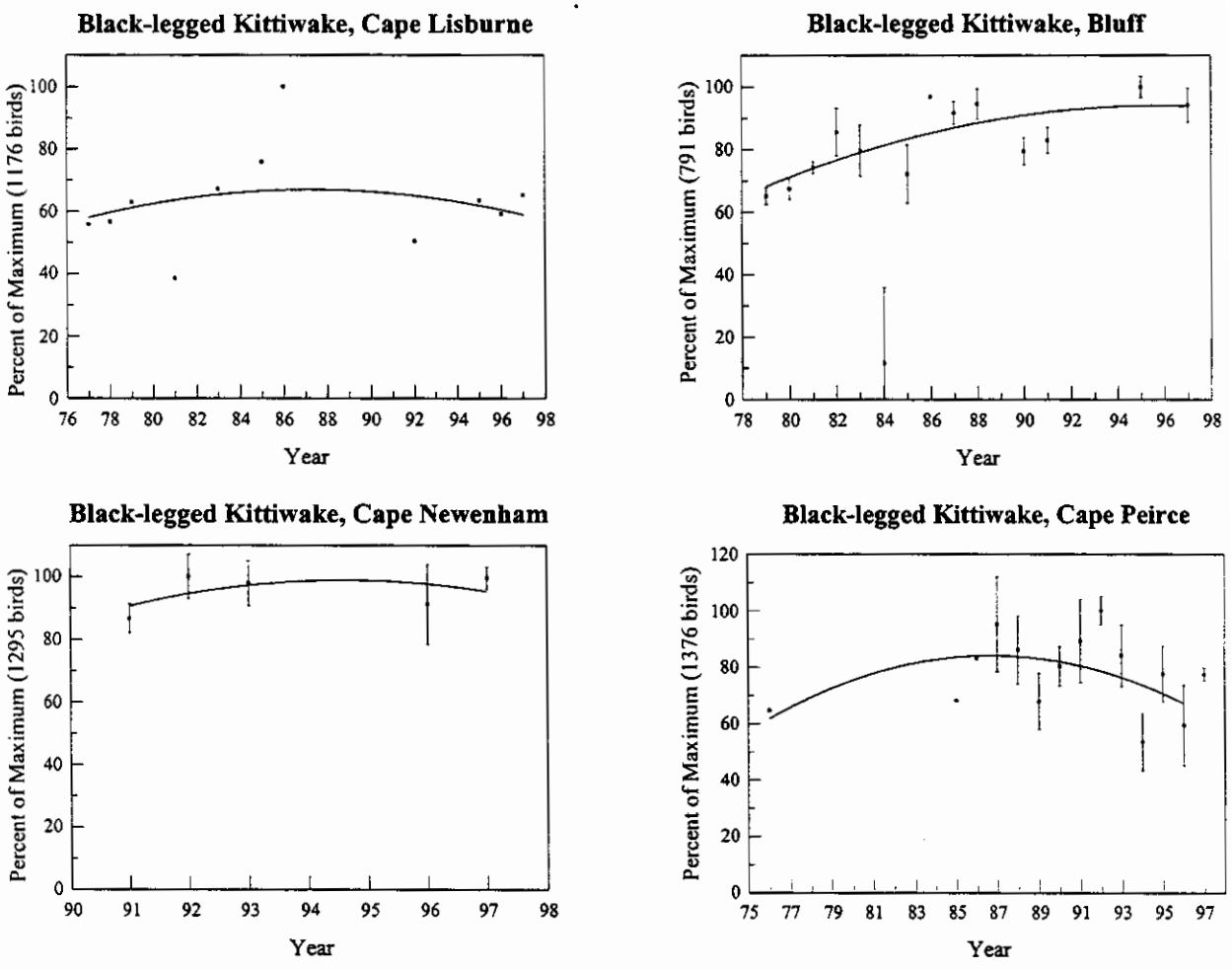

Figure 11. Trends in populations of black-legged kittiwakes at Alaskan sites monitored in 1997. Error bars (90% confidence intervals) are shown for years with multiple counts.

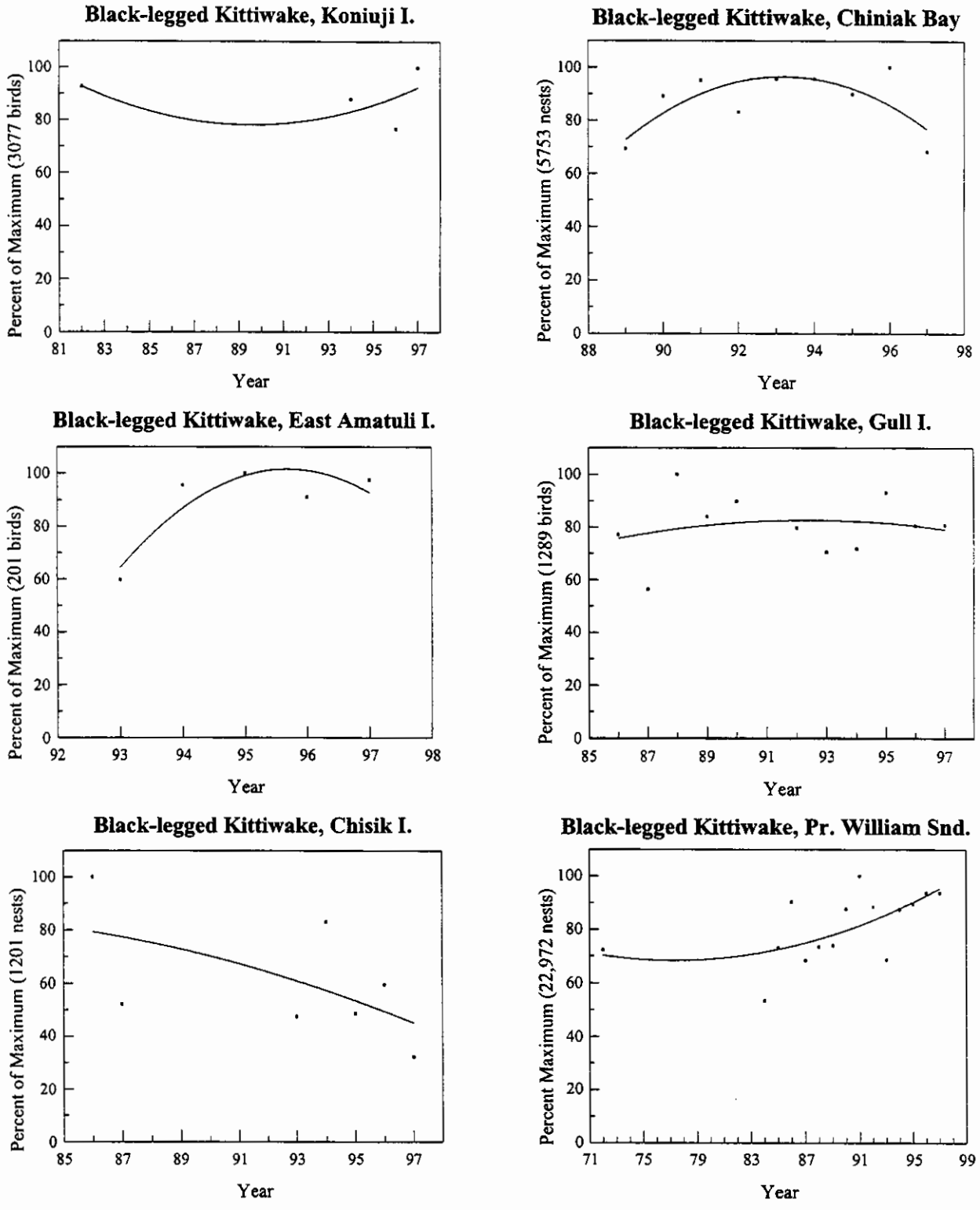

Figure 11. Trends in populations of black-legged kittiwakes at Alaskan sites monitored in 1997 (continued).

Red-legged Kittiwake (*Rissa brevirostris*)

Breeding Chronology.--Chicks hatched in mid-July at all three sites where they were monitored in 1997 (Table 10). Hatch dates in 1997 were a week earlier than the long-term average at St. Paul Island, but timing at both St. George Island and Buldir Island was similar to past years.

Table 10. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Saint Paul I.		19 Jul (11)[a]	26 Jul (12)[a]	Cartin and Cavin 1997
Saint George I.		18 Jul (74)	21 Jul (16)	Schindler 1997
Buldir I.	13 Jul	15 July(73)	13 Jul (10)	Williams et al. 1998

[a]Sample size in parentheses represent 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.

Productivity.-- In 1997, red-legged kittiwakes experienced average reproductive success at St. Paul Island, St. George Island, and Buldir Island (Table 11, Fig. 12). Rates were higher at all three sites than in 1996. A short visit to Bogoslof Island during the late incubation and early chick-rearing period, indicated 75% of the nests were still successful at that point suggesting success would be relatively high at that site in 1997 (Byrd and Williams 1997).

Table 11. Reproductive performance of red-legged kittiwakes at Alaskan sites monitored in 1997.

Site	Chicks Fledged/Nest[a]	No. of Plots	No. of Nests	Reference
Saint Paul I.	0.24 (0.68)[b]	2	29	Carten and Cavin 1997
Saint George I.	0.26 (0.16)	9	227	Schindler 1997
Buldir I.	0.19 (0.03)	12	259	Williams et al. 1998
Bogoslof I.	0.75[c]	1	8	Byrd and Williams 1997

[a]Nests with fledged chick/Total nests

[b]Standard deviation in parentheses

[c]Value obtained during a short visit to the colony in the late incubation/ early chick-rearing period and so should be considered a maximum estimate of productivity.

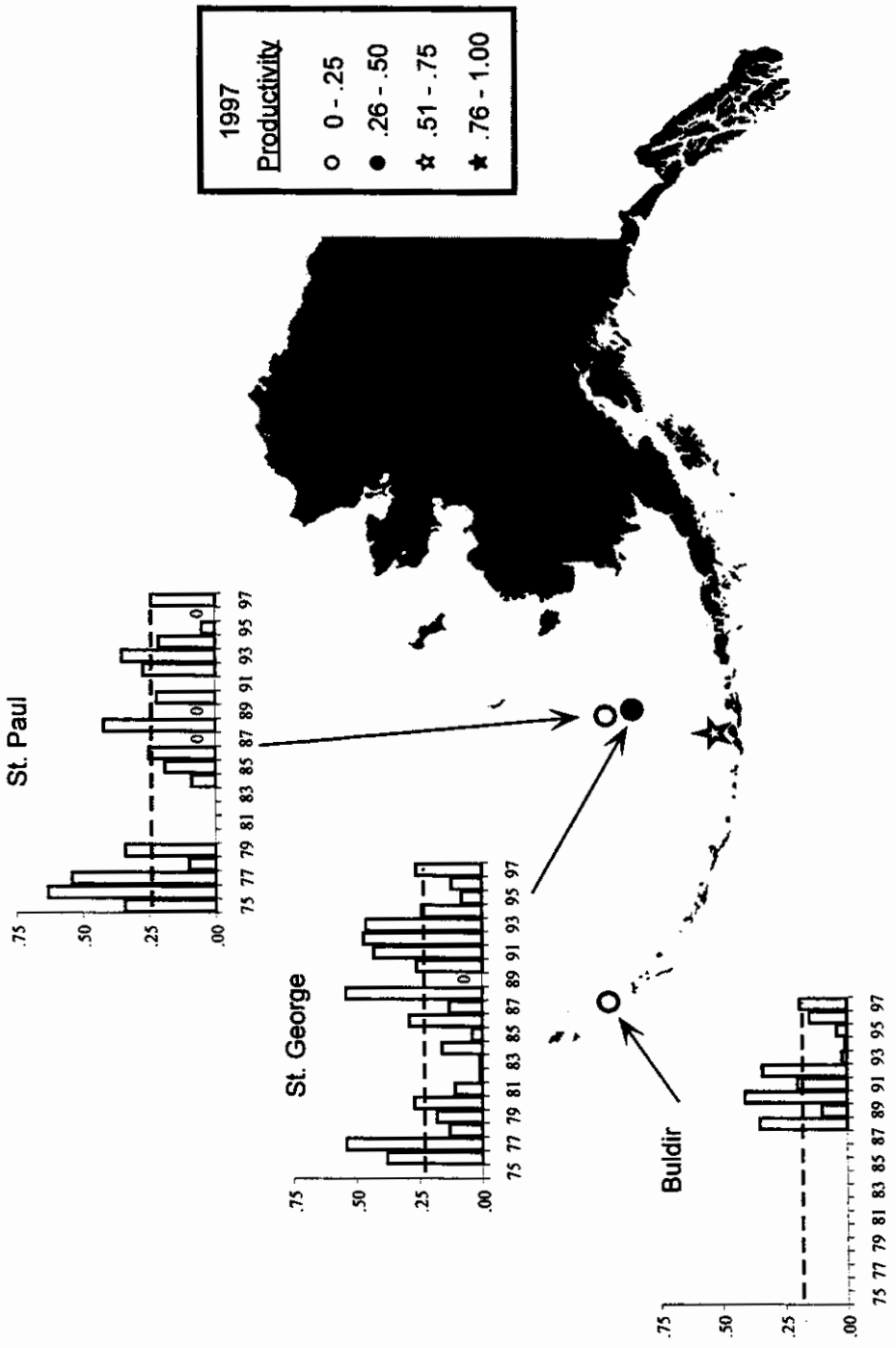

Figure 12. Productivity of red-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Populations.--Red-legged kittiwakes were not counted at St. Paul Island, St. George Island, Buldir Island, or Bogoslof Island in 1997. Population counts at these sites are scheduled at 3-year intervals. Nevertheless, we visited the new colony at Koniuji Island discovered in 1996 and found 20 birds and 10 nests in 1997, up from 13 birds and 3 nests in 1996 (Sharf and Williams 1997).

Common Murre (*Uria aalge*)

Breeding Chronology.--Timing of nesting events was earliest at colonies on mainland capes, i.e. Newenham and Peirce (average hatch the third week in July) and Lisburne (average hatch the end of July) (Table 12). The median hatch date was during the first 10 days of August at most sites in the northern Gulf of Alaska (E. Amatuli Island, Gull Island, Chisik Island), in the Pribilofs (St. Paul Island and St. George Island), and in the central Aleutians (Kasatochi Island). Colonies with the latest average hatching dates (mid-August) were in the eastern Aleutians (Aiktak Island) and Southeastern Alaska (St. Lazaria Island). Average hatch date was earlier in 1997 at East Amatuli Island than in previous years. Hatching occurred later than average at the Pribilofs, but hatching at all other sites occurred at about average dates.

Table 12. Hatching chronology of common murres at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Cape Lisburne	29 Jul	30 Jul (25)[a]	2 Aug (3)[a]	D. Roseneau Pers. Com.[b]
Saint Paul I.		10 Aug (30)	4 Aug (13)	Cartin and Cavin 1997
Saint George I.		9 Aug (15)	4 Aug (14)	Schindler 1997
Cape Newenham		22 Jul (33)	20 Jul (3)	Haggblom 1997
Cape Peirce		16 Jul (83)	19 Jul (3)	Haggblom 1997
Kasatochi I.	5 Aug	8 Aug (20)	8 Aug (2)	Scharf and Williams 1997
Aiktak I.	18 Aug	16 Aug (35)	16 Aug (3)	Woodward 1998
East Amatuli I.	2 Aug (278)		8 Aug (5)	A. Kettle Pers. Com.[c]
Gull I.	9 Aug (123)		12 Aug (2)	S. Zador Pers. Com.[d]
Chisik I.	7 Aug (168)		9 Aug (2)	S. Zador Pers. Com.[d]
Saint Lazaria I.	14 Aug	14 Aug (44)	14 Aug (4)	Slater et al. 1998

[a]Sample size in parentheses represent 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.
[b]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.
[c]Kettle, A., Alaska Maritime NWR, USFWS. Personal Communication, 1998.
[d]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Productivity.--At most sites in Alaska, annual productivity normally averages between 55%-70% (Byrd et al. 1993). Reproductive success of common murres was particularly high (>80%) in 1997 at East Amatuli Island in the Gulf of Alaska, and murres breeding at other sites

in this region (i.e., Chisik/Duck Islands, Gull Island, St. Lazaria Island) also had average or higher success (Fig. 13). Rates of success were below average in the Bering Sea, but about average in the Chukchi Sea region (Table 13, Fig. 13). Compared to 1996, rates of success in 1997 were similar at Cape Lisburne, lower in the southern Bering Sea (Pribilofs, n. Bristol Bay, and the Aleutians), and mixed in the Gulf of Alaska (higher in 1997 at E. Amatuli Island and St. Lazaria Island but lower at Chisik/Duck Islands and Gull Island).

Table 13. Reproductive performance of common murres at Alaskan sites monitored in 1997.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
Cape Lisburne	0.66	1	35	D. Roseneau Pers. Com.[b]
Saint Paul I.	0.40 (0.17)[c]	4	77	Carten and Cavin 1997
Saint George I.	0.33 (0.07)	4	45	Schindler 1997
Cape Newenham	0.14 (0.03)	4	73	Haggblom 1997
Cape Peirce	0.33 (0.19)	10	192	Haggblom 1997
Kasatochi I.	0.26 (0.05)	1	70	Scharf and Williams 1997
Aiktak I.	0.53 (0.15)	6	168	Woodward 1998
East Amatuli I.	0.81 (0.09)	10	311	Roseneau et al. 1998*a*
Gull I.	0.56 (0.23)	8	109	S. Zador Pers. Com.[d]
Chisik I./Duck I.	0.63 (0.13)	11	168	S. Zador Pers. Com.[d]
Saint Lazaria I.	0.71 (0.09)	4	56	Slater et al. 1998

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.
[b]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.
[c]Standard deviation in parentheses
[d]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998

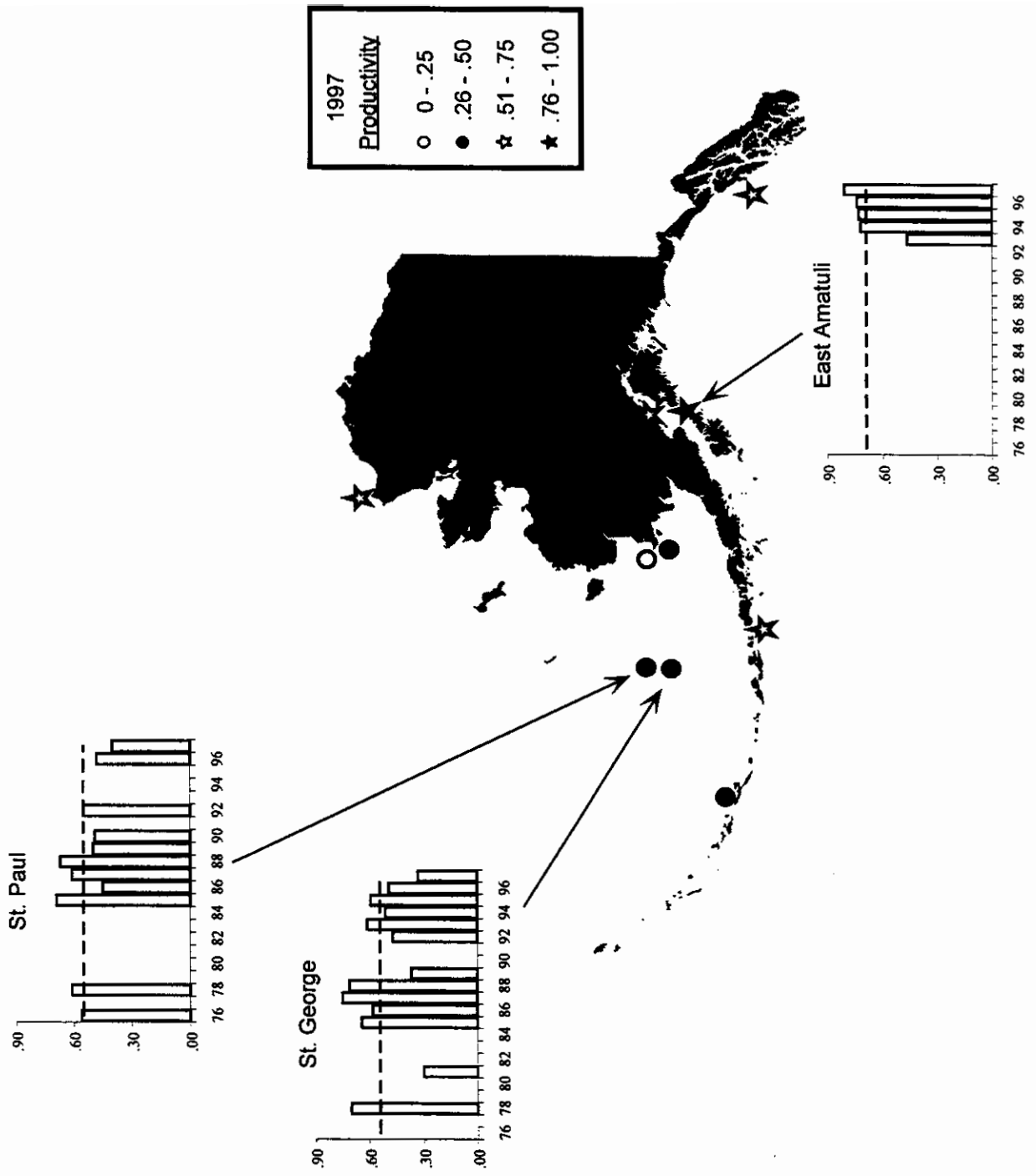

Figure 13. Productivity of common murres (chicks fledged/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Populations.--In 1997, common murres were counted at 17 sites. Trends could be estimated at 12 sites, but too few counts have been made in previous years to plot overall trends for the other 5 sites (Walrus Island, Koniuji Island, Kasatochi Island, Ulak Island, and Semisopochnoi Island). Nevertheless, comparisons for these latter sites are made with available prior data. At Cape Lisburne in the Chukchi Sea, murres (both species combined) have increased since the mid-1970s, particularly since the mid-1980s (Fig. 14). In the Bering Sea, no trend was evident in common murres at Bluff since the early 1980s, and numbers at Cape Newenham and Cape Peirce appear to have been stable since 1993 and 1989, respectively. At Hall Island, numbers were higher in 1997 than the previous count in 1991, but there was no overall trend. At Walrus Island, Pribilofs, fewer common murres were counted in 1997 than were seen in 1987 (Byrd 1997). In the Aleutians, counts were made of either common murres or both species combined at five islands; Aiktak, Koniuji, Kasatochi, Ulak, and Semisopochnoi. At Aiktak Island, fewer murres were present in 1997 than in 1996, and the overall trend is relatively level after an apparent decline in the early 1980s (Fig. 14). Elsewhere in the Aleutians, common murre numbers remained similar to 1996 at Kasatochi Island, counts of common and thick-billed murres combined where higher in 1997 than any previous year (1994-1996) at Koniuji Island (Scharf and Williams 1997) and numbers of the two species (combined) were higher at Semisopochnoi Island in 1997 than in 1977, the previous count year (Thomson 1997). Numbers of murres at Ulak Island in 1997 (3,356 birds, both species combined, Scharf and Williams 1997) also were higher than in 1980 (1,195, Early et al. 1981). In the northern Gulf of Alaska, counts of common murres generally were higher in 1997 than in 1996 at Gull Island where populations have increased since the mid-1980s and at East Amatuli Island, and Nord Island where numbers recently appear to be increasing following the *Exxon Valdez* oil spill in 1989 (Roseneau et al 1998*b*). In contrast, murre numbers at Chisik and Duck Islands in Cook Inlet, Middleton Island in the central Gulf of Alaska, and St. Lazaria Island in Southeastern Alaska are continuing to decline (Fig. 14).

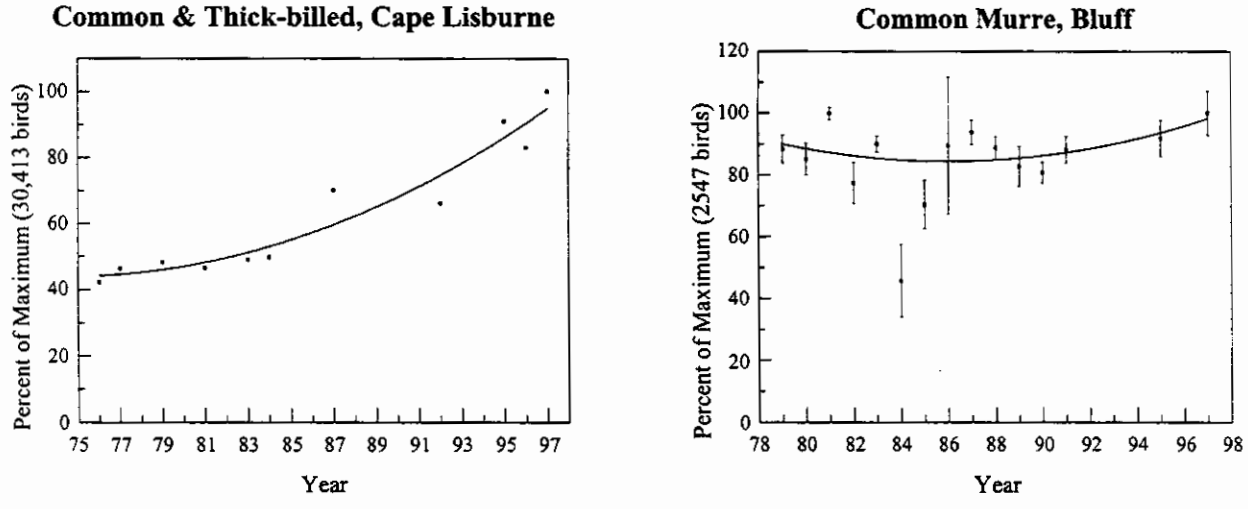

Figure 14. Trends in populations of murres at Alaskan sites monitored in 1997. Error bars (90% confidence intervals) are shown for years with multiple counts.

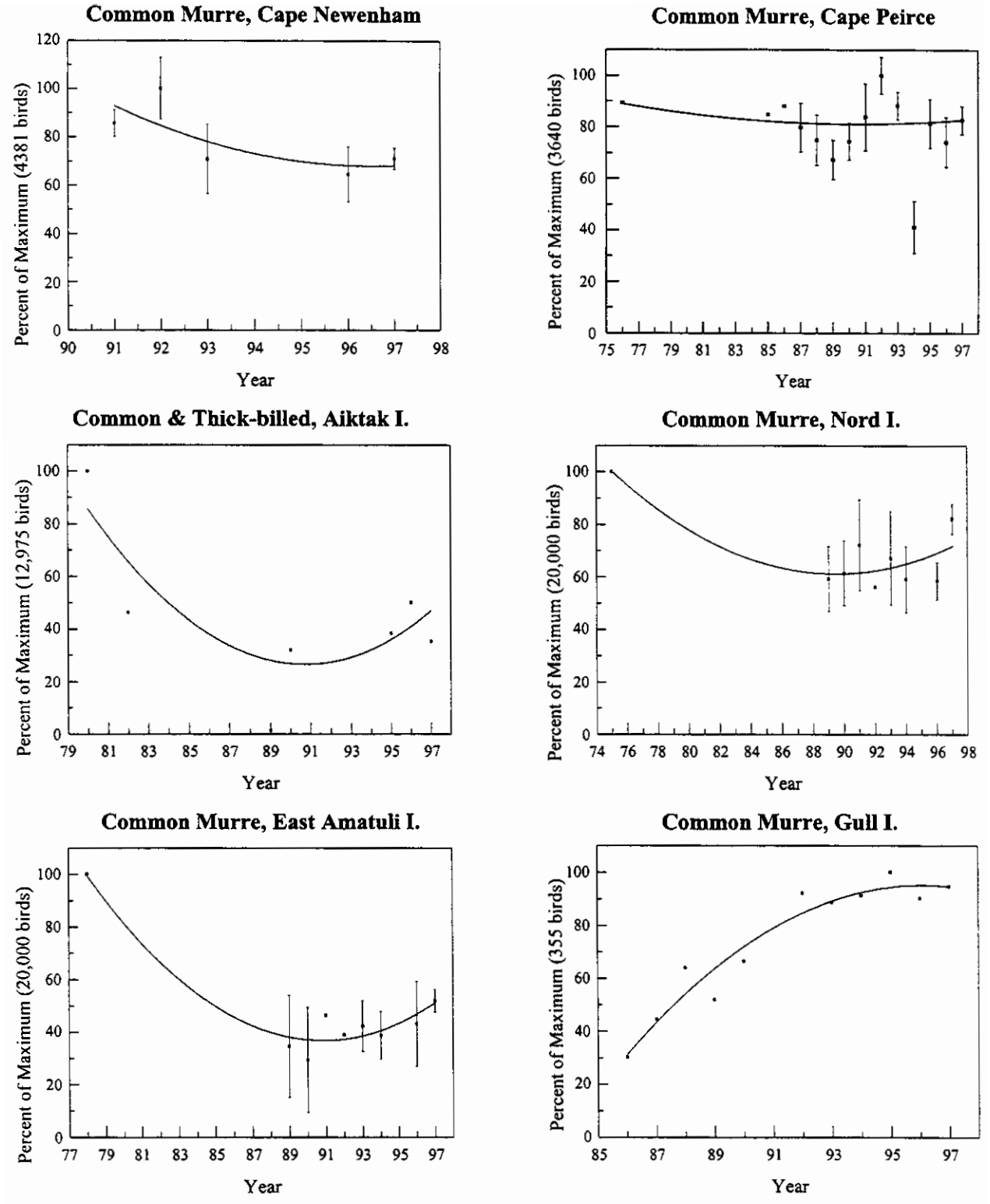

Figure 14. Trends in populations of murres at Alaskan sites monitored in 1997 (continued). Error bars (90% confidence intervals) are shown for years with multiple counts.

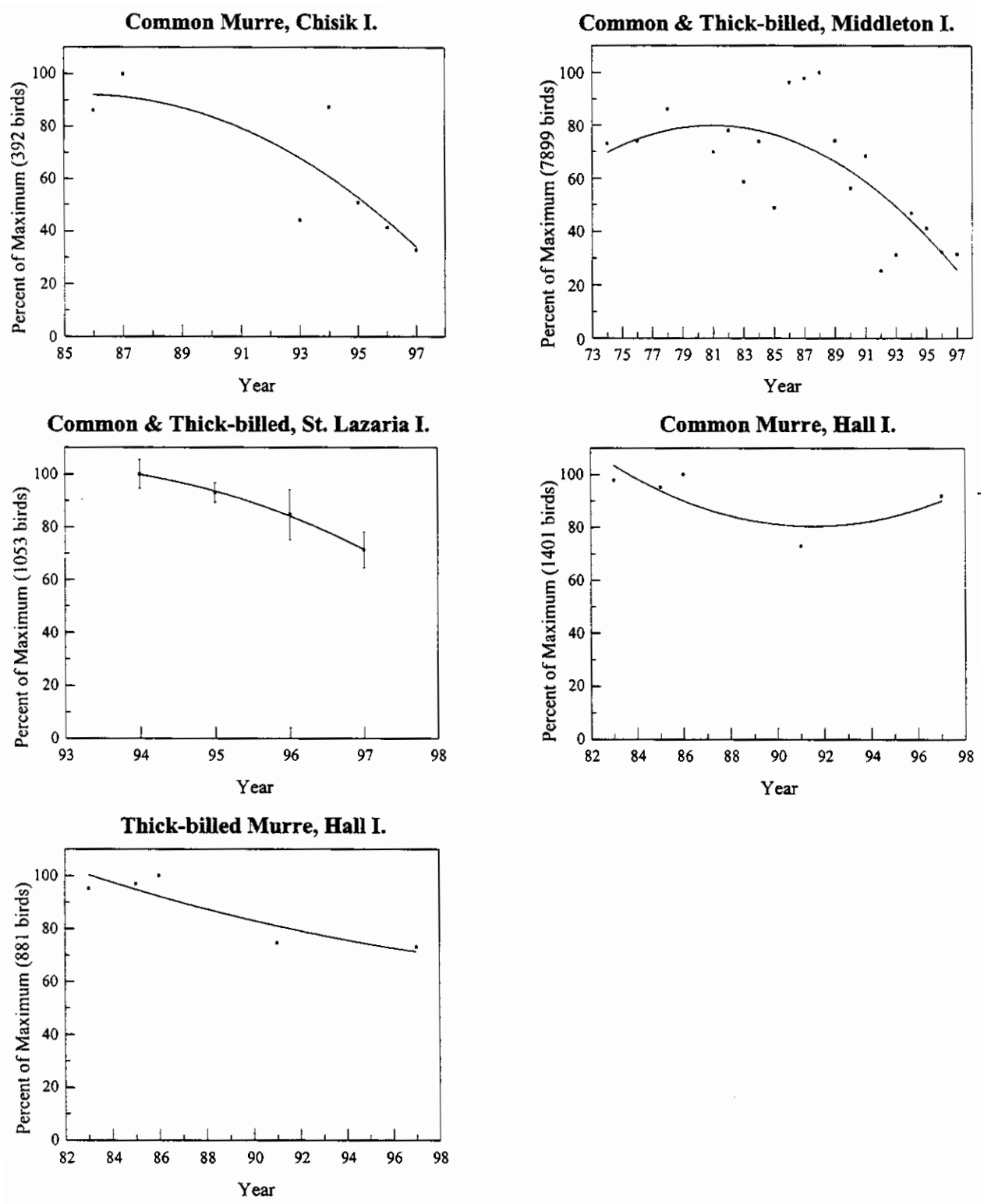

Figure 14. Trends in populations of murres at Alaskan sites monitored in 1997 (continued). Error bars (90% confidence intervals) are shown for years with multiple counts.

Thick-billed Murre (*Uria lomvia*)

Breeding Chronology.--The timing of nesting events was considerably earlier (mid-July) at Buldir Island in the western Aleutians than elsewhere in Alaska in 1997 (Table 14). Eggs hatched at the end of July at Cape Lisburne on the mainland coast of the Chukchi Sea, but elsewhere peaks of hatch occured in August. An unusual difference was observed in the Pribilof Islands where mean hatch dates were nearly two weeks later at St. Paul Island than at St. George Island. The average hatch date in 1997 was earlier at Buldir Island than in previous years and later at St. Paul Island than the long-term average. Hatch occurred at dates similar to the long-term means at all other sites.

Table 14. Hatching chronology of thick-billed murres at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Cape Lisburne	29 Jul	28 Jul (186)[a]	30 Jul (3)[a]	D. Roseneau Pers. Com.[b]
Saint Paul I.		13 Aug (133)	4 Aug (14)	Carten and Cavin 1997
Saint George I.		2 Aug (138)	31 Jul (16)	Schindler 1997
Buldir I.	11 Jul	11 Jul (182)	17 Jul (10)	Williams et al. 1998
Kasatochi I.	5 Aug	7 Aug (133)	8 Aug (2)	Scharf and Williams 1997
Aiktak I.	8 Aug	9 Aug (14)	11 Aug (3)	Woodward 1998
Saint Lazaria I.	7 Aug	10 Aug (38)	12 Aug (4)	Slater et al. 1998

[a]Sample size in parentheses represent 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.
[b]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.

Productivity.--Annual productivity averages for thick-billed murres tend to be slightly lower than for common murres at most sites in Alaska, typically ranging between 36% and 72% (Byrd et al. 1993). Compared to 1996, reproductive rates in 1997 (Table 15, Fig. 15) were higher at Cape Lisburne, lower at St. Paul Island, similar at St. George Island, slightly lower at Kasatochi Island, and higher at Buldir Island, Aiktak Island, and St. Lazaria Island. Compared to long-term averages rates in 1997 were below average at Pribilof sites, but higher at Buldir Island (Fig. 15).

Table 15. Reproductive performance of thick-billed murres at Alaskan sites monitored in 1997.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	No. of Nest Sites	Reference
Cape Lisburne	0.63(0.14)[b]	10	265	D. Roseneau Pers. Com.[c]
Saint Paul I.	0.36 (0.08)	13	293	Carten and Cavin 1997
Saint George I.	0.47 (0.05)	11	297	Schindler 1997
Buldir I.	0.72 (0.03)	15	407	Williams et al. 1998
Kasatochi I.	0.38 (0.05)	11	285	Scharf and Williams 1997
Aiktak I.	0.62 (0.06)		73	Woodward 1998
Saint Lazaria I.	0.70 (<0.01)	3	46	Slater et al. 1998

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.
[b]Standard deviation in parentheses
[c]Roseneau, D. G., U. S. Fish and Wildlife Service, Personal communication, 1998.

Populations.--Thick-billed murres were included with common murres at all sites where they were counted in 1997 except Hall Island where they appear to have declined since 1983 (Fig. 14). Typically thick-billed murres are monitored every three years at St. Paul, St. George, and Buldir islands, but none of these sites were surveyed in 1997.

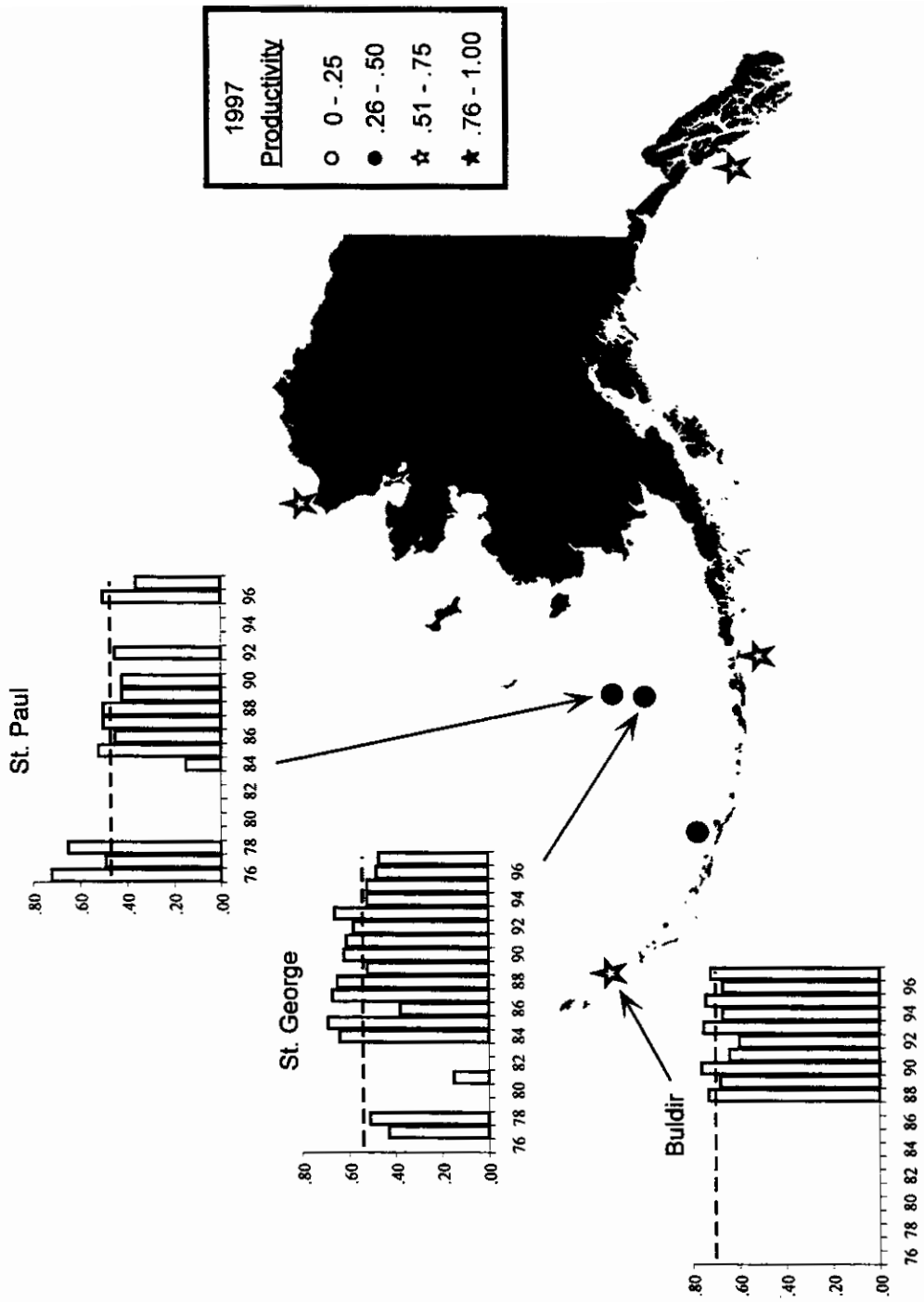

Figure 15. Productivity of thick-billed murres (chicks fledged/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Parakeet Auklet (*Cyclorrhynchus psittacula*)

Breeding Chronology.--In 1997, the peak of hatching for parakeet auklet eggs was in early July, similar to past years there and slightly later than the other species of auklets at Buldir Island (Table 16).

Table 16. Hatching chronology of auklets at Alaskan sites monitored in 1997.

Site/Species	Median	Mean	Long-term Average	Reference
Parakeet Auklet				
Buldir I.	1 Jul	3 Jul (22)	4 Jul (7)	Williams et al. 1998
Least Auklet				
Buldir I.	25 Jun	27 Jun (35)[a]	28 Jun (9)[a]	Williams et al. 1998
Kasatochi I.	27 Jun	28 Jun (74)	27 Jun (2)	Scharf and Williams 1997
Crested Auklet				
Buldir I.	25 Jun	28 Jun (11)	28 Jun (9)	Williams et al. 1998
Kasatochi I.	1 Jul	3 Jul (80)	1 Jul (2)	Scharf and Williams 1997
Whiskered Auklet				
Buldir I.	21 Jun	24 Jun (33)	24 Jun (9)	Williams et al. 1998

[a]Sample size in parentheses represent 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.

Productivity.--The only site where we are currently able to monitor this species is Buldir Island in the western Aleutians. In 1997, productivity was 0.48 chicks fledged per nest (Table 17), lower than the long-term average there (0.58 chicks fledged per egg, n = 7 years).

Populations.--We currently know of no method of monitoring populations of parakeet auklets. Research is needed to develop a method that could be employed at annual monitoring sites in the Aleutian, Pribilof, and Semidi islands.

Table 17. Reproductive performance of auklets at Alaskan sites monitored in 1997.

Site/Species	Chicks Fledged/ Nest Site[a]	No. of Nest Sites	Reference
Parakeet			
Buldir I.	0.48 (0.06)[b]	62	Williams et al. 1998
Least			
Buldir I.	0.60 (0.05)	84	Williams et al. 1998
Kasatochi I	0.55 (0.05)	91	Scharf and Williams 1997
Crested			
Buldir I.	0.76 (0.05)	82	Williams et al. 1998
Kasatochi I.	0.55 (0.06)	76	Scharf and Williams 1997
Whiskered			
Buldir I.	0.66 (0.05)	90	Williams et al. 1998

[a]Nest site is defined as a site where an egg was laid.
[b]Standard deviation in parentheses.

Least Auklet (*Aethia pusilla*) and Crested Auklet (*Aethia cristatella*)

Breeding Chronology.---The average dates of hatching for least and crested auklets in the Aleutians were in late June and early July in 1997 (Table 16). The mean hatching dates were almost identical for least auklets at Buldir and Kasatochi islands (Table 16). Crested auklets apparently hatched a few days earlier at Buldir Island than at Kasatochi Island and were similar in timing to least auklets at Buldir Island. Hatching dates in 1997 were about average for both species at both sites.

Productivity.--Least and crested auklets are being monitored at two sites in the Aleutians (Buldir and Kasatochi islands). In 1997, reproductive success for least aukets was 0.60 chicks fledged per nest at Buldir Island, slightly above the long-term average (Fig. 16). At Kasatochi Island, least auklets produced 0.55 chicks fledged per nest, lower than 1996, the only previous year for which data are available. Crested auklets had relatively high productivity at Buldir Island in 1997compared to the long-term average. At Kasatochi Island, success was lower than in 1996 (Table 17, Fig. 17).

Populations.--Plots for monitoring population trends have been established at St. Paul Island (least only), St. George Island (least only), Buldir Island, and Kasatochi Island. In 1997, counts were made only at Kasatochi Island where it appears least auklet numbers have declined and crested auklet numbers have been similar since 1991 (Scharf and Williams 1997).

Figure 16. Productivity of least auklets (chicks fledged/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

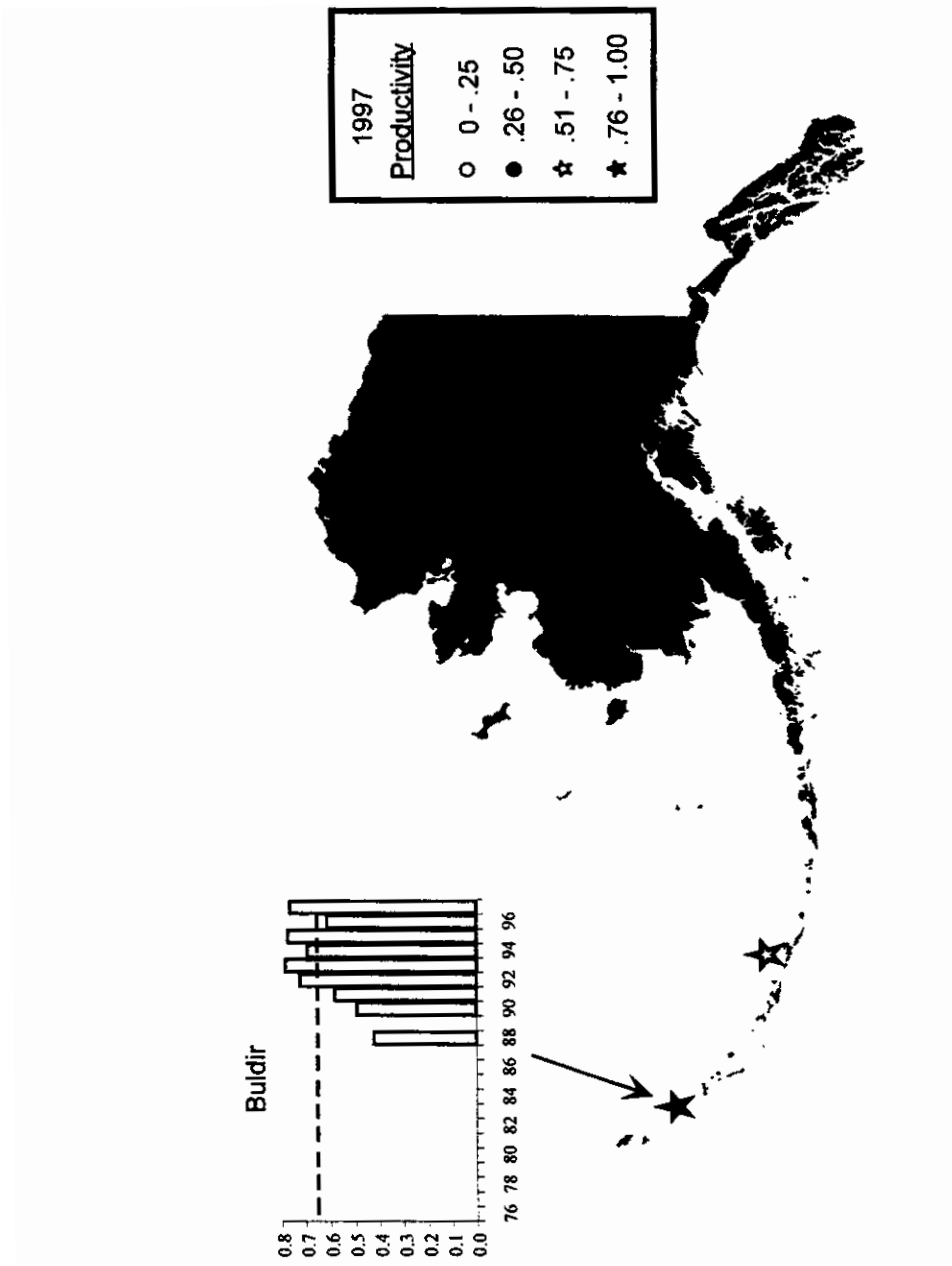

Figure 17. Productivity of crested auklets (chicks fledged/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Whiskered Auklet (*Aethia pygmaea*)

Breeding Chronology.--At Buldir Island, whiskered auklets hatched slightly earlier than crested and least auklets in 1997 (Table 16). The average hatch date was similar to the average from other years.

Productivity.--We are able to monitor whiskered auklets only at one site, Buldir Island (Table 17). In 1997, 0.66 chicks fledged per egg compared to 0.70 in 1996. The values were slightly higher than the long-term average at Buldir (0.63, n = 8 years, J. Williams unpubl. data).

Populations.--Although experiments are being conducted with capture-recapture methods (J. Williams and I. Jones, pers. comm.), no accepted approach for monitoring population trends has yet been developed. Once methods are developed, it might be possible to monitor whiskered auklets at Buldir Island, Kasatochi/Koniuji/Ulak Islands, and at several less-frequently visited sites.

Tufted Puffin (*Fratercula cirrhata*)

Breeding Chronology.--Average hatch dates for tufted puffins varied from mid-July at Buldir Island to early August at Aiktak Island (Table 18). The median hatch date in 1997 at East Amatuli Island was 23 July. The average hatch dates in 1997 at Buldir and E. Amatuli islands were similar to averages of past years, but hatching was later at Aiktak Island (Table 18).

Table 18. Hatching chronology of tufted puffins at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	15 Jul	16 Jul (27)[a]	15 Jul (9)[a]	Williams et al. 1998
Aiktak I.	4 Aug	2 Aug (27)	28 Jul (3)	Woodward 1998
East Amatuli I.	23 Jul (44)		21 Jul (3)	A. Kettle Pers. Com.[b]

[a]Sample size in parentheses represent 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.
[b]Kettle, A., Alaska Maritime NWR, USFWS. Personal Communication, 1998.

Productivity.-- In a review of available data on productivity of tufted puffins, Byrd et al. (1993) indicated that the average was 0.46 fledglings per egg. At our monitoring sites, rates of reproductive success varied substantially among sites in 1997. At Buldir and Aiktak islands, tufted puffins had lower than average success in 1997, and productivity was higher than average at E. Amatuli Island (Table 19, Fig. 18). Every egg monitored at St. Lazaria Island (n = 39) produced a chick which was still alive at our last check in August (Table 19).

Table 19. Reproductive performance of tufted puffins at Alaskan sites monitored in 1997.

Site	Chicks Fledged[a]/ Egg	Chicks/ Occupied Burrow	No. of Eggs	Reference
Buldir I.	0.21 (0.05)[b]		57	Williams et al. 1998
Aiktak I.	0.22 (0.08)		74	Woodward 1998
East Amatuli I.		0.34 (0.17)		A. Kettle Pers. Com.[c]
Saint Lazaria I.	1.00 (0.00)		39	Slater et al. 1998

[a]Fledged chick defined as being still alive at last check in August or September.
[b]Standard deviation in parentheses.
[c]Kettle, A., Alaska Maritime NWR, USFWS. Personal Communication, 1998.

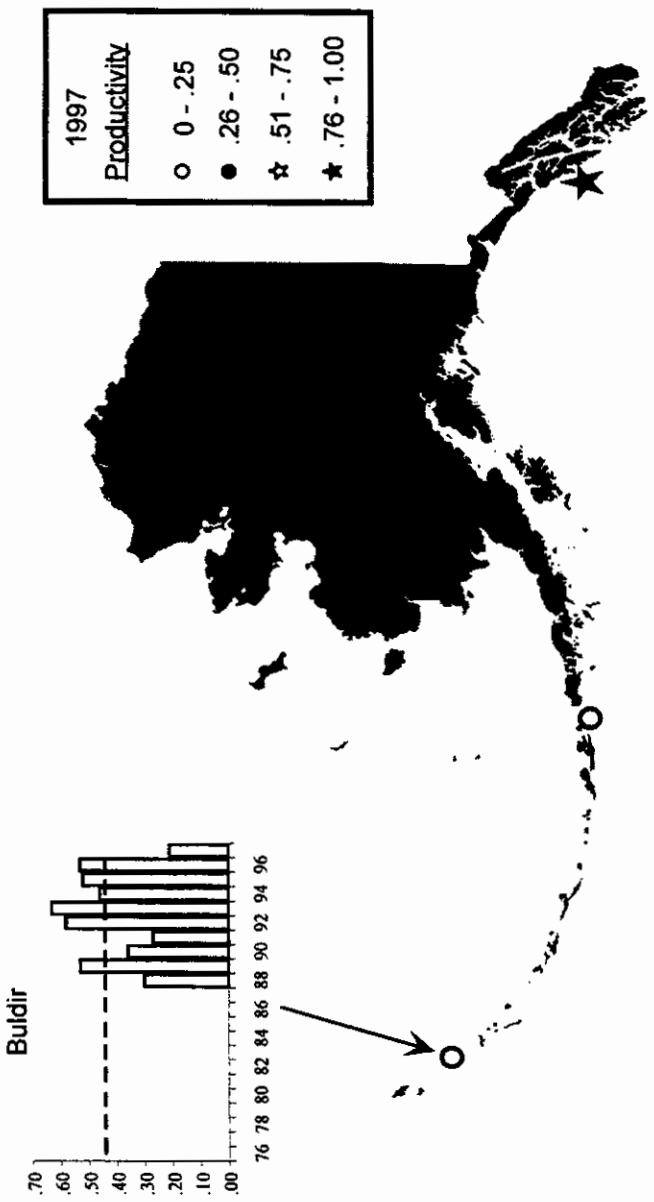

Figure 18. Productivity of tufted puffins (chicks/egg) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

Populations.--Plots for monitoring changes in numbers of nesting tufted puffins have been set up at the following annual monitoring sites: Buldir, Ulak, Aiktak, Chowiet, E. Amatuli, and St. Lazaria islands. Plots were surveyed at all sites except Buldir and Chowiet islands in 1997. None of the time-series span more than a few years except Aiktak Island where a slight increase appears to have occurred since 1989 (Woodward 1998) and E. Amatuli Island where numbers have remained stable since 1994 (Roseneau et al. 1998*b*) (Fig. 19). Intermittent counts at Bogoslof Island suggest puffins have increased there since 1973 (Byrd and Williams 1997), and burrow counts at Petrel Island in Southeastern Alaska were also substantially higher, since 1995 (L. Slater pers. comm.).

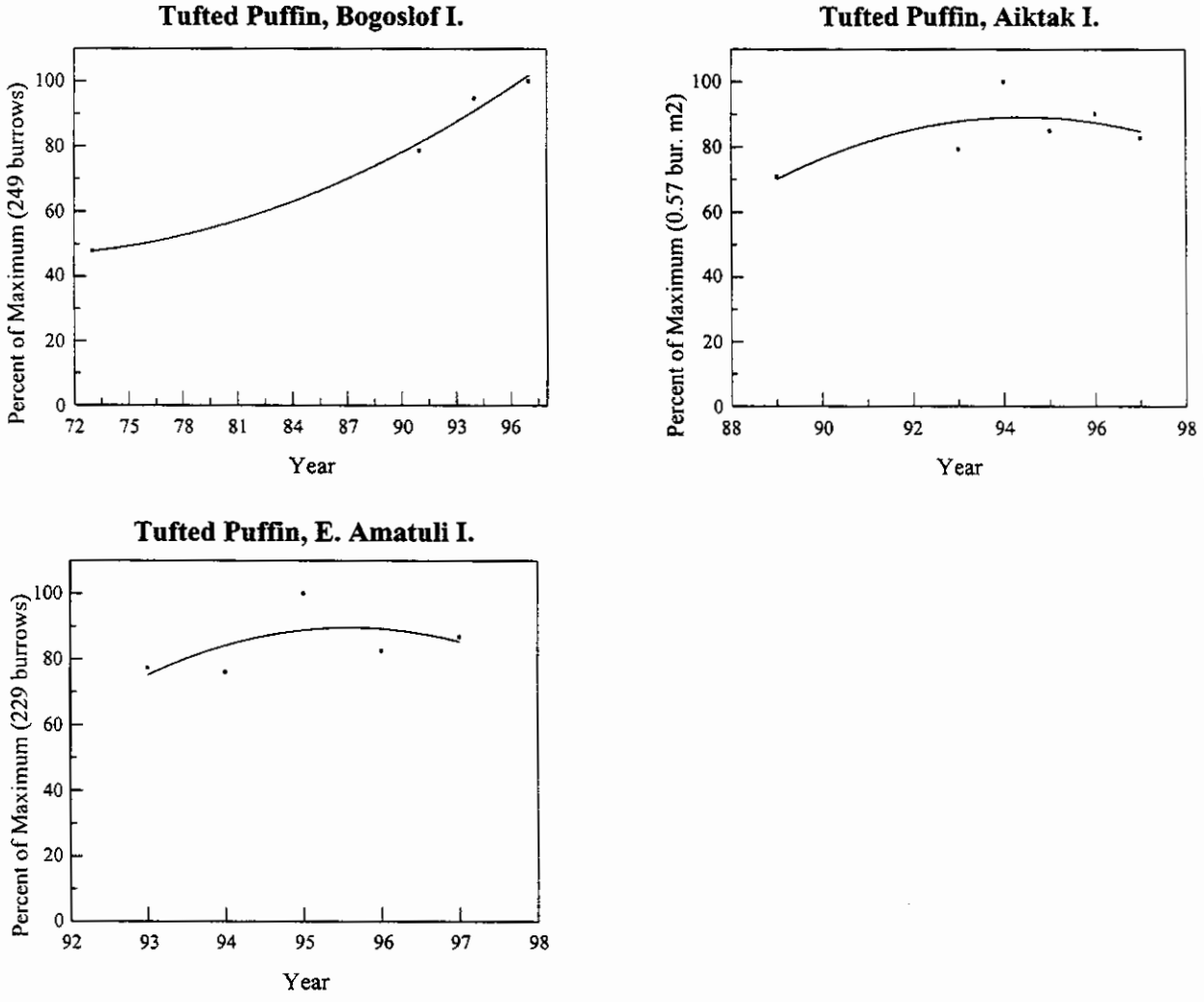

Figure 19. Trends in populations of tufted puffins at Alaskan sites monitored in 1997.

Horned Puffin (*Fratercula corniculata*)

Breeding Chronology.--The peak hatch occurred around 24-27 July at both Buldir and Duck islands in 1997 (Table 20). These dates were similar to the average for past years at the two sites.

Table 20. Hatching chronology of horned puffins at Alaskan sites monitored in 1997.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	24 Jul	25 Jul (21)[a]	24 Jul (10)[a]	Williams et al. 1998
Chisik I./Duck I.	27 Jul (68)		25 Jul (2)	S. Zador Pers. Com.[b]

[a]Sample size in parentheses represent 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.
[b]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Productivity.--Horned puffins were monitored at Buldir (0.58 fledglings egg^{-1}) and Chisik/Duck (0.52 fledglings egg^{-1}) islands in 1997 (Table 21, Fig. 20). These estimates were similar to and lower, respectively, than estimates in 1996. The average for 18 estimates of productivity reported by Byrd et al. (1993) for various sites in Alaska was 0.57 fledglings per egg, therefore, success rates in 1997 were nearly average.

Table 21. Reproductive performance of horned puffins at Alaskan sites monitored in 1997.

Site	Chicks Fledged[a]/Egg	No. of Plots	No. of Eggs	Reference
Buldir I.	0.58 (0.07)[b]	1	52	Williams et al. 1998
Chisik I./Duck I.	0.52 (0.06)	4	68	S. Zador Pers. Com.[c]

[a]Fledged chick defined as being still alive at last check in August or September.
[b]Standard deviation in parentheses
[c]Zador, S., Biol. Res. Div., USGS. Personal Communication, 1998.

Populations.--Although plots have been set up at Buldir Island to monitor trends in horned puffins, no accepted method of monitoring has been developed, and no counts were made in 1997.

Figure 20. Productivity of horned puffins (hatching success) at Alaskan sites monitored in 1997. Lack of bars on graphs indicates that no data were gathered in those years. Dashed line is the mean productivity at the site in all years for which there are data.

CONCLUSIONS

Species Differences

Surface Plankton-Feeders.--In 1997, the timing of hatching for fork-tailed storm-petrels (FTSP on Table 22) was later than average at both Aiktak and St. Lazaria islands. Leach's storm-petrel (LHSP) eggs also hatched later at Aiktak Island than normal, but were about average at St. Lazaria Island. Late hatching did not seem to result in lower than normal reproductive success for either species at these two sites. Reproductive success was also normal for fork-tailed storm-petrels at Buldir Island, but this species had below average success at Ulak Island. Leach's storm-petrels had relatively high success at Buldir Island in 1997 (Table 23). Based on the sites where population indices were measured in 1997, it appears storm-petrel burrow counts (both species combined) have been increasing recently (Table 24).

Surface Fish-Feeders.--Glaucous-winged gulls (GWGU) are treated here, although they are opportunistic feeders taking other birds as well as fish for prey. We had one sampling site in each of the regions except the northern Bering and Chukchi seas. In 1997, gull eggs hatched earlier than average at Aiktak Island, and about average timing at Gull Island in Cook Inlet (Table 22). Gulls had average success in 1997 at all the sites we monitored except in the western Aleutians, where rates were above average (Table 23). Numbers of nesting gulls apparently have declined at Buldir Island in the western Aleutians, have remained relatively stable at sites in the eastern Aleutians and the northern Gulf of Alaska, and have increased at St. Lazaria Island in southeast Alaska (Table 24).

Black-legged kittiwakes (BLKI) had average or earlier hatch dates in 1997 everywhere but Cape Newenham and East Amatuli Island, where dates were slightly later than average (Table 22). No complete reproductive failures were recorded in 1997, but rates of success were lower than normal at one site each in the Chukchi Sea, eastern Bering Sea, western Aleutians, and Cook Inlet (Table 23). Success was average or higher at all other monitoring sites. At sites where population trends were monitored in 1997, it appears kittiwake population trends varied among sites (Table 24). Numbers have been relatively stable in the Chukchi Sea, have increased slightly in the northern Bering Sea, have remained stable or decreased in the eastern Bering Sea (Capes Peirce and Newenham and Walrus Island) and central Aleutians (Koniuji Island). In the Gulf of Alaska, recent population trends are relatively stable at two sites, down at two sites and up at one site.

Red-legged kittiwake (RLKI) eggs hatched earlier than normal at St. Paul Island and were nearly average at St. George and Buldir islands in 1997 (Table 22). Reproductive success was average or higher at all four sites monitored (Table 23). No counts were made in 1997 except at the newly discovered colony at Koniuji Island (Byrd and Dragoo 1997) which appears to be increasing (Table 24).

Diving Fish-Feeders (nearshore).--Timing of nesting events has been monitored long enough for comparisons at only one site each for pelagic (PECO) and red-faced cormorants (RFCO), both in the eastern Bering Sea. Hatching for pelagic cormorants was earlier than

normal at Cape Peirce in 1997, but red-faced cormorants hatched later than average at St. Paul Island (Table 22).

Productivity for at least one species of cormorant was monitored in every region. Like other nearshore feeders, reproductive success may be based on very local conditions which may not prevail region-wide. Pelagic cormorants had above average success at Bluff in the northern Bering Sea, but success was below average in the eastern Bering Sea. In the Aleutians success was about average in 1997, but in the Gulf of Alaska, rates of success were above, average, and below average one site each (Table 23).

Red-faced cormorants (RFCO) had above average reproductive success in the central Aleutian Islands in 1997, but below average success at sites in the eastern Bering Sea and Gulf of Alaska (Table 23).

Numbers of pelagic cormorants (or mixed species where they could not be distinguished) have declined at sites in the Aleutians and Gulf of Alaska, but have increased at a site in the eastern Bering Sea (Table 24). In southeast Alaska numbers have increased substantially at St. Lazaria, but counts were similar in 1997 to the previous count at Forrester Island.

Red-faced cormorants were counted together with pelagic and double-crested cormorants at Aiktak Island in the eastern Aleutians, and the combined group has declined overall since the first count in 1980, but remained relatively stable in the past decade (Table 24). A similar pattern has occurred at Chiniak Bay for red-faced cormorants.

Diving Fish-Feeders (offshore).--Murres had average hatch dates at 13 of 18 sites we monitored in 1997 (Table 22). Common murres (COMU) were late in the Pribilof Islands, but earlier than normal at East Amatuli Island in the Barrens. Thick-billed murres (TBMU) also were relatively late at St. Paul Island in the Pribilofs, but in the western Aleutians the timing of hatching was relatively early in 1997.

Murres exhibited average reproductive success at half the sites we monitored in 1997 (Table 23). For common murres, below average rates were recorded at three of the four sites monitored in the eastern Bering Sea, in the central Aleutians, and at one site in Cook Inlet. The only site with above average success in 1997 was in southeast Alaska. Thick-billed murres had below average success at St. Paul in the Pribilofs, and they were above average in the eastern Aleutians and in southeast Alaska.

Numbers of murres continue to increase at Cape Lisburne in the Chukchi Sea, and recently a slight increase seems to be occurring at Bluff in the northern Bering Sea (Table 24). In contrast, at sites in the central and eastern Bering Sea trends appear to be slightly down or level. In the Aleutians, counts in the past decade indicate numbers are level or were slightly higher in 1997. In the northern Gulf of Alaska, numbers were up in 1997 at the Barren Islands and at Gull Island in Cook Inlet, but down farther north in Cook Inlet and at Middleton Island. Numbers also have continued to decline in southeast Alaska since 1994.

Tufted puffin (TUPU) eggs hatched at average dates in the western Aleutians, were later than normal in the eastern Aleutians, and were average at East Amatuli Island in the northern Gulf of Alaska (Table 22). Reproductive success was below average in the Aleutian Islands in 1997, above average in the northern Gulf of Alaska, and about average in southeast Alaska (Table 23). Population indices suggest tufted puffin populations are level in the eastern

Aleutians and in the northern Gulf of Alaska, but increasing in the eastern Bering Sea and in southeast Alaska.

Horned puffins (HOPU) hatched at average dates at both sites where they were monitored in 1997 (Table 22). Reproductive success was average in Cook Inlet and above average in the western Aleutians (Table 23). We have no information on population trends.

Diving Plankton-Feeders.--Parakeet (PAAU), least (LEAU), crested (CRAU) and whiskered auklets (WHAU) all timed hatching at about average dates in 1997 (Table 22), and reproductive success also was average for all species at both monitoring sites (Table 23). We have no long-term trend data on populations for any of the species, but counts at Kasatochi were lower for least auklets and similar for crested auklets in 1997 compared to the early 1990s (Table 24).

Table 22. Seabird relative breeding chronology compared to averages for past years within regions.

Region	Site	Storm-petrel FTSP/LHSP	Cormorant PECO/RFCO	Gull GWGU	Kittiwake BLKI/RLKI	Murre COMU/TBMU	Auklet PAAU/LEAU/CRAU/WHAU	Puffin TUPU/HOPU
N. Bering/Chukchi								
	C. Lisburne				=/*	=/=		
SE Bering								
	St. Paul		*/+		--/--	+/+		
	St. George				=/=	+/=		
	C. Newenham				+/*	=/*		
	C. Peirce		--/*		=/*	=/*		
	Aiktak	+/+		--		=/=		+/*
SW Bering								
	Buldir				=/=	*/--	= / = / = / =	=/=
	Kas/Kon/Ul[a]					=/=	* / = / = / *	
N. Gulf of Alaska								
	Barrens				+/*	--/*		=/*
	Gull			=	=/*	=/*		
	Chisik/Duck				=/*	=/*		*/=
Southeast								
	St. Lazaria	+/=				=/=		

Codes:

"--" indicates productivity was >3 days earlier than average for the site or region,

"=" indicates within 3 days of average,

"+" indicates >3 days later than average,

"*" indicates the species (in particular species pairs) was not present or was not monitored in 1997.

[a]Kasatochi, Koniuji and Ulak islands combined for reporting purposes.

Table 23. Seabird relative productivity levels compared to averages for past years within regions.

Region	Site	Storm-petrel FTSP/LHSP	Cormorant PECO/RFCO	Gull GWGU	Kittiwake BLKI/RLKI	Murre COMU/TBMU	Auklet PAAU/LEAU/CRAUWHAU	Puffin TUPU/HOPU
N. Bering/Chukchi								
	C. Lisburne				--/*	=/=		
	Bluff		+/*		=/*			
	Hall				=/*			
SE Bering								
	St. Paul		*/--		=/=	--/--		
	St. George				+/=	--/=		
	C. Newenham				--/*	--/*		
	C. Peirce		--/*		+/*	=/*		
	Aiktak	=/=	*/ND	=		=/+		--/*
SW Bering								
	Buldir	=/+	=/*	+	--/=	*/=	= / = / = / =	--/+
	Kas/Kon/Ul[a]	--/*	=/+		=/*	--/=	* / = / = / *	
	Bogoslof				+/+			
N. Gulf of Alaska								
	Chiniak		--/--		=/*			
	Barrens				=/*	=/*		+/*
	Gull		=/*	=	+/*	--/*		
	Chisik/Duck			=	--/*	=/*		*/=
	PWS				=/*			
Southeast								
	St. Lazaria	=/=	+/*	=		+/+		=/*

Codes:

"--" indicates productivity was >20% below average for the site or region,

"=" indicates within 20% of average,

"+" indicates >20% above average,

"*" indicates the species (in particular species pairs) was not present or was not monitored in 1997.

"ND" indicates that previous data are not available.

[a]Kasatochi, Koniuji and Ulak islands combined for reporting purposes.

Table 24. Seabird population trends compared within regions.

Region	Site	Fulmar NOFU	Storm-petrel FTSP/LHSP	Cormorant PECO/RFCO	Gull GWGU	Kittiwake BLKI/RLKI	Murre COMU/TBMU	Auklet LEAU/CRAU	Puffin TUPU/HOPU
N. Bering/Chukchi									
	C. Lisburne					=/*	+		
	Bluff					+/*	=/*		
	Hall	+					=/--		
SE Bering									
	Walrus			*/--		--/*	--/*		
	C. Newenham					=/*	=/*		
	C. Peirce			+/*		--/*	=/*		
	Aiktak		+*	--	=		=		+/*
SW Bering									
	Buldir		+	--/*	--				
	Semisopochnoi						+		
	Kasatochi			+/+			=/*	--/=	
	Koniuji					=/+	+		
	Ulak		+				+		
	Bogoslof								+/*
N. Gulf of Alaska									
	Chiniak Bay			--/--		--/*			
	Barrens				=	=/*	+/*		=/*
	Gull			--/*		=/*	+/*		
	Chisik					--/*	--/*		
	P. William Snd.					+/*			
	Middleton						--/*		
Southeast									
	St. Lazaria		+	+/*	+		--		
	Petrel		+						+/*
	Forrester		=						

Codes:

"--" indicates negative population trend for the site or region,

"=" indicates no discernable trend,

"+" indicates positive population trend.

"*" indicates the species (in particular species pairs) was not present or was not monitored in 1997.

*Single symbols in a column with multiple species indicate that species were combined for population count purposes.

Regional Differences

N. Bering/Chukchi.--The timing of nesting events for kittiwakes and murres apparently was normal in 1997 (Table 22). Reproductive success of nearshore fish-feeding cormorants was relatively high at Bluff and Hall Island in 1997. Offshore fish-feeders (kittiwakes and murres) had average reproductive rates everywhere except Cape Lisburne where kittiwakes were below average (Table 23). The only population trend data are for offshore fish-feeders. Surface feeding kittiwakes have been stable or increasing in the region over the past decade and diving common murres have remained stable or increased in the Chukchi Sea and in Norton Sound. In contrast, thick-billed murres have apparently declined at Hall Island where common murres have remained stable (Table 24).

SE Bering.--Hatch dates for diving fish-feeders (nearshore and offshore) tended to be later than average in the Pribilofs in 1997 (Table 22). Tufted puffins (an offshore diving fish-feeder) also were late in the eastern Aleutians, and interestingly, surface plankton feeders (storm-petrels) also were later than average in the eastern Aleutians. Elsewhere, murres hatched at average dates and surface fish-feeders (gulls and kittiwakes) tended to hatch at normal or early dates throughout the region (except that kittiwakes were late at Cape Newenham).

In spite of the late start, storm-petrels apparently had adequate plankton available for normal reproduction in 1997, but the diving fish-feeders that were late tended to have lower than average success. Surface fish-feeders generally had average or higher success everywhere except Cape Newenham (Table 23).

Plankton feeding storm-petrel populations are increasing in the eastern Aleutians. Nearshore fish-feeders (cormorants) seem to be declining in the eastern Aleutians and in the Pribilofs (based on counts at Walrus Island), but on the mainland coast increases have been recorded (Table 24). Populations of gulls appear stable in the eastern Aleutians. Whereas, counts of kittiwakes were down at Walrus Island in the Pribilofs and at Cape Peirce, there was no obvious trend at nearby Cape Newenham. Diving fish-feeder populations recently have been relatively stable or increasing in the region, except that we found fewer murres at Walrus Island in 1997 than had been present a decade earlier (Table 24).

SW Bering.--Species using all parts of the food web had average hatch dates in the central and western Aleutian Islands in 1997, except that thick-billed murres were early at Buldir Island (Table 22).

Plankton feeders, both surface (storm-petrels) and divers (auklets) had average or higher success in 1997 in most cases, except that fork-tailed storm-petrels were below average at Ulak Island in the central Aleutians (Table 23). Fish-feeders had average or higher reproductive success throughout the range of species and sites (11 cases) except in three cases: black-legged kittiwakes and tufted puffins were below average at Buldir Island, and common murres were below average at Kasatochi Island.

Storm-petrel populations appear to be increasing in the region, but diving plankton feeders were either down (least auklets at Kasatochi Island) or level (crested auklets at Kasatochi Island) in 1997. Trends in surface-feeding fish eaters were mixed, gulls being down at Buldir

Island but kittiwakes being equal to or higher than previous counts at Koniuji Island (Table 24). Populations of both nearshore and oceanic fish-feeders seem to be stable or increasing, except for pelagic cormorants at Buldir Island which have declined.

N. Gulf of Alaska.--Fork-tailed storm-petrels normally are monitored at East Amatuli Island, but data were not available for 1997 at the time of this report, therefore, only fish-feeding species are compared. With the exception of black-legged kittiwakes in the Barren Islands (which hatched slightly later than average), all other species in this region were either on time or early (common murres in the Barrens) in 1997 (Table 22).

Productivity of nearshore divers (cormorants) was lower than average at Chiniak Bay, Kodiak, but about normal at Gull Island. Surface-feeding fish feeders had normal or higher rates of productivity in almost every case. Black-legged kittiwakes had lower than average success at Chisik Island, where they normally raise few young. Diving fish feeders experienced average or higher success in this region in 1997, except common murres had slightly lower than average success (Table 23).

Although cormorant populations appear to be declining at the sites we monitored in the region, overall patterns are not so clear for the other foraging guilds. Populations of surface fish feeders (gulls and kittiwakes) were stable or increasing at four sites and down at two sites (kittiwakes at Chiniak Bay and Chisik). Off shore divers either were stable or increasing at three sites, but common murres have declined at Chisik and Middleton islands (Table 24).

Southeast.--Fork-tailed storm-petrels were later than normal, but Leach's were on time in 1997. Murre eggs also hatched at average dates in 1997 (Table 22).

Productivity rates in 1997 were average or above for all species we monitored in southeast Alaska (Table 23).

Apparently, conditions are good for breeding seabirds in this region because most species appear to be undergoing population increases (e.g., storm-petrels, cormorants, gulls, and puffins). The exception was murres which have declined over the past four years at St. Lazaria Island (Table 24).

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