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COMMON MURRE MONITORING AT EAST AMATULI ISLAND, ALASKA DURING 1993-2014

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INTRODUCTION

The Alaska Maritime National Wildlife Refuge (AMNWR, or "Refuge") conducts annual ecological monitoring at nine sites throughout Alaska (Figure 1). The objective of this long-term monitoring program is to collect baseline status and trend information for a suite of seabird species representing piscivorous and planktivorous trophic guilds, including key species that serve as indicators of ecosystem health. Members of these guilds include surface-feeders and divers feeding in both nearshore and offshore waters. By comparing the data with environmental conditions and information from other sites, ecosystem processes may be better understood. Data also provide a basis for directing management and research actions, and in assessing effects of management.

East Amatuli Island has been a Refuge-funded annual monitoring site since 2000 (except in 2012 when due to a Refuge budget cut monitoring did not occur at this site). During the previous years 1993-1999, selected seabird species were monitored annually for oil spill damage assessment and recovery by the Refuge with funding from the *Exxon Valdez* Oil Spill Trustee Council (Roseneau et al 1995, 2000). Because of the vulnerability of the common murre (*Uria aalge*) to mortality from floating oil and of the number of murre carcasses found on beaches in the Barren Islands and other areas after the 1989 spill, productivity and population monitoring of this species received focused attention.

During 1995-1999 murre Refuge monitoring at East Amatuli Island was included in a multi-colony comparison project called the Alaska Predator Ecosystem Experiment (APEX), funded by the *Exxon Valdez* Oil Spill Trustee Council's research program.

Also associated with the *Exxon Valdez* spill were observations of common murres made earlier by AMNWR and University of Washington (UW) personnel. The purposes of these earlier observations were to determine whether spilled oil caused population declines or abnormal egg-laying phenology and productivity. During 1989-1992 AMNWR personnel conducted brief ship-based observations of murre colonies at East Amatuli and nearby Nord Island. During 1990-1992 UW conducted skiff-based observations at East Amatuli from a field camp on the island.

Earlier, a few brief murre productivity observations and some counts of adults were made by University of Washington (UW) personnel during 1977-1979. Also in the 1970s some estimates of murre population size were made at the breeding cliffs by Edgar P. Bailey (U.S. Fish and Wildlife Service [USFWS]; Bailey 1975, 1976), who in 1974 and 1975 made the first quantitative reconnaissance of seabirds at the Barren Islands; and by UW personnel.

Population counts made of the entire island and population plots by USFWS (including counts made by AMNWR through 1999) and by UW have been treated in previous publications (Nysewander et al. 1993, Boersma et al. 1995, Roseneau et al. 2000). Pre-1993 phenology and productivity observations have also been treated there. Counts and photographs of the larger plots and the island made since 1999 will be treated in a future report. In this report population trend analysis used repeated, detailed counts of adults on a consistent set of productivity observation plots monitored since 1993. Phenology and productivity observations were more detailed than were pre-1993 observations; the previous results are not compared here with the more recent data.

This report presents methods and results from AMNWR monitoring of common murres at East Amatuli Island during the period 1993-2014. It contains parameters that can be compared with those from other monitoring sites in the refuge, as well as other parameters. Results for some murre parameters from the APEX years 1995-1999 are not included here but have been presented elsewhere (Roseneau et al.

1999). These include chick provisioning frequency, foraging trip duration, activity budgets of adults, and chick measurements.

Monitoring of common murres at East Amatuli Island was not conducted in 2015. However, based on observations from a one-day trip to the island late in the nesting season that year when no murres were seen on the cliffs, it is probable that no chicks fledged that year. In 2016 monitoring with time-lapse cameras did occur. No eggs (or chicks) were observed in the plots that year (Kettle 2017). Both 2015 and 2016 were years of unusually warm sea-surface temperatures (SST) in the northern Gulf of Alaska. This report contains a brief description of the SST pattern, but productivity and population numbers from these years have not been included here; they will be treated in a future report.

Any corrections or changes to the data presented in this report will be archived at the AMNWR headquarters in Homer, Alaska. Updates to the summary results from future monitoring work will be included in AMNWR annual reports.

STUDY AREA

East Amatuli Island (58°55' N, 152°10' W) is one of the seven Barren Islands, located between the Kodiak archipelago and the Kenai Peninsula (Figures 2, 3, and 4). The islands range in size from 10 to 2,800 ha, totaling about 4,000 ha. Geologically the islands are a continuation of the Kenai Peninsula and are of mixed origin (from the map by Wilson et al. 2009). They are generally steep and tall, ranging to an elevation of 650 m. Among the eighteen species of seabirds that breed on the islands are about 75,000 pairs of fork-tailed storm-petrels (*Oceanodroma furcata*), 25,000 pairs of black-legged kittiwakes, 3,400 pairs of glaucous-winged gulls (*Larus glaucescens*), 60,000 pairs of common murres (*Uria aalge*), and 70,000 pairs of tufted puffins (*Fratercula cirrhata*; Manuwal 1980, Roseneau et al. 2000).

Of the Barren Islands group, East Amatuli contains the highest seabird abundance. The island provides ledges physically suitable for cliff-nesting birds and contains substrate for burrow-nesters. While the North American river otter (*Lontra canadensis*) is common across the island group, other mammalian seabird predators, such as the northern red-backed vole (*Myodes rutilus*, present on West Amatuli and Ushagat) and Arctic ground squirrel (*Spermophilus parryii*, present on Ushagat) are absent from East Amatuli.

Most of the island is comprised of steep slopes, with an east-west spine ranging up to 470 m. Lower elevations are dominated by grasses and sedges; higher elevations by crowberry (*Empetrum nigrum*) and other maritime tundra plants.

High marine productivity around the Barren Islands provides seabird foraging habitat. Steep local bathymetry, the location at the entrance to Cook Inlet with its large tides and currents, the surrounding Alaska Coastal Current, and the strong winds of the area are water-mixing factors that contribute to making the Barren Islands prolific for large numbers of breeding seabirds and marine mammals.

METHODS

Breeding Chronology

The annual index for murre breeding chronology was mean hatch date. To calculate hatch dates I used data from regular observations of the murre plots described below in *Reproductive Performance*.

During 1994-1999 and 2011 plot observations began before the incubation period started. During the other years (1993, 2000-2010, and 2013-2014) observations began later, ranging from just after the start of egg-laying in some years to after most eggs had hatched in two years.

In most of these other years observations began before eggs had hatched (Figures 5 and 6; Table 2), and we were able to record observations of both eggs and chicks. We used this information to estimate hatch dates for each nest-site that had adequate observations. For each of these years I calculated hatch date for each nest-site (site with an egg; see *Reproductive Performance*) as the midpoint between the last observation of an egg and the first observation of a chick, as described below in *Data Analysis...*. In this report I use as an abbreviation for this method "hd_obs" (this and other parameter abbreviations are listed in Table 42).

During 1994-1999 and 2014 the proportion of chicks with hatch dates from observations was higher than 95 percent (Figures 7 and 8). Observational hatch-date results for these years can be compared using almost all nest-sites.

For some years not all nest-sites had observational data that allowed calculation of hatch dates from observations of both egg and chick. For this reason, for all nest-sites (for all years) I calculated hatch date for each nest-site with another method: the nest-site's chick-disappearance date minus a standard nestling period (21 days at this location, Kettle unpubl. data), as described below in "Data Analysis...". The chick-disappearance-date-minus-21-days method is abbreviated as "hd_dd21". When combined with the hd_obs method (for each nest-site: either "hd_obs", if available, or "hd_dd21" if not), I used the term "hd_obs_or_hd_dd21".

In a third parameter, to omit chicks that disappeared before they were old enough to fledge I restricted the "hd_dd21" sample to those chicks that were seen on the plots for at least 10 days after their plots' mean hatch date (see *Reproductive Performance* below). I've use the abbreviation "hd_dd21_10" for this parameter, and when combined with "hd_obs" I've used "hd_obs_or_dd21_10".

To compare these parameters as measures of breeding chronology I present results for each measure, each year for the period 1994-1999, when observations covered more of the incubation period than in other years. For comparisons and trends across the entire span of years I have used the combination hatch date method "hd_obs_or_dd21_10".

For each year I calculated a mean hatch date and variance (one standard deviation), using two methods. First, I calculated a mean hatch date among chicks for each plot, and then the mean and standard deviation across the sample of plot means. Because the number of chicks was low in some plots in some years, I also used a second method for comparison. This method pooled nest-sites across plots for the mean.

Hatch dates were not tested statistically for between-year differences because of non-continuous within-year data-clumping caused by gaps in nest-sites observations.

Reproductive Performance

Murre productivity data were collected from periodic observations of nest-sites in 10 plots established during 1993-1995 for this purpose on East Amatuli's eastern headlands (see Roseneau et al. 1995). The plots were selected to represent low and high nest-site density and steep and flat nesting habitat in the

proportion generally observed in the colony. The same plot-set was used in all years. In most years all plots in the set were observed but in some years the data were collected from a subset of the plots.

The number of nest-sites (sites that contained an egg) in plots varied among plots and years; the range of among-year plot means was 22-37 nest-sites. The plots were viewed from land-based observation posts using binoculars and spotting scopes. Viewing distances varied from about 20 m to about 100 m. Each observer was assigned plots to monitor through the field season. Nest-sites were mapped with sketches and photographs, and data were recorded for each nest-site using established codes. A plot check consisted of recording in a field book whether each nest-site contained an egg or a chick, the number of adults attending the site, and whether an adult was in incubation posture or brooding posture. On each day that we observed the plots we counted all adults in each plot. These counts were made during the time of day (1100-2000) when, at this colony, the numbers of murres attending the cliffs are most stable (Boersma et al. 1995). Some plot sub-areas were counted separately, so there were a total of 14 counting-areas.

Commutes from the field camp to the observation posts required a 15-minute skiff trip and then rock-climbing. Because good sea and climbing conditions were required, while we strove for an average observation interval of three days per AMNWR protocol, in practice the interval varied from 1 to 12 days.

In 2008 we began to use time-lapse cameras to augment our observations of murre nest-sites. When a data gap between live observations of nest-sites exceeded seven days, where possible we used data from the images to fill the gap. By 2013 we had eight cameras that recorded images of most of the plots once an hour through the field season. For some plots in 2013, because event data from the images were much more precise (1-day precision) than the live observations, we chose to use image data rather than plot visit data for determining chick disappearance dates. In 2014, nest-sites on all 10 plots were counted only from photographs, and all productivity observations were made from time-lapse images of the three plots (containing 99 nest-sites) with complete records. Image recording that year began during late incubation and early chick-rearing.

The primary Refuge monitoring index for murre reproductive performance in monitored plots is fledglings/nest-sites: the final product of the year's reproductive effort (the number of fledglings produced) is divided by the initial product (nest-sites). For murres, a "nest-site" is defined as a site where an egg is produced. Murres do not build nest structures, so if the egg is missed by observers, the nest-site is missed. When a chick is observed where an egg has not been observed, the chick's "nest-site" is not included in ratio parameters that use "nest-site" as a divisor. Additional ratio parameters used in Refuge protocol are chicks/eggs and fledglings/chicks.

A "fledgling" is defined in Refuge protocol as a chick that reaches at least 15 days of age at its nest-site (see "Data Analysis...", below for ageing protocol). Because in some years limited pre-hatching observations at East Amatuli prevented ageing of some chicks (see Figures 7 and 8), an alternative definition of fledgling was also used: chicks seen at least 10 days after each plot's mean hatch date. (In years with early observations and many aged chicks, very few chicks seen 10 days after mean hatch subsequently disappeared before reaching 15 days of age.) The "plot's mean hatch date" used for this purpose was calculated from nest-sites' "hd_obs" (observation hatch date) where available; otherwise from nest-sites' "hd_dd21" (chick-disappearance date minus a standard nestling period of 21 days; see *Breeding Chronology*). This additional category of seen-for-10-days-after-hatch-date "fledging" provided a larger sample size for "fledged" chicks in some years.

Other reproductive performance parameters used for monitoring at East Amatuli were: the total number in the productivity plots of (1) nest-sites (sites with an egg, in years with egg data); (2) chicks; and (3) chicks fledged. The number-of-nest-sites parameter could indicate adult condition near the start of the nesting season, while total output of fledglings reflects breeding capacity to that later part of the season. These other indices allow among-years comparison of reproductive output in absolute units, rather than ratio measures of one parameter relative to another. These count indices can be used only at sites where plots remain the same among years and all viewable nest-sites within each plot are used--at East Amatuli the plot substrate is very stable, so the same boundaries were used each year.

Because in many of the monitoring years at this site we began observations after at least some eggs had been laid, some eggs may have been lost before we saw them. Therefore, we may have missed nest-sites. For the four years (2000, 2001, 2002, and 2013; Figure 5, Table 2) with the highest proportions of chicks without sighted eggs (indicating that we missed egg-sightings) I did not calculate productivity measures that depend on the number of nest-sites. The exception was for aged fledglings/adjusted nest-sites ("fldg_obs/egg_adj") in 2013 because for that ratio an adjustment in the egg number accounted for eggs already hatched (see *Data Analysis*... below; the other years [2000-2002] were excluded because of high numbers of non-aged chicks).

Data Analysis for Breeding Chronology and Reproductive Performance

Because egg-laying and -hatching and chick-fledging were rarely observed, the date that nest-sites changed status (e.g., from eggs to chicks) was estimated from the midpoint between the closest pre- and post-event observation dates. For nest-sites with replaced lost eggs (when we deduced this), replacement eggs were excluded from the breeding chronology index. Two methods maintained precision during analysis. First, if a nest-site's pre- and post-egg-lay observation span was smaller than that for pre- and post-hatch observations, hatch date was calculated by adding 32 days to the lay date (32 days is the average incubation period; see Byrd 1986, 1989; Kettle, unpubl. data from this monitoring site). Second, nest-sites with observation data gaps of more than seven days during both laying and hatching were excluded from the analysis.

In 2013 and 2014, for many observations made with the time-lapse images, midpoints were not used because the images allowed us to determine the precise day that egg-laying, egg-hatching, and chick-fledging occurred.

For calculation of ratio parameters that used both a count of aged fledglings and a count of the number of nest-sites (sites with eggs), we made an adjustment to the number of nest-sites: Since "fledging" of an aged chick was calculated (from midpoints of observation dates surrounding the chick's disappearance) rather than directly observed, this status was dependent on the second analysis rule above: A nest-site with both an imprecise egg-lay date and an imprecise hatch date was excluded from chick-ageing and therefore from calculation of whether its chick fledged. Each such nest-site was excluded from the fledgling count. But nest-sites that never produced a chick ("egg-only" nest-sites) did not have the "opportunity" to be excluded via an imprecise hatch date; therefore they would be over-represented in the fledgling-per-nest-sites ratio. To reduce this bias, before calculating fledglings-per-nest-sites, we subtracted from the egg-only nest-sites a proportion equal to the (excluded nest-sites)/(nest-sites with a chick) proportion.

For nesting dates back-calculated from chicks' "Disappearance Date" (see "Breeding Chronology" above), we determined the disappearance date as the midpoint between the last day the chick was seen and the

first day we subsequently observed that the chick was missing. Abbreviations for parameters that use the disappearance date are labeled in the report tables with a “dd” suffix.

In most years we obtained data from all 10 plots. Because in some years (1993, 1994, and 2014) not all plots were observed, in order to compare among years the counts of nest-sites, eggs, chicks, and chicks fledged, I transformed the data for all years. For each count-year I first found, for each plot with counts, the among-year maximum count of, for example, nest-sites. Then I divided the count-year’s across-plot count sum by the sum of the among-year maximum counts for those plots. This proportion-of-maximum summary was the annual index for each count type.

To compare the various methods of quantifying breeding chronology and reproductive success, I used data from the years 1994-1999, when observations covered more of the incubation period than in other years. I tested the comparisons using correlation analysis with significance levels (“rcorr” function, type=”pearson”, in “hmisc” package in R). The correlation coefficients and significant p-values are listed in Table 44 of this report. Because of the large numbers of comparisons some random significant results could be expected, but overall patterns of significance among similar indices were used to support the use of substitute indices.

During 1995-2013 (except 2012) all plots were observed. For these years, with plots as sample units, among-year differences in counts of nest-sites (sites with eggs)(except for the years with insufficient egg observations), chicks, and fledglings were tested with repeated-measures ANOVA (using the “aov” procedure in R; R Core Team 2015), for parameters with adequate data.

In addition, all year-pairs (including years when not all plots were observed) were tested for differences in counts of nest-sites (sites with eggs)(except for the years with insufficient egg observations), chicks, and fledglings, with plots pooled. First, the count for each plot, each year, was transformed to proportion-of-among-year-maximum. These proportions were then arcsine-transformed. Post-hoc pairwise t-tests with adjusted p-values (Holm method in R) were then used to identify the significantly different year-pairs. The significance level used was 0.05.

Population Trend

During each productivity check we also counted adults on the productivity plots. For each count-day the among-plot counts were added to obtain a sum for the day. In most years and on most count-days adults in all 10 plots were counted. Because in some years and on some count-days some plots were omitted, to make the counts comparable across all years and as many days as possible I transformed the data. I first found the among-year maximum count (within the “census period”, described below) for each plot. Then for each count-day in a year I divided the among-plot count sum by the sum of the among-year maximum counts for the plots counted that day. The result was a proportion-of-maximum sum for the plots counted that day.

The annual index for population trend was the among-day mean of these proportion-of-maximum summary counts. Included in the mean were only counts made during the “census period”, when counts are most stable: from mid-incubation until the start of fledging, and during the time of day (1100-2000) when, at this colony, the numbers of murres attending the cliffs are most stable (Boersma et al. 1995).

Among-year differences in among-day proportion-of-maximum counts of adult were tested with ANOVA (using the “aov” procedure in R; R Core Team 2015). The proportions were first arcsine-transformed.

Post-hoc pairwise t-tests with adjusted p-values (Holm method in R) were then used to identify the significantly different year-pairs. The significance level used was 0.05.

Chick Diet

From a station about 15 m diagonally above a dense group of nest-sites, on several days during the nestling period prey items delivered to murre chicks were identified in parents' bills as murres returned head-on to nest-sites. During 1995-2011 observations were made with 7 x 42 binoculars; during 2013-2014 prey were identified from photographs taken with a digital SLR camera (Canon 60D with Canon 70-300 f/4-5.6L IS zoom lens). The photographic method resulted in higher sample sizes. We identified prey to species or family groups using color and shape of the body and fins (e.g., caudal, anal, and adipose fins). Few prey items were not identifiable (typically less than 5 percent per year; maximum 7.8 percent). For each year I calculated percent chick diet composition by number of prey items in each prey category.

Comparisons among Murre Indices

This report compares the reproductive parameter indices, population trend index, and chick diet parameters with each other, among years, and with environmental variables.

I used various reproductive parameters rather than just one because each parameter may indicate environmental influences on different parts of the breeding season. For example, egg production may reflect conditions early in the season, while fledging may be most affected by later conditions. The reproductive indices used for this analysis are listed in Table 42.

The breeding parameter indices were compared with each other to examine which factors appeared to vary independently and which covaried. I used correlation analysis with significance levels ("rcorr" function; type="pearson"; in "hmisc" package in R statistics software, Harrell et al. 2015; significance level 0.05).

Because of the large number of comparisons made, some significant correlation results would be expected to occur at random. The comparisons were exploratory—for observing patterns and forming initial inquiries.

Correlations analysis of the chick diet data needs an additional measure of caution. Because they are compositional data they are not independent from each other within a given year—an increase in one diet species must be offset by a decrease in at least one of the other species. I have nonetheless included the analysis here as exploratory; it will be refined in a future publication.

Comparison of Annual Murre Indices with Monthly Environmental Indices

To search for components of the environment correlated with murre reproductive success, I compared environmental indices with reproductive indices. I used environmental indices that had adequate time-series and that seemed fundamental to changes in the physical environment. I chose sea-surface temperature (SST) indices and an atmospheric pressure index. Because environmental changes vary within each year, and because I was interested in effects on components of productivity that occur at various times of each breeding season, I used monthly values of the environmental indices for comparison.

Uncertain whether local or broader-scale SST would be more important, I used several SST datasets. These datasets were from: 1) dataloggers we deployed at Amatuli Cove, East Amatuli Island; 2) a NOAA tide station at Seldovia (Station 9455500, 55 km north of East Amatuli [seven consecutive months of erroneous data were replaced with data from an adjacent sensor operated by the Kachemak Bay Research Reserve]); 3) the "GAK1 Mooring" outside Resurrection Bay; and 4) NOAA Buoy 46001, 324 km southeast of Kodiak. For each of these datasets the anomaly from the among-year mean for each month was calculated; this monthly anomaly was the index used for comparisons. The station locations are shown in Figure 2.

We also used the Pacific Decadal Oscillation monthly index, defined as:

"...the leading PC [principal component] of monthly SST anomalies in the North Pacific Ocean, poleward of 20N. The monthly mean global average SST anomalies are removed to separate this pattern of variability from any 'global warming' signal that may be present in the data" (http://jisao.washington.edu/pdo/PDO.latest)

When this index has a high positive value, SST is high along the west coast of North America from Alaska to the equator and cool in the central North Pacific. When the index is strongly negative, the opposite spatial SST pattern occurs.

The atmospheric pressure index used was the North Pacific Index, defined as:

"The...area-weighted sea level pressure over the region 30°N-65°N, 160°E-140°W. The NP Index is defined to measure interannual to decadal variations in the atmospheric circulation. The dominant atmosphere-ocean relation in the North Pacific is one where atmospheric changes lead changes in sea surface temperatures by one to two months."

This definition was taken from <https://climatedataguide.ucar.edu/climate-data/north-pacific-np-index-trenberth-and-hurrell-monthly-and-winter>, which cites The North Pacific Index (Trenberth and Hurrell 1994; Hurrell et al. 2014). Monthly values were obtained from: <https://climatedataguide.ucar.edu/sites/default/files/climate_index_files/npindex_monthly_1.txt>.

These six environmental variables were tested for associations among themselves by month with correlation analysis with significance levels ("rcorr" function, type="pearson", in "hmisc" package in R, significance level 0.05). The correlation coefficients and significant p-values are listed in tables of this report.

To compare the monthly environmental values with the breeding parameters I used correlation analysis with significance levels ("rcorr" function, type="pearson", in "hmisc" package in R, significance level 0.05). The correlation coefficients and significant p-values are listed in tables of this report.

To see whether environmental changes during the years(s) before the breeding year were important, in addition to testing correlation with matched-year monthly environmental variables and breeding parameters, the tests were repeated with lagged breeding parameters—the breeding parameter values were paired with environmental values from the previous year, and from two years previous.

Because of the large number of comparisons made, some significant correlation results would be expected to occur randomly. The comparisons were exploratory—for observing patterns and forming initial inquiries.

RESULTS AND DISCUSSION

Comparisons Across and Between Years, by Breeding Parameter

Breeding Chronology

Mean hatch date calculated from egg-to-chick repeated observations during 1994-1999 appeared to closely match those obtained by subtracting a standard nestling period from observed chick fledge dates (Figure 9; Table 3). Correlation testing substantiated this relationship (see "hd_obs" compared with "hd_dd21" and with "hd_dd21_10" in Table 44).

In the full series of hatch dates back-calculated from fledge dates (1994-2014; Figure 10; Tables 3 and 4), the interannual pattern varied apparently somewhat sinusoidally around the mean date of 15 August. Annual mean dates ranged from 12 days earlier to 17 days later than the overall mean—a span of 30 days. Generally, the mean date in 1993 was at the among-year mean, then became earlier until about 1999, then later until about 2010, then remained about a week later than average through 2014.

Reproductive Performance

During the six years with full-season egg-laying and -hatching data (1994-1999; seven years [1993-1999] for some parameters), the various methods of measuring absolute chick and fledgling production produced results that matched each other fairly well and showed a similar pattern across the years (Figure 11; Table 6; correlation results in Table 43).

Also similar to each other and sharing a similar pattern across years were results from the two methods (using the "observed-age" and the "seen-for-10-days-after-mean-plot-hatch-date" definitions of "fledgling") of measuring the primary ratio parameters used for estimating reproductive success for these years (Figure 12; Table 6; correlation results in Table 43).

For the seven years (1994-1999 and 2014) with observational data suitable for among-year comparison of chick-fledging from observational data (which required a hatch date determined from observations before and after hatching, and observations that the chick was at least 15 days old before it disappeared; see Figures 7 and 8 for the proportion of chicks without hatch dates for each year), components of productivity (egg loss, chick loss, and chick fledging) were similar across years (Figure 13; Table 6).

When "fledging" was based on chicks seen for at least 10 days after their plot's mean hatch date (rather than requiring observations both before and after hatching), all the monitoring years but four (2000-2002 and 2013) had data suitable for calculating components of productivity. With the added years, there was some indication of increased egg- and -chick loss during 2009-2011 (Figure 14; Table 6).

All but the years 2000-2002 and 2013 (and 2012, the no-data year) had data suitable for comparing the absolute counts of eggs in the plots among years (Figures 5 and 6; Table 2 show the proportion of eggs already hatched when we started observations). For the comparable years the number of eggs declined slightly (and some of this resulted from the small proportion of eggs already hatched in some of the later years) from the start of the monitoring years to 2011, and then increased to the original number in 2014 (Figures 15 and 16; Table 21). When I added chicks without prior egg-sightings to the number of nest-sites, the decline from the earlier years to the later years was similar (Figures 17 and 18; Table 25).

ANOVA with plots pooled showed that the number of eggs seen in 1995 was significantly higher than in 2004, 2005 and 2008-2011 (Table 49). In the repeated-measures test (comparing consistent plots across years) more years were excluded from analysis because some plots in some years had no data. There were no significant between-year differences in egg counts in the paired test (Table 51).

The number of chicks showed a decline larger than that of eggs, from the early years through 2011. The number increased again in 2013 and 2014 (Figures 19 and 20; Table 23).

Unpaired ANOVA showed that the chick count in 1997 was significantly higher than in 6 later years (2005, 2007-2008, 2010-2011, and 2013). Also higher than counts in 2010-2011 were counts in 1994 (higher than just 2010), 1995, 2000-2001, and 2003 (Table 52). The paired comparison showed a diminished similar pattern (Table 54).

Fledglings aged from observations of eggs and chicks had suitable data from 1994-1999 and 2014. Numbers varied by a maximum of 30% among years (Figures 21 and 22; Table 33). ANOVA of percent-of-maximum counts for 1994-1999 showed that the numbers of aged fledglings in 1997 were significantly higher than in 1996 and 1998 (Table 56).

“Fledglings” determined from chicks seen on the plots for at least 10 days after their plot’s mean hatch date had suitable data for all years but 2012. The pattern was very similar to that of all chicks: a decline from the earlier years (1994-2001) to 2011, and then back up in 2013 and 2014 (Figures 23 and 24; Table 30).

ANOVA showed the number of these “fledglings” was significantly higher in 1995 and 1997 than in 1998, 2004-2005, 2007 (lower than 1997 only), 2008-2011, and 2013 (1997 only; Table 57). The paired comparison showed very diminished similar results; 1997 counts were significantly higher than those from 2007-2008, 2010, and 2013; 2005 counts were significantly higher than those in just 2010 (Table 59).

The ratio of nest-sites with eggs to nest-sites that later had a chick showed a downward trend during 2003-2011, but then the ratio was back up in 2014 (Figures 25 and 26; Table 32).

The ratio of aged-fledglings to adjusted-eggs followed a similar pattern: a downward trend from 0.82 in 1997 to 0.38 in 2011, then back up to 0.63 in 2014 (Figures 27 and 28; Table 33).

The ratio of hatch-date-chicks to aged-fledged followed a similar but more subtle pattern (Figures 29 and 30; Table 34).

The among-year pattern for the ratio of nest-sites-with-eggs to chicks seen for 10 days after their plot’s mean hatch date was very similar to the pattern for the proportion of aged-fledglings to adjusted-eggs, as described above: a downward trend from almost 0.80 in 2002 to about 0.40 in 2011, then back up in 2014 (Figures 31 and 32; Table 35).

The ratio of all chicks to chicks seen 10 days after their plot’s mean hatch date was between 0.71 and 0.98 across years; the mean line on the chart was relatively flat (Figures 33 and 34;Table 36). The ratio on some plots varied much more than did the mean.

Population Trend

Counts of adult murres on the productivity plots dropped from 1993 to 1994, generally increased during 1994-2011, and then dropped in 2013-2014 to slightly below the beginning years (Figure 35, Table 39; there were no counts in 2012). The among-year patterns of these plot-summary adult counts were fairly consistent within the plots themselves: it appeared that in years when the among-plot sum was lower, for example, most of the individual plots contained fewer adults (Figure 36; this is reflected also in the error bars on Figure 35).

ANOVA showed that counts in 1993 were significantly higher than just the 1995 counts (Table 61). Counts in 1994-1996 were significantly lower than counts in many later years. Counts during 1997-2004 (except 2001, when counts were higher than the surrounding years) were lower than some of the later years but the number of significant pairings diminished through the period. Counts during 2005-2011 were, with 2001, the highest. Counts in 2013 and 2014 were significantly lower than in many of the previous years.

It appears that our field protocol that designates the start of fledging as the end of the each year's murre "census period" was generally accurate—a decline in murre counts generally began near the first-fledge date (Figure 37).

Chick Diet

In most years capelin (*Mallotus villosus*) comprised more than 90 percent of the number of prey items delivered to chicks by adults (Figure 38; Table 40). In two years (2004 and 2006) gadid prey made up 25-30 percent, and in 2007 sand lance (*Ammodytes personatus*) comprised almost 20 percent. Gadids, sand lance, squid, prowfish, and salmonids were present in most other years in small numbers. There was no overall trend in diet composition apparent across the years.

Comparisons between Breeding Indices, by Breeding Parameter

Abbreviations used in the breeding and diet parameter tables are described in Table 42. The data years for each parameter are shown in Table 43.

The correlation results listed and discussed in the following breeding parameter sections are from Tables 44-48. Except where noted, the results use all the data-years during 1993-2014 that were available for the tests.

Hatch Date Results

For the years with the most complete data for comparison (1993-1999) all of the hatch date parameters, whether from observations of egg-to-chicks, or back-calculated from chick disappearance dates, were highly correlated with each other, at level ≤0.002 (Table 44). I decided to use for all-years comparisons the parameter hd_obs_or_dd21_10, as this would maximize the sample size of hatch dates.

Correlation results for later (positive) hatch date (using hd_obs_or_dd21_10):

Parameter	No lag correlation	Years[a] in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	-[b]	21	pos	pos
Number of sites with egg	neg[c]	17	neg	-
Number of chicks	neg	21	neg	neg
Number of fledglings by age (fldg_obs)	-	7	-	-
Number of fledglings by seen-10-days	neg	21	neg	neg
Productivity_1 (fldg_obs/egg_adj)	neg	17	neg	neg
Productivity_2 (fldg_10/egg)	neg	17	neg	neg
Hatching success_1 (fldg_obs/ch_adj)	neg	19	neg	neg
Hatching success_2 (fldg_10/ch)	neg	21	-	-
Population size (pop_prod)	pos	21	pos	pos
Osmerid	-	18	-	-
Salmonid	neg	18	-	neg
Gadid	-	18	-	-
Sand lance	-	18	-	-

[a] Number of years.
[b] A dash means "no data".
[c] For hatch date, negative is earlier.

Hatch Date Discussion

Later hatch date was significantly associated with lower productivity as measured by almost all productivity measures. The exception--number of aged fledglings (there were only seven years of aged fledgling data)—also tended to be lower but was not significantly so. The number of adults counted on the plots was significantly higher in years of later hatch date. The proportion of salmonids in the chick diet was lower in "late" years (but the proportion was very low in all years).

When hatch date was compared with parameters from one and two years previous, correlation results showed hatch date positively correlated with itself: later hatch date one year was correlated with later hatch date both one and two years earlier. Results for the other parameters were fairly similar to the no-lag results: a parameter significantly correlated with same-year hatch date values tended to also be correlated (with the same sign) with hatch date values from both one and two years previous.

Number of Eggs Results

Correlation results for higher egg counts:

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	17	neg	neg
Number of sites with egg	-	17	-	-
Number of chicks	pos	17	-	pos
Number of fledglings by age (fldg_obs)	-	7	-	-
Number of fledglings by seen-10-days	pos	17	-	pos
Productivity_1 (fldg_obs/egg_adj)	pos	16	pos	pos
Productivity_2 (fldg_10/egg)	pos	17	-	pos
Hatching success_1 (fldg_obs/ch_adj)	pos	17	pos	pos
Hatching success_2 (fldg_10/ch)	pos	17	-	-
Population size (pop_prod)	neg	17	neg	neg
Osmerid	-	14	-	-

Salmonid	-	14		-
Gadid	-	14	-	-
Sand lance	-	14	-	-

Number of Eggs Discussion

Higher egg count was significantly associated with earlier hatch date and higher values of almost all other productivity parameter values. The exception was the number of aged fledglings, which also tended to be positive, but not significantly so (but for this parameter there were only seven comparable years). Higher egg count was significantly associated with lower counts of adults.

When the number of eggs was compared with parameter values from one and two years previous, results were similar to same-year results, but the associations were not significant in some cases.

Number of Chicks Results

Correlation results for higher chick counts:

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	21	neg	neg
Number of sites with egg	pos	17	-	-
Number of chicks	-	21	pos	-
Number of fledglings by age (fldg_obs)	pos	7	-	-
Number of fledglings by seen-10-days	pos	21	-	-
Productivity_1 (fldg_obs/egg_adj)	pos	17	pos	pos
Productivity_2 (fldg_10/egg)	pos	17	pos	pos
Hatching success_1 (fldg_obs/ch_adj)	pos	19	-	pos
Hatching success_2 (fldg_10/ch)	pos	21	-	-
Population size (pop_prod)	neg	21	neg	-
Osmerid	-	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	-	-

Number of Chicks Discussion

Higher chick count was significantly correlated with earlier hatching, and with all measures of productivity. Higher annual values of the parameter were significantly correlated with counts of adults.

When compared with parameter values from one and two years previous, results for the number of chicks were similar to same-year results, but the associations were not significant in some cases.

Number of Fledglings (fldg_obs) Results

Correlation results for higher fledgling (fldg_obs) counts:

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	-	7	-	neg
Number of sites with egg	-	7	-	-

Number of chicks	pos	7	-	-
Number of fledglings by age (fldg_obs)	-	7	-	-
Number of fledglings by seen-10-days	pos	7	-	-
Productivity_1 (fldg_obs/egg_adj)	pos	7	-	-
Productivity_2 (fldg_10/egg)	pos	7	-	-
Hatching success_1 (fldg_obs/ch_adj)	pos	7	-	-
Hatching success_2 (fldg_10/ch)	pos	7	-	-
Population size (pop_prod)	-	7	-	-
Osmerid	-	5	-	neg
Salmonid	-	5	-	-
Gadid	-	5	-	-
Sand lance	-	5	-	-

Number of Fledglings (fldg_obs) Discussion

For the seven years of comparable aged-fledgling counts, higher counts of were significantly positively correlated with all other measures of productivity except the number of eggs (which had a positive but nonsignificant relationship).

There was little significant correlation between the number of fldg_obs chicks and one-year- and two-years-previous values from the other parameters.

Number of Fledglings (fldg_10) Results

Correlation results for higher fledgling (fldg_10) counts:

Parameter	Sign of correlation	Years[a] in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	21	neg	neg
Number of sites with egg	pos	17	-	-
Number of chicks	pos	21	pos	pos
Number of fledglings by age (fldg_obs)	-	7	-	-
Number of fledglings by seen-10-days	pos	21	pos	pos
Productivity_1 (fldg_obs/egg_adj)	pos	17	pos	pos
Productivity_2 (fldg_10/egg)	pos	17	pos	pos
Hatching success_1 (fldg_obs/ch_adj)	pos	19	-	pos
Hatching success_2 (fldg_10/ch)	pos	21	-	-
Population size (pop_prod)	neg	21	neg	-
Osmerid	-	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	-	-

Number of Fledglings (fldg_10) Discussion

The number of fledglings determined from chicks seen for 10 days after their plot's mean hatch date was significantly correlated with earlier hatch date. The parameter was significantly positively correlated with all other measures of productivity. It was significantly negatively correlated with adult counts.

When compared with parameter values from one and two years previous, results for the number of fldg_10 chicks were similar to same-year results, but the associations were not significant so in some cases.

Aged Fledglings/Eggs (fldg_obs/egg_adj) Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	17	neg	neg
Number of sites with egg	pos	16	pos	pos
Number of chicks	pos	17	pos	pos
Number of fledglings by age	pos	7	-	-
Number of fledglings by seen-10-days	pos	17	pos	pos
Productivity_1 (fldg_obs/egg_adj)	-	17	pos	pos
Productivity_2 (fldg_10/egg)	pos	16	pos	pos
Hatching success_1 (fldg_obs/ch_adj)	pos	17	pos	pos
Hatching success_2 (fldg_10/ch)	pos	17	-	-
Population size (pop_prod)	neg	17	neg	-
Osmerid	-	15	-	-
Salmonid	-	15	-	pos
Gadid	-	15	-	-
Sand lance	-	15	-	-

Aged Fledglings/Eggs Discussion

Higher aged fledglings-to-eggs ratio was significantly associated with earlier hatch date. The ratio was significantly positively correlated with all other measures of productivity. It was negatively associated with counts of adults.

Comparison of the ratio with values collected one and two years previous yielded similar results.

Aged Fledglings/Chicks (fldg_obs/ch_adj) Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	19	neg	neg
Number of sites with egg	pos	17	pos	-
Number of chicks	pos	19	pos	pos
Number of fledglings by age (fldg_obs)	pos	7	-	-
Number of fledglings by seen-10-days	pos	19	pos	pos
Productivity_1 (fldg_obs/egg_adj)	pos	17	pos	pos
Productivity_2 (fldg_10/egg)	pos	17	pos	pos
Hatching success_1 (fldg_obs/ch_adj)	-	19	pos	pos
Hatching success_2 (fldg_10/ch)	pos	19	-	-
Population size (pop_prod)	neg	19	neg	neg
Osmerid	-	16	-	-
Salmonid	-	16	-	pos
Gadid	-	16	-	-
Sand lance	-	16	-	-

Aged Fledglings/Chicks Discussion

Higher aged fledglings-to-chicks ratio was significantly associated with earlier hatch date. The ratio was significantly positively correlated with all other measures of productivity. It was negatively associated with counts of adults.

Comparison of the ratio with values collected one and two years previous yielded similar results.

Population Size (counts of adults) Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	pos	21	pos	pos
Number of sites with egg	neg	17	neg	-
Number of chicks	neg	21	neg	neg
Number of fledglings by age (fldg_obs)	-	7	-	-
Number of fledglings by seen-10-days	neg	21	neg	neg
Productivity_1 (fldg_obs/egg_adj)	neg	17	neg	neg
Productivity_2 (fldg_10/egg)	neg	17	neg	neg
Hatching success_1 (fldg_obs/ch_adj)	neg	19	neg	neg
Hatching success_2 (fldg_10/ch)	neg	21	-	-
Population size (pop_prod)	-	21	pos	pos
Osmerid	-	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	-	-

Population Size Discussion

Among years, higher counts of adults in the productivity plots were significantly correlated with later hatch date. Higher counts were significantly negatively associated with most productivity measures; aged fledglings was the single exception: that parameter had only seven comparable years and was negatively associated but not significantly so.

Comparison of adult counts with those from one and two years previous yielded similar results.

Chick Diet: Chick diet correlation results need to be viewed with the caveat stated in Methods: The diet data are compositional and therefore are not independent from each other within a given year—an increase in one diet species must be offset by a decrease in at least one of the other species. In addition, there may be significant but unidentified joint relationships that aren't seen when looking at individual species.

Osmerids in Chick Diet Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	-	18	-	-
Number of sites with egg	-	14	-	-
Number of chicks	-	18	-	-
Number of fledglings by age (fldg_obs)	-	5	-	-
Number of fledglings by seen-10-days	-	18	-	-
Productivity_1 (fldg_obs/egg_adj)	-	15	-	-
Productivity_2 (fldg_10/egg)	-	14	-	-
Hatching success_1 (fldg_obs/ch_adj)	-	16	-	-
Hatching success_2 (fldg_10/ch)	-	18	-	-
Population size (pop_prod)	-	18	-	-
Osmerid	-	18	-	-
Salmonid	-	18	-	-

Gadid	neg	18	-	-
Sand lance	neg	18	-	-

Osmerids in Chick Diet Discussion

The proportion of osmerids in chick diets (all of the osmerids identified were capelin) was negatively correlated with the proportion of gadid and sand lance. The proportion was not significantly associated with any of the other parameters.

When the proportion of osmerids was compared with parameters values from one and two years previous, there were no significant results.

Salmonids in Chick Diet Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	neg	18	neg	-
Number of sites with egg	-	14	-	-
Number of chicks	-	18	-	pos
Number of fledglings by age (fldg_obs)	-	5	-	-
Number of fledglings by seen-10-days	-	18	-	-
Productivity_1 (fldg_obs/egg_adj)	-	15	pos	-
Productivity_2 (fldg_10/egg)	-	14	-	-
Hatching success_1 (fldg_obs/ch_adj)	-	16	-	-
Hatching success_2 (fldg_10/ch)	-	18	-	-
Population size (pop_prod)	-	18	-	-
Osmerid	-	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	-	-

Salmonids in Chick Diet Discussion

A higher proportion of salmonids in chick diet was significantly correlated with same-year earlier hatch date—possibly a spurious lone result.

There were few cases of salmonids being significantly correlated with the previous two years' values.

Gadids in Chick Diet Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	-	18	-	-
Number of sites with egg	-	14	-	-
Number of chicks	-	18	-	-
Number of fledglings by age (fldg_obs)	-	5	-	-
Number of fledglings by seen-10-days	-	18	-	-
Productivity_1 (fldg_obs/egg_adj)	-	15	-	-
Productivity_2 (fldg_10/egg)	-	14	-	-
Hatching success_1 (fldg_obs/ch_adj)	-	16	-	-
Hatching success_2 (fldg_10/ch)	-	18	-	-
Population size (pop_prod)	-	18	-	-

Osmerid	neg	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	pos	-

Gadids in Chick Diet Discussion

A higher proportion of gadids in chick diets was significantly correlated only with a same-year lower proportion of osmerids and previous-year higher proportion of sand lance.

Sand lance in Chick Diet Results

Parameter	Sign of correlation	Years in shared dataset	Lag 1yr correlation	Lag 2yr correlation
Hatch date (hd_obs_or_dd21_10)	-	18	-	-
Number of sites with egg	-	14	-	-
Number of chicks	-	18	-	-
Number of fledglings by age (fldg_obs)	-	5	-	-
Number of fledglings by seen-10-days	-	18	-	-
Productivity_1 (fldg_obs/egg_adj)	-	15	-	-
Productivity_2 (fldg_10/egg)	-	14	-	-
Hatching success_1 (fldg_obs/ch_adj)	-	16	-	-
Hatching success_2 (fldg_10/ch)	-	18	-	neg
Population size (pop_prod)	-	18	-	-
Osmerid	neg	18	-	-
Salmonid	-	18	-	-
Gadid	-	18	-	-
Sand lance	-	18	-	-

Sand lance in Chick Diet Discussion

A higher proportion of sand lance in chick diets was significantly correlated only with a lower proportion of osmerids in the diet.

There was only one significant correlation, possibly spurious, when the proportion of sand lance was compared with parameter values from the previous two years.

Chick Diet Summary—Not Lagged

Diet group	Gadid	Sand lance
Osmerid	neg	neg
Salmonid	-	-

A higher proportion of osmerids in chick diet was significantly correlated with lower proportions of gadids and sand lance.

Comparisons between Environmental Variables

Data years for each environmental variable are shown in Table 63.

Results

All significant between-station sea-surface temperature monthly anomaly correlations (Table 64) were positive except one (between GAK1 and Buoy 46001 in September).

Sea-surface temperature anomalies at the Seldovia tide station were most synchronized with those at Amatuli Cove—they were highly correlated for all months of the year. The station with the next-highest number of months with anomalies similar to those at Seldovia was Buoy 46001: only the September pairing was not significant. Comparison of Seldovia with GAK1 showed that August through October were the months with SSTs not significantly similar.

After its similarity to Seldovia's SST, East Amatuli's SST anomaly was next-most similar to that at Buoy 46001, with all but three months significantly correlated. Similar to results for Seldovia's SST, East Amatuli's SST anomaly was not synchronized with GAK1's during July through October.

Finally, Buoy 46001's SST anomalies were correlated with GAK1's for just half the months of the year.

All significant correlations between the Pacific Decadal Oscillation (PDO) values and sea-surface temperature anomalies were positive (Table 65).

The PDO values were most similar to the pattern of Amatuli Cove's SST anomalies—only October's values were not significantly correlated. Next were Seldovia's SST (September and October were not significant) and Buoy 46001 (July and August were not significant), and then GAK1 (June through October were not significant). (Note, however, that Amatuli Cove's data-years available for comparison were fewer than those for Seldovia and Buoy 46001 [Table 63].)

The North Pacific Index (NPI) was much less synchronized with the other variables. All significant correlations were negative. The NPI and PDO values were significantly correlated for just four months, Seldovia SST three months, and Amatuli Cove and GAK1 for just January. Lagging the temperatures one, two, and three months behind the NPI (as suggested by the definition in *Methods*, "The dominant atmosphere-ocean relation in the North Pacific is one where atmospheric changes lead changes in sea surface temperatures by one to two months") did not increase the number of significant correlations.

Discussion

SST anomalies at Seldovia, Amatuli Cove, and Buoy 46001 were well synchronized with each other.

Anomalies at the GAK1 mooring station were less synchronized with the other stations, for the summer months and later.

The PDO index was well synchronized with the SST station anomalies (except for GAK1 during the summer). This is logical, since the PDO is calculated from SSTs, and a positive PDO is formed partly from positive temperature anomalies in the Gulf of Alaska.

The NPI is calculated from atmospheric pressure values; apparently the pressure values didn't correlate tightly with SST anomalies in this area, for the time periods tested.

Comparisons of Lagged and Non-lagged Murre Indices with Environmental Variables, by Environmental Dataset

Data years and months for each environmental variable used are shown in Table 63. Breeding parameter-environmental variable results are listed in Tables 66-83. Correlations between the environmental variables themselves are shown in Tables 64-65.

Seldovia SST Monthly Anomaly, Murre Indices Not Lagged, Results

Parameter	Month[a]	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	20-21
Number of sites with egg	-	-	16-17
Number of chicks	-	-	20-21
Number of fledglings by age	-	-	6-7
Number of fledglings by seen-10-days	-	-	20-21
Productivity_1 (fldg_obs/egg_adj)	-	-	16-17
Productivity_2 (fldg_10/egg)	-	-	16-17
Hatching success_1 (fldg_obs/ch_adj)	-	-	18-19
Hatching success_2 (fldg_10/ch)	-	-	20
Population size (pop_prod)	-	-	20
Osmerid	-	-	18
Salmonid	12	neg	18
Gadid	-	-	18
Sand lance	3	neg	18

[a] Month(s) (by month-of-year number) with SST anomaly significantly correlated with each breeding parameter.

Seldovia SST Monthly Anomaly, Murre Indices Not Lagged, Discussion

There were very few significant correlations between same-year Seldovia SST and the murre parameters. (And a few spurious results would be expected, given the large number of comparisons made.)

Seldovia SST Monthly Anomaly, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	20-21
Number of sites with egg	-	-	16-17
Number of chicks	-	-	20-21
Number of fledglings by age	12	neg	6-7
Number of fledglings by seen-10-days	-	-	20-21
Productivity_1 (fldg_obs/egg_adj)	-	-	16-17
Productivity_2 (fldg_10/egg)	-	-	16-17
Hatching success_1 (fldg_obs/ch_adj)	-	-	18-19
Hatching success_2 (fldg_10/ch)	-	-	20
Population size (pop_prod)	-	-	20
Osmerid	4-8,10	neg	17-18
Salmonid	-	-	17-18
Gadid	5-8,10	pos	17-18
Sand lance	1,9	pos	17-18

Seldovia SST Monthly Anomaly, Murre Indices Lagged One Year, Discussion

Previous-year warmer water at Seldovia was significantly correlated with lower proportions of osmerids and higher proportions of gadids in murre chick diets over several months before and during the nesting season. There were two months of significant positive correlation with sand lance in the diet, although the months were January and September.

Seldovia SST Monthly Anomaly, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	19-21
Number of sites with egg	-	-	16-17
Number of chicks	-	-	20-21
Number of fledglings by age	10	pos	6-7
Number of fledglings by seen-10-days	-	-	19-21
Productivity_1 (fldg_obs/egg_adj)	-	-	16-17
Productivity_2 (fldg_10/egg)	4	pos	15-17
Hatching success_1 (fldg_obs/ch_adj)	9	neg	17-19
Hatching success_2 (fldg_10/ch)	-	-	19
Population size (pop_prod)	9	pos	19
Osmerid	12	neg	17-18
Salmonid	-	-	17-18
Gadid	12	pos	17-18
Sand lance	7-8,12	pos	17-18

Seldovia SST Monthly Anomaly, Murre Indices Lagged Two Years, Discussion

There is some indication that warmer water two years previous to a breeding season increased the availability of sand lance to the murres. Some various single months of “significant” correlation may be spurious.

Barrens (East Amatuli Cove mooring) SST Monthly Anomaly, Murre Indices Not Lagged, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	15-17
Number of sites with egg	9,11	pos	11-13
Number of chicks	7,9,11	pos	15-17
Number of fledglings by age	-	-	2-4
Number of fledglings by seen-10-days	7,9,11	pos	15-17
Productivity_1 (fldg_obs/egg_adj)	7,9	pos	12-14
Productivity_2 (fldg_10/egg)	7,9	pos	11-13
Hatching success_1 (fldg_obs/ch_adj)	7	pos	13-15
Hatching success_2 (fldg_10/ch)	9	pos	15
Population size (pop_prod)	11	neg	15
Osmerid	-	-	14-16
Salmonid	-	-	14-16
Gadid	-	-	14-16
Sand lance	-	-	14-16

Barrens SST Monthly Anomaly, Murre Indices Not Lagged, Discussion

Warmer Barrens SST in July was associated with higher chick counts and higher values of some of the ratio parameters. Correlation with months at the end of or after the breeding season wouldn't be expected to have a functional relationship with earlier nesting parameters (such as the September and November correlations with the number of eggs)—perhaps autocorrelation of SST across months may play a role in these results. The correlation table (Table 69) shows that the months of significant correlation are surrounded by months of same-sign but non-significant correlation results.

Barrens SST same-year correlations with murre indices showed more significant results than did those using Seldovia SST. This is interesting, given the high correlation between Seldovia and Barrens SST anomaly values themselves (Table 64). One observation is that several of the significant results occurred in the months with lower between-SST-site correlation coefficients.

Barrens SST Monthly Anomaly, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	6-7,11	neg	11-13
Number of sites with egg	-	-	10-12
Number of chicks	11	pos	14-16
Number of fledglings by age	-	-	1-3
Number of fledglings by seen-10-days	-	-	14-16
Productivity_1 (fldg_obs/egg_adj)	3,6	pos	11-13
Productivity_2 (fldg_10/egg)	-	-	10-12
Hatching success_1 (fldg_obs/ch_adj)	6	pos	12-14
Hatching success_2 (fldg_10/ch)	-	-	14
Population size (pop_prod)	-	-	14
Osmerid	3-6,8-10	neg	13-15
Salmonid	-	-	13-15
Gadid	4-5,8-10	pos	13-15
Sand lance	-	-	13-15

Barrens SST Monthly Anomaly, Murre Indices Lagged One Year, Discussion

Hatch date was earlier when the previous year's Barrens SST was warmer in June, July, and November. The number of chicks had a positive significant result for November, and two of the ratio parameters had significant results for March and/or June. The correlation table (Table 70) shows that the months of significant correlation are surrounded by months of same-sign but non-significant correlation results.

The proportion of osmerids in the chick diet was higher and the proportion of gadids was lower after the previous year's SST was warmer. This association was significant for several months' values.

Barrens SST Monthly Anomaly, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	13-15
Number of sites with egg	-	-	10-12
Number of chicks	-	-	14-16
Number of fledglings by age	-	-	1-2
Number of fledglings by seen-10-days	-	-	13-15

Productivity_1 (fldg_obs/egg_adj)	7	pos	11-12
Productivity_2 (fldg_10/egg)	4,6-7	pos	10-11
Hatching success_1 (fldg_obs/ch_adj)	-	-	12-13
Hatching success_2 (fldg_10/ch)	-	-	13
Population size (pop_prod)	-	-	13
Osmerid	12	neg	12-14
Salmonid	-	-	12-14
Gadid	-	-	12-14
Sand lance	7-8,12	pos	12-14

Barrens SST Monthly Anomaly, Murre Indices Lagged Two Years, Discussion

Fledgling-per-egg parameters tended to be higher two years after Barrens summer SST temperatures were higher.

Warmer temperatures at the Barrens were also correlated with more sand lance in murre chick diet two years later.

GAK1 SST Monthly Anomaly, Murre Indices Not Lagged, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	13-14
Number of sites with egg	4	pos	9-10
Number of chicks	-	-	13-14
Number of fledglings by age	-	-	1-2
Number of fledglings by seen-10-days	-	-	13-14
Productivity_1 (fldg_obs/egg_adj)	-	-	10-11
Productivity_2 (fldg_10/egg)	-	-	9-10
Hatching success_1 (fldg_obs/ch_adj)	-	-	11-12
Hatching success_2 (fldg_10/ch)	-	-	13
Population size (pop_prod)	-	-	13
Osmerid	-	-	12-14
Salmonid	-	-	12-14
Gadid	-	-	12-14
Sand lance	-	-	12-14

[a] Month(s) (by month-of-year number) with SST anomaly significantly correlated with each breeding parameter.

GAK1 SST Monthly Anomaly, Murre Indices Not Lagged, Discussion

There was little significant same-year correlation between GAK1 temperatures and murre parameters. There was one month (April) of significant positive correlation between the number of eggs produced and GAK1 SST.

GAK1 SST Monthly Anomaly, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	4	neg	12-14
Number of sites with egg	-	-	9-11
Number of chicks	-	-	13-14
Number of fledglings by age	-	-	1-2
Number of fledglings by seen-10-days	-	-	12-14

Productivity_1 (fldg_obs/egg_adj)	-	-	10-12
Productivity_2 (fldg_10/egg)	-	-	9-11
Hatching success_1 (fldg_obs/ch_adj)	-	-	11-13
Hatching success_2 (fldg_10/ch)	-	-	12
Population size (pop_prod)	-	-	12
Osmerid	1,5-6,11	neg (11 pos))	11-13
Salmonid	-	-	11-13
Gadid	5,10-11	neg (5 pos)	11-13
Sand lance	-	-	11-13

GAK1 SST Monthly Anomaly, Murre Indices Lagged One Year, Discussion

Higher GAK1 SST in 4 months was significantly correlated with fewer osmerids in the chicks diets the following year. The significant results for gadids were mixed: positive for May and negative for October and November.

GAK1 SST Monthly Anomaly, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	11-13
Number of sites with egg	-	-	9-11
Number of chicks	-	-	12-14
Number of fledglings by age	-	-	1
Number of fledglings by seen-10-days	-	-	11-13
Productivity_1 (fldg_obs/egg_adj)	-	-	10-11
Productivity_2 (fldg_10/egg)	5	pos	9-10
Hatching success_1 (fldg_obs/ch_adj)	-	-	11-12
Hatching success_2 (fldg_10/ch)	-	-	11
Population size (pop_prod)	-	-	11
Osmerid	-	-	10-12
Salmonid	-	-	10-12
Gadid	-	-	10-12
Sand lance	10	neg	10-12

GAK1 SST Monthly Anomaly, Murre Indices Lagged Two Years, Discussion

There were just two parameter-months of significant correlation with two-years-previous GAK1 SST.

B46001 SST Monthly Anomaly, Murre Indices Not Lagged, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	18-21
Number of sites with egg	-	-	14-17
Number of chicks	-	-	18-21
Number of fledglings by age	-	-	6-7
Number of fledglings by seen-10-days	-	-	18-21
Productivity_1 (fldg_obs/egg_adj)	-	-	14-17
Productivity_2 (fldg_10/egg)	-	-	14-17
Hatching success_1 (fldg_obs/ch_adj)	-	-	16-19
Hatching success_2 (fldg_10/ch)	-	-	14-17
Population size (pop_prod)	-	-	18
Osmerid	10	neg	16-18

Salmonid	-	-	16-18
Gadid	10	pos	16-18
Sand lance	-	-	16-18

[a] Month(s) (by month-of-year number) with SST anomaly significantly correlated with each breeding parameter.

B46001 SST Monthly Anomaly, Murre Indices Not Lagged, Discussion

There were just two significant parameter-month correlations between Buoy 46001 SST and that year's murre parameters, and those correlations were for October, after the nesting season.

B46001 SST Monthly Anomaly, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	18-21
Number of sites with egg	-	-	14-17
Number of chicks	-	-	18-21
Number of fledglings by age	2	neg	6-7
Number of fledglings by seen-10-days	-	-	18-21
Productivity_1 (fldg_obs/egg_adj)	-	-	16-19
Productivity_2 (fldg_10/egg)	-	-	14-17
Hatching success_1 (fldg_obs/ch_adj)	-	-	14-17
Hatching success_2 (fldg_10/ch)	-	-	18
Population size (pop_prod)	-	-	18
Osmerid	1-3	neg	15-18
Salmonid	-	-	15-18
Gadid	1-2	pos	15-18
Sand lance	1	pos	15-18

B46001 SST Monthly Anomaly, Murre Indices Lagged One Year, Discussion

Warmer SST at Buoy 46001 during the winter before the breeding season was correlated with fewer osmerids and more gadids and sand lance in murre chick diets.

B46001 SST Monthly Anomaly, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	18-21
Number of sites with egg	-	-	14-17
Number of chicks	-	-	18-21
Number of fledglings by age	-	-	6-7
Number of fledglings by seen-10-days	-	-	18-21
Productivity_1 (fldg_obs/egg_adj)	-	-	14-17
Productivity_2 (fldg_10/egg)	-	-	14-17
Hatching success_1 (fldg_obs/ch_adj)	-	-	16-19
Hatching success_2 (fldg_10/ch)	-	-	18
Population size (pop_prod)	-	-	18
Osmerid	10,12	neg	15-18
Salmonid	-	-	15-18
Gadid	10,12	pos	15-18
Sand lance	6	pos	15-18

B46001 SST Monthly Anomaly, Murre Indices Lagged Two Years, Discussion

Warmer autumn SST at Buoy 46001 was correlated with a lower proportion of osmerids and a higher proportion of gadids in murre chick diets two years later.

PDO Monthly Index, Murre Indices Not Lagged, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	21
Number of sites with egg	4-7,10	pos	17
Number of chicks	7	pos	21
Number of fledglings by age	-	-	7
Number of fledglings by seen-10-days	7	pos	21
Productivity_1 (fldg_obs/egg_adj)	6-8	pos	17
Productivity_2 (fldg_10/egg)	7	pos	17
Hatching success_1 (fldg_obs/ch_adj)	4-5	pos	19
Hatching success_2 (fldg_10/ch)	-	-	21
Population size (pop_prod)	3-5	neg	21
Osmerid	-	-	18
Salmonid	-	-	18
Gadid	-	-	18
Sand lance	-	-	18

[a] Month(s) (by month-of-year number) with SST anomaly significantly correlated with each breeding parameter.

PDO Monthly Index, Murre Indices Not Lagged, Discussion

Higher same-year PDO index during April-July was correlated with more eggs counted. Higher July PDO was correlated with more chicks and with more fledglings (using the flg_10 method that has more years of data). Ratio reproductive parameters were generally higher in years of higher PDO; significantly so in some spring and summer months. Lower adult counts were correlated with higher PDO index in March-May.

PDO Monthly Index, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	3-5	neg	21
Number of sites with egg	-	-	17
Number of chicks	-	-	21
Number of fledglings by age	-	-	7
Number of fledglings by seen-10-days	-	-	21
Productivity_1 (fldg_obs/egg_adj)	3-5	pos	17
Productivity_2 (fldg_10/egg)	3-5	pos	17
Hatching success_1 (fldg_obs/ch_adj)	3-5	pos	19
Hatching success_2 (fldg_10/ch)	-	-	21
Population size (pop_prod)	-	-	21
Osmerid	1-2	neg	18
Salmonid	-	-	18
Gadid	-	-	18
Sand lance	-	-	18

PDO SST Monthly Index, Murre Indices Lagged One Year, Discussion

Higher PDO index in March and April was correlated with earlier hatch date the following year. Higher PDO in March-May was correlated with higher productivity ratios the following year.

It's possible that higher PDO in the winter of one year is associated with fewer osmerids in the murre chick diets the following year.

PDO SST Monthly Index, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	3-5,7	neg	21
Number of sites with egg	-	-	17
Number of chicks	3,4	pos	21
Number of fledglings by age	-	-	7
Number of fledglings by seen-10-days	4-5	pos	21
Productivity_1 (fldg_obs/egg_adj)	3-7	pos	17
Productivity_2 (fldg_10/egg)	2-7	pos	17
Hatching success_1 (fldg_obs/ch_adj)	4	pos	19
Hatching success_2 (fldg_10/ch)	-	-	21
Population size (pop_prod)	-	-	21
Osmerid	-	-	18
Salmonid	-	-	18
Gadid	-	-	18
Sand lance	-	-	18

PDO Monthly Index, Murre Indices Lagged Two Years, Discussion

Higher PDO index in March-May and July was associated with earlier hatching two years later. PDO in March and April was associated with more chicks two years later. There were more fledglings two years after higher PDO in April and May. There were higher fledgling/egg productivity ratios 2 years after spring-summer PDO.

NPI Monthly Index, Murre Indices Not Lagged, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	-	-	16
Number of sites with egg	-	-	15
Number of chicks	12	neg	19
Number of fledglings by age	5	neg	6
Number of fledglings by seen-10-days	-	-	19
Productivity_1 (fldg_obs/egg_adj)	-	-	16
Productivity_2 (fldg_10/egg)	-	-	15
Hatching success_1 (fldg_obs/ch_adj)	-	-	17
Hatching success_2 (fldg_10/ch)	-	-	19
Population size (pop_prod)	2	pos	19
Osmerid	7	pos	18
Salmonid	-	-	18
Gadid	-	-	18
Sand lance	7	neg	18

NPI Monthly Index, Murre Indices Not Lagged, Discussion

There were few significant correlations between the North Pacific Index and same-year murre parameters. Higher NPI in February was associated with more adults counted on the productivity plots.

Higher NPI was associated with a higher proportion of osmerids and a lower proportion of sand lance in murre chick diets.

NPI Monthly Index, Murre Indices Lagged One Year, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	2,3	pos	18
Number of sites with egg	-	-	14
Number of chicks	-	-	18
Number of fledglings by age	-	-	5
Number of fledglings by seen-10-days	-	-	18
Productivity_1 (fldg_obs/egg_adj)	-	-	15
Productivity_2 (fldg_10/egg)	-	-	14
Hatching success_1 (fldg_obs/ch_adj)	-	-	16
Hatching success_2 (fldg_10/ch)			18
Population size (pop_prod)	-	-	18
Osmerid	11	11 neg	17
Salmonid	2-3	neg	17
Gadid	11	pos	17
Sand lance	-	-	17

NPI SST Monthly Index, Murre Indices Lagged One Year, Discussion

Higher NPI in February and March was associated with later hatch date the next year.

Higher NPI in November was associated with a lower proportion of osmerids and a higher proportion of sand lance in murre diets the following breeding season. It's possible that higher NPI in February and March results in a lower proportion of salmonids in chick diets during the second breeding season after that.

NPI SST Monthly Index, Murre Indices Lagged Two Years, Results

Parameter	Month	Sign of correlation	Years in shared dataset
Hatch date (hd_obs_or_dd21_10)	9	pos	17
Number of sites with egg	-	-	14
Number of chicks	2	neg	18
Number of fledglings by age	12	neg	4
Number of fledglings by seen-10-days	2	neg	17
Productivity_1 (fldg_obs/egg_adj)	2	neg	14
Productivity_2 (fldg_10/egg)	1	neg	13
Hatching success_1 (fldg_obs/ch_adj)	2	neg	15
Hatching success_2 (fldg_10/ch)	-	-	17
Population size (pop_prod)	-	-	17
Osmerid	-	-	16
Salmonid	-	-	16

Gadid	10	neg	16
Sand lance	5,12	neg	16

NPI SST Monthly Index, Murre Indices Lagged Two Years, Discussion

There were some single-month significant correlations between NPI and two-years-later murre parameters.

Higher NPI in November was associated with a lower proportion of gadids in chick diets two years later. Higher NPI in May and December was associated with a lower proportion in chick diets two years later.

Summary of Comparisons of Non-lagged and One- and Two-Year-Lagged Murre Indices with Environmental Variables, by Environmental Dataset

1. Seldovia SST: Seldovia SST showed little significant correlation with murre reproductive parameters. Seldovia SST was correlated with proportions of fish in chick diets, mostly when the diet results were lagged one years later than the SST. In that case, warmer SST was associated with lower proportions of osmerid and higher proportions of gadids and salmonids in chick diets. There was some indication that warmer SST two years before a breeding season was associated with a higher sand lance proportion in the diet.

2. East Amatuli mooring: There were more significant correlations with East Amatuli ("Barrens") SST than with Seldovia's. In general, warmer SST at East Amatuli during the summer was associated with higher productivity of murres. The significant months were July and September, and November. September SST would be too late to have an effect on egg production, however; and November SST is too late to affect any of the parameters.

Higher SST at East Amatuli was associated with earlier hatch dates the following year. Seldovia SST showed a similar pattern although the results were not significant. As with Seldovia SST, uiwarmer SST at East Amatuli was associated with fewer osmerids and more gadids in murre chicks diets the following year, and a higher proportion of sand lance two years later.

3. GAK1 mooring: There was little significant correlation with the bird data for same-year SST at the GAK1 mooring. The first half of the lag-one year was significantly negative for the proportion of osmerids and positive for gadids, as with SST at Seldovia and East Amatuli.

The lagged-two-years results showed earlier hatching and there was a large positive response for the proportion of sand lance in chick diets.

4. Buoy 46001: As with SST at Seldovia and GAK1, there were very few same-year months of SST significantly correlated with murre parameters. Same-year, 1-year-lagged, and 2-year-lagged comparisons had results similar to the other SST areas: warmer SST was associated with fewer osmerids, more gadids, and in some cases more sand lance, in murre chicks diets.

5. PDO index: The same-year correlation results for the PDO index were similar to those for the Barrens SST, although the months of significance were earlier. There was no significant months for hatch date, but parameters of egg and chick counts and hatching and fledging success were generally higher in years of warmer SST at the Barrens and of higher PDO index (which is associated with warmer coastal water). Counts of adults tended to be lower after the PDO was higher during March-May.

As with Barrens SST, warm temperatures one year tended to be associated with earlier hatching and higher murre productivity the following year. For the PDO, this association was significant for two years later also.

6. NPI: The North Pacific Index was generally weakly associated with the murre breeding indices, and for the few months that correlations were significant the association was generally opposite those for the PDO and for SST.

Summary of Comparisons of Murre Indices with Environmental Variables, by Murre Index

Hatch Date

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation[a]	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	20-21	-	-	-
Barrens SST	15-17	-	6-7,11 (-)	-
GAK1 SST	13-14	-	4 (-)	-
Buoy 46001 SST	18-21	-	-	-
PDO	21	-	3-5 (-)	3-5,7 (-)
NPI	19	-	2,3 (+)	9 (+)

[a] Month-number of significant correlation; sign of correlation in parentheses

There were no cases of significant correlation between murre hatch date and same-year months of SST or atmospheric indices. For previous-year indices there were some significant correlations—most from Barrens SST and PDO. Higher previous SST and PDO were associated with earlier hatch date. Previous-year correlation results from the NPI were opposite in sign.

Eggs

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	16-17	-	-	-
Barrens SST	11-13	9,11 (+)	-	-
GAK1 SST	9-10	4 (+)	-	-
Buoy 46001 SST	14-17	-	-	-
PDO	17	4-7,10 (+)	-	-
NPI	15	-	-	-

April-July PDO was significantly correlated with a higher number of eggs counted on the plots. GAK1 and Barrens SSTs had one month of significant correlation each, but for the Barrens SST it was September--after the eggs were produced.

Chicks

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	20-21	-	-	-
Barrens SST	15-17	7,9,11 (+)	11 (+)	-
GAK1 SST	13-14	-	-	-
Buoy 46001 SST	18-21	-	-	-
PDO	21	7 (+)	-	3,4 (+)

NPI	19	12 (-)	-	2 (-)

The number of chicks counted on the plots was not significantly correlated with SST at Seldovia, GAK1, or Buoy 46001. July SST at the Barrens was positively correlated with the number of chicks counted (September and November were also associated this way, but these occurred after the chick-production period). Barrens previous-year SST was positively associated with chicks, but only for November. As with Barrens SST, same-year July PDO was positively associated with the number of chicks. Previous-year PDO was not significant, but two-years-previous PDO in March and April was positively associated. NPI was not associated with chicks (except for November after the chicks fledged).

Fledglings (fldg_10)

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	20-21	-	-	-
Barrens SST	15-17	7,9,11 (+)	-	-
GAK1 SST	13-14	-	-	-
Buoy 46001 SST	18-21	-	-	-
PDO	21	7 (+)	-	4-5 (+)
NPI	19	-	-	2 (-)

Neither Seldovia, GAK1, nor Buoy 46001 SST was significantly correlated with the number of fledglings. Same-year SST at the Barrens was significant for July and September (most chicks fledge by mid-September). Previous 1- and 2-year Barrens SST was not significant. The PDO was positively significant for same-year July. Previous-by-2-years PDO was positively significant for April-May. NPI was negatively associated for one month in year minus 2.

Fledglings/Eggs (fldg_obs/egg_adj)

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	16-17	-	-	-
Barrens SST	12-14	7,9 (+)	3,6 (+)	(7) (+)
GAK1 SST	10-11	-	-	-
Buoy 46001 SST	14-17	-	-	-
PDO	17	6-8 (+)	3-5 (+)	3-7(+)
NPI	16	-	-	2 (-)

Results for the ratio fledglings/eggs (“reproductive success”) generally followed those for fledglings. The ratio was significantly greater when Barrens SST was higher in same-year July-August. It was also greater when previous-year Barrens SST was higher in March and June. Results for the PDO were similar to those for Barrens SST: a greater ratio occurred when the PDO was higher in same-year June-August, and previous-year March-May. Both Barrens SST and PDO also showed some significant correlation when matched with two-years-later fledglings/eggs ratio. There were no significant correlations with the other environmental variables, except for one two-years-lagged month for the NPI.

Fledglings/Chicks (fldg_obs/ch_adj)

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	17-19	-	-	9 (-)
Barrens SST	13-15	7 (+)	6 (+)	-
GAK1 SST	11-12	-	-	-
Buoy 46001 SST	16-19	-	-	-
PDO	19	4-5 (+)	3-5 (+)	-
NPI	17	-	-	2 (-)

Results for the ratio fledglings/chicks ("hatching success") were similar to those for fledglings/eggs. Both Barrens SST and the PDO were positively correlated with the ratio. For Barrens SST, the significant same-year month was July; for the PDO it was April and May. For the previous year, the Barrens SST significant month was June; for the PDO the months were March-May.

Adult Counts

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	20	-	-	9 (+)
Barrens SST	15	11 (-)	-	-
GAK1 SST	13	-	-	-
Buoy 46001 SST	18	-	-	-
PDO	21	3-5 (-)	-	-
NPI	19	2 (+)	-	-

When the PDO was higher during March-May, same-year adult counts tended to be lower. The NPI had one significant opposite-sign result for February. There were few significant correlations between adult counts and the other environmental variables and years.

Chick Diet: Chick diet correlation results should be viewed with the caveat stated in Methods: The diet data are compositional and therefore are not independent from each other within a year. Because of this there may be significant but unidentified joint relationships that aren't seen when looking at individual species.

Chick Diet: Osmerid

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	18	-	4-8,10 (-)	12 (-)
Barrens SST	14-16	-	3-6,8-10 (-)	12 (-)
GAK1 SST	12-14	-	1,5-6 (-),11(+)	-
Buoy 46001 SST	16-18	10 (-)	1-3 (-)	10,12 (-)
PDO	18	-	1-2(-)	-
NPI	18	7 (+)	11(-)	-

There were few significant correlations between the proportion of capelin (the only osmerid we identified) in chick diets and same-year environmental variables. However, there were many significant correlation results for environmental parameters measurements for the year previous to the breeding season. For SST measured at all locations and for the PDO, previous-year warmer SST was associated with a lower proportion of capelin in murre chick diets the following year. The effect carried back to the previous

December (and October in one case). The NPI had one same-year month (July) of significant positive correlation with capelin.

Chick Diet: Salmonid

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	20-21	-	-	-
Barrens SST	14-16	-	-	-
GAK1 SST	12-14	-	-	-
Buoy 46001 SST	16-18	-	-	-
PDO	18	-	-	-
NPI	18	-	2-3 (-)	-

There were no same-year significant correlations between the proportion of salmonids in chick diet and the monthly environmental variables. There were two significant months of negative correlation for one-year-previous values of the NPI. It should be noted that the number of salmonids seen was small—the highest proportion seen was 2 percent (of 408 prey items observed) in 1998.

Chick Diet: Gadid

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	18	-	5-8,10 (+)	12 (+)
Barrens SST	14-16	-	4-5,8-10 (+)	-
GAK1 SST	12-14	-	5(+),10-11 (-)	-
Buoy 46001 SST	16-18	10 (+)	1-2 (+)	10,12 (+)
PDO	18	-	-	-
NPI	18	-	11 (+)	10 (-)

Results for the proportion of gadids in murre chick diets were generally opposite results for the proportion of osmerids. For same-year comparisons, there was only one month of significant same-year correlation, for one variable (October SST at Buoy 46001). However, there were several significant correlation results for environmental parameters measurements for the year previous to the breeding season. For SST measured at the four locations, previous-year warmer SST was associated with a higher proportion of gadids in murre chick diets the following year, except for late-year SST at GAK1. The association carried back to the previous December for two locations (and October in one case). Interestingly (because PDO is composed of SST measurements), the PDO had no significant correlations.

Chick Diet: Sand lance

Environmental parameter	Shared years in dataset (no lag)	Lag 0yr correlation	Lag 1yr correlation	Lag 2yr correlation
Seldovia SST	18	3 (-)	1,9 (+)	7-8,12 (+)
Barrens SST	14-16	-	-	7-8,12 (+)
GAK1 SST	12-14	-	-	10 (-)
Buoy 46001 SST	16-18	-	1 (+)	6 (+)
PDO	18	-	-	-
NPI	18	7 (-)	-	5,12 (-)

There were few same-year significant correlations between environmental variables and the proportion of sand lance in murre chick diets. There were significant results between sand lance and SSTs measured

two years previous to the breeding season—generally, when SSTs were higher, the proportion of sand lance in the diets was higher two years later. The PDO had no significant results; the NPI's results were generally opposite the SST results.

Chick Diet Summary

Chick diet contained a higher proportion of osmerids (capelin) and a lower proportion of gadids when previous-year coastal SST was lower during winter through summer. There was some indication that the diet contained a higher proportion of sand lance two years after warmer SST at Seldovia and the Barrens.

CONCLUSIONS

Summary

Breeding Parameter Time Series

Hatch date showed considerable variation and in recent years was about two weeks later than in the mid-to-late 1990s.

The number of eggs, chicks, and fledglings on the plots all followed a general pattern of slight gradual decline from the mid-1990s to 2011 and then an increase in 2013-2014 to the previous levels. Ratio parameters showed a similar pattern.

Adult counts showed a gradual upward trend from the mid-1990s to 2011 and then a decline during 2013-2014 to the previous levels—the pattern was opposite that of the productivity indices.

Correlation Analysis of Breeding Parameters

In general, earlier hatch date; higher egg, chick, and fledgling production; and lower adult counts occurred together. The one exception was that hatch date was not significantly correlated with egg count.

Chick diet type was not significantly correlated with productivity variables.

Comparisons between Environmental Variables

Most of the SST indices (including the PDO) were strongly (positively) correlated with each other for most months. The least similar pair in the comparisons was Buoy 46001 and the GAK1 mooring. The NPI was not strongly correlated with the SST indices for most months; the significant correlations were negative.

Comparisons between Breeding Parameters and Environmental Variables

Earlier hatch date was generally associated with warmer coastal water during the spring and summer months of the previous year. This was true for Barrens SST and the PDO but not significantly so for Seldovia SST. The PDO association occurred two-years-previous also.

Egg counts were positively correlated with the PDO index for same-year spring and early summer.

Chick and fledgling counts were positively associated with same-year PDO and Barrens SST, but only for July (and September for Barrens SST).

The ratio measures fledglings/eggs and fledglings/chicks generally had environmental variable associations similar to counts of eggs, chicks, and fledglings.

Adult counts were higher when same-year spring monthly PDO indices were lower.

Chick diet contained a higher proportion of osmerids (capelin) and a lower proportion of gadids when previous-year coastal SST was lower during winter through summer. There was some indication that the diet contained a higher proportion of sand lance two years after warmer SST at Seldovia and the Barrens.

Discussion

Monitoring of common murres at East Amatuli Island was not conducted in 2015. However, based on observations from a one-day trip to the island late in the nesting season that year, it is probable that no chicks fledged that year. In 2016, monitoring with time-lapse cameras did occur. No eggs were observed in the plots that year; murre breeding failed at the colony. Both 2015 and 2016 were years of unusually warm sea-surface temperatures (SST) in the northern Gulf of Alaska (see Figure 39). (Productivity and population numbers from 2016 [and 2017] have not been included in this report; they will be treated in a future report.)

Another example is from the El Niño year 1998, when winter and spring SST in the northern Gulf of Alaska was anomalously warm (see Figure 39). In that year, murre hatch dates at the East Amatuli were late and the number of fledglings was depressed, relative to years immediately before and after 1998.

Because of observations that murres sometimes breed poorly in warm-water years, I expected that there would be a negative association between same-year warmer SST and the breeding parameters during the study years of this report. Instead, overall, there was some indication that same-year warmer water was associated with higher egg, chick, and fledgling counts and higher productivity ratios.

In addition, warmer water during the two years previous to a breeding season was associated with earlier hatch dates.

Perhaps in years of extremely warm SST (as in 2015 and 2016), murre breeding is disrupted through mechanisms different from those that affect breeding when SST is not extreme. For example, in an extreme year prey may because of warm water temperature change their distribution in ways that make them unavailable to the birds. Murres can dive very deeply for their prey, so their foraging domain can be somewhat separated from SST measurement depth. Perhaps only in extreme years do SST anomalies seen at the surface affect prey throughout the foraging domain.

Perhaps the role of lagged response of some breeding parameters to SST is related to production and development of larval and juvenile stages of the prey of adult or chick murre diets in the years previous to the breeding years.

Another possibility for lagged response is that success during the breeding season may depend on the condition of the birds well before the breeding season—perhaps the year before.

Autocorrelation of the SST anomalies (see Figure 39) may also play a part in the lagged results. This will be examined in a future publication.

Murre reproductive parameters varied together—when one value was higher the others tended to be higher. When productivity was higher, hatch dates tended to be earlier. Perhaps it is advantageous for murres to breed earlier when conditions allow, and perhaps the conditions required are those that also allow higher productivity. Or alternatively, perhaps earlier breeding is the key, and when conditions allow that, success follows.

Years of better breeding success were associated with lower adult counts. Perhaps in years of higher breeding success there is a higher proportion of adults out foraging for either their upcoming incubation or chick-brooding duties, or for chick-feeding.

Chick diet type was not significantly correlated with productivity variables. However, the diet's proportion of osmerids, which are high in energy content, was never lower than 90 percent—so the variation seen (and analyzed) was a small proportion of the diet overall. In addition, within years, the compositional data were not independent within years and so the correlation results must be viewed with caution. These data will be further analyzed in the future.

Chick diet tended to contain a higher proportion of osmerids (capelin) and a lower proportion of gadids when previous-year coastal SST was lower during winter through summer. There was some indication that the diet contained a higher proportion of sand lance two years after warmer SST at Seldovia and the Barrens. Perhaps SST differentially affects the growth or survival of developing osmerids and/or gadids and/or sand lance through time, ultimately varying their future availability to murres foraging during the nestling period.

More information on foraging areas of the murres, both during the breeding season and during the winter; on prey development and growth; and on prey availability and the causes of its among-year differences would improve understanding of patterns observed in the colony monitoring data. For example, coastal SST anomalies tend to be opposite those further south in the Gulf (Figures 40 and 41). If during the nonbreeding seasons the murres are far enough offshore, episodes of warmer SST we observe at the coast may be experienced by the murres and their prey as cold-water periods.

The data and results in this report will be updated and examined further in future publications.

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Edgar ("Ed") P. Bailey, as a U.S. Fish and Wildlife employee, in 1974 and 1975 made the first quantitative reconnaissance of seabirds in the Barren Islands, and assisted the University of Washington (UW) with situating and establishing their East Amatuli field camp in 1976.

Bill St. Lawrence (Polar Alpine Inc.) and his early-1990s time-lapse murre-monitoring projects on East Amatuli's remote clifftops inspired our use of this technology.

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FIGURES AND TABLES

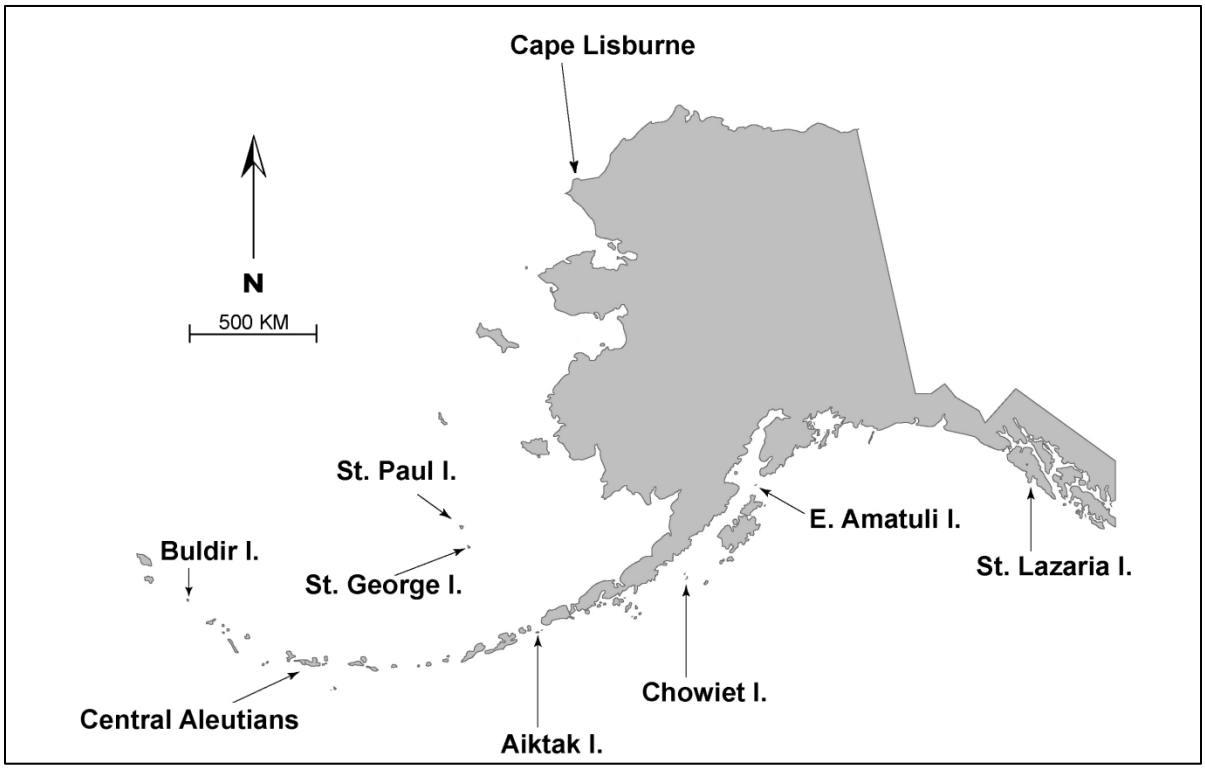

Figure 1. Location of East Amatuli Island and other annual monitoring sites across the Alaska Maritime National Wildlife Refuge.

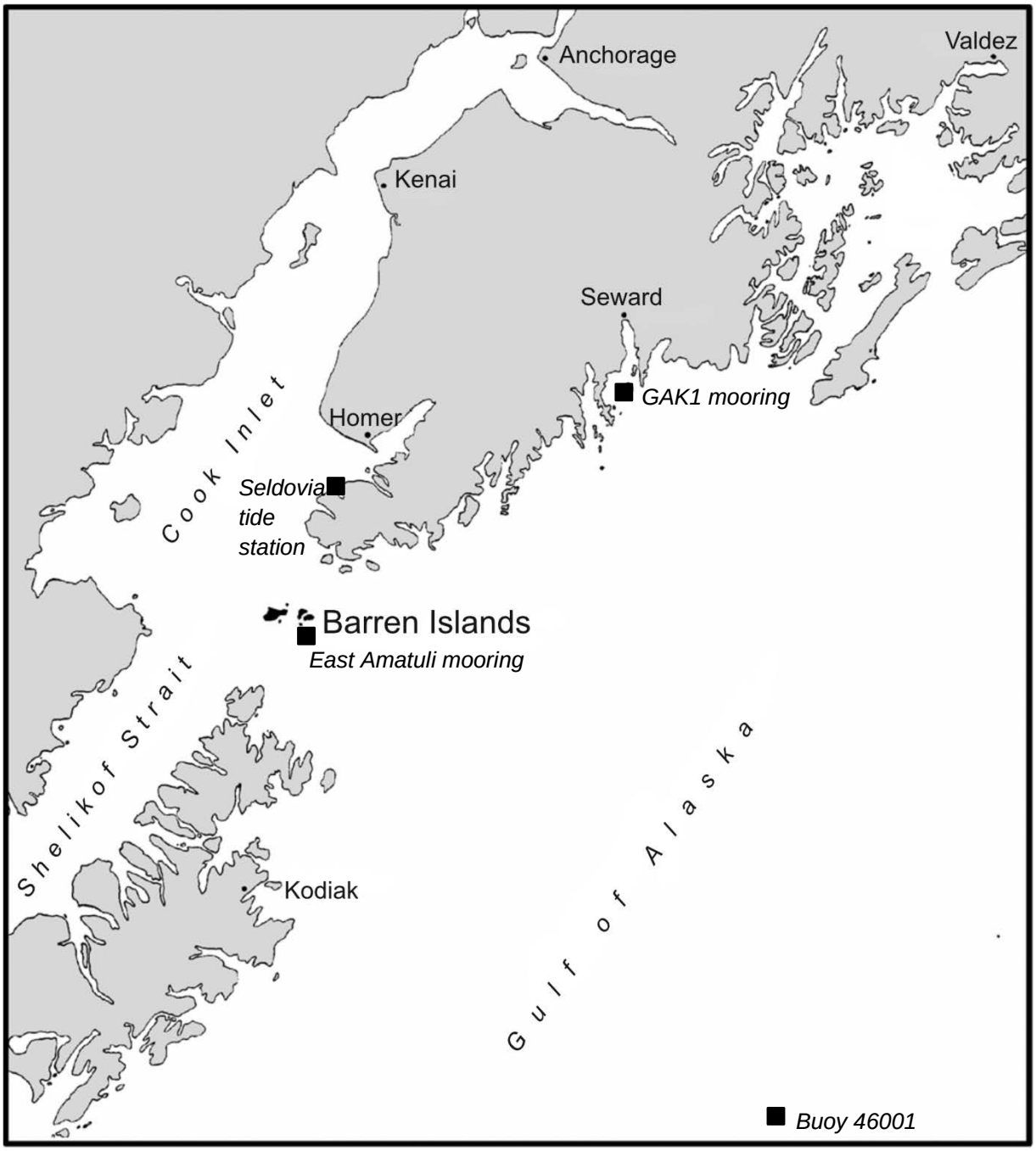

Figure 2. Location of the Barren Islands, Alaska and sea-surface temperature sensor locations (black squares).

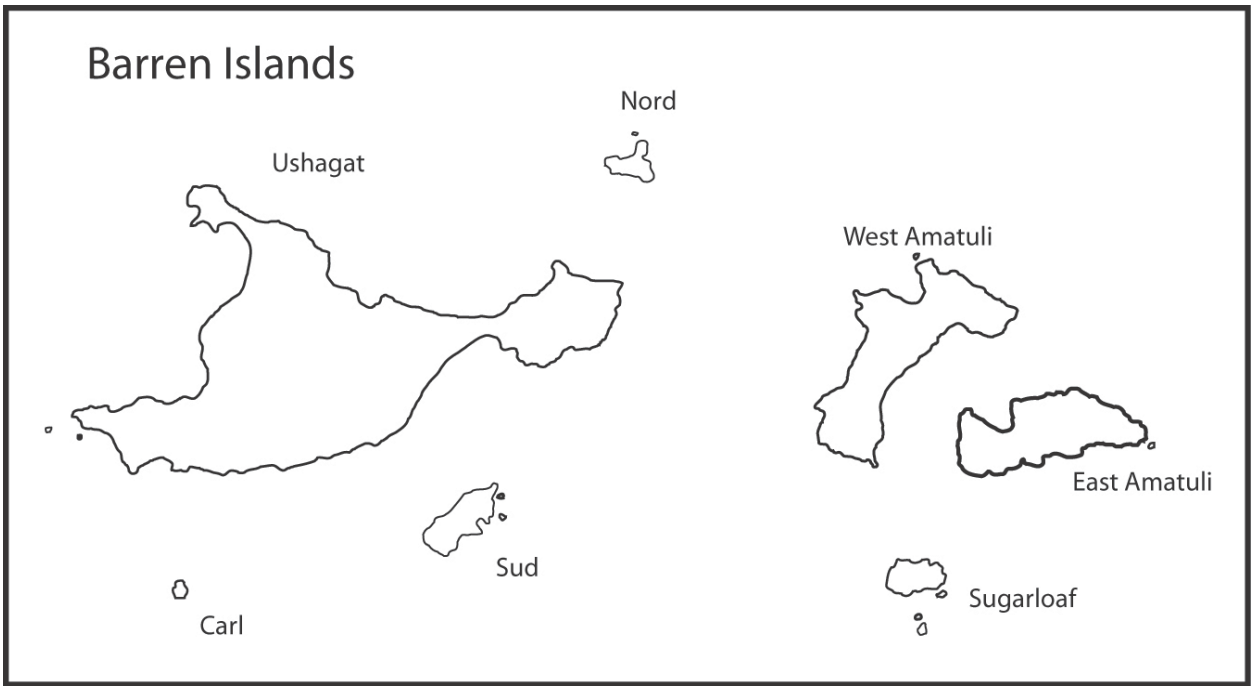

Figure 3. Map of the Barren Islands group.

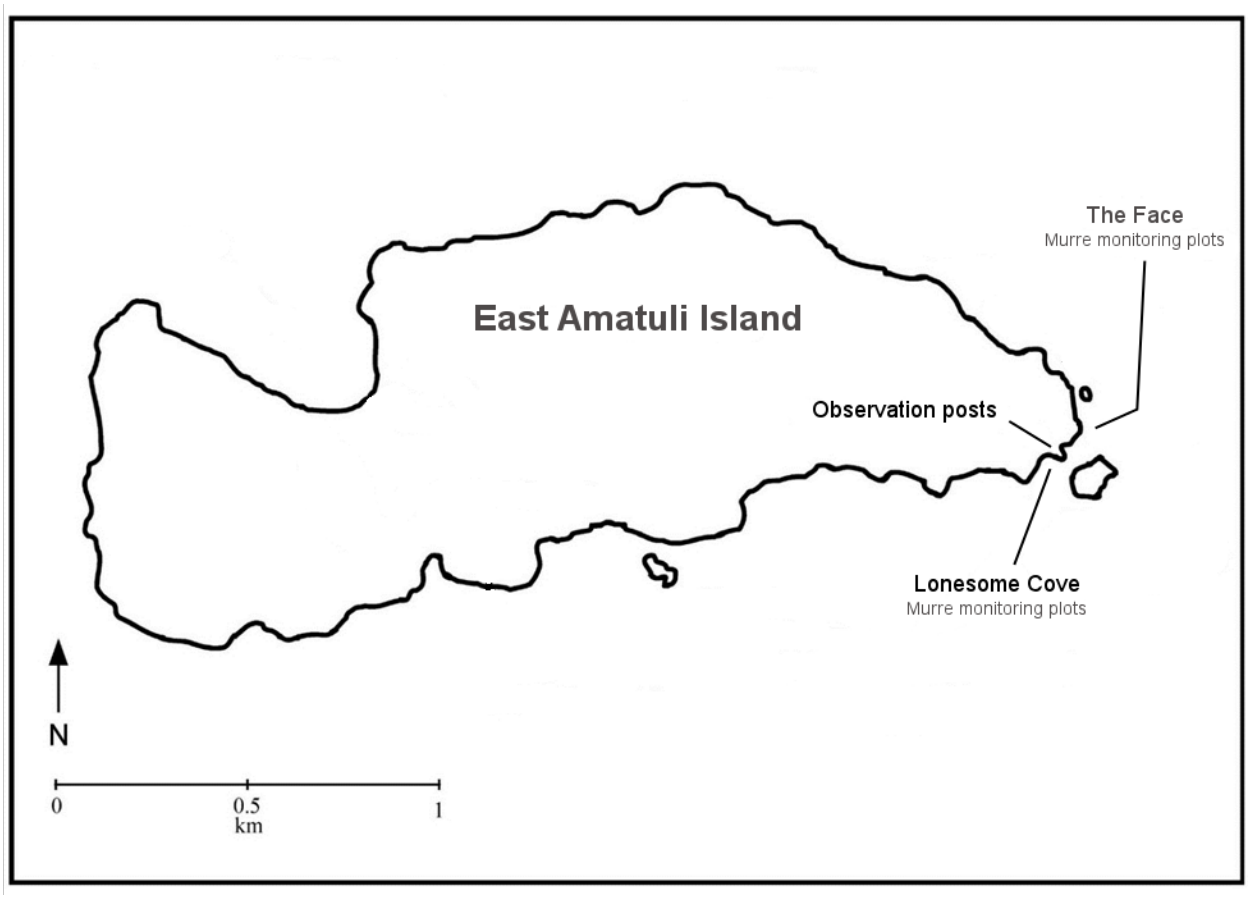

Figure 4. East Amatuli Island, showing locations of murre reproductive performance monitoring areas.

Table 1. Dates of observation of murre plots at East Amatuli Island, Alaska. In 2013 and 2014 observations from time-lapse cameras are included.

Date	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
20 Jun													
21 Jun													
22 Jun													
23 Jun				x			x						
24 Jun			x				x						
25 Jun			x	x	x		x						
26 Jun						x							
27 Jun				x									
28 Jun		x		x	x	x							
29 Jun				x	x								
30 Jun		x			x	x	x						
1 Jul						x	x						
2 Jul		x	x										
3 Jul		x	x	x	x								
4 Jul					x	x							
5 Jul		x	x				x						
6 Jul	x		x		x	x							
7 Jul		x				x	x						
8 Jul		x	x	x	x		x						
9 Jul	x		x		x	x							
10 Jul	x												
11 Jul						x	x						
12 Jul						x	x						
13 Jul		x		x	x	x							
14 Jul	x	x	x	x									
15 Jul		x		x		x	x						
16 Jul	x			x			x						
17 Jul	x		x			x							
18 Jul			x										
19 Jul	x	x					x						
20 Jul			x	x	x		x						
21 Jul	x												
22 Jul							x						
23 Jul													
24 Jul	x	x											
25 Jul					x	x	x						
26 Jul	x	x	x	x		x	x						
27 Jul		x				x							
28 Jul		x					x						
29 Jul	x				x	x	x						
30 Jul	x		x	x							x		
31 Jul		x		x		x				x			x
1 Aug	x				x					x			x
2 Aug				x	x	x	x						
3 Aug						x					x	x	
4 Aug	x	x		x							x		
5 Aug	x	x	x										x
6 Aug		x	x		x					x	x	x	
7 Aug					x		x						

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Table 1 (rows continued). Dates of observation of murre plots at East Amatuli Island, Alaska. In 2013 and 2014 observations from time-lapse cameras are included.

Date	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
8 Aug		x	x	x		x							x
9 Aug	x	x		x		x	x		x	x	x		
10 Aug	x					x							
11 Aug	x	x				x	x		x				x
12 Aug	x	x		x				x				x	
13 Aug					x				x				
14 Aug		x			x	x	x		x	x		x	
15 Aug		x		x									
16 Aug			x				x	x				x	
17 Aug	x		x	x	x						x		
18 Aug		x		x			x		x	x			
19 Aug					x	x		x					x
20 Aug		x						x					
21 Aug			x		x	x					x	x	x
22 Aug		x	x	x									
23 Aug	x	x						x		x	x		
24 Aug		x	x	x			x		x				
25 Aug		x			x	x							x
26 Aug			x		x	x	x	x		x			x
27 Aug				x	x						x	x	
28 Aug												x	x
29 Aug	x			x	x	x						x	
30 Aug		x	x										x
31 Aug	x	x			x			x		x	x	x	
1 Sep		x		x			x						
2 Sep	x	x							x				x
3 Sep	x	x	x		x						x		
4 Sep				x		x	x						
5 Sep												x	x
6 Sep												x	
7 Sep	x	x									x	x	x
8 Sep						x					x	x	x
9 Sep												x	
10 Sep													x
11 Sep												x	
12 Sep												x	
13 Sep													
14 Sep													
15 Sep													
16 Sep													
17 Sep													
18 Sep													
19 Sep													
20 Sep													
Observations	30	44	29	34	39	39	33	7	7	12	15	18	16

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Table 1 (columns continued). Dates of observation of murre plots at East Amatuli Island, Alaska. In 2013 and 2014 observations from time-lapse cameras are included.

Date	2006	2007	2008	2009	2010	2011	2012	2013	2014
20 Jun									
21 Jun									
22 Jun									
23 Jun									
24 Jun									
25 Jun									
26 Jun									
27 Jun									
28 Jun									
29 Jun									
30 Jun									
1 Jul									
2 Jul									
3 Jul									
4 Jul									
5 Jul									
6 Jul									
7 Jul									
8 Jul									
9 Jul									
10 Jul									
11 Jul									
12 Jul									
13 Jul									
14 Jul									
15 Jul									x
16 Jul									x
17 Jul									x
18 Jul									x
19 Jul									x
20 Jul									x
21 Jul									x
22 Jul									x
23 Jul									x
24 Jul									x
25 Jul									x
26 Jul									x
27 Jul									x
28 Jul									x
29 Jul									x
30 Jul									x
31 Jul		x				x			
1 Aug	x				x				x
2 Aug					x				
3 Aug			x	x					
4 Aug									
5 Aug		x			x	x			
6 Aug	x		x	x	x				
7 Aug				x	x	x			

(rows continue on next page)

Table 1 (rows continued). Dates of observation of murre plots at East Amatuli Island, Alaska. In 2013 and 2014 observations from time-lapse cameras are included.

Date	2006	2007	2008	2009	2010	2011	2012	2013	2014
8 Aug			x		x	x			
9 Aug	x	x							
10 Aug		x	x						
11 Aug				x	x				
12 Aug									
13 Aug	x	x				x		x	
14 Aug	x					x		x	
15 Aug						x		x	
16 Aug	x	x		x					
17 Aug			x			x			
18 Aug						x			x
19 Aug									x
20 Aug								x	x
21 Aug	x	x							x
22 Aug			x					x	x
23 Aug	x		x		x	x		x	
24 Aug				x		x		x	x
25 Aug		x							x
26 Aug			x		x			x	
27 Aug	x							x	
28 Aug					x				x
29 Aug	x		x			x		x	x
30 Aug		x	x					x	x
31 Aug		x		x				x	x
1 Sep	x	x		x		x		x	x
2 Sep	x	x				x			x
3 Sep	x				x			x	
4 Sep	x					x		x	
5 Sep			x					x	
6 Sep		x		x	x			x	
7 Sep								x	
8 Sep					x			x	
9 Sep						x		x	
10 Sep	x	x			x			x	x
11 Sep			x		x			x	x
12 Sep	x				x			x	x
13 Sep	x	x				x		x	x
14 Sep		x			x			x	x
15 Sep								x	x
16 Sep					x			x	x
17 Sep			x			x		x	
18 Sep				x	x	x			
19 Sep				x	x				
20 Sep					x			x	x
Observations	18	19	14	20	32	41	0	37	63

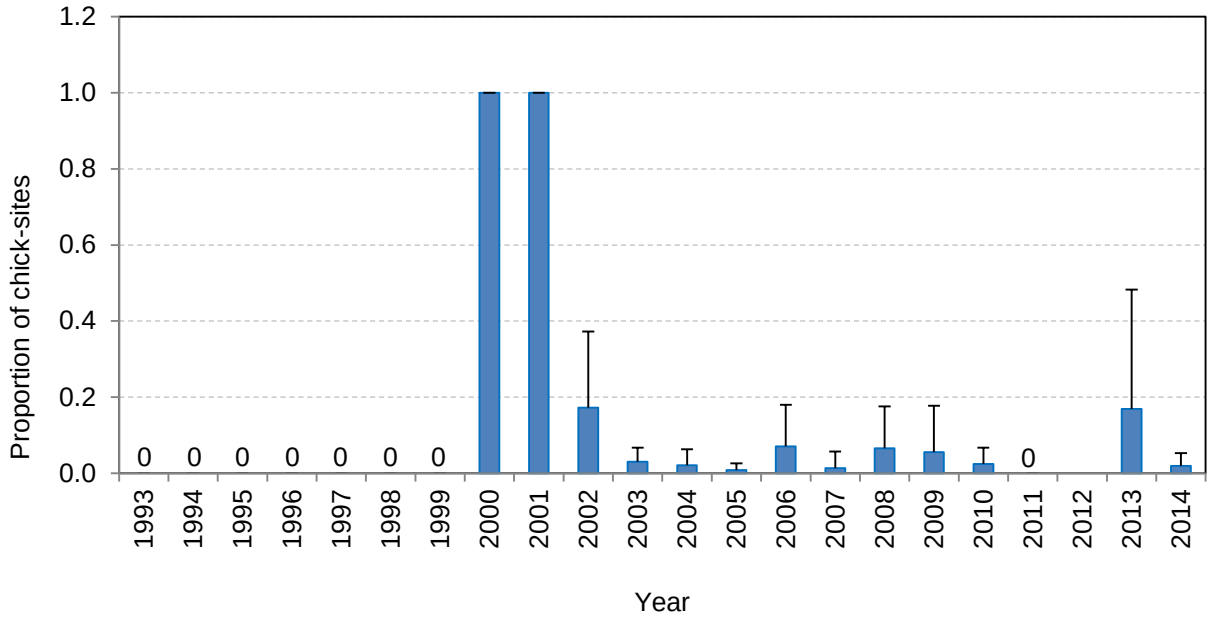

Figure 5. The proportion of chicks without previous egg-sightings on productivity monitoring plots at East Amatuli Island, Alaska. Bars show the annual mean among plots; error bars show one standard deviation. No data were collected in 2012.

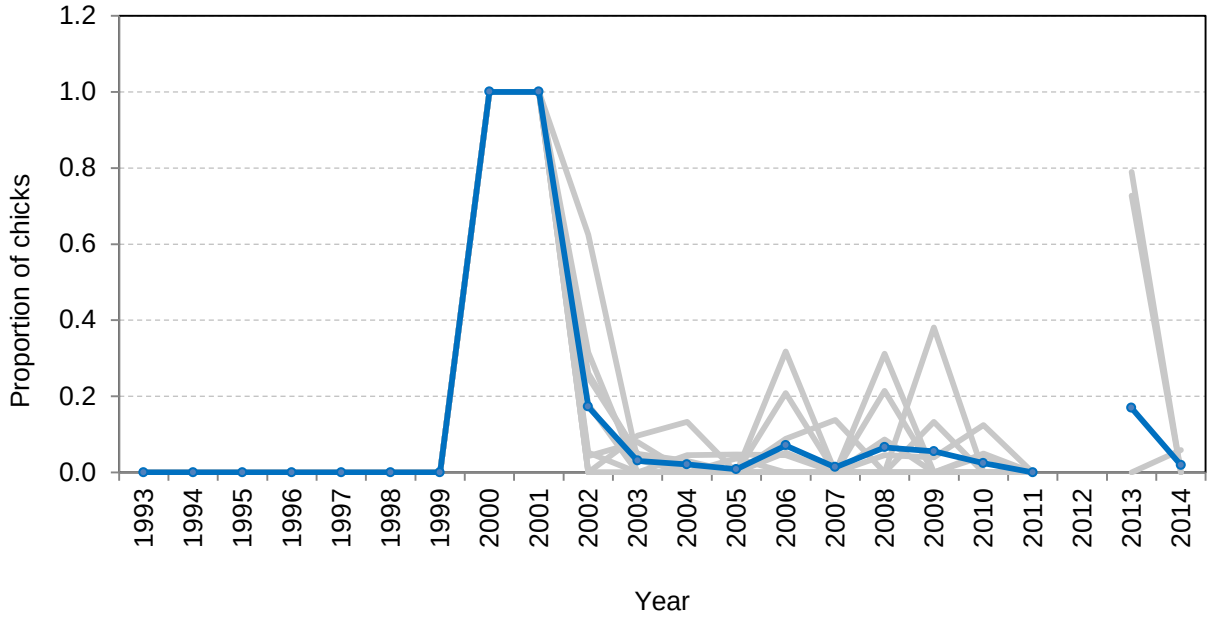

Figure 6. The proportion of chicks without previous egg-sightings on productivity monitoring plots at East Amatuli Island, Alaska. The blue line shows the annual mean; grey lines show values for each plot. No data were collected in 2012.

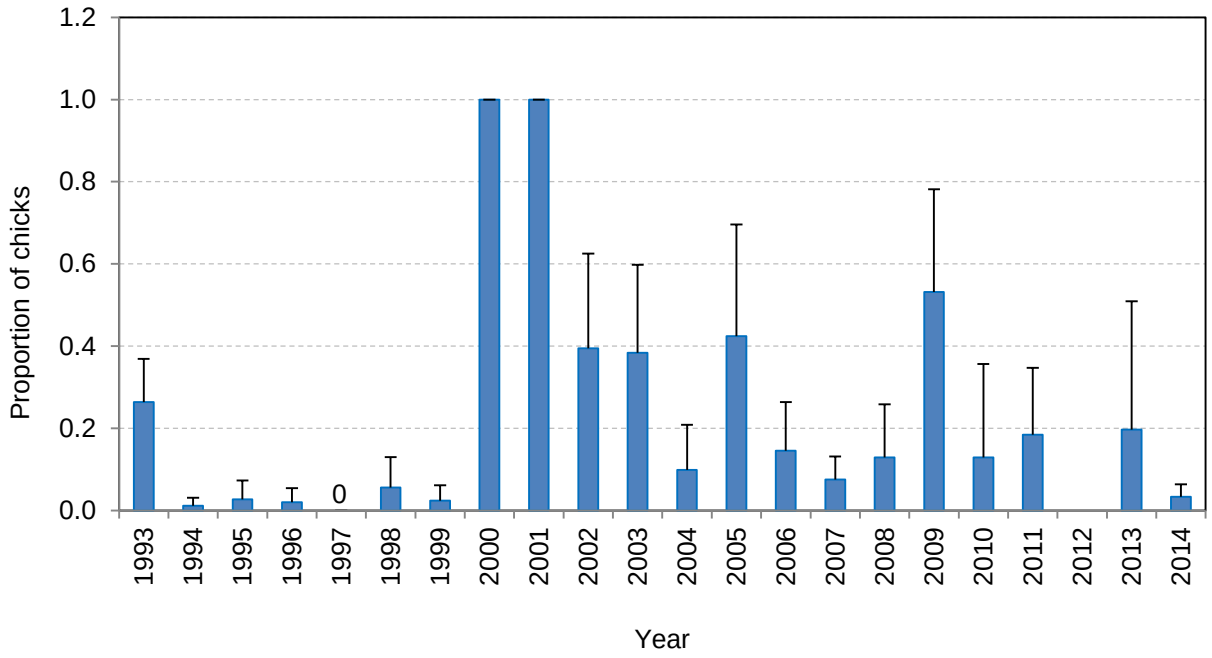

Figure 7. The proportion of chicks without hatch dates, from observation on productivity monitoring plots at East Amatuli Island, Alaska. Bars show the annual mean among plots; error bars show one standard deviation. No data were collected in 2012.

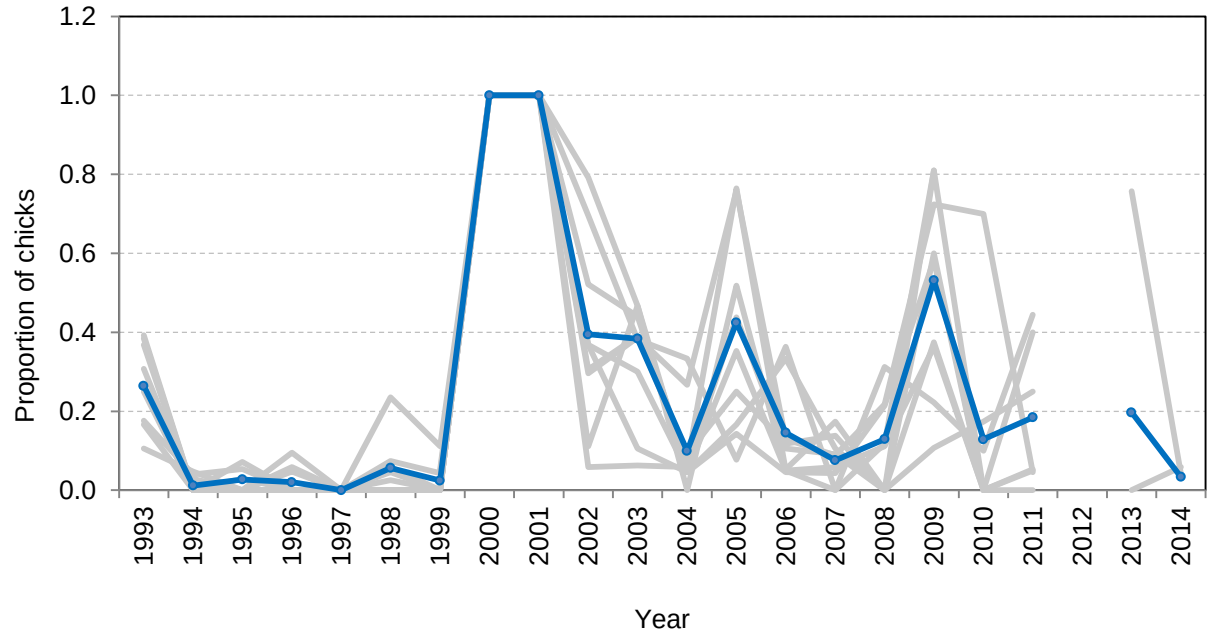

Figure 8. The proportion of chicks without hatch dates, from observation on productivity monitoring plots at East Amatuli Island, Alaska. The blue line shows the annual mean; grey lines show values for each plot. No data were collected in 2012.

Table 2. Proportion of nest-sites with eggs already hatched and proportion of nest-sites without hatch dates for chicks on productivity plots at East Amatuli Island, Alaska. Proportion data are mean and standard deviation (SD) among plots. Dashes indicate “no data”.

Year	Nest-sites with egg observed	Nest-sites with chick but no egg observed	Proportion of nest-sites with egg already hatched (plot mean)	Proportion of nest-sites with egg already hatched (plot SD)	Nest-sites with chick observed	Nest-sites with chick with hatch date	Proportion of chicks without hatch date (plot mean)	Proportion of chicks without hatch date (plot SD)
1993	241	0	0.00	0.00	167	122	0.26	0.10
1994	306	0	0.00	0.00	244	241	0.01	0.02
1995	353	0	0.00	0.00	297	289	0.03	0.05
1996	266	0	0.00	0.00	222	218	0.02	0.03
1997	311	0	0.00	0.00	280	280	0.00	0.00
1998	240	0	0.00	0.00	214	201	0.06	0.07
1999	284	0	0.00	0.00	241	236	0.02	0.04
2000	0	255	1.00	0.00	255	0	1.00	0.00
2001	0	252	1.00	0.00	252	0	1.00	0.00
2002	0	43	0.17	0.20	243	147	0.39	0.23
2003	293	9	0.03	0.04	258	153	0.38	0.21
2004	258	6	0.02	0.04	216	196	0.10	0.11
2005	234	2	0.01	0.02	189	97	0.42	0.27
2006	275	17	0.07	0.11	235	200	0.15	0.12
2007	264	4	0.01	0.04	201	184	0.08	0.06
2008	243	11	0.07	0.11	186	163	0.13	0.13
2009	256	11	0.06	0.12	199	88	0.53	0.25
2010	251	4	0.02	0.04	147	123	0.13	0.23
2011	249	0	0.00	0.00	147	123	0.18	0.16
2012	-	-	-	-	-	-	-	-
2013	172	42	0.17	0.31	200	153	0.20	0.31
2014	98	1	0.02	0.03	72	70	0.03	0.03

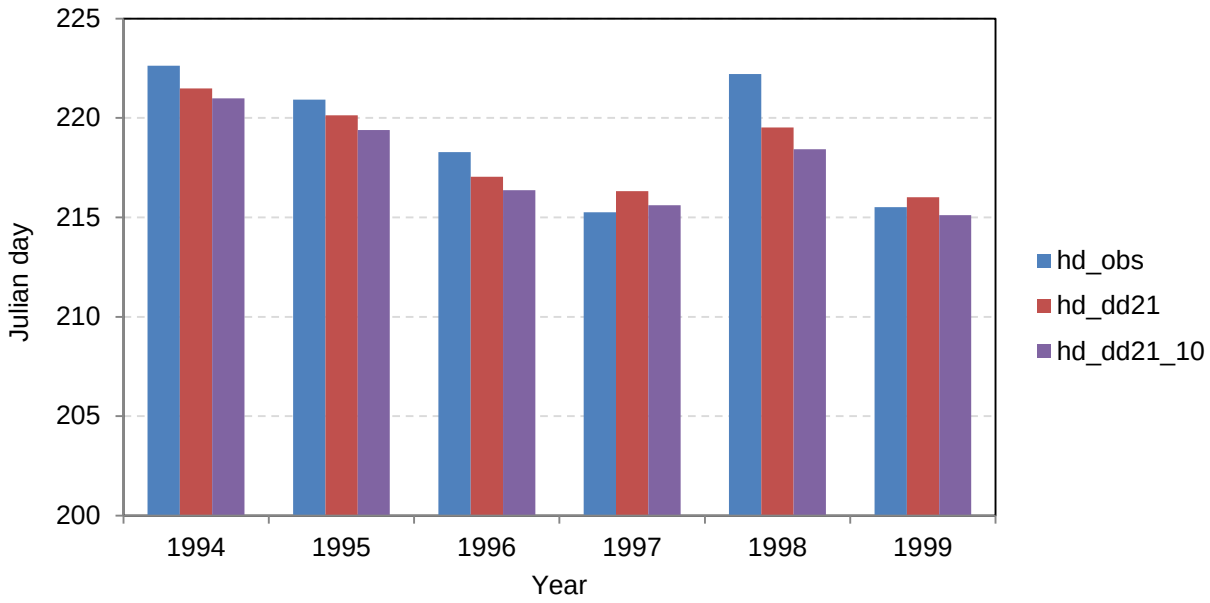

Figure 9. Three measures of mean hatch date of common murres at East Amatuli Island, Alaska for the years with the most complete egg-to-chick observation data.

Blue bars: Hatch date derived from observations made during the egg-to-chick period, for each chick with adequate observations (abbreviation: “hd_obs”).

Red bars: Hatch date calculated by subtracting a standard nestling period (21 days) from the date each chick disappeared from the plots, for each chick with adequate observations (abbreviation: “hd_dd21”).

Purple bars: Hatch date calculated by subtracting 21 days from the date each chick disappeared, for chicks observed at least 10 days after each chick’s plot’s mean hatch date (abbreviation: “hd_dd21_10”).

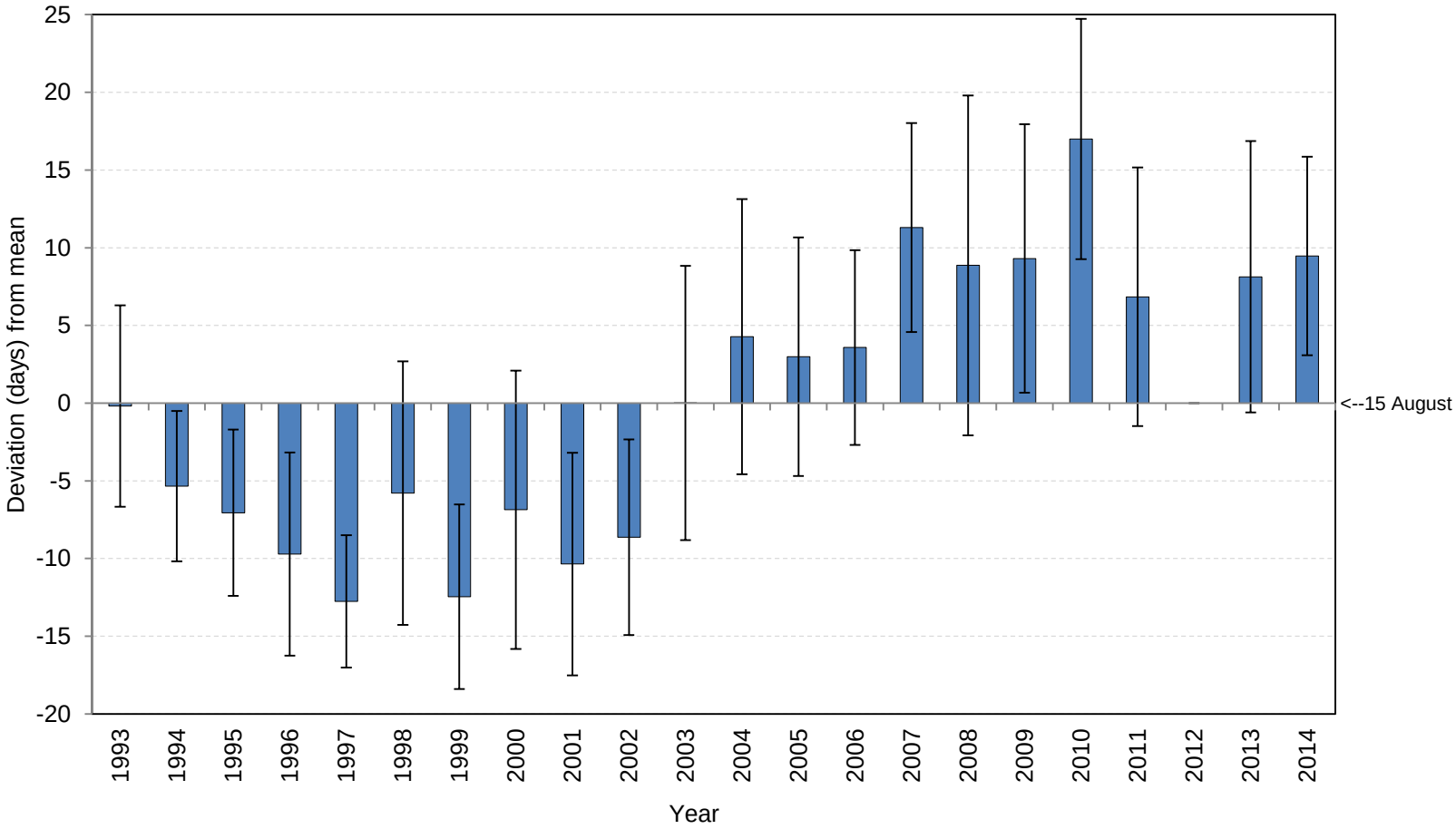

Figure 10. Yearly deviation from the mean (15 August) for hatch dates of common murres at East Amatuli Island, Alaska. For each chick, hatch date was calculated from egg-to-chick observations if possible; otherwise, for chicks that were seen on the plots for at least 10 days after their plot's mean hatch date, a standard nestling period (21 days) was subtracted from the date of each chick's disappearance from the plots (in this report, this parameter is abbreviated as hd_obs_or_dd21_10). Sample unit = chicks; error bars = 1 standard deviation. Within-year clumping of observations affects measure of error. Data were not collected in 2012.

Table 3. Mean hatch dates of common murres at East Amatuli Island, Alaska, calculated from (A) egg-to-chick observations; (B) chick disappearance dates; (C) uses (A) when observations allow; if not then (B); (D) disappearance dates for chicks that were seen for at least 10 days after their plot's mean hatch date; (E) uses (A) when observations allow; if not then (D). Within years, irregular observation intervals cause artificial clumping of hatch date distribution; this affects dispersion values. The sample unit is the nest-site. Abbreviations used in this report are included in the column headings.

Year	(A) From egg-to-chick observations ("hd_obs")			(B) Back-calculation from chick-disappearance date ("hd_dd21")			(C) From egg-to-chick obs. or chick-disappearance date ("hd_obs_or_dd21")			(D) Back-calculation from disappearance date of ch_10 chicks ("hd_dd21_10")			(E) From egg-to-chick obs. or disappearance date of ch_10 chicks ("hd_obs_or_dd21_10")		
	Mean hatch	SD[1]	*n*	Mean hatch	SD	*n*	Mean hatch	SD	*n*	Mean hatch	SD	*n*	Mean hatch	SD	*n*
1993	16-Aug-93	6.58	129	10-Aug-93	5.34	50	15-Aug-93	6.48	137	14-Aug-93	3.85	140	15-Aug-93	6.53	140
1994	10-Aug-94	4.84	241	09-Aug-94	4.59	213	10-Aug-94	4.84	242	10-Aug-94	3.96	232	10-Aug-94	4.84	242
1995	08-Aug-95	5.38	288	08-Aug-95	3.84	166	08-Aug-95	5.35	292	09-Aug-95	3.66	271	08-Aug-95	5.35	292
1996	05-Aug-96	6.54	218	04-Aug-96	4.63	166	05-Aug-96	6.53	221	06-Aug-96	5.21	209	05-Aug-96	6.53	221
1997	03-Aug-97	4.26	280	04-Aug-97	3.79	273	03-Aug-97	4.26	280	04-Aug-97	3.35	274	03-Aug-97	4.26	280
1998	10-Aug-98	8.51	177	07-Aug-98	4.41	128	10-Aug-98	8.49	178	09-Aug-98	5.73	163	10-Aug-98	8.51	177
1999	03-Aug-99	5.97	227	04-Aug-99	4.41	171	03-Aug-99	5.94	230	04-Aug-99	4.73	214	03-Aug-99	5.94	230
2000	21-Aug-00	3.70	34	02-Aug-00	4.18	108	07-Aug-00	8.96	140	07-Aug-00	3.80	224	08-Aug-00	8.34	136
2001	14-Aug-01	3.56	27	30-Jul-01	2.22	72	03-Aug-01	7.16	99	05-Aug-01	4.21	239	05-Aug-01	4.69	213
2002	08-Aug-02	6.22	148	03-Aug-02	4.49	124	07-Aug-02	6.30	188	06-Aug-02	3.96	203	07-Aug-02	5.95	192
2003	17-Aug-03	8.26	153	09-Aug-03	6.89	149	14-Aug-03	8.82	220	14-Aug-03	4.38	215	16-Aug-03	7.59	206
2004	19-Aug-04	8.49	196	13-Aug-04	5.73	146	18-Aug-04	8.86	208	15-Aug-04	5.08	162	19-Aug-04	8.49	205
2005	21-Aug-05	7.36	97	13-Aug-05	5.28	121	18-Aug-05	7.68	174	16-Aug-05	4.23	162	18-Aug-05	7.15	161
2006	19-Aug-06	6.19	201	15-Aug-06	5.57	171	19-Aug-06	6.27	226	17-Aug-06	4.85	211	19-Aug-06	6.05	226
2007	27-Aug-07	6.36	185	16-Aug-07	4.35	63	27-Aug-07	6.72	193	22-Aug-07	2.89	150	27-Aug-07	6.42	190
2008	24-Aug-08	10.47	163	12-Aug-08	7.34	93	23-Aug-08	10.94	176	20-Aug-08	7.33	148	23-Aug-08	10.52	169
2009	28-Aug-09	7.41	88	20-Aug-09	7.38	40	26-Aug-09	8.63	106	23-Aug-09	4.22	167	25-Aug-09	6.83	170
2010	02-Sep-10	6.58	123	23-Aug-10	5.13	67	01-Sep-10	7.73	139	28-Aug-10	3.10	111	02-Sep-10	6.97	133
2011	22-Aug-11	8.26	123	17-Aug-11	7.47	93	22-Aug-11	8.32	129	21-Aug-11	5.78	115	22-Aug-11	8.10	132
2012	*no data*	-	-	*no data*	-	-	*no data*	-	-	*no data*	-	-	*no data*	-	-
2013	26-Aug-13	6.41	155	20-Aug-13	7.24	159	23-Aug-13	8.73	195	21-Aug-13	6.48	182	24-Aug-13	8.24	192
2014	25-Aug-14	6.20	68	23-Aug-14	4.44	53	25-Aug-14	6.39	70	25-Aug-14	4.02	67	25-Aug-14	6.16	69
												Mean 93-14:	15 August		

[1] "SD" = one standard deviation

Table 4. Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	1993 (a)	1993 (b)	1994 (a)	1994 (b)	1995 (a)	1995 (b)	1996 (a)	1996 (b)	1997 (a)	1997 (b)	1998 (a)	1998 (b)	1999 (a)	1999 (b)
20 Jul	-	-	-	2	-	-	-	3	-	4	-	-	-	1
21 Jul	-	-	-	-	-	3	-	-	-	-	-	-	-	3
22 Jul	-	-	-	-	-	2	-	-	-	1	-	-	-	1
23 Jul	-	-	-	-	-	-	-	2	-	1	-	-	-	-
24 Jul	-	-	-	-	-	-	-	-	1	-	-	-	1	-
25 Jul	-	-	-	-	-	1	2	-	-	1	-	-	5	-
26 Jul	-	-	-	2	-	1	3	5	-	-	-	2	7	-
27 Jul	-	-	-	1	-	-	4	2	1	-	-	-	5	4
28 Jul	-	1	1	-	2	1	10	1	4	1	-	-	10	-
29 Jul	-	-	-	2	4	4	16	23	3	-	2	-	11	1
30 Jul	-	6	1	-	2	1	12	2	17	7	3	3	-	3
31 Jul	-	-	1	3	-	-	10	-	15	-	3	1	56	39
1 Aug	-	-	-	1	-	2	18	-	61	5	7	1	9	5
2 Aug	-	-	3	6	24	13	13	24	64	92	17	26	1	-
3 Aug	-	-	3	1	1	1	15	2	14	3	16	-	37	1
4 Aug	-	-	10	-	15	12	-	35	23	6	1	6	7	83
5 Aug	-	4	5	2	13	2	-	10	18	79	15	-	9	1
6 Aug	-	1	12	34	35	-	38	3	11	7	8	30	14	-
7 Aug	2	19	34	5	54	41	-	37	31	33	5	-	4	5
8 Aug	14	-	18	-	23	-	13	6	3	2	23	-	16	36
9 Aug	-	8	15	20	21	9	3	16	2	16	11	3	2	3
10 Aug	2	1	29	45	-	-	9	-	-	5	13	-	4	-
11 Aug	16	1	5	24	16	91	6	1	2	9	10	62	4	-
12 Aug	10	6	22	29	18	-	-	9	-	-	7	-	3	15
13 Aug	10	2	24	-	1	1	5	-	-	-	2	4	4	-
14 Aug	12	9	15	1	-	-	13	-	3	1	2	-	2	-
15 Aug	5	15	15	37	6	-	6	-	1	-	-	-	11	-
16 Aug	8	-	11	-	23	-	7	-	-	4	-	11	1	-
17 Aug	4	1	4	-	12	-	4	-	-	-	1	-	9	-
18 Aug	3	-	-	-	-	-	7	-	-	-	-	-	-	-
19 Aug	3	-	8	-	8	-	2	-	-	-	-	-	1	-
20 Aug	18	-	-	-	2	-	3	-	3	-	7	-	1	-
21 Aug	1	-	2	-	4	-	-	-	-	-	1	-	1	-
22 Aug	1	-	1	-	2	-	-	-	-	-	-	-	1	-
23 Aug	1	-	-	-	1	-	-	-	1	-	16	-	-	-
24 Aug	2	-	-	-	-	1	-	-	-	-	12	-	-	-
25 Aug	-	-	-	-	2	-	-	-	-	-	1	-	1	-
26 Aug	8	-	-	-	-	-	-	-	-	-	8	-	-	-
27 Aug	1	-	1	-	-	-	-	-	-	-	4	-	1	-
28 Aug	-	-	-	-	-	-	1	-	2	-	6	-	-	-
29 Aug	1	-	-	-	-	-	-	-	-	-	-	-	-	-
30 Aug	1	-	1	-	-	-	-	-	-	-	2	-	-	-
31 Aug	2	-	-	-	-	-	-	-	-	-	-	-	-	-
1 Sep	2	-	-	-	-	-	-	-	-	-	1	-	-	-
2 Sep	-	-	-	-	-	-	-	-	-	-	1	-	-	-
3 Sep	-	-	-	-	-	-	-	-	-	-	1	-	-	-
4 Sep	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5 Sep	-	-	1	-	-	-	-	-	-	-	-	-	-	-
6 Sep	-	-	-	-	-	-	-	-	-	-	1	-	-	-
7 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Sep	1	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table 5 (rows continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	1993	1993	1994	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999	1999
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
9 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10 Sep	-	-	-	-	-	-	-	-	1	-	-	-	-	-
11 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n	129	74	242	213	289	181	220	176	280	271	207	149	238	196

(year-columns continue on next page)

Table 5 (year-columns continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	2000 (a)	2000 (b)	2001 (a)	2001 (b)	2002 (a)	2002 (b)	2003 (a)	2003 (b)	2004 (a)	2004 (b)	2005 (a)	2005 (b)	2006 (a)	2006 (b)
20 Jul	-	-	-	-	-	1	-	2	-	-	-	-	-	-
21 Jul	-	-	-	-	-	2	-	-	-	-	-	-	-	-
22 Jul	-	-	-	2	-	-	-	-	-	-	-	-	-	-
23 Jul	-	-	-	1	-	1	-	1	-	2	-	-	-	-
24 Jul	-	7	-	-	-	-	-	-	-	-	-	-	-	-
25 Jul	-	2	-	-	-	-	-	1	-	1	-	-	-	1
26 Jul	-	-	-	7	-	6	-	-	-	-	-	-	-	-
27 Jul	-	3	-	-	-	-	-	-	-	-	-	-	-	-
28 Jul	-	1	-	-	-	1	-	-	-	1	-	-	-	2
29 Jul	-	5	-	4	-	-	-	10	-	-	-	-	-	-
30 Jul	-	-	-	-	-	20	-	1	-	-	-	2	-	-
31 Jul	-	10	-	62	2	-	-	1	-	-	-	-	-	-
1 Aug	-	-	-	-	7	2	4	9	-	-	-	2	-	1
2 Aug	-	9	-	-	-	1	-	-	-	1	-	7	-	-
3 Aug	-	34	-	-	32	28	2	1	-	6	-	1	-	1
4 Aug	-	2	-	3	23	-	2	15	4	2	-	1	-	4
5 Aug	-	-	-	-	-	1	8	-	4	-	-	1	-	3
6 Aug	-	2	-	-	-	9	-	2	-	4	1	4	-	-
7 Aug	-	39	-	126	17	63	12	-	-	9	1	1	2	7
8 Aug	-	-	-	-	21	-	14	17	-	4	1	5	-	-
9 Aug	-	-	-	-	-	-	-	7	36	11	3	-	1	19
10 Aug	-	-	4	-	-	-	-	-	-	-	11	9	-	1
11 Aug	-	-	1	-	8	-	-	20	-	2	-	-	5	11
12 Aug	-	-	9	-	9	-	-	1	-	30	-	-	4	7
13 Aug	-	-	2	-	-	-	-	-	13	2	-	27	7	12
14 Aug	-	-	-	-	-	-	-	-	1	-	-	1	7	-
15 Aug	-	-	2	-	1	-	-	53	9	17	-	-	42	1
16 Aug	1	-	5	-	12	-	-	-	-	9	-	17	-	5
17 Aug	-	-	-	-	-	-	-	15	-	14	-	28	4	54
18 Aug	5	-	-	-	-	-	-	-	30	16	-	-	29	5
19 Aug	8	-	-	-	-	-	34	-	21	2	-	15	23	-
20 Aug	6	-	-	-	8	-	2	-	-	16	26	-	2	-
21 Aug	3	-	4	-	6	-	-	-	-	4	-	-	2	34
22 Aug	1	-	-	-	-	-	34	-	1	-	3	-	21	17
23 Aug	-	-	-	-	-	-	2	-	-	-	19	-	-	-
24 Aug	3	-	-	-	-	-	1	-	23	-	-	-	2	-
25 Aug	2	-	-	-	-	-	20	-	-	-	2	-	18	-
26 Aug	-	-	-	-	-	-	-	-	-	-	4	-	1	-
27 Aug	-	-	-	-	-	-	1	-	8	-	6	-	-	-
28 Aug	2	-	-	-	1	-	-	-	9	-	1	-	9	-
29 Aug	3	-	-	-	1	-	6	-	6	-	8	-	-	-
30 Aug	-	-	-	-	-	-	1	-	10	-	1	-	4	-
31 Aug	-	-	-	-	-	-	-	-	3	-	3	-	8	-
1 Sep	-	-	-	-	-	-	1	-	-	-	1	-	2	-
2 Sep	-	-	-	-	-	-	1	-	7	-	-	-	-	-
3 Sep	-	-	-	-	-	-	-	-	6	-	1	-	4	-
4 Sep	-	-	-	-	-	-	-	-	-	-	1	-	2	-
5 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 Sep	-	-	-	-	-	-	-	-	-	-	3	-	-	-
7 Sep	-	-	-	-	-	-	-	-	2	-	1	-	2	-
8 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(rows continue on next page)

Table 5 (rows continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	2000 (a)	2000 (b)	2001 (a)	2001 (b)	2002 (a)	2002 (b)	2003 (a)	2003 (b)	2004 (a)	2004 (b)	2005 (a)	2005 (b)	2006 (a)	2006 (b)
9 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10 Sep	-	-	-	-	-	-	-	-	1	-	-	-	-	-
11 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n	34	114	27	202	148	131	145	153	194	151	97	121	201	185

(year-columns continue on next page)

Table 5 (year-columns continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	2007 (a)	2007 (b)	2008 (a)	2008 (b)	2009 (a)	2009 (b)	2010 (a)	2010 (b)	2011 (a)	2011 (b)	2012 (a)	2012 (b)	2013 (a)	2013 (b)
20 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27 Jul	-	-	-	-	-	2	-	-	-	1	-	-	-	1
28 Jul	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 Jul	-	-	-	1	-	-	-	-	-	-	-	-	-	-
30 Jul	-	-	-	-	-	-	-	-	-	2	-	-	-	-
31 Jul	-	-	-	-	-	-	-	-	-	1	-	-	-	-
1 Aug	-	-	-	2	-	-	-	-	-	1	-	-	-	1
2 Aug	-	-	-	-	-	1	-	-	-	-	-	-	-	-
3 Aug	-	-	-	2	-	-	-	-	-	-	-	-	-	1
4 Aug	-	-	1	1	-	-	-	-	-	-	-	-	-	-
5 Aug	-	-	-	4	-	-	-	-	-	3	-	-	-	1
6 Aug	-	-	-	5	-	-	-	-	-	-	-	-	-	2
7 Aug	-	-	4	1	-	2	-	-	1	-	-	-	-	2
8 Aug	-	-	-	9	1	-	-	-	-	-	-	-	-	2
9 Aug	-	-	15	-	1	-	1	-	3	2	-	-	-	5
10 Aug	-	4	-	-	-	2	-	1	3	2	-	-	-	8
11 Aug	1	1	-	4	-	-	1	-	3	6	-	-	-	4
12 Aug	-	-	-	24	-	-	-	-	1	5	-	-	-	-
13 Aug	1	-	16	-	5	14	2	-	1	4	-	-	1	5
14 Aug	1	3	17	-	4	-	-	7	4	1	-	-	3	11
15 Aug	4	-	-	2	1	-	-	1	25	4	-	-	4	3
16 Aug	-	-	-	-	1	-	-	-	2	14	-	-	-	1
17 Aug	-	1	-	-	-	-	-	1	1	-	-	-	8	3
18 Aug	3	11	-	10	-	3	1	-	-	7	-	-	5	10
19 Aug	4	2	9	-	-	8	1	4	1	2	-	-	2	-
20 Aug	-	-	6	-	-	-	-	6	10	-	-	-	-	11
21 Aug	-	8	-	6	-	-	-	4	2	12	-	-	13	5
22 Aug	-	-	2	-	-	83	-	-	2	-	-	-	2	14
23 Aug	59	3	1	-	-	-	1	4	2	8	-	-	5	6
24 Aug	1	-	5	21	-	1	2	-	2	1	-	-	16	26
25 Aug	-	-	3	-	-	2	1	10	-	22	-	-	2	4
26 Aug	-	-	3	-	-	-	-	-	19	1	-	-	10	7
27 Aug	26	-	10	-	12	-	7	13	-	6	-	-	11	6
28 Aug	22	-	6	-	15	18	-	7	1	-	-	-	1	34
29 Aug	1	-	5	-	-	-	-	10	-	-	-	-	21	-
30 Aug	1	-	3	-	-	-	-	-	11	-	-	-	-	-
31 Aug	17	-	-	-	6	-	28	-	6	-	-	-	12	-
1 Sep	6	-	-	-	6	-	1	-	4	-	-	-	7	-
2 Sep	5	-	28	-	-	-	4	-	8	-	-	-	3	-
3 Sep	1	-	-	-	18	-	2	-	7	-	-	-	1	-
4 Sep	9	-	5	-	13	-	14	-	-	-	-	-	12	-
5 Sep	-	-	5	-	3	-	17	-	-	-	-	-	8	-
6 Sep	-	-	-	-	-	-	10	-	4	-	-	-	2	-
7 Sep	3	-	9	-	1	-	11	-	1	-	-	-	-	-
8 Sep	6	-	2	-	1	-	3	-	-	-	-	-	3	-

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Table 5 (rows continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year													
	2007 (a)	2007 (b)	2008 (a)	2008 (b)	2009 (a)	2009 (b)	2010 (a)	2010 (b)	2011 (a)	2011 (b)	2012 (a)	2012 (b)	2013 (a)	2013 (b)
9 Sep	3	-	5	-	-	-	6	-	-	-	-	-	-	-
10 Sep	2	-	-	-	-	-	4	-	-	-	-	-	1	-
11 Sep	2	-	-	-	-	-	-	-	1	-	-	-	-	-
12 Sep	2	-	-	-	-	-	1	-	-	-	-	-	-	-
13 Sep	1	-	-	-	-	-	2	-	-	-	-	-	-	-
14 Sep	-	-	1	-	-	-	-	-	-	-	-	-	-	-
15 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16 Sep	-	-	-	-	-	-	1	-	-	-	-	-	-	-
17 Sep	-	-	-	-	-	-	1	-	-	-	-	-	-	-
18 Sep	2	-	-	-	-	-	-	-	-	-	-	-	-	-
19 Sep	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20 Sep	-	-	-	-	-	-	1	-	-	-	-	-	-	-
n	183	33	161	92	88	136	123	68	125	105	-	-	153	173

(year-columns continue on next page)

Table 5 (year-columns continued). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year	
	2014 (a)	2014 (b)
24 Jul	-	-
25 Jul	-	-
26 Jul	-	-
27 Jul	-	-
28 Jul	-	-
29 Jul	-	-
30 Jul	-	-
31 Jul	-	-
1 Aug	-	-
2 Aug	-	-
3 Aug	-	-
4 Aug	-	-
5 Aug	-	-
6 Aug	-	-
7 Aug	-	-
8 Aug	-	-
9 Aug	-	-
10 Aug	-	1
11 Aug	-	-
12 Aug	-	1
13 Aug	-	1
14 Aug	1	-
15 Aug	1	-
16 Aug	-	2
17 Aug	4	1
18 Aug	5	-
19 Aug	6	2
20 Aug	3	6
21 Aug	4	6
22 Aug	3	-
23 Aug	3	6
24 Aug	5	5
25 Aug	1	5
26 Aug	2	-
27 Aug	1	12
28 Aug	2	8
29 Aug	6	-
30 Aug	9	-
31 Aug	2	-
1 Sep	4	-
2 Sep	4	-
3 Sep	2	-
4 Sep	-	-
5 Sep	-	-
6 Sep	1	-
7 Sep	1	-
8 Sep	-	-

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Table 5 (rows continued from previous page). Frequency distribution of hatch dates for common murres at East Amatuli Island, Alaska. Column (a) contains hatch dates calculated from egg-to-chick observations. Column (b) list hatch dates back-calculated from chick disappearance dates. Irregular observation dates cause artificial clumping of data distribution.

Date	Year	
	2014 (a)	2014 (b)
9 Sep	-	-
10 Sep	-	-
11 Sep	-	-
12 Sep	-	-
13 Sep	-	-
14 Sep	-	-
15 Sep	-	-
16 Sep	-	-
17 Sep	-	-
18 Sep	-	-
19 Sep	-	-
20 Sep	-	-
n	70	56

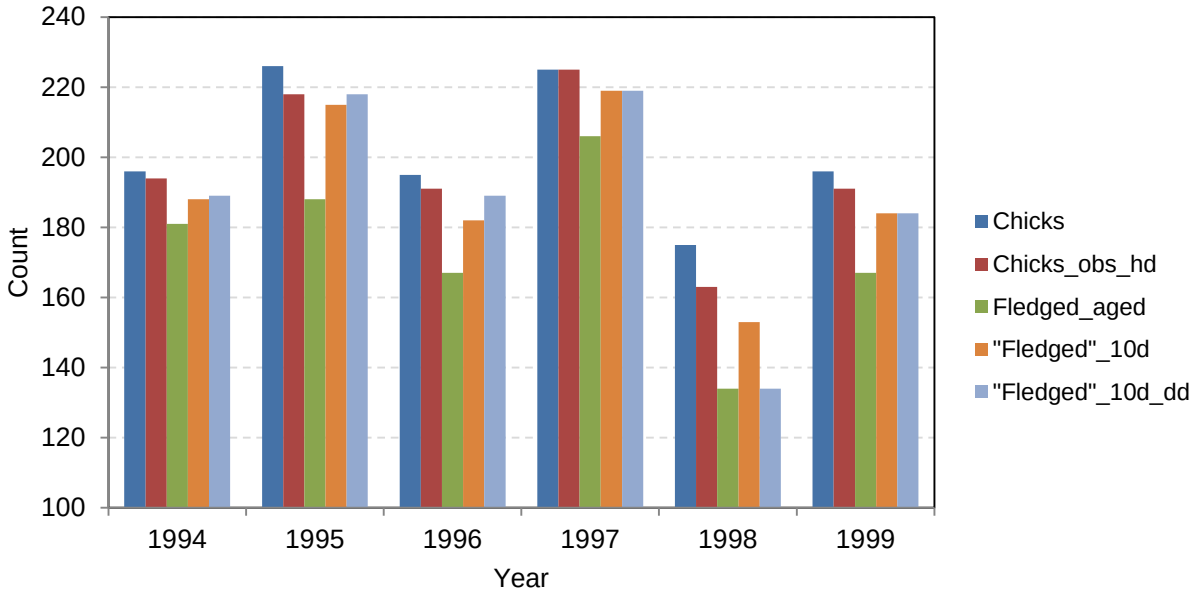

Figure 11. Comparisons among measures of productivity of common murres on ten monitoring plots at East Amatuli Island, Alaska. These comparisons are made for the years with the longest field-season observation periods, to gauge the accuracy of substituting measures in other years, when temporal differences in observation periods precluded the use of methods requiring egg-to-fledging observations for some nest-sites.

“Chicks” is the number of chicks counted in the plots each year.

“Chicks_obs_hd” is the number of chicks with hatch dates determined from no-egg-to-egg observations or egg-to-chick observations.

“Fledged_aged” is the number of chicks each with a hatch date from observations and a disappearance-date at least 15 days after that date.

“Fledged_10d” is the number of chicks each with a hatch date from observations and seen for at least 10 days after that date.

“Fledged_10d_dd” is the number of chicks each with a hatch date determined by subtracting 21 days from the chick’s disappearance date, and seen for at least 10 days after that date.

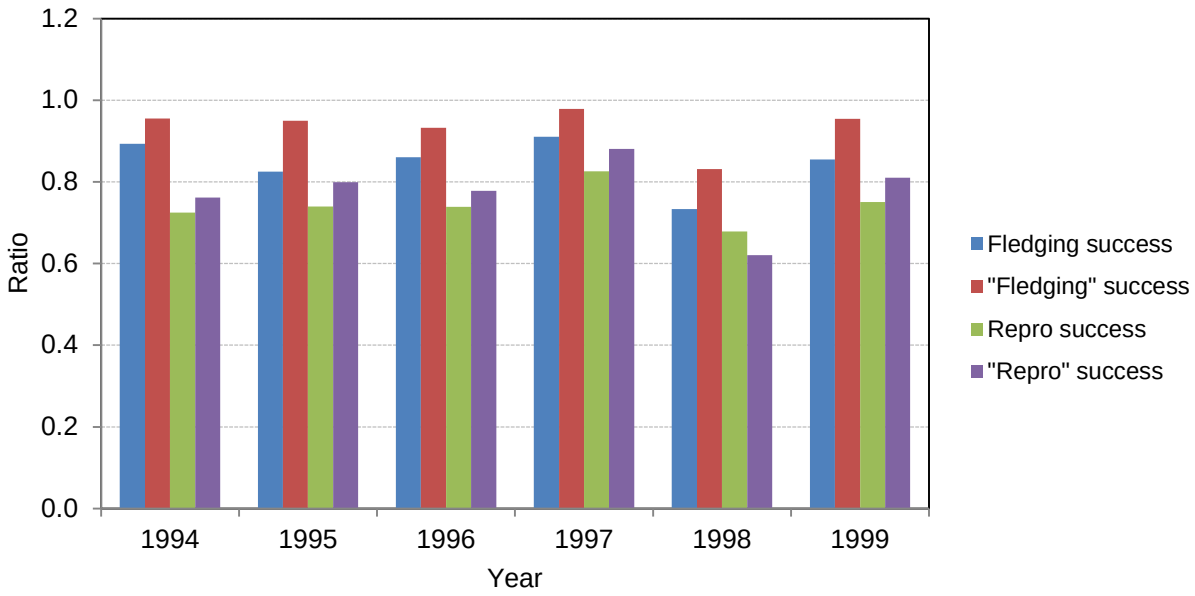

Figure 12. Comparisons among ratio measures of productivity of common murres on ten monitoring plots at East Amatuli Island, Alaska.

Fledging success is the number of chicks each with a hatch date from observations and with a disappearance date at least 15 days after that date, divided by the number of chicks ("fldg_obs/ch_adj" on Table 42).

"Fledging" success is the number of chicks seen for at least 10 days after each chick's mean plot hatch date, divided by the number of chicks ("fldg_10/chick" on Table 42).

Repro success is the number of chicks each with a hatch date from observations and with a disappearance date at least 15 days after that date, divided by the number of eggs (with an adjustment factor; "fldg_obs/egg_adj" on Table 42).

"Repro" success is the number of chicks seen for at least 10 days after each chick's mean plot hatch date, divided by the number of eggs ("fldg_10/egg" on Table 42).

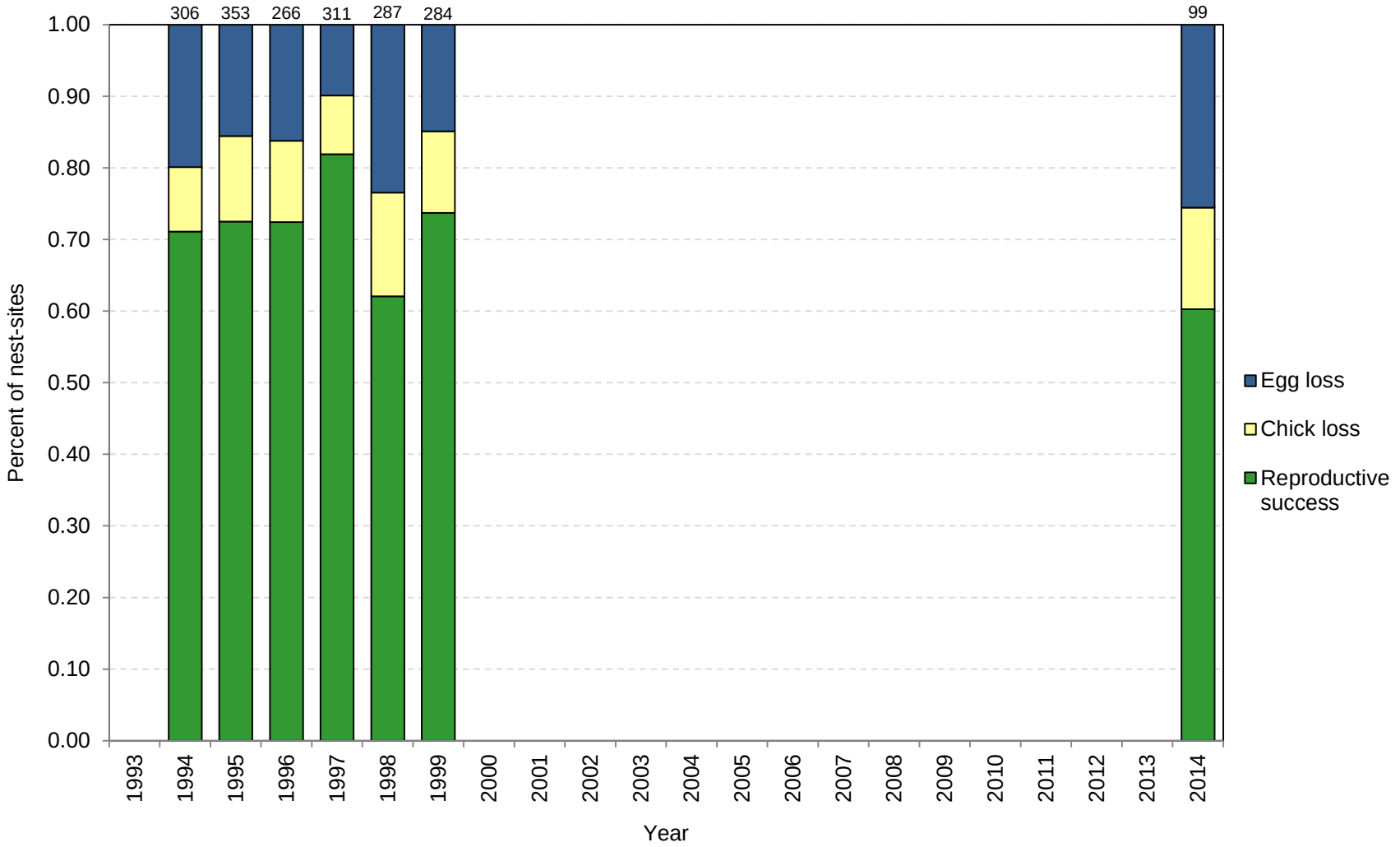

Figure 13. Reproductive performance of common murres at East Amatuli Island, Alaska. In this chart the parameters Chick loss and Reproductive success are restricted to aged chicks. From Table 6, Egg loss=(A-B)/A; Chick loss=(B'-C)/A'; Reproductive success=C/A', where A=nest-sites with eggs; A'=nest-sites with eggs (adjusted; see Table 6); B=nest-sites with chicks; B'=nest-sites with aged chicks; C=nest-sites with aged chicks fledged. Numbers above columns indicate sample sizes. Blank years had insufficient or (in 2012) no data.

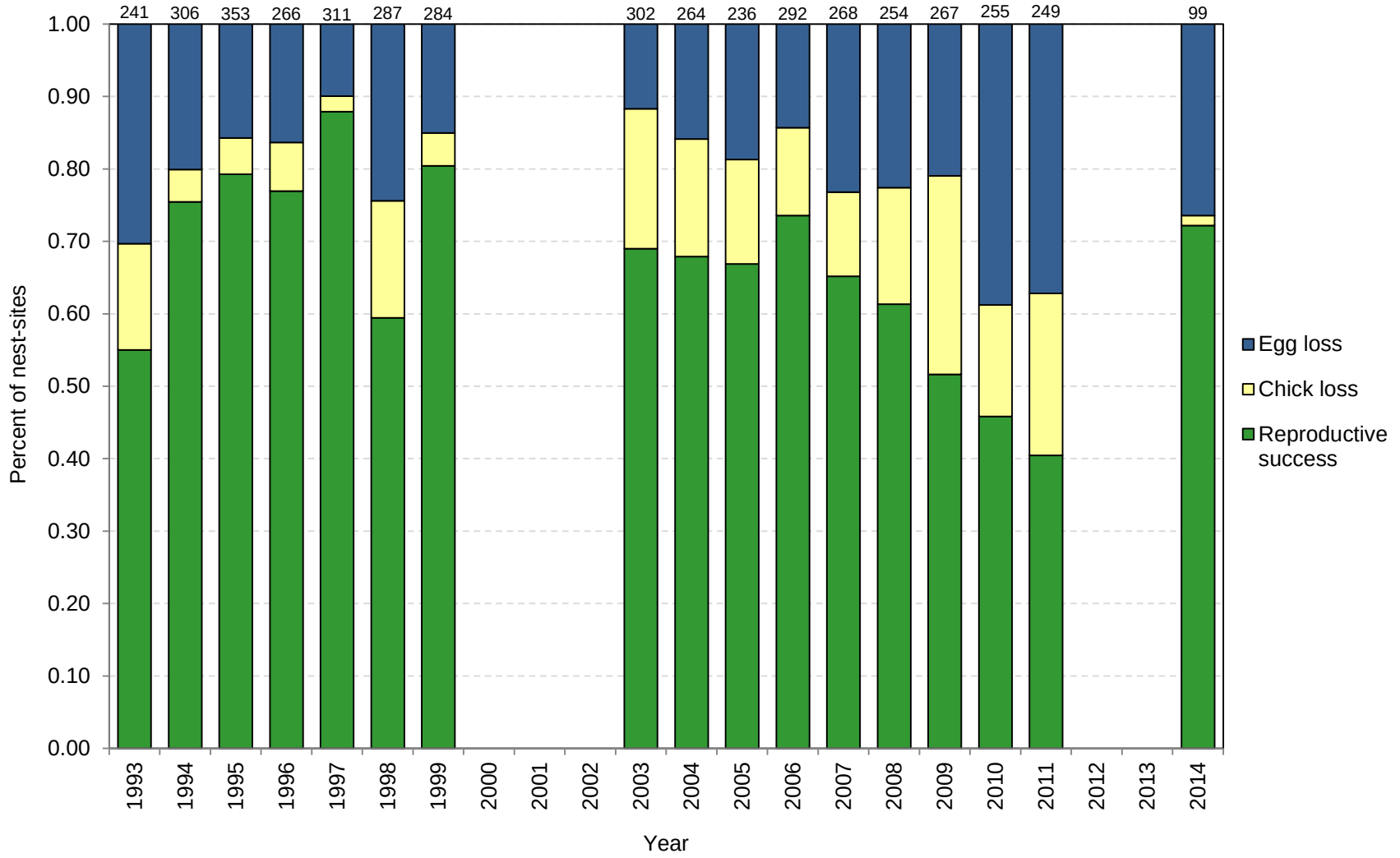

Figure 14. Reproductive performance of common murre nest-sites at East Amatuli Island, Alaska. In this chart a "fledged" chick in the parameters Chick loss and Reproductive success is defined as a chick seen on its plot at least 10 days after its plot's mean hatch date. From Table 6, Egg loss=(A-B)/A; Chick loss=(B-C')/A; Reproductive success=C'/A, where A=nest-sites with eggs; B=nest-sites with chicks; C'=nest-sites with aged chicks "fledged". Numbers above columns indicate sample sizes. Blank years had insufficient or (in 2012) no data.

Table 6. Reproductive performance of common murres at East Amatuli Island, Alaska. In years when the monitoring schedule yielded data insufficient for egg counts or chick-ageing, parameter-cells requiring these data contain dashes. Data were not collected in 2012.

Year	Number of plots	Sites with an egg or chick seen	Eggs seen (A)	Re-laid egg	Adjusted eggs[a] (A')	Chicks seen (B)	Chicks with prior observed egg	Proportion of chicks w/o prior observed egg	Chicks with hatch date (B')	Proportion of chicks without hatch date	Nest-sites with an aged chick ≥ 15 days old: fledged (C)	Nest-sites with a chick seen ≥ 10 days after plot mean hatch date: "fledged"[b] (C')	Proportion of chicks present at end of season but not yet seen for 10 days after their plot's mean hatch date
1993	9	241	241	0	151.6	167	167	0.00	105	0.37	78	153	0.00
1994	10	306	306	0	300.9	244	244	0.00	240	0.02	218	232	0.00
1995	10	353	353	1	331.2	297	297	0.00	279	0.06	245	282	0.00
1996	10	266	266	13	258.5	222	222	0.00	216	0.03	191	206	0.00
1997	10	311	311	2	308.7	280	280	0.00	278	0.01	255	274	0.00
1998	10	287	240	45	231.5	214	214	0.00	186	0.13	157	181	0.00
1999	10	284	284	12	274.4	241	241	0.00	233	0.03	206	229	0.00
2000	10	255	-	-	-	255	0	1.00	-	1.00	-	213	0.69
2001	10	253	-	-	-	252	0	1.00	-	1.00	-	236	0.20
2002	10	268	215	0	145.8	243	200	0.18	129	0.47	109	229	0.00
2003	10	302	293	0	151.0	258	249	0.03	129	0.50	88	218	0.00
2004	10	264	258	0	197.1	216	210	0.03	165	0.24	127	175	0.00
2005	10	236	234	0	98.4	189	187	0.01	78	0.59	60	168	0.00
2006	10	292	275	0	231.2	235	218	0.07	181	0.23	139	209	0.00
2007	10	268	264	0	172.3	201	197	0.02	133	0.34	96	177	0.00
2008	10	254	243	0	193.9	186	175	0.06	139	0.25	94	157	0.00
2009	10	267	256	0	114.1	199	188	0.06	84	0.58	52	154	0.00
2010	10	255	251	0	160.8	147	143	0.03	92	0.37	63	129	0.00
2011	10	249	249	0	186.1	147	147	0.00	118	0.20	81	115	0.00
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	10	227	185	0	171.8	200	158	0.21	147	0.27	105	180	0.00
2014	3	99	98	1	92.6	72	71	0.01	68	0.06	58	69	0.00

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Table 6 (columns continued). Reproductive performance of common murres at East Amatuli Island, Alaska. In years when the monitoring schedule yielded data insufficient for egg counts or chick-ageing, parameter-cells requiring these data contain dashes. Data were not collected in 2012.

Year	Chicks/ Eggs (B/A)	"Fledglings"/ Chicks (C'/B)	Fledglings/ Chicks (C/B')	"Fledglings" /Eggs (C'/A)	Fledglings /Eggs (C/A')	Proportion of eggs that didn't hatch: Egg loss ([A-B]/A)	Proportion of chicks present at end of season but not yet seen for 10 days after their plot's mean hatch date	Proportion of aged chicks that disappeared before fledging (before 15 days old): Chick loss ([B'-C]/B')	Proportion of chicks that disappeared before "fledging" (before observed 10 days after plot's mean hatch date): "Chick loss" ([B-C']/B)
1993	0.68	0.87	ND	0.59	ND	0.32	0.00	0.30	0.13
1994	0.80	0.95	0.89	0.76	0.72	0.20	0.00	0.09	0.05
1995	0.84	0.95	0.82	0.80	0.74	0.16	0.00	0.12	0.05
1996	0.83	0.93	0.86	0.77	0.74	0.17	0.00	0.12	0.07
1997	0.90	0.98	0.91	0.88	0.83	0.10	0.00	0.08	0.02
1998	0.75	0.85	0.73	0.63	0.68	0.25	0.00	0.16	0.15
1999	0.85	0.95	0.85	0.81	0.75	0.15	0.00	0.12	0.05
2000	-	0.84	-	-	-	-	0.69	-	-
2001	-	0.94	-	-	-	-	0.20	-	-
2002	-	0.94	-	-	-	-	0.00	0.16	0.06
2003	0.88	0.84	-	0.74	-	0.12	0.00	0.32	0.16
2004	0.84	0.81	-	0.68	-	0.16	0.00	0.23	0.19
2005	0.81	0.89	-	0.72	-	0.19	0.00	0.23	0.11
2006	0.85	0.89	-	0.76	-	0.15	0.00	0.23	0.11
2007	0.76	0.88	-	0.67	-	0.24	0.00	0.28	0.12
2008	0.77	0.84	-	0.65	-	0.23	0.00	0.32	0.16
2009	0.78	0.77	-	0.60	-	0.22	0.00	0.38	0.23
2010	0.59	0.88	-	0.51	-	0.41	0.00	0.32	0.12
2011	0.59	0.78	-	0.46	-	0.41	0.00	0.31	0.22
2012	-	-	-	-	-	-	-	-	-
2013	-	0.90	-	-	-	-	0.00	0.29	0.10
2014	0.73	0.96	0.81	0.70	0.63	0.27	0.00	0.15	0.04

[a] For years with observations during egg-hatching, "adjusted nest-sites" are raw count of nest-sites, minus nest-sites with a large observation data gap around chick-hatching, minus a proportion of nest-sites without chicks equal to the proportion of chick-nest-sites that were dropped because of their hatch-date gap. It is this adjusted number of nest-sites that is used as the divisor for ratios with numerators of aged fledglings.

[b] "Fledged" in quotes is based on chicks disappearing late in the season, rather than on ageing from hatch dates.

Table 7. Ratio reproductive performance parameters for common murres at East Amatuli Island, Alaska. In years when the monitoring schedule yielded data insufficient for egg counts or chick-ageing, parameter-cells requiring these data contain dashes. Data were not collected in 2012.

Year	No. plots	Nest-sites with eggs	Sampling design	Nesting success (chicks/eggs)	Fledging success (fledglings/chicks)	Reproductive success (fledglings/eggs)	"Fledging success" (c_10 "fledglings"/chicks)	"Reproductive success" (c_10 "fledglings"/eggs)
1993	9	241	Cluster by plot	0.66	-	-	0.87	0.59
1994	10	306	Cluster by plot	0.80	0.89	0.72	0.95	0.76
1995	10	353	Cluster by plot	0.84	0.82	0.74	0.95	0.80
1996	10	266	Cluster by plot	0.84	0.86	0.74	0.93	0.77
1997	10	311	Cluster by plot	0.90	0.91	0.83	0.98	0.88
1998	10	240	Cluster by plot	0.80	0.73	0.68	0.85	0.63
1999	10	284	Cluster by plot	0.85	0.85	0.75	0.95	0.81
2000	10	-	Cluster by plot	-	-	-	0.84	-
2001	10	-	Cluster by plot	-	-	-	0.94	-
2002	10	215	Cluster by plot	0.88	-	-	0.94	-
2003	10	293	Cluster by plot	0.85	-	-	0.84	0.74
2004	10	258	Cluster by plot	0.84	-	-	0.81	0.68
2005	10	234	Cluster by plot	0.79	-	-	0.89	0.72
2006	10	275	Cluster by plot	0.78	-	-	0.89	0.76
2007	10	264	Cluster by plot	0.77	-	-	0.88	0.67
2008	10	243	Cluster by plot	0.72	-	-	0.84	0.65
2009	10	256	Cluster by plot	0.74	-	-	0.77	0.60
2010	10	251	Cluster by plot	0.57	-	-	0.88	0.51
2011	10	249	Cluster by plot	0.63	-	-	0.78	0.46
2012	*no data*	-	-	-	-	-	-	-
2013	10	172	Cluster by plot	0.85	-	-	0.90	-
2014	3	98	Cluster by plot	0.73	0.81	0.63	0.96	0.70

Table 8. Standard deviation in reproductive performance ratio parameters of common murres at East Amatuli Island, Alaska. Calculated with a ratio estimator (Ackerman et al. 1987). In years when the monitoring schedule yielded data insufficient for egg counts or chick-ageing, parameter-cells requiring these data contain dashes. Data were not collected in 2012.

Year	No. plots	Nest-sites with eggs	Sampling design	Nesting success (chicks/eggs)	Fledging success (fledglings/chicks)	Reproductive success (fledglings/eggs)	"Fledging success" (c_10 "fledglings"/chicks)	"Reproductive success" (c_10 "fledglings"/eggs)
1993	9	241	Cluster by plot	0.05	0.04	0.05	0.03	0.06
1994	10	306	Cluster by plot	0.02	0.03	0.03	0.01	0.02
1995	10	353	Cluster by plot	0.02	0.02	0.03	0.01	0.03
1996	10	266	Cluster by plot	0.03	0.02	0.03	0.01	0.03
1997	10	311	Cluster by plot	0.03	0.02	0.03	0.01	0.03
1998	10	240	Cluster by plot	0.04	0.07	0.08	0.06	0.08
1999	10	284	Cluster by plot	0.03	0.03	0.03	0.01	0.03
2000	10	-	Cluster by plot	-	-	-	-	-
2001	10	-	Cluster by plot	-	-	-	-	-
2002	10	215	Cluster by plot	0.08	-	-	0.02	0.08
2003	10	293	Cluster by plot	0.02	-	-	0.03	0.03
2004	10	258	Cluster by plot	0.06	-	-	0.04	0.06
2005	10	234	Cluster by plot	0.04	-	-	0.02	0.04
2006	10	275	Cluster by plot	0.05	-	-	0.02	0.05
2007	10	264	Cluster by plot	0.03	-	-	0.03	0.04
2008	10	243	Cluster by plot	0.04	-	-	0.04	0.04
2009	10	256	Cluster by plot	0.03	-	-	0.07	0.06
2010	10	251	Cluster by plot	0.04	-	-	0.03	0.04
2011	10	249	Cluster by plot	0.05	-	-	0.03	0.06
2012	-	-	-	-	-	-	-	-
2013	10	172	Cluster by plot	0.04	-	-	0.04	-
2014	3	98	Cluster by plot	0.08	0.05	0.08	0.03	0.10

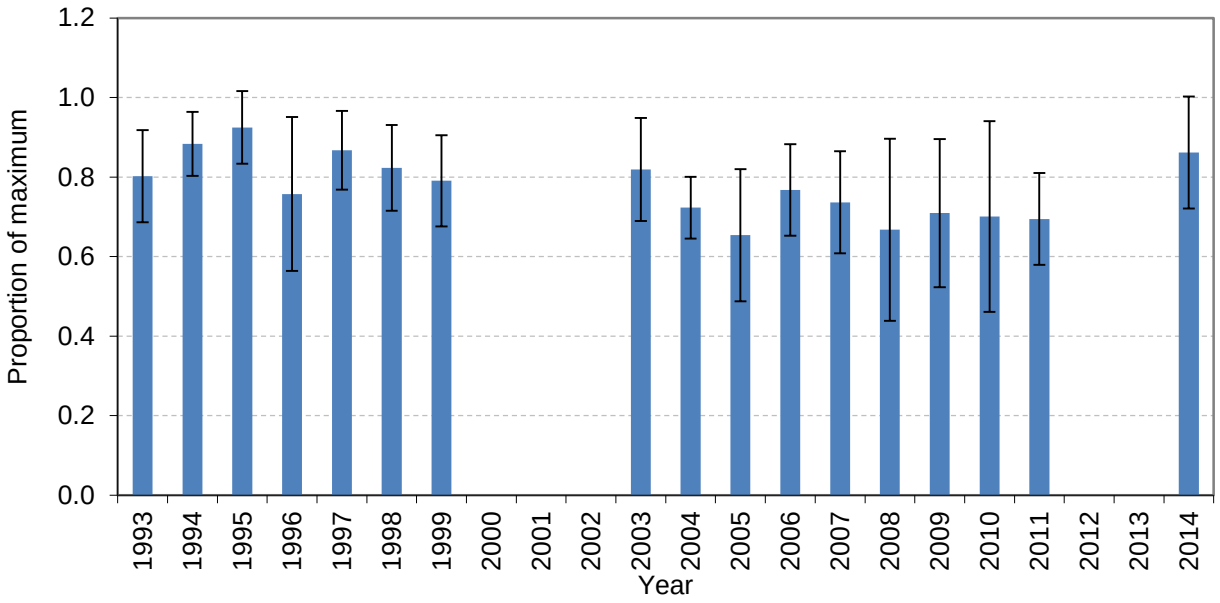

Figure 15. The number of nest-sites with eggs observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. Bars show the annual mean percentage among plots; error bars show one standard deviation. Years without bars had data insufficient for an accurate egg count index.

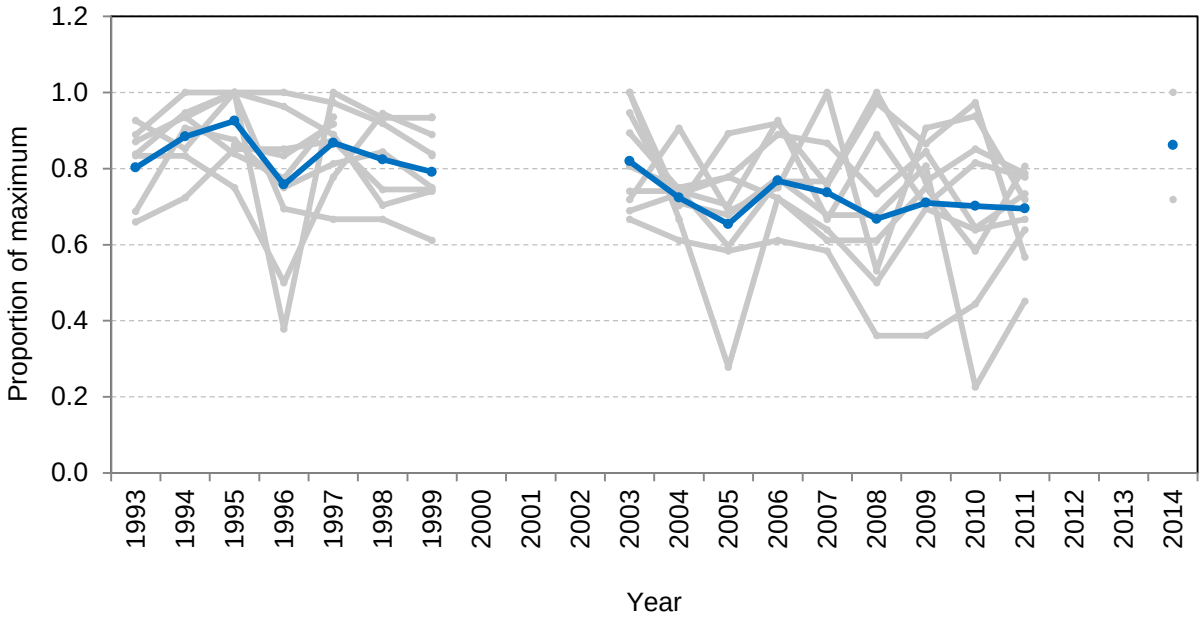

Figure 16. The number of nest-sites with eggs observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. The blue line shows the annual mean percentage among plots; grey lines show values for each plot. Gap years had data insufficient for an accurate egg count index.

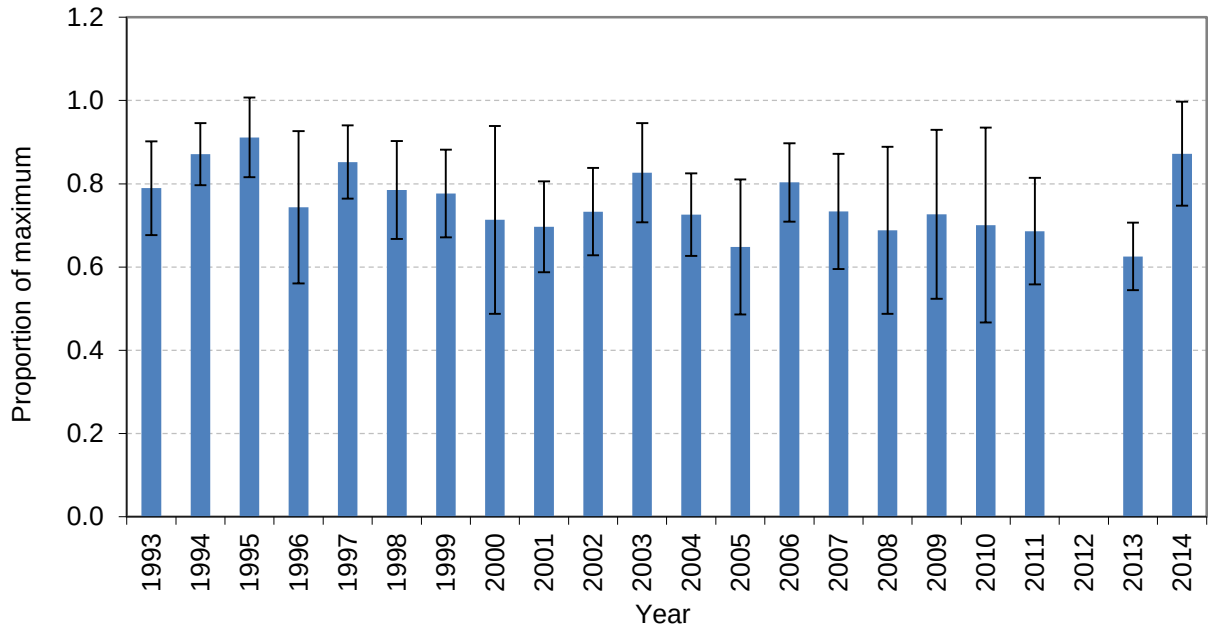

Figure 17. The number of nest-sites with an egg and/or a chick observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. Bars show the annual mean percentage among plots; error bars show one standard deviation. No data were collected in 2012.

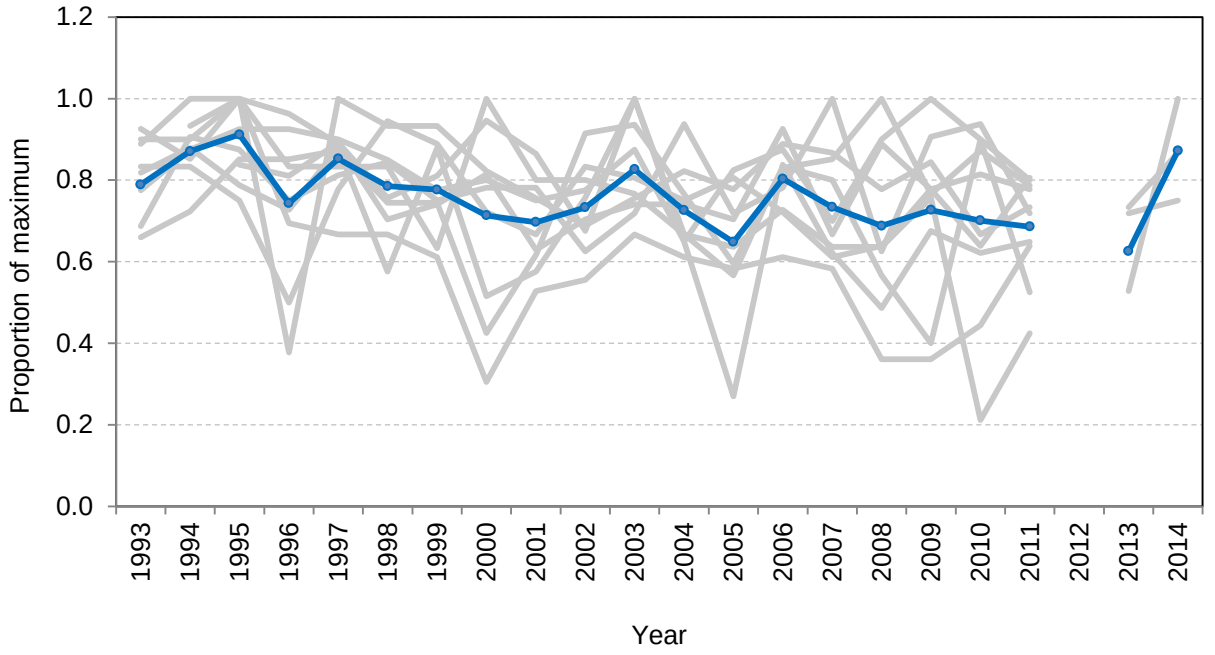

Figure 18. The number of nest-sites with an egg and/or a chick observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. The blue line shows the annual mean percentage among plots; grey lines show values for each plot. No data were collected in 2012.

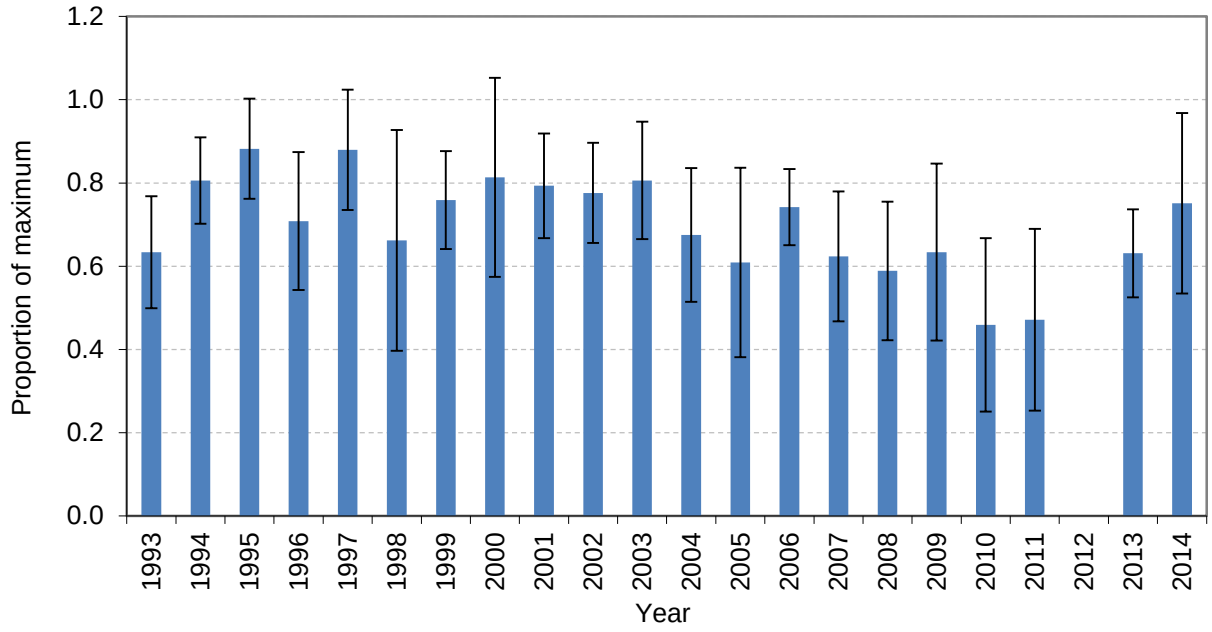

Figure 19. The number of nest-sites with a chick observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. Bars show the annual mean percentage among plots; error bars show one standard deviation. No data were collected in 2012.

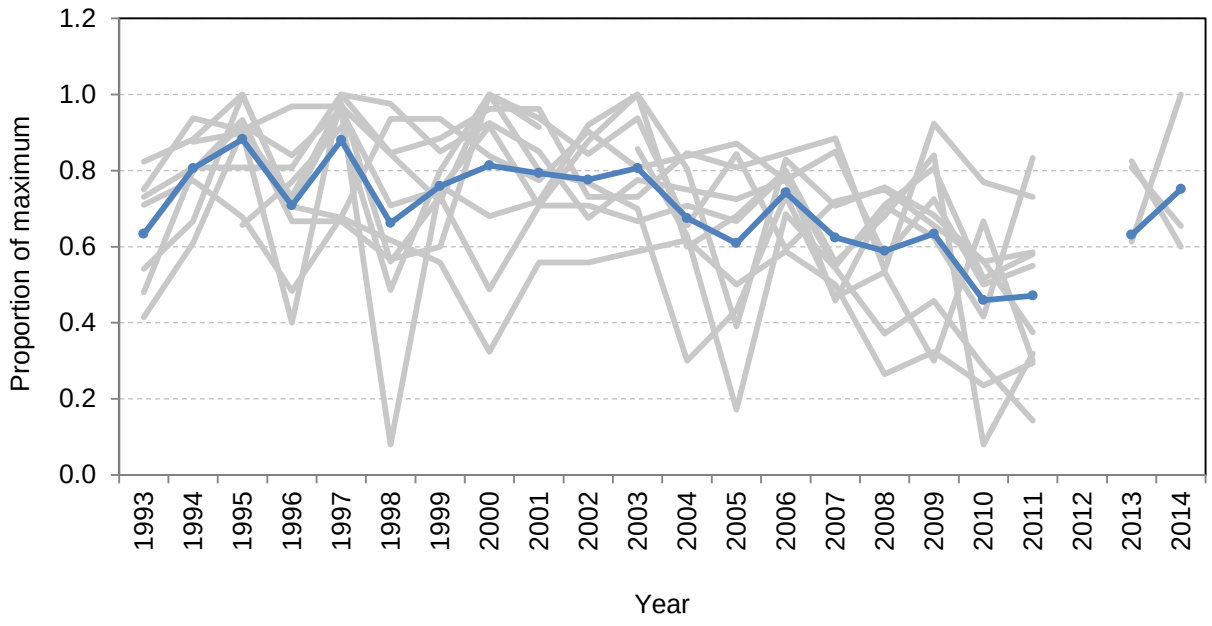

Figure 20. The number of nest-sites with a chick observed on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. The blue line shows the annual mean percentage among plots; grey lines show values for each plot. No data were collected in 2012.

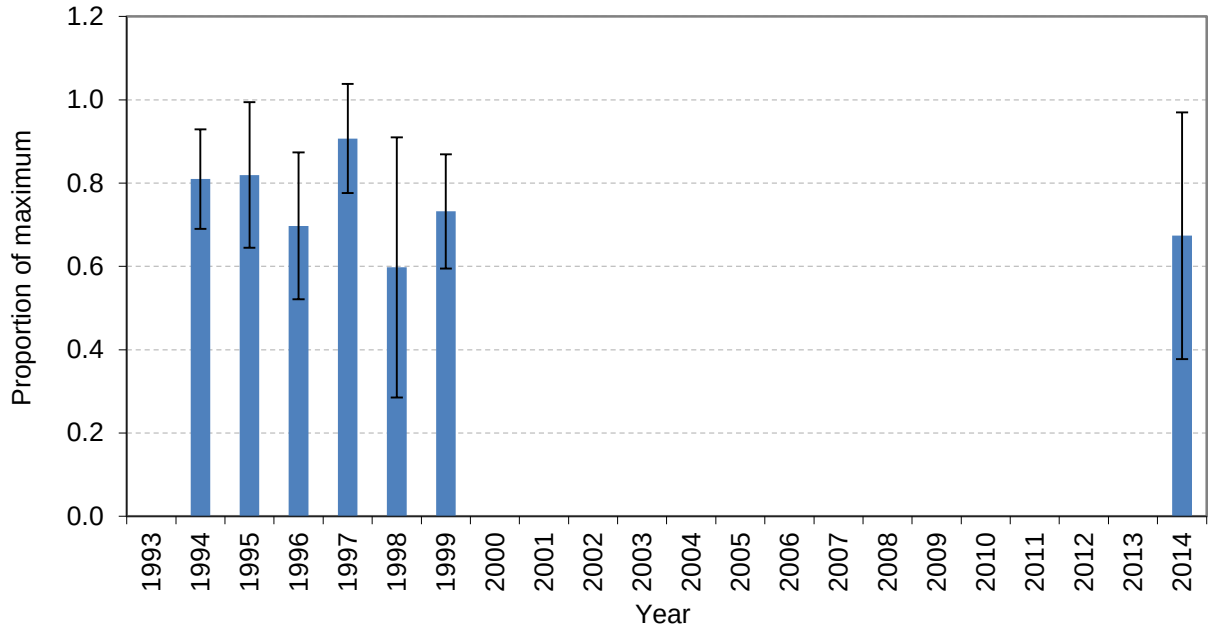

Figure 21. The number of nest-sites with chicks that were observed to reach 15 days of age on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. Bars show the annual mean percentage among plots; error bars show one standard deviation. Years without bars had data insufficient for this parameter.

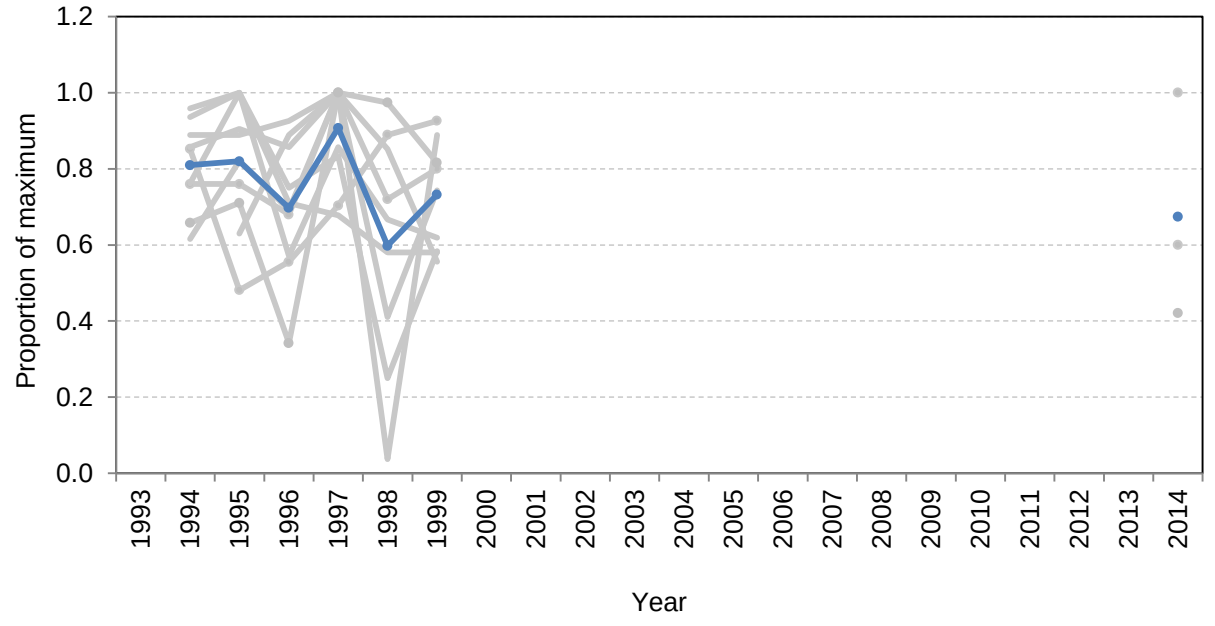

Figure 22. The number of nest-sites with chicks that were observed to reach 15 days of age on productivity monitoring plots at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. The blue line shows the annual mean percentage among plots; grey lines show values for each plot. Years without points had data insufficient for this parameter.

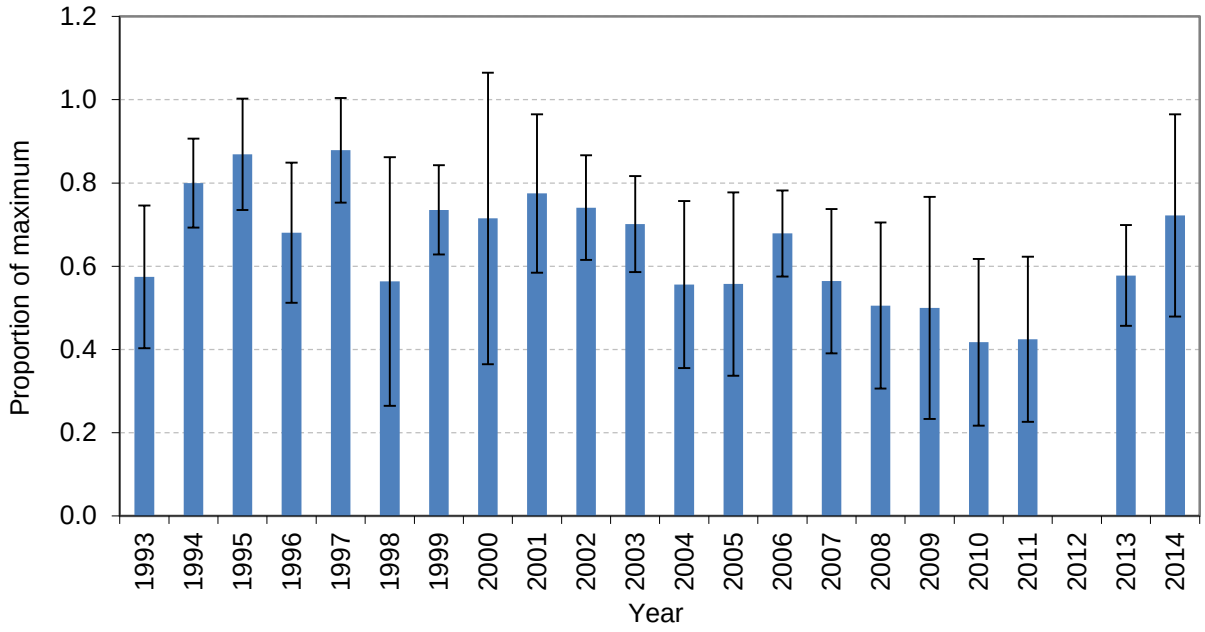

Figure 23. The number of nest-sites with chicks that were observed at least 10 days after plot mean hatch dates at at East Amatuli Island, Alaska. To calculate the index for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. No data were collected in 2012.

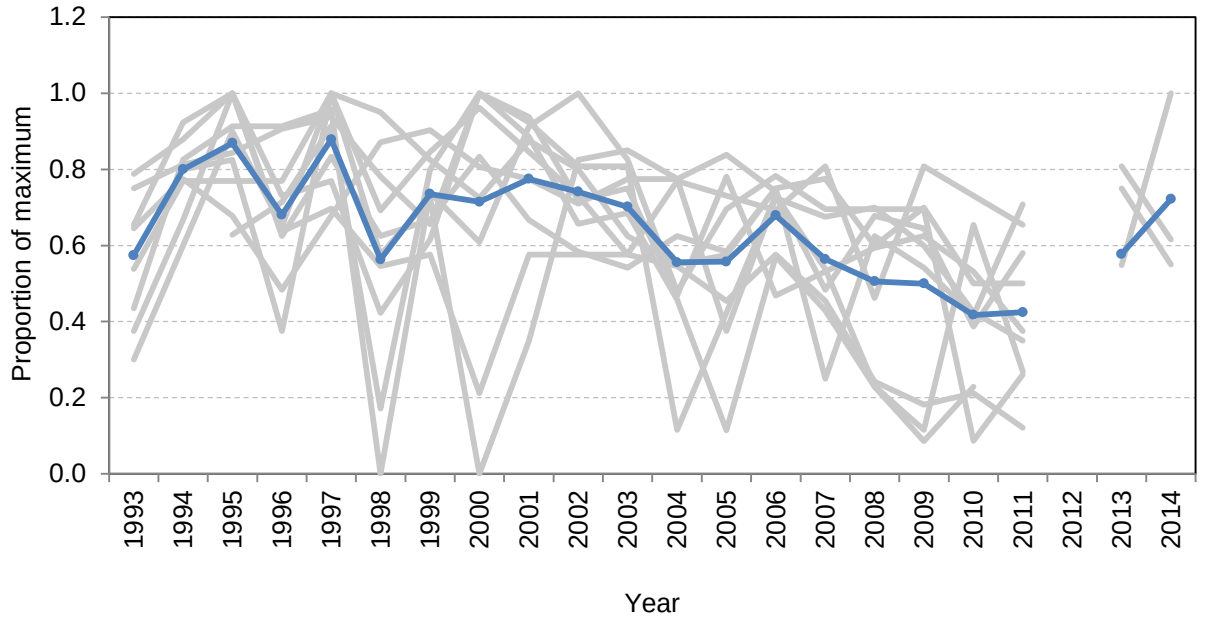

Figure 24. The number of nest-sites with chicks that were observed at least 10 days after plot mean hatch dates at East Amatuli Island, Alaska. Grey lines track each of the 11 plots. To calculate the result for each year, counts that year were summed across plots; then this sum was divided by the sum of the among-year maximum counts for those plots. The blue line is the annual index: the sum of nest-site-counts for all plots counted divided by the sum of the among-year maxima for the counted plots. No data were collected in 2012.

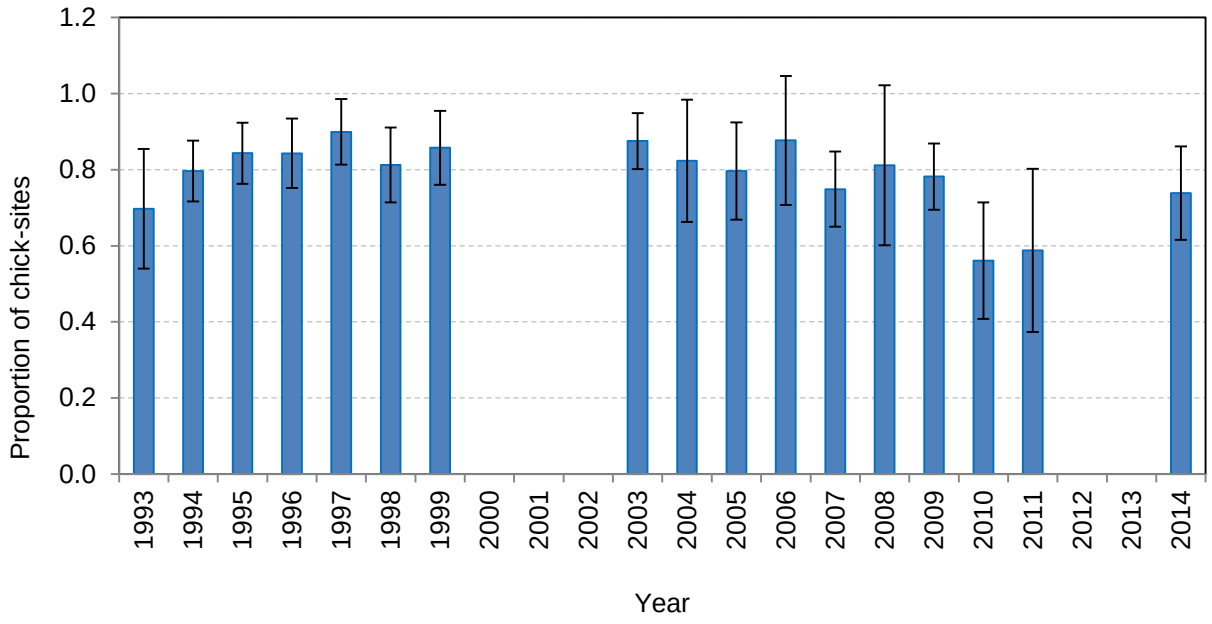

Figure 25. The proportion of nest-sites with an egg that produced a chick, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Bars show the annual mean among plots; error bars show one standard deviation. Years without bars had insufficient egg data.

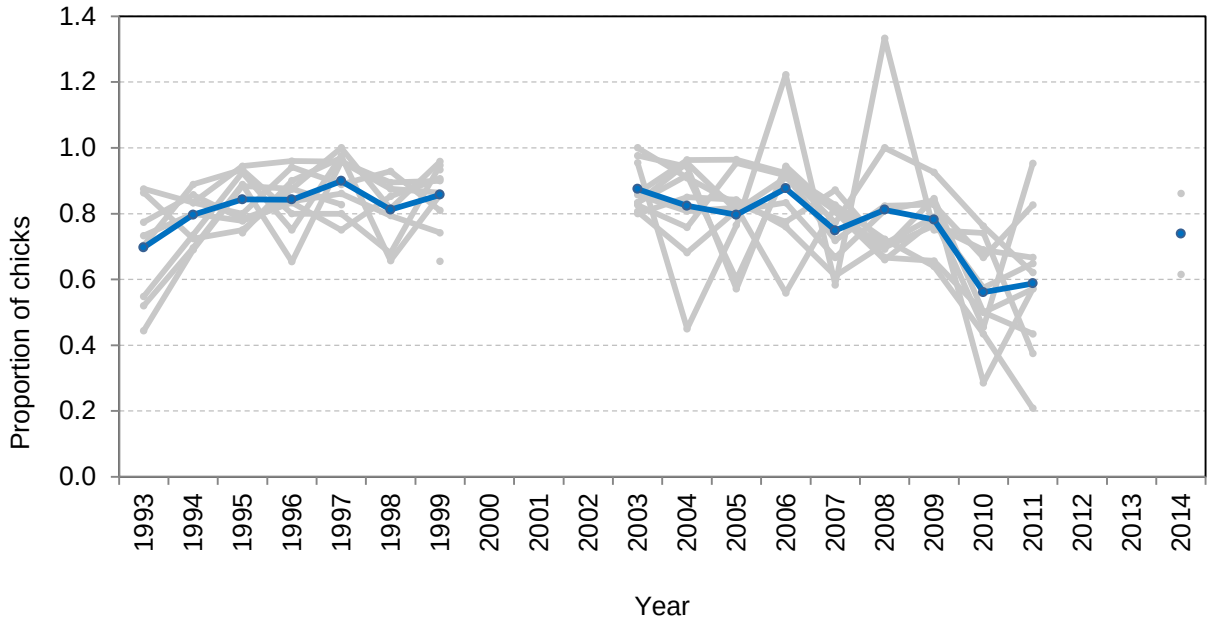

Figure 26. The proportion of nest-sites with an egg that produced a chick, as observed on productivity monitoring plots at East Amatuli Island, Alaska. The blue line shows the annual mean; grey lines show values for each plot. Years without points had insufficient egg data.

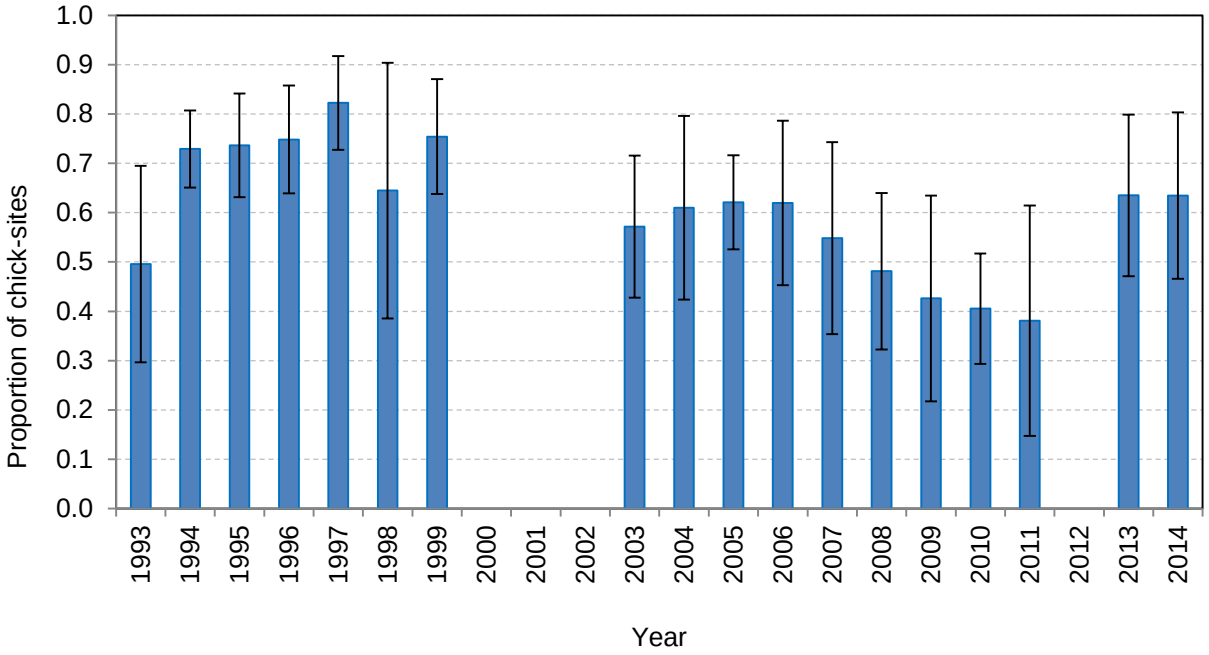

Figure 27. The proportion of nest-sites with an egg that produced an aged fledgling, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Bars show the annual mean among plots; error bars show one standard deviation. Years without bars had insufficient egg data.

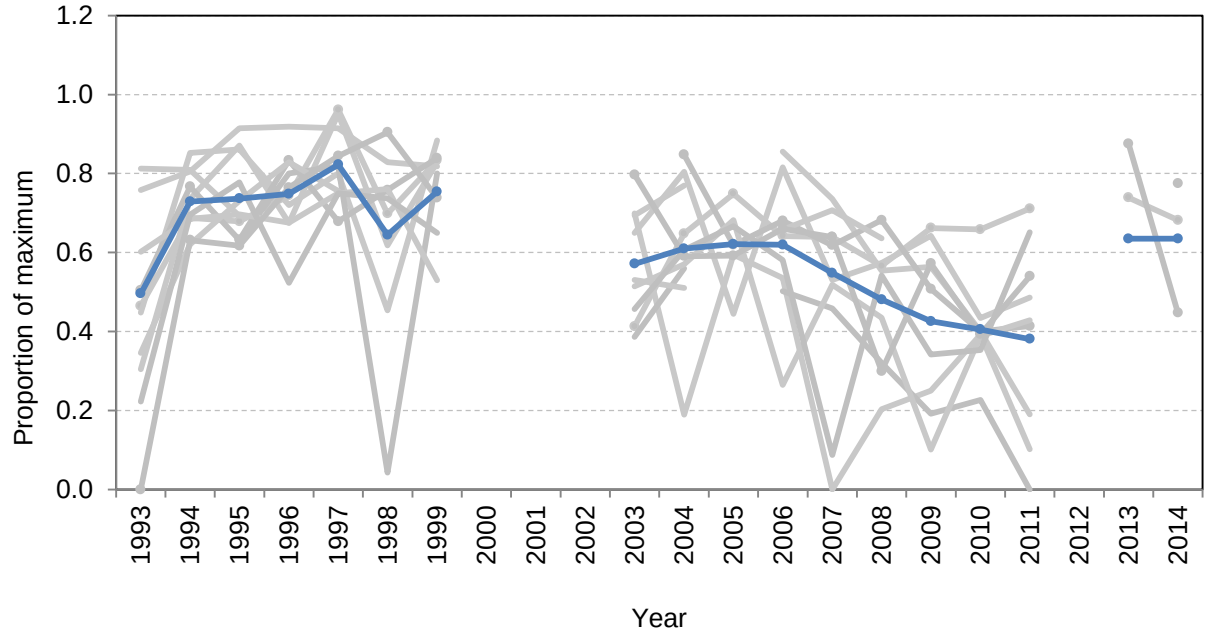

Figure 28. The proportion of nest-sites with an egg that produced an aged fledgling, as observed on productivity monitoring plots at East Amatuli Island, Alaska. The blue line shows the annual mean; grey lines show values for each plot. Years without points had insufficient egg data.

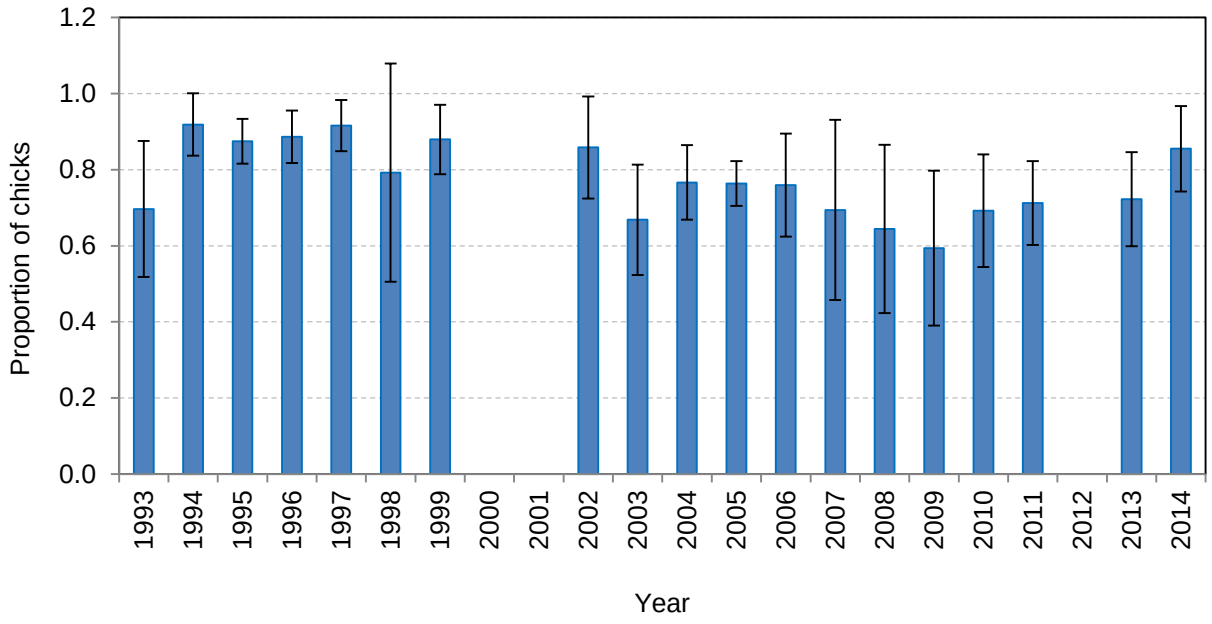

Figure 29. The proportion of chicks with egg-to-chick observation hatch dates that produced an aged fledgling, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Bars show the annual mean among plots; error bars show one standard deviation. Years without bars had insufficient egg-to-chick observation data.

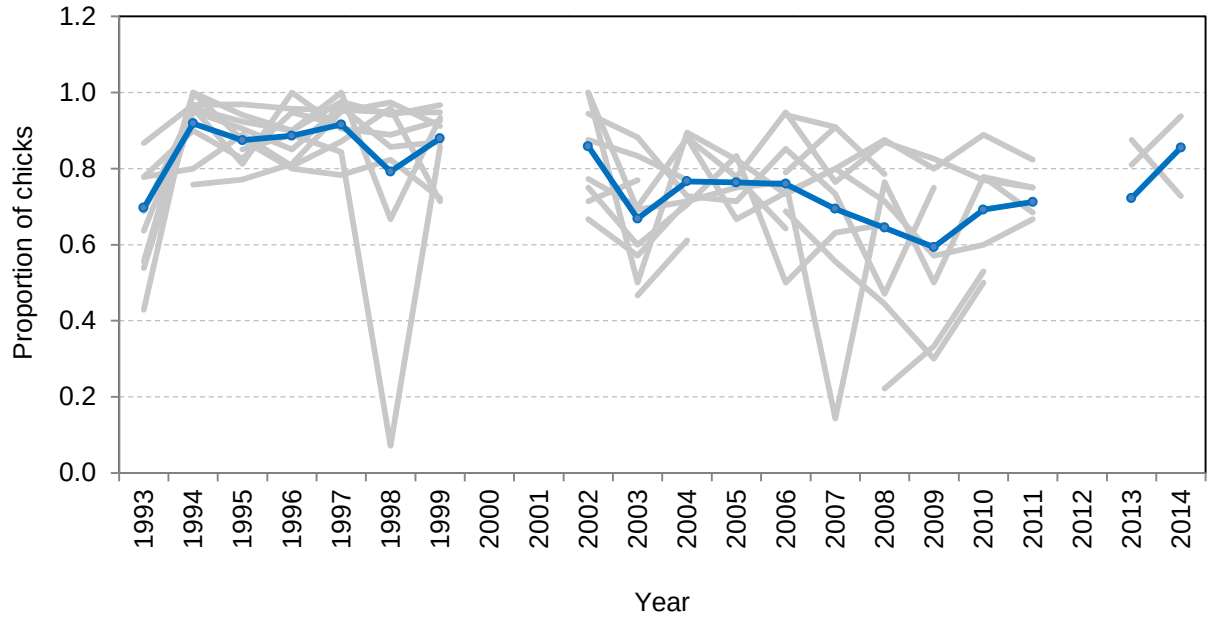

Figure 30. The proportion of chicks with egg-to-chick observation hatch dates that produced an aged fledgling, as observed on productivity monitoring plots at East Amatuli Island, Alaska. The blue line shows the annual mean; grey lines show values for each plot. Years without points had insufficient egg-to-chick observation data.

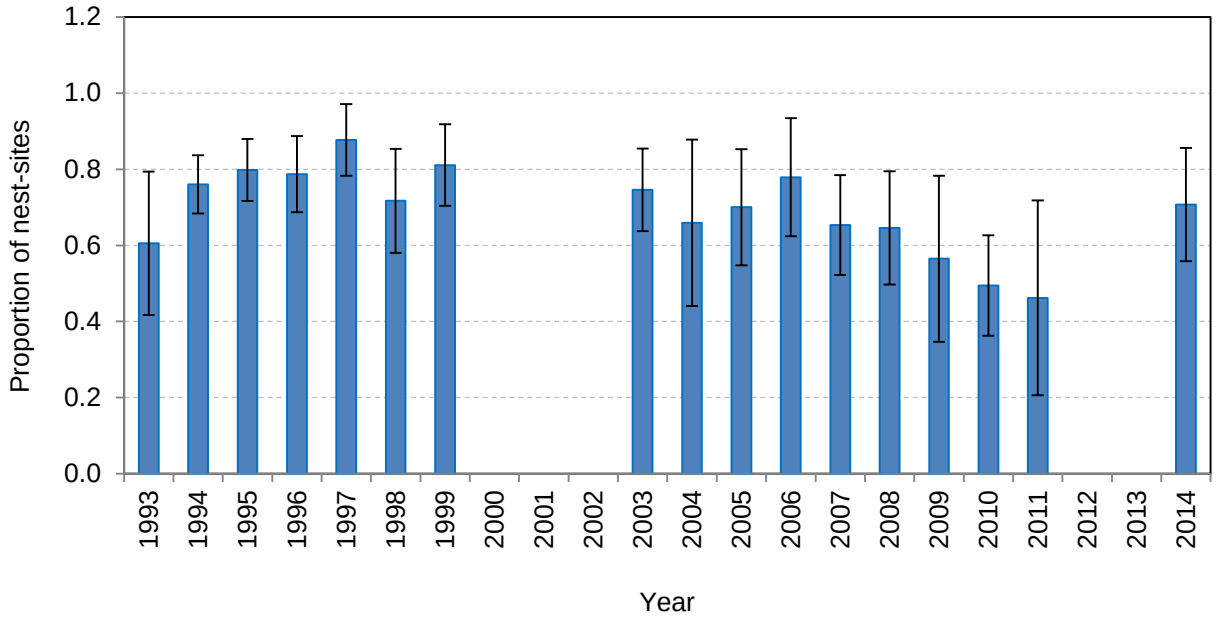

Figure 31. The proportion of nest-sites with an egg that produced a chick that was seen at least ten days after its plot's mean hatch date, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Sites where a chick but not an egg was seen are excluded. Bars show the annual mean among plots; error bars show one standard deviation. Years without bars had insufficient egg data.

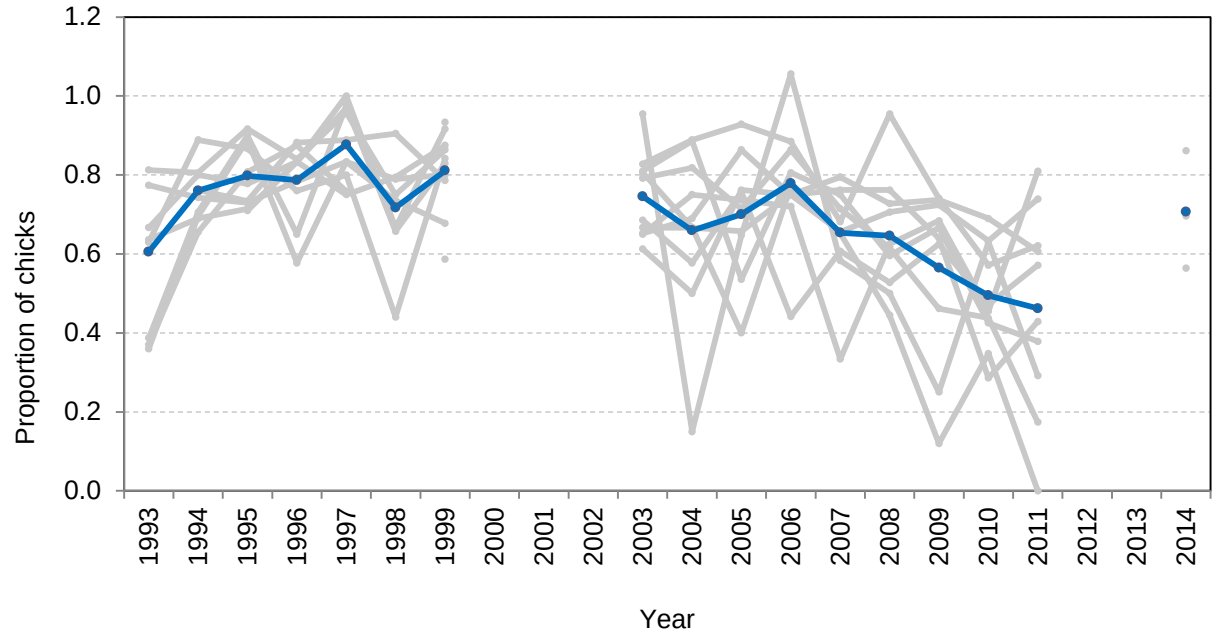

Figure 32. The proportion of nest-sites with an egg that produced a chick that was seen at least ten days after its plot's mean hatch date, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Sites where a chick but not an egg was seen are excluded. The blue line shows the annual mean; grey lines show values for each plot. Years without points had insufficient egg data.

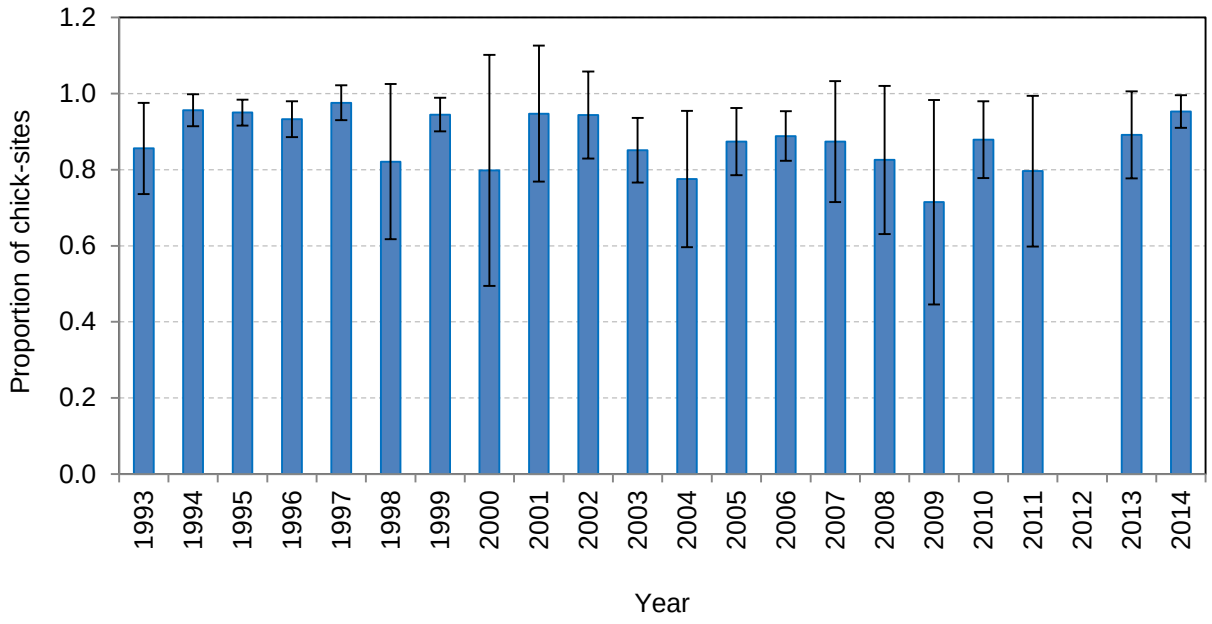

Figure 33. The proportion of chicks seen at least ten days after their plot's mean hatch date, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Sites where a chick but not an egg was seen are excluded. Bars show the annual mean among plots; error bars show one standard deviation. No data were collected in 2012.

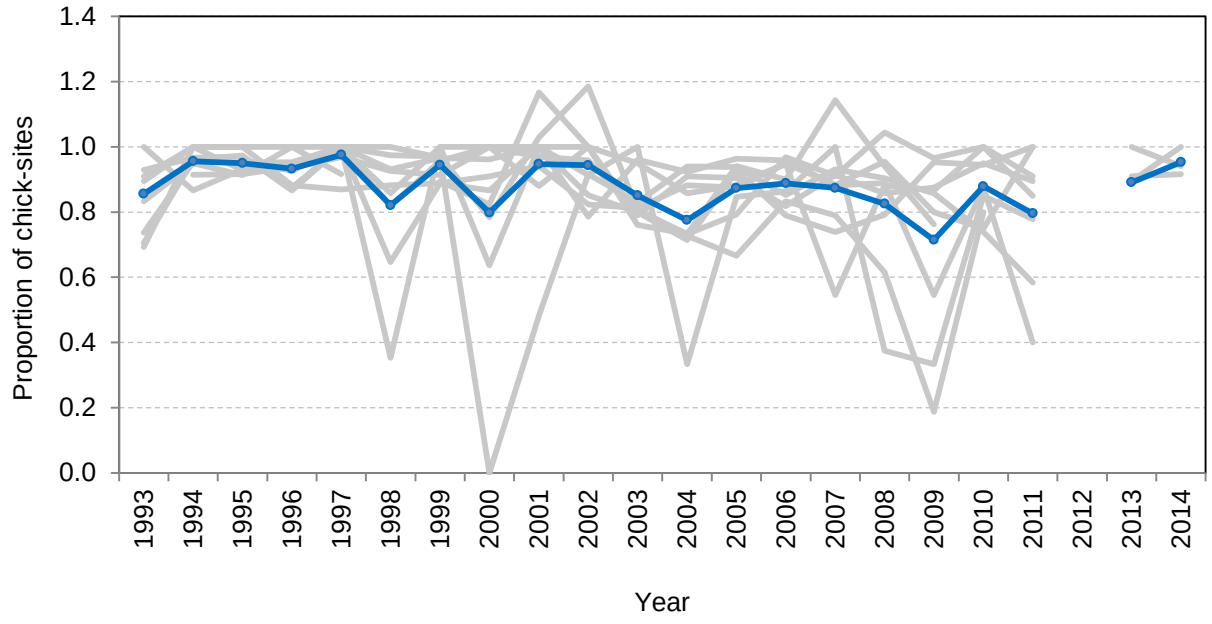

Figure 34. The proportion of chicks seen at least ten days after their plot's mean hatch date, as observed on productivity monitoring plots at East Amatuli Island, Alaska. Sites where a chick but not an egg was seen are excluded. The blue line shows the annual mean; grey lines show values for each plot. No data were coleccted in 2012.

Table 9. Reproductive performance of common murres at East Amatuli Island, Alaska. Year is given at table's upper left; results for previous years are continued on following pages. Dashes indicate "no data".

2014

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	-	-	23	-	-	-	36	-	-	-	39			98	
Eggs, adjusted (B)	-	-	22.0	-	-	-	34.8	-	-	-	35.8			92.6	
Chicks (C)	-	-	17	-	-	-	31	-	-	-	24			72	
Chicks with previous egg sighting (D)	-	-	16	-	-	-	31	-	-	-	24			71	
Chicks with hatch date (E)	-	-	16	-	-	-	30	-	-	-	22			68	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	-	-	24	-	-	-	36	-	-	-	39			99	
Fledglings by age (G)	-	-	15	-	-	-	27	-	-	-	16			58	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	-	-	16	-	-	-	31	-	-	-	22			69	
Proportion of chicks with previous egg sighting (E/D)	-	-	0.94	-	-	-	1.00	-	-	-	1.00			0.99	
Proportion of chicks with hatch date (E/C)	-	-	0.94	-	-	-	0.97	-	-	-	0.92			0.94	
Chicks/eggs (C/A)	-	-	0.74	-	-	-	0.86	-	-	-	0.62	0.74	0.12	0.73	0.08
Fledglings/eggs (G/B)	-	-	0.68	-	-	-	0.78	-	-	-	0.45	0.63	0.17	0.63	0.08
Fledglings/chicks (G/C)	-	-	0.88	-	-	-	0.87	-	-	-	0.67	0.81	0.12	0.81	0.05
"Fledglings"/eggs (H/A)	-	-	0.70	-	-	-	0.86	-	-	-	0.56	0.71	0.15	0.70	0.10
"Fledglings"/chicks (H/C)	-	-	0.94	-	-	-	1.00	-	-	-	0.92	0.95	0.04	0.96	0.03

[a] Productivity plots 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 have respective field names M1-LC, M2-LC, M3-LC, M4-LC, M5-LR, M1-F, M2-F, M3-F, M4-F, and M5-F.

[b] Standard deviation calculated with ratio estimation (Ackerman et al. 1987).

Table 10 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2013

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	22	22	23	-	17	20		27	16	19				166	
Eggs, adjusted (B)	28.0	22.0	23.0	-	15.9	20.0	4.0	24.0	11.4	15.4	8.0			171.8	
Chicks (C)	23	19	21	-	18	18	19	18	15	16	33			200	
Chicks with previous egg sighting (D)	23	19	21	-	16	18	4	18	14	16	9			158	
Chicks with hatch date (E)	23	19	21	-	15	18	4	16	10	13	8			147	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	28	22	23	-	19	20	19	27	17	19	33			227	
Fledglings by age (G)	13	12	17	-	13	15	3	10	6	9	7			105	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	23	18	21	-	14	18	17	14	10	15	30			180	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00	-	0.89	1.00	0.21	1.00	0.93	1.00	0.27			0.79	
Proportion of chicks with hatch date (E/C)	1.00	1.00	1.00	-	0.83	1.00	0.21	0.89	0.67	0.81	0.24			0.74	
Chicks/eggs (C/A)	1.05	0.86	0.91	-	-	0.90	-	0.67	0.94	0.84	-	0.88	0.12	-	0.04
Fledglings/eggs (G/B)	0.46	0.55	0.74	-	-	0.75	-	-	-	-	-	0.62	0.14	-	-
Fledglings/chicks (G/C)	0.57	0.63	0.81	-	-	0.83	-	-	-	-	-	0.71	0.13	-	-
"Fledglings"/eggs (H/A)	1.05	0.82	0.91	-	0.82	0.90	-	0.52	0.63	0.79	-	0.80	0.17	1.08	-
"Fledglings"/chicks (H/C)	1.00	0.95	1.00	-	0.78	1.00	0.89	0.78	0.67	0.94	0.91	0.89	0.11	0.90	0.04

2012

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eggs, adjusted (B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicks (C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicks with previous egg sighting (D)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicks with hatch date (E)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings by age (G)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proportion of chicks with previous egg sighting (E/D)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proportion of chicks with hatch date (E/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicks/eggs (C/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/chicks (H/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 11 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2011

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	23	23	23		24	24	29	21	14	21	33			235	
Eggs, adjusted (B)	24.7	10.5	19.7		9.8	14.4	24.2	21.0	10.5	20.0	31.5			186.1	
Chicks (C)	24	10	19		9	5	18	12	8	20	22			147	
Chicks with previous egg sighting (D)	24	10	19		9	5	18	12	8	20	22			147	
Chicks with hatch date (E)	16	5	17		4	3	15	12	6	19	21			118	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	37	23	23		24	24	29	21	14	21	33			249	
Fledglings by age (G)	12	2	14		1	0	10	9	3	13	17			81	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	14	4	17		7	0	18	12	6	17	20			115	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	0.67	0.50	0.89		0.44	0.60	0.83	1.00	0.75	0.95	0.95			0.80	
Chicks/eggs (C/A)	1.04	0.43	0.83		0.38	0.21	0.62	0.57	0.57	0.95	0.67	0.63	0.26	0.63	0.05
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	0.43	-	0.65	0.54	0.54	0.11	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	0.75	-	0.65	0.77	0.72	0.07	-	-
"Fledglings"/eggs (H/A)	0.61	0.17	0.74		0.29	0.00	0.62	0.57	0.43	0.81	0.61	0.48	0.26	0.49	0.06
"Fledglings"/chicks (H/C)	0.58	0.40	0.89		0.78	0.00	1.00	1.00	0.75	0.85	0.91	0.72	0.31	0.78	0.03

2010

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	16	16	30		27	23	21	36	7	22	29			227	
Eggs, adjusted (B)	23.0	7.5	12.2		23.0	13.2	15.0	36.0	3.5	19.8	7.6			160.8	
Chicks (C)	23	8	20		20	10	16	18	2	10	20			147	
Chicks with previous egg sighting (D)	22	8	20		20	10	14	18	2	10	19			143	
Chicks with hatch date (E)	13	4	9		17	6	10	18	1	9	5			92	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	41	16	30		27	23	23	36	7	22	30			255	
Fledglings by age (G)	10	3	8		9	3	6	14	0	7	3			63	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	17	7	19		17	8	12	17	2	10	20			129	
Proportion of chicks with previous egg sighting (E/D)	0.96	1.00	1.00		1.00	1.00	0.88	1.00	1.00	1.00	0.95			0.97	
Proportion of chicks with hatch date (E/C)	0.57	0.50	0.45		0.85	0.60	0.63	1.00	0.50	0.90	0.25			0.63	
Chicks/eggs (C/A)	1.44	0.50	0.67		0.74	0.43	-	0.50	0.29	0.45	0.69	0.63	0.33	0.65	0.04
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	0.39	-	0.35	-	0.37	0.02	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	0.78	-	0.70	-	0.74	0.05	-	-
"Fledglings"/eggs (H/A)	1.06	0.44	0.63		0.63	0.35	0.57	0.47	0.29	0.45	0.69	0.56	0.22	0.57	0.04
"Fledglings"/chicks (H/C)	0.74	0.88	0.95		0.85	0.80	0.75	0.94	1.00	1.00	1.00	0.89	0.10	0.88	0.03

Table 12 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2009

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	13	13	29		12	25	27	32	25	19	38			233	
Eggs, adjusted (B)	29.6	7.1	12.1		8.0	15.6	7.9	9.8	4.8	8.8	10.5			114.1	
Chicks (C)	28	11	24		9	16	25	21	21	15	29			199	
Chicks with previous egg sighting (D)	28	11	24		9	16	24	13	21	13	29			188	
Chicks with hatch date (E)	23	6	10		6	10	7	4	4	6	8			84	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	36	13	29		12	25	28	40	25	21	38			267	
Fledglings by age (G)	19	4	8		2	3	4	1	2	3	6			52	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	24	6	21		3	3	20	20	16	13	28			154	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	0.96	0.62	1.00	0.87	1.00			0.94	
Proportion of chicks with hatch date (E/C)	0.82	0.55	0.42		0.67	0.63	0.28	0.19	0.19	0.40	0.28			0.42	
Chicks/eggs (C/A)	2.15	0.85	0.83		0.75	0.64	0.93	-	0.84	-	0.76	0.97	0.49	0.85	0.03
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	1.85	0.46	0.72		0.25	0.12	0.74	0.63	0.64	0.68	0.74	0.68	0.46	0.66	0.06
"Fledglings"/chicks (H/C)	0.86	0.55	0.88		0.33	0.19	0.80	0.95	0.76	0.87	0.97	0.71	0.27	0.77	0.07

2008

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	13	13	17		12	18	22	36	21	24	33			209	
Eggs, adjusted (B)	34.9	7.2	12.4		9.8	12.5	14.7	34.5	17.3	24.0	26.7			193.9	
Chicks (C)	31	9	14		16	13	22	24	17	17	23			186	
Chicks with previous egg sighting (D)	31	9	11		11	13	21	24	17	17	21			175	
Chicks with hatch date (E)	23	5	8		9	9	14	23	14	17	17			139	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	47	13	20		17	18	23	36	21	24	35			254	
Fledglings by age (G)	20	4	7		2	4	10	15	11	13	8			94	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	28	8	12		6	8	21	19	16	15	24			157	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	0.79		0.69	1.00	0.95	1.00	1.00	1.00	0.91			0.94	
Proportion of chicks with hatch date (E/C)	0.74	0.56	0.57		0.56	0.69	0.64	0.96	0.82	1.00	0.74			0.75	
Chicks/eggs (C/A)	2.38	0.69			-	0.72	1.00	0.67	0.81	0.71	0.70	0.96	0.59	0.89	0.04
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	0.43	-	0.54	-	0.49	0.08	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	0.63	-	0.76	-	0.69	0.10	-	-
"Fledglings"/eggs (H/A)	2.15	0.62	0.71		0.50	0.44	0.95	0.53	0.76	0.63	0.73	0.80	0.50	0.75	0.04
"Fledglings"/chicks (H/C)	0.90	0.89	0.86		0.38	0.62	0.95	0.79	0.94	0.88	1.04	0.83	0.19	0.84	0.04

Table 13 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2007

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	21	21	32		24	23	22	28	21	18	39			249	
Eggs, adjusted (B)	24.5	13.6	13.9		6.9	10.9	19.4	23.1	14.1	11.5	34.4			172.3	
Chicks (C)	29	17	23		14	19	17	23	14	11	34			201	
Chicks with previous egg sighting (D)	25	17	23		14	19	17	23	14	11	34			197	
Chicks with hatch date (E)	17	11	10		4	9	15	19	11	7	30			133	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	40	21	32		24	23	22	28	21	18	39			268	
Fledglings by age (G)	13	10	8		3	5	12	12	10	1	22			96	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	27	15	21		14	15	15	17	16	6	31			177	
Proportion of chicks with previous egg sighting (E/D)	0.86	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			0.98	
Proportion of chicks with hatch date (E/C)	0.59	0.65	0.43		0.29	0.47	0.88	0.83	0.79	0.64	0.88			0.66	
Chicks/eggs (C/A)	-	0.81	0.72		0.58	0.83	0.77	0.82	0.67	0.61	0.87	0.74	0.10	0.81	0.03
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	1.29	0.71	0.66		0.58	0.65	0.68	0.61	0.76	0.33	0.79	0.71	0.24	0.71	0.04
"Fledglings"/chicks (H/C)	0.93	0.88	0.91		1.00	0.79	0.88	0.74	1.14	0.55	0.91	0.87	0.16	0.88	0.03

2006

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	22	22	24		18	26	26	34	24	25	40			261	
Eggs, adjusted (B)	22.1	18.7	17.1		16.8	21.9	20.6	34.0	22.8	22.4	34.8			231.2	
Chicks (C)	34	20	22		22	24	24	19	20	19	31			235	
Chicks with previous egg sighting (D)	31	20	21		15	19	24	18	20	19	31			218	
Chicks with hatch date (E)	19	17	15		14	16	19	18	19	17	27			181	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	39	22	25		25	31	26	35	24	25	40			292	
Fledglings by age (G)	18	16	11		9	11	14	9	15	13	23			139	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	29	19	18		19	20	23	15	18	18	30			209	
Proportion of chicks with previous egg sighting (E/D)	0.91	1.00	0.95		0.68	0.79	1.00	0.95	1.00	1.00	1.00			0.93	
Proportion of chicks with hatch date (E/C)	0.56	0.85	0.68		0.64	0.67	0.79	0.95	0.95	0.89	0.87			0.77	
Chicks/eggs (C/A)	1.55	0.91	0.92		-	-	0.92	0.56	0.83	0.76	0.78	0.90	0.29	0.90	0.05
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	0.26	0.66	-	-	0.46	0.28	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	0.47	0.75	-	-	0.61	0.20	-	-
"Fledglings"/eggs (H/A)	1.32	0.86	0.75		1.06	0.77	0.88	0.44	0.75	0.72	0.75	0.83	0.23	0.80	0.05
"Fledglings"/chicks (H/C)	0.85	0.95	0.82		0.86	0.83	0.96	0.79	0.90	0.95	0.97	0.89	0.07	0.89	0.02

Table 14 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2005

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	21	21	22		17	10	28	33	21	19	35			227	
Eggs, adjusted (B)	15.8	4.9	18.7		11.8	5.0	6.5	14.7	3.7	9.0	8.4			98.4	
Chicks (C)	16	17	21		13	6	27	27	17	16	29			189	
Chicks with previous egg sighting (D)	16	17	20		13	6	26	27	17	16	29			187	
Chicks with hatch date (E)	9	4	17		9	3	6	12	3	8	7			78	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	28	21	23		17	10	29	33	21	19	35			236	
Fledglings by age (G)	7	4	14		7	1	4	10	2	6	5			60	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	15	15	19		11	4	26	25	16	14	23			168	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	0.95		1.00	1.00	0.96	1.00	1.00	1.00	1.00			0.99	
Proportion of chicks with hatch date (E/C)	0.56	0.24	0.81		0.69	0.50	0.22	0.44	0.18	0.50	0.24			0.41	
Chicks/eggs (C/A)	0.76	0.81	0.95		0.76	0.60	0.96	0.82	0.81	0.84	0.83	0.82	0.10	0.83	0.04
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	0.71	0.71	0.86		0.65	0.40	0.93	0.76	0.76	0.74	0.66	0.72	0.14	0.74	0.04
"Fledglings"/chicks (H/C)	0.94	0.88	0.90		0.85	0.67	0.96	0.93	0.94	0.88	0.79	0.87	0.09	0.89	0.02

2004

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	22	22	29		20	24	27	26	22	20	33			245	
Eggs, adjusted (B)	27.3	13.0	26.2		10.6	19.6	26.0	21.0	9.8	16.5	27.1			197.1	
Chicks (C)	33	21	22		9	22	26	21	15	17	30			216	
Chicks with previous egg sighting (D)	32	21	21		9	22	26	21	15	17	26			210	
Chicks with hatch date (E)	25	13	19		5	18	25	17	7	14	22			165	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	36	22	30		20	24	27	26	22	20	37			264	
Fledglings by age (G)	22	10	17		2	11	22	12	5	10	16			127	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	31	18	20		3	16	24	15	11	15	22			175	
Proportion of chicks with previous egg sighting (E/D)	0.97	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00	0.87			0.97	
Proportion of chicks with hatch date (E/C)	0.76	0.62	0.86		0.56	0.82	0.96	0.81	0.47	0.82	0.73			0.76	
Chicks/eggs (C/A)	1.50	0.95	0.76		0.45	0.92	0.96	0.81	0.68	0.85	-	0.88	0.28	0.88	0.06
Fledglings/eggs (G/B)	-	-	-	-	-	-	0.85	-	-	-	-	0.85	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	0.85	-	-	-	-	0.85	-	-	-
"Fledglings"/eggs (H/A)	1.41	0.82	0.69		0.15	0.67	0.89	0.58	0.50	0.75	0.67	0.71	0.32	0.71	0.06
"Fledglings"/chicks (H/C)	0.94	0.86	0.91		0.33	0.73	0.92	0.71	0.73	0.88	0.73	0.78	0.18	0.81	0.04

Table 15 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2003

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	24	24	23		22	36	29	35	31	20	31			275	
Eggs, adjusted (B)	21.5	14.4	7.3		14.3	18.1	4.6	17.5	17.0	17.5	18.8			151.0	
Chicks (C)	41	20	19		21	30	25	30	25	16	31			258	
Chicks with previous egg sighting (D)	39	20	19		20	29	25	30	23	16	28			249	
Chicks with hatch date (E)	20	12	6		13	15	4	15	13	14	17			129	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	44	24	23		23	37	29	35	33	20	34			302	
Fledglings by age (G)	14	10	3		10	7	3	9	9	8	15			88	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	34	19	15		21	24	24	24	19	13	25			218	
Proportion of chicks with previous egg sighting (E/D)	0.95	1.00	1.00		0.95	0.97	1.00	1.00	0.92	1.00	0.90			0.97	
Proportion of chicks with hatch date (E/C)	0.49	0.60	0.32		0.62	0.50	0.16	0.50	0.52	0.88	0.55			0.50	
Chicks/eggs (C/A)	1.71	0.83	0.83		0.95	0.83	0.86	0.86	0.81	0.80	1.00	0.95	0.27	0.94	0.02
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	1.42	0.79	0.65		0.95	0.67	0.83	0.69	0.61	0.65	0.81	-	0.24	0.79	0.03
"Fledglings"/chicks (H/C)	0.83	0.95	0.79		1.00	0.80	0.96	0.80	0.76	0.81	0.81	0.85	0.09	0.84	0.03

2002

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	14	14	19		18		25	31	24	19	31			195	
Eggs, adjusted (B)	27.7	8.6	10.6		7.4	1.1	14.1	27.6	12.0	16.8	20.0			145.8	
Chicks (C)	36	19	19		23	24	28	27	23	17	27			243	
Chicks with previous egg sighting (D)	27	13	18		17	9	23	27	22	17	27			200	
Chicks with hatch date (E)	22	8	10		7	1	13	24	11	15	18			129	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	43	20	20		24	25	30	31	25	19	31			268	
Fledglings by age (G)	17	7	10		5	1	13	18	11	10	17			109	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	33	19	19		21	23	22	23	23	14	32			229	
Proportion of chicks with previous egg sighting (E/D)	0.75	0.68	0.95		0.74	0.38	0.82	1.00	0.96	1.00	1.00			0.82	
Proportion of chicks with hatch date (E/C)	0.61	0.42	0.53		0.30	0.04	0.46	0.89	0.48	0.88	0.67			0.53	
Chicks/eggs (C/A)	-	-	1.00		-	-	-	0.87	0.96	0.89	0.87	0.92	0.06	-	0.08
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	2.36	1.36	1.00		1.17	-	0.88	0.74	0.96	0.74	1.03	1.14	0.50	1.17	0.08
"Fledglings"/chicks (H/C)	0.92	1.00	1.00		0.91	0.96	0.79	0.85	1.00	0.82	1.19	0.94	0.11	0.94	0.02

Table 16 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

2001

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	-	-	-	-	-	-	-	-	-	-	-			-	
Eggs, adjusted (B)	-	-	-	-	-	-	-	-	-	-	-			-	
Chicks (C)	29	19	25		24	32	24	30	18	17	34			252	
Chicks with previous egg sighting (D)	-	-	-	-	-	-	-	-	-	-	-			-	
Chicks with hatch date (E)	-	-	-	-	-	-	-	-	-	-	-			-	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	29	19	25		24	32	24	30	19	17	34			253	
Fledglings by age (G)	-	-	-	-	-	-	-	-	-	-	-			-	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	14	19	22		24	31	24	30	21	16	35			236	
Proportion of chicks with previous egg sighting (E/D)	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Proportion of chicks with hatch date (E/C)	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Chicks/eggs (C/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/chicks (H/C)	0.48	1.00	0.88		1.00	0.97	1.00	1.00	1.17	0.94	1.03	0.95	0.18	0.94	-

2000

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	-	-	-	-	-	-	-	-	-	-	-			0	
Eggs, adjusted (B)	-	-	-	-	-	-	-	-	-	-	-			0.0	
Chicks (C)	20	11	25		30	35	26	32	17	22	37			255	
Chicks with previous egg sighting (D)	-	-	-	-	-	-	-	-	-	-	-			0	
Chicks with hatch date (E)	-	-	-	-	-	-	-	-	-	-	-			0	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	20	11	25		30	35	26	32	17	22	37			255	
Fledglings by age (G)	-	-	-	-	-	-	-	-	-	-	-			0	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	0	7	25		26	35	25	32	14	20	29			213	
Proportion of chicks with previous egg sighting (E/D)	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Proportion of chicks with hatch date (E/C)	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	
Chicks/eggs (C/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/eggs (H/A)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
"Fledglings"/chicks (H/C)	0.00	0.64	1.00		0.87	1.00	0.96	1.00	0.82	0.91	0.78	0.80	0.30	0.84	-

Table 17 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

1999

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	22	22	24		19	30	32	31	29	20	42			271	
Eggs, adjusted (B)	35.0	22.0	24.0		15.8	30.0	29.8	28.3	27.5	20.0	42.0			274.4	
Chicks (C)	30	19	23		18	28	29	23	19	18	34			241	
Chicks with previous egg sighting (D)	30	19	23		18	28	29	23	19	18	34			241	
Chicks with hatch date (E)	30	19	23		15	28	27	21	18	18	34			233	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	35	22	24		19	30	32	31	29	20	42			284	
Fledglings by age (G)	29	18	20		14	24	25	15	17	13	31			206	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	29	19	22		16	28	28	21	17	16	33			229	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	1.00	1.00	1.00		0.83	1.00	0.93	0.91	0.95	1.00	1.00			0.97	
Chicks/eggs (C/A)	1.36	0.86	0.96		0.95	0.93	0.91	0.74	0.66	0.90	0.81	0.91	0.19	0.89	0.03
Fledglings/eggs (G/B)	0.83	0.82	0.83		-	0.80	0.84	0.53	0.62	0.65	0.74	0.74	0.11	0.75	0.03
Fledglings/chicks (G/C)	0.97	0.95	0.87		-	0.86	0.86	0.65	0.89	0.72	0.91	0.85	0.10	0.85	0.03
"Fledglings"/eggs (H/A)	1.32	0.86	0.92		0.84	0.93	0.88	0.68	0.59	0.80	0.79	0.86	0.19	0.85	0.03
"Fledglings"/chicks (H/C)	0.97	1.00	0.96		0.89	1.00	0.97	0.91	0.89	0.89	0.97	0.94	0.04	0.95	0.01

1998

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	24	24	27		25		34	34		19	42			229	
Eggs, adjusted (B)	25.9	21.7	25.8		13.2	23.1	31.7	30.2	0.0	19.0	40.9			231.5	
Chicks (C)	23	21	22		17	17	29	27	2	17	39			214	
Chicks with previous egg sighting (D)	23	21	22		17	17	29	27	2	17	39			214	
Chicks with hatch date (E)	17	19	21		9	14	27	24	0	17	38			186	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	35	24	27		25	28	34	34	19	19	42			287	
Fledglings by age (G)	16	18	18		6	1	24	23	0	14	37			157	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	23	18	18		11	6	27	25	0	15	38			181	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	0.74	0.90	0.95		0.53	0.82	0.93	0.89	0.00	1.00	0.97			0.87	
Chicks/eggs (C/A)	0.96	0.88	0.81		0.68	-	0.85	0.79	-	0.89	0.93	0.85	0.09	0.93	0.04
Fledglings/eggs (G/B)	-	0.83	0.70		-	-	0.76	-	-	0.74	0.90	0.79	0.08	-	0.08
Fledglings/chicks (G/C)	-	0.86	0.82		-	-	0.83	-	-	0.82	0.95	0.86	0.05	-	0.07
"Fledglings"/eggs (H/A)	0.96	0.75	0.67		0.44	-	0.79	0.74	-	0.79	0.90	0.75	0.16	0.79	0.08
"Fledglings"/chicks (H/C)	1.00	0.86	0.82		0.65	0.35	0.93	0.93	0.00	0.88	0.97	0.74	0.32	0.85	0.06

Table 18 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

1997

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	24	24	26		25	33	28	36	29	24	45			294	
Eggs, adjusted (B)	41.0	23.0	26.0		25.0	33.0	28.0	36.0	27.8	24.0	45.0			308.7	
Chicks (C)	40	23	26		20	32	21	31	24	23	40			280	
Chicks with previous egg sighting (D)	40	23	26		20	32	21	31	24	23	40			280	
Chicks with hatch date (E)	40	22	26		20	32	21	31	23	23	40			278	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	41	24	26		25	33	28	36	29	24	45			311	
Fledglings by age (G)	39	21	25		20	27	19	27	21	18	38			255	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	40	23	26		20	32	21	30	22	20	40			274	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	1.00	0.96	1.00		1.00	1.00	1.00	1.00	0.96	1.00	1.00			0.99	
Chicks/eggs (C/A)	1.67	0.96	1.00		0.80	0.97	0.75	0.86	0.83	0.96	0.89	0.97	0.26	0.95	0.03
Fledglings/eggs (G/B)	0.95	0.91	0.96		0.80	0.82	0.68	0.75	0.76	0.75	0.84	0.82	0.09	0.83	0.03
Fledglings/chicks (G/C)	0.98	0.91	0.96		1.00	0.84	0.90	0.87	0.88	0.78	0.95	0.91	0.07	0.91	0.02
"Fledglings"/eggs (H/A)	1.67	0.96	1.00		0.80	0.97	0.75	0.83	0.76	0.83	0.89	0.95	0.27	0.93	0.03
"Fledglings"/chicks (H/C)	1.00	1.00	1.00		1.00	1.00	1.00	0.97	0.92	0.87	1.00	0.98	0.05	0.98	0.01

1996

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	25	25	24		25	30	18	37	24	26	17			251	
Eggs, adjusted (B)	40.0	24.0	22.9		25.0	30.0	18.0	37.0	21.7	22.9	17.0			258.5	
Chicks (C)	30	24	21		20	27	15	31	21	17	16			222	
Chicks with previous egg sighting (D)	30	24	21		20	27	15	31	21	17	16			222	
Chicks with hatch date (E)	30	23	20		20	27	15	31	19	15	16			216	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	40	25	24		25	30	18	37	24	26	17			266	
Fledglings by age (G)	27	22	17		18	24	15	25	18	12	13			191	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	26	21	20		19	25	15	29	21	15	15			206	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	1.00	0.96	0.95		1.00	1.00	1.00	1.00	0.90	0.88	1.00			0.97	
Chicks/eggs (C/A)	1.20	0.96	0.88		0.80	0.90	0.83	0.84	0.88	0.65	0.94	0.89	0.14	0.88	0.03
Fledglings/eggs (G/B)	0.68	0.92	0.74		0.72	0.80	0.83	0.68	0.83	-	0.76	0.77	0.08	0.74	0.03
Fledglings/chicks (G/C)	0.90	0.92	0.81		0.90	0.89	1.00	0.81	0.86	-	0.81	0.88	0.06	0.86	0.02
"Fledglings"/eggs (H/A)	1.04	0.84	0.83		0.76	0.83	0.83	0.78	0.88	0.58	0.88	0.83	0.12	0.82	0.03
"Fledglings"/chicks (H/C)	0.87	0.88	0.95		0.95	0.93	1.00	0.94	1.00	0.88	0.94	0.93	0.05	0.93	0.01

Table 19 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

1995

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	36	36	28	26	30	31	27	37	26	27	45			349	
Eggs, adjusted (B)	36.8	33.9	28.0	26.0	27.9	27.0	20.6	34.4	26.0	27.0	43.8			331.2	
Chicks (C)	37	34	21	21	28	23	21	29	23	24	36			297	
Chicks with previous egg sighting (D)	37	34	21	21	28	23	21	29	23	24	36			297	
Chicks with hatch date (E)	34	32	21	21	26	20	16	27	23	24	35			279	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	40	36	28	26	30	31	27	37	26	27	45			353	
Fledglings by age (G)	32	31	19	18	24	17	13	24	19	21	27			245	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	36	33	20	19	26	22	21	27	21	24	33			282	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	0.92	0.94	1.00	1.00	0.93	0.87	0.76	0.93	1.00	1.00	0.97			0.94	
Chicks/eggs (C/A)	1.03	0.94	0.75	0.81	0.93	0.74	0.78	0.78	0.88	0.89	0.80	0.85	0.09	0.85	0.02
Fledglings/eggs (G/B)	0.87	0.91	0.68	0.69	0.86	-	-	0.70	0.73	0.78	0.62	0.76	0.10	0.74	0.03
Fledglings/chicks (G/C)	0.86	0.91	0.90	0.86	0.86	-	-	0.83	0.83	0.88	0.75	0.85	0.05	0.82	0.02
"Fledglings"/eggs (H/A)	1.00	0.92	0.71	0.73	0.87	0.71	0.78	0.73	0.81	0.89	0.73	0.81	0.10	0.81	0.03
"Fledglings"/chicks (H/C)	0.97	0.97	0.95	0.90	0.93	0.96	1.00	0.93	0.91	1.00	0.92	0.95	0.03	0.95	0.01

1994

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	36	36	29	21	27		30	35	29	23	42			308	
Eggs, adjusted (B)	32.6	36.0	27.6	21.0	27.0		30.0	35.0	29.0	23.0	39.6			300.9	
Chicks (C)	25	30	21	19	24		24	30	20	16	35			244	
Chicks with previous egg sighting (D)	25	30	21	19	24		24	30	20	16	35			244	
Chicks with hatch date (E)	24	30	20	19	24		24	30	20	16	33			240	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	34	36	29	21	27		30	35	29	23	42			306	
Fledglings by age (G)	24	29	19	17	23		23	24	18	16	25			218	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	24	29	20	18	24		24	26	19	16	32			232	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00			1.00	
Proportion of chicks with hatch date (E/C)	0.96	1.00	0.95	1.00	1.00		1.00	1.00	1.00	1.00	0.94			0.98	
Chicks/eggs (C/A)	0.69	0.83	0.72	0.90	0.89		0.80	0.86	0.69	0.70	0.83	0.79	0.08	0.79	0.02
Fledglings/eggs (G/B)	0.74	0.81	0.69	0.81	0.85		0.77	0.69	0.62	0.70	0.63	0.73	0.08	0.72	0.03
Fledglings/chicks (G/C)	0.96	0.97	0.90	0.89	0.96		0.96	0.80	0.90	1.00	0.71	0.91	0.09	0.89	0.03
"Fledglings"/eggs (H/A)	0.67	0.81	0.69	0.86	0.89		0.80	0.74	0.66	0.70	0.76	0.76	0.08	0.75	0.02
"Fledglings"/chicks (H/C)	0.96	0.97	0.95	0.95	1.00		1.00	0.87	0.95	1.00	0.91	0.96	0.04	0.95	0.01

Table 20 (continued) Reproductive performance of common murres at East Amatuli Island, Alaska.

1993

Parameter	Plot											Plot mean	SD	Total	SD
	1	2	3	4	5	6	7	8	9	10	11				
Eggs (A)	32	32	22	16	27		30	31	27	25	-			242	
Eggs, adjusted (B)	16.4	17.1	15.1	8.6	15.6		21.8	23.3	20.3	13.5	-			151.6	
Chicks (C)	17	28	19	13	19		22	24	12	13	-			167	
Chicks with previous egg sighting (D)	17	28	19	13	19		22	24	12	13	-			167	
Chicks with hatch date (E)	9	15	13	7	11		16	18	9	7	-			105	
Sites with an egg or a chick (chicks w/o egg sightings included) (F)	31	32	22	16	27		30	31	27	25	-			241	
Fledglings by age (G)	5	13	7	7	7		11	14	7	3	-			74	
"Fledglings" by disappearance date at least 10 days after chick first seen (H)	12	26	14	13	17		20	24	10	9	-			145	
Proportion of chicks with previous egg sighting (E/D)	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	-			1.00	
Proportion of chicks with hatch date (E/C)	0.53	0.54	0.68	0.54	0.58		0.73	0.75	0.75	0.54	-			0.63	
Chicks/eggs (C/A)	0.53	0.88	0.86	0.81	0.70		0.73	0.77	0.44	0.52	-	0.70	0.16	0.69	0.05
Fledglings/eggs (G/B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
Fledglings/chicks (G/C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
"Fledglings"/eggs (H/A)	0.38	0.81	0.64	0.81	0.63		0.67	0.77	0.37	0.36	-	0.60	0.19	0.60	0.06
"Fledglings"/chicks (H/C)	0.71	0.93	0.74	1.00	0.89		0.91	1.00	0.83	0.69	-	0.86	0.12	0.87	0.03

Table 21. Counts of nest-sites (sites with egg sighted) and among-year maxima for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plot											Across-plot sum	Among-plot %max[a]	Number of plots
	1	2	3	4	5	6	7	8	9	10	11			
1993	31	32	22	16	27	-	30	31	27	25	-	241	0.80	9
1994	34	36	29	21	27	-	30	35	29	23	42	306	0.88	10
1995	40	36	28	26	30	31	27	37	26	27	45	353	0.92	11
1996	40	25	24	-	25	30	18	37	24	26	17	266	0.75	10
1997	41	24	26	-	25	33	28	36	29	24	45	311	0.87	10
1998	35	24	27	-	25	-	34	34	-	19	42	240	0.83	8
1999	35	22	24	-	19	30	32	31	29	20	42	284	0.80	10
2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	42	24	23	-	22	36	29	35	31	20	31	293	0.82	10
2004	35	22	29	-	20	24	27	26	22	20	33	258	0.72	10
2005	28	21	22	-	17	10	28	33	21	19	35	234	0.66	10
2006	36	22	24	-	18	26	26	34	24	25	40	275	0.77	10
2007	36	21	32	-	24	23	22	28	21	18	39	264	0.74	10
2008	47	13	17	-	12	18	22	36	21	24	33	243	0.68	10
2009	36	13	29	-	12	25	27	32	25	19	38	256	0.72	10
2010	40	16	30	-	27	23	21	36	7	22	29	251	0.70	10
2011	37	23	23	-	24	24	29	21	14	21	33	249	0.70	10
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	28	22	23	-	17	20	-	27	16	19	-	172	-	8
2014	-	-	23	-	-	-	36	-	-	-	39	98	0.87	3
Among-year max	47	36	32	26	30	36	36	37	31	27	45			

[a] The sum of the plots’ listed nest-site counts for the year is divided by the sum of those plots’ among-year maximum counts.

Table 22. Counts of nest-sites (sites with egg sighted), as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashes indicate “no data”.

Year	Plot											Mean	SD
	1	2	3	4	5	6	7	8	9	10	11		
1993	0.66	0.89	0.69	0.62	0.90	-	0.83	0.84	0.87	0.93	-	0.80	0.12
1994	0.72	1.00	0.91	0.81	0.90	-	0.83	0.95	0.94	0.85	0.93	0.88	0.08
1995	0.85	1.00	0.88	1.00	1.00	0.86	0.75	1.00	0.84	1.00	1.00	0.93	0.09
1996	0.85	0.69	0.75	-	0.83	0.83	0.50	1.00	0.77	0.96	0.38	0.76	0.19
1997	0.87	0.67	0.81	-	0.83	0.92	0.78	0.97	0.94	0.89	1.00	0.87	0.10
1998	0.74	0.67	0.84	-	0.83		0.94	0.92		0.70	0.93	0.82	0.11
1999	0.74	0.61	0.75	-	0.63	0.83	0.89	0.84	0.94	0.74	0.93	0.79	0.11
2000	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	0.89	0.67	0.72	-	0.73	1.00	0.81	0.95	1.00	0.74	0.69	0.82	0.13
2004	0.74	0.61	0.91	-	0.67	0.67	0.75	0.70	0.71	0.74	0.73	0.72	0.08
2005	0.60	0.58	0.69	-	0.57	0.28	0.78	0.89	0.68	0.70	0.78	0.65	0.17
2006	0.77	0.61	0.75	-	0.60	0.72	0.72	0.92	0.77	0.93	0.89	0.77	0.12
2007	0.77	0.58	1.00	-	0.80	0.64	0.61	0.76	0.68	0.67	0.87	0.74	0.13
2008	1.00	0.36	0.53	-	0.40	0.50	0.61	0.97	0.68	0.89	0.73	0.67	0.23
2009	0.77	0.36	0.91	-	0.40	0.69	0.75	0.86	0.81	0.70	0.84	0.71	0.19
2010	0.85	0.44	0.94	-	0.90	0.64	0.58	0.97	0.23	0.81	0.64	0.70	0.24
2011	0.79	0.64	0.72	-	0.80	0.67	0.81	0.57	0.45	0.78	0.73	0.69	0.12
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.60	0.61	0.72	-	0.57	0.56	-	0.73	0.52	0.70	-	-	-
2014	-	-	0.72	-	-	-	1.00	-	-	-	0.87	0.86	0.14

Table 23. Counts of nest-sites with chicks and among-year maxima for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plot											Across-nest-site sum	Among-nest-site %max[a]	Number of plots
	1	2	3	4	5	6	7	8	9	10	11			
1993	17	28	19	13	19	-	22	24	12	13	-	167	0.63	9
1994	25	30	21	19	24	-	24	30	20	16	35	244	0.80	10
1995	37	34	21	21	28	23	21	29	23	24	36	297	0.88	11
1996	30	24	21	-	20	27	15	31	21	17	16	222	0.70	10
1997	40	23	26	-	20	32	21	31	24	23	40	280	0.88	10
1998	23	21	22	-	17	17	29	27	2	17	39	214	0.67	10
1999	30	19	23	-	18	28	29	23	19	18	34	241	0.76	10
2000	20	11	25	-	30	35	26	32	17	22	37	255	0.80	10
2001	29	19	25	-	24	32	24	30	18	17	34	252	0.79	10
2002	36	19	19	-	23	24	28	27	23	17	27	243	0.76	10
2003	41	20	19	-	21	30	25	30	25	16	19	246	0.77	10
2004	33	21	22	-	9	22	26	21	15	17	30	216	0.68	10
2005	16	17	21	-	13	6	27	27	17	16	29	189	0.59	10
2006	34	20	22	-	22	24	24	19	20	19	31	235	0.74	10
2007	29	17	23	-	14	19	17	23	14	11	34	201	0.63	10
2008	31	9	14	-	16	13	22	24	17	17	23	186	0.58	10
2009	28	11	24	-	9	16	25	21	21	15	29	199	0.63	10
2010	23	8	20	-	20	10	16	18	2	10	20	147	0.46	10
2011	24	10	19	-	9	5	18	12	8	20	22	147	0.46	10
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	23	19	21	-	18	18	19	18	15	16	33	200	0.63	10
2014	-	-	17	-	-	-	31	-	-	-	24	72	0.74	3
Among-year max	47	36	32	26	30	36	36	37	31	27	45			

[a] The sum of the plots’ listed nest-site counts for the year is divided by the sum of the plots’ among-year maximum counts.

Table 24. Counts of nest-sites with chicks, as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashes indicate “no data”.

Year	Plots											Mean	SD
	1	2	3	4	5	6	7	8	9	10	11		
1993	0.41	0.82	0.73	0.62	0.63	-	0.71	0.75	0.48	0.54	-	0.63	0.13
1994	0.61	0.88	0.81	0.90	0.80	-	0.77	0.94	0.80	0.67	0.88	0.81	0.10
1995	0.90	1.00	0.81	1.00	0.93	0.66	0.68	0.91	0.92	1.00	0.90	0.88	0.12
1996	0.73	0.71	0.81	-	0.67	0.77	0.48	0.97	0.84	0.71	0.40	0.71	0.17
1997	0.98	0.68	1.00	-	0.67	0.91	0.68	0.97	0.96	0.96	1.00	0.88	0.14
1998	0.56	0.62	0.85	-	0.57	0.49	0.94	0.84	0.08	0.71	0.98	0.66	0.27
1999	0.73	0.56	0.88	-	0.60	0.80	0.94	0.72	0.76	0.75	0.85	0.76	0.12
2000	0.49	0.32	0.96	-	1.00	1.00	0.84	1.00	0.68	0.92	0.93	0.81	0.24
2001	0.71	0.56	0.96	-	0.80	0.91	0.77	0.94	0.72	0.71	0.85	0.79	0.13
2002	0.88	0.56	0.73	-	0.77		0.90	0.84	0.92	0.71	0.68	0.78	0.12
2003	1.00	0.59	0.73	-	0.70	0.86	0.81	0.94	1.00	0.67	0.78	0.81	0.14
2004	0.80	0.62	0.85	-	0.30	0.63	0.84	0.66	0.60	0.71	0.75	0.68	0.16
2005	0.39	0.50	0.81	-	0.43	0.17	0.87	0.84	0.68	0.67	0.73	0.61	0.23
2006	0.83	0.59	0.85	-	0.73	0.69	0.77	0.59	0.80	0.79	0.78	0.74	0.09
2007	0.71	0.50	0.88	-	0.47	0.54	0.55	0.72	0.56	0.46	0.85	0.62	0.16
2008	0.76	0.26	0.54	-	0.53	0.37	0.71	0.75	0.68	0.71	0.58	0.59	0.17
2009	0.68	0.32	0.92	-	0.30	0.46	0.81	0.66	0.84	0.63	0.73	0.63	0.21
2010	0.56	0.24	0.77	-	0.67	0.29	0.52	0.56	0.08	0.42	0.50	0.46	0.21
2011	0.59	0.29	0.73	-	0.30	0.14	0.58	0.38	0.32	0.83	0.55	0.47	0.22
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.56	0.56	0.81	-	0.60	0.51	0.61	0.56	0.60	0.67	0.83	0.63	0.11
2014	-	-	0.65	-	-	-	1.00	-	-	-	0.60	0.75	0.22

Table 25. Counts of nest-sites with eggs or chicks and among-year maxima for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plot											Across-nest-site sum	Among-nest-site %max[a]	Number of plots
	1	2	3	4	5	6	7	8	9	10	11			
1993	31	32	22	16	27	-	30	31	27	25	-	241	0.79	9
1994	34	36	29	21	27	-	30	35	29	23	42	306	0.87	10
1995	40	36	28	26	30	31	27	37	26	27	45	353	0.91	11
1996	40	25	24	-	25	30	18	37	24	26	17	266	0.73	10
1997	41	24	26	-	25	33	28	36	29	24	45	311	0.86	10
1998	35	24	27	-	25	28	34	34	19	19	42	287	0.79	10
1999	35	22	24	-	19	30	32	31	29	20	42	284	0.78	10
2000	20	11	25	-	30	35	26	32	17	22	37	255	0.70	10
2001	29	19	25	-	24	32	24	30	19	17	34	253	0.70	10
2002	43	20	20	-	24	25	30	31	25	19	31	268	0.74	10
2003	44	24	23	-	23	37	29	35	33	20	34	302	0.83	10
2004	36	22	30	-	20	24	27	26	22	20	37	264	0.73	10
2005	28	21	23	-	17	10	29	33	21	19	35	236	0.65	10
2006	39	22	25	-	25	31	26	35	24	25	40	292	0.80	10
2007	40	21	32	-	24	23	22	28	21	18	39	268	0.74	10
2008	47	13	20	-	17	18	23	36	21	24	35	254	0.70	10
2009	36	13	29	-	12	25	28	40	25	21	38	267	0.74	10
2010	41	16	30	-	27	23	23	36	7	22	30	255	0.70	10
2011	37	23	23	-	24	24	29	21	14	21	33	249	0.69	10
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	28	22	23	-	19	20	19	27	17	19	33	227	0.63	10
2014	-	-	24	-	-	-	36	-	-	-	39	99	0.88	3
Among-year max	47	36	32	26	30	37	36	40	33	27	45			

[a] The sum of the plots’ listed nest-site counts for the year is divided by the sum of the plots’ among-year maximum counts.

Table 26. Counts of nest-sites with eggs or chicks, as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashed indicate “no data”.

Year	Plots											Mean	SD
	1	2	3	4	5	6	7	8	9	10	11		
1993	0.66	0.89	0.69	0.62	0.90	-	0.83	0.78	0.82	0.93		0.79	0.11
1994	0.72	1.00	0.91	0.81	0.90	-	0.83	0.88	0.88	0.85	0.93	0.87	0.07
1995	0.85	1.00	0.88	1.00	1.00	0.84	0.75	0.93	0.79	1.00	1.00	0.91	0.10
1996	0.85	0.69	0.75	-	0.83	0.81	0.50	0.93	0.73	0.96	0.38	0.74	0.18
1997	0.87	0.67	0.81	-	0.83	0.89	0.78	0.90	0.88	0.89	1.00	0.85	0.09
1998	0.74	0.67	0.84	-	0.83	0.76	0.94	0.85	0.58	0.70	0.93	0.79	0.12
1999	0.74	0.61	0.75	-	0.63	0.81	0.89	0.78	0.88	0.74	0.93	0.78	0.11
2000	0.43	0.31	0.78	-	1.00	0.95	0.72	0.80	0.52	0.81	0.82	0.71	0.23
2001	0.62	0.53	0.78	-	0.80	0.86	0.67	0.75	0.58	0.63	0.76	0.70	0.11
2002	0.91	0.56	0.63	-	0.80	0.68	0.83	0.78	0.76	0.70	0.69	0.73	0.11
2003	0.94	0.67	0.72	-	0.77	1.00	0.81	0.88	1.00	0.74	0.76	0.83	0.12
2004	0.77	0.61	0.94	-	0.67	0.65	0.75	0.65	0.67	0.74	0.82	0.73	0.10
2005	0.60	0.58	0.72	-	0.57	0.27	0.81	0.83	0.64	0.70	0.78	0.65	0.16
2006	0.83	0.61	0.78	-	0.83	0.84	0.72	0.88	0.73	0.93	0.89	0.80	0.09
2007	0.85	0.58	1.00	-	0.80	0.62	0.61	0.70	0.64	0.67	0.87	0.73	0.14
2008	1.00	0.36	0.63	-	0.57	0.49	0.64	0.90	0.64	0.89	0.78	0.69	0.20
2009	0.77	0.36	0.91	-	0.40	0.68	0.78	1.00	0.76	0.78	0.84	0.73	0.20
2010	0.87	0.44	0.94	-	0.90	0.62	0.64	0.90	0.21	0.81	0.67	0.70	0.23
2011	0.79	0.64	0.72	-	0.80	0.65	0.81	0.53	0.42	0.78	0.73	0.69	0.13
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.60	0.61	0.72	-	0.63	0.54	0.53	0.68	0.52	0.70	0.73	0.63	0.08
2014	-	-	0.75	-	-	-	1.00	-	-	-	0.87	0.87	0.13

Table 27. Proportion of observed chicks without prior egg-sightings for common murres on productivity plots at East Amatuli Island, Alaska.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-	0.00
1994	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.20	0.04	0.05	-	0.00	0.04	0.00	0.03	0.00	0.00	0.00	0.04
1997	0.00	0.04	0.00	-	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.01
1998	0.30	0.10	0.09	-	0.24	0.53	0.00	0.00	-	0.00	0.00	0.14
1999	0.00	0.00	0.00	-	0.39	0.00	0.00	0.00	0.11	0.06	0.00	0.05
2000	1.00	1.00	1.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2001	1.00	1.00	1.00	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2002	0.25	0.32	0.05	-	0.26	0.63	0.18	0.00	0.04	0.00	0.00	0.17
2003	0.05	0.00	0.00	-	0.05	0.03	0.00	0.00	0.08	0.00	0.10	0.03
2004	0.03	0.00	0.05	-	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.02
2005	0.00	0.00	0.05	-	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.01
2006	0.09	0.00	0.05	-	0.32	0.21	0.00	0.05	0.00	0.00	0.00	0.07
2007	0.14	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
2008	0.00	0.00	0.21	-	0.31	0.00	0.05	0.00	0.00	0.00	0.09	0.07
2009	0.00	0.00	0.00	-	0.00	0.00	0.04	0.38	0.00	0.13	0.00	0.06
2010	0.04	0.00	0.00	-	0.00	0.00	0.13	0.00		0.00	0.05	0.02
2011	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.00	0.00	0.00	-	0.11	0.00	0.79	0.00	0.07	0.00	0.73	0.17
2014	-	-	0.06	-	-	-	0.06	-	-	-	0.00	0.04

Table 28. Counts of nest-sites with aged fledglings and among-year maxima for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”. Only years with observations adequate for among-year comparisons of raw numbers have proportion-of-maximum calculated.

	Plots											Across-nest-site	Among-nest-site	Number of
Year	1	2	3	4	5	6	7	8	9	10	11	sum	%max[a]	plots
1993	5	13	7	7	7	-	11	14	7	3		74		9
1994	24	29	19	17	23	-	23	24	18	16	25	218	0.86	10
1995	32	31	19	18	24	17	13	24	19	21	27	245	0.88	11
1996	27	22	17	-	18	24	15	25	18	12	13	191	0.68	10
1997	39	21	25	-	20	27	19	27	21	18	38	255	0.91	10
1998	16	18	18	-	6	1	24	23	0	14	37	157	0.56	10
1999	29	18	20	-	14	24	25	15	17	13	31	206	0.74	10
2000	0	0	0	-	0	0	0	0	0	0	0	-	-	10
2001	0	0	0	-	0	0	0	0	0	0	0	-	-	10
2002	17	7	10	-	5	1	13	18	11	10	17	109	-	10
2003	14	10	3	-	10	7	3	9	9	8	15	88	-	10
2004	22	10	17	-	2	11	22	12	5	10	16	127	-	10
2005	7	4	14	-	7	1	4	10	2	6	5	60	-	10
2006	18	16	11	-	9	11	14	9	15	13	23	139	-	10
2007	13	10	8	-	3	5	12	12	10	1	22	96	-	10
2008	20	4	7	-	2	4	10	15	11	13	8	94	-	10
2009	19	4	8	-	2	3	4	1	2	3	6	52	-	10
2010	10	3	8	-	9	3	6	14	0	7	3	63	-	10
2011	12	2	14	-	1	0	10	9	3	13	17	81	-	10
2012	-	-	-	-		-		-	-	-	-	-	-	0
2013	13	12	17	-	13	15	3	10	6	9	7	105	-	10
2014	-		15	-		-	27	-	-	-	16	58	0.64	3
Among-year max	39	31	25	-	24	27	27	27	21	21	38			

[a] The sum of the plots' listed nest-site counts for the year is divided by the sum of the plots' among-year maximum counts.

Table 29. Counts of nest-sites with aged fledglings, as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashes indicate “no data”.

Year	Plots											Mean	SD
	1	2	3	4	5	6	7	8	9	10	11		
1993	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	0.62	0.94	0.76	-	0.96	-	0.85	0.89	0.86	0.76	0.66	0.81	0.12
1995	0.82	1.00	0.76	-	1.00	0.63	0.48	0.89	0.90	1.00	0.71	0.82	0.17
1996	0.69	0.71	0.68	-	0.75	0.89	0.56	0.93	0.86	0.57	0.34	0.70	0.18
1997	1.00	0.68	1.00	-	0.83	1.00	0.70	1.00	1.00	0.86	1.00	0.91	0.13
1998	0.41	0.58	0.72	-	0.25	0.04	0.89	0.85		0.67	0.97	0.60	0.31
1999	0.74	0.58	0.80	-	0.58	0.89	0.93	0.56	0.81	0.62	0.82	0.73	0.14
2000	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	-	-	-	-	-	-	-	-
2008	-	-	-	-	-	-	-	-	-	-	-	-	-
2009	-	-	-	-	-	-	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	0.60	-	-	-	1.00	-	-	-	0.42	0.67	0.30

Table 30. Counts of chicks seen >= 10d after plot's estimated mean hatch date, and among-year maxima, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

	Plots											Across-nest-site	Among-nest-site	Number of
Year	1	2	3	4	5	6	7	8	9	10	11	sum	%max[a]	plots
1993	12	26	14	13	17	-	20	24	10	9	-	145	0.57	9
1994	24	29	20	18	24	-	24	26	19	16	32	232	0.79	10
1995	36	33	20	19	26	22	21	27	21	24	33	282	0.86	11
1996	26	21	20	-	19	25	15	29	21	15	15	206	0.66	10
1997	40	23	26	-	20	32	21	30	22	20	40	274	0.88	10
1998	23	18	18	-	11	6	27	25	0	15	38	181	0.58	10
1999	29	19	22	-	16	28	28	21	17	16	33	229	0.74	10
2000	0	7	25	-	26	35	25	32	14	20	29	213	0.69	10
2001	14	19	22	-	24	31	24	30	21	16	35	236	0.76	10
2002	33	19	19	-	21	23	22	23	23	14	32	229	0.74	10
2003	34	19	15	-	21	24	24	24	19	13	29	222	0.72	10
2004	31	18	20	-	3	16	24	15	11	15	22	175	0.56	10
2005	15	15	19	-	11	4	26	25	16	14	23	168	0.54	10
2006	29	19	18	-	19	20	23	15	18	18	30	209	0.67	10
2007	27	15	21	-	14	15	15	17	16	6	31	177	0.57	10
2008	28	8	12	-	6	8	21	19	16	15	24	157	0.51	10
2009	24	6	21	-	3	3	20	20	16	13	28	154	0.50	10
2010	17	7	19	-	17	8	12	17	2	10	20	129	0.42	10
2011	14	4	17	-	7	0	18	12	6	17	20	115	0.37	10
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	23	18	21	-	14	18	17	14	10	15	30	180	0.58	10
2014	-	-	16	-	-	-	31	-	-	-	22	69	0.71	3
Among-year max	40	33	26	19	26	35	31	32	23	24	40			

[a] The sum of the plots' listed nest-site counts for the year is divided by the sum of the plots' among-year maximum counts.

Table 31. Counts of chicks seen >= 10d after plot's estimated mean hatch date, as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashes indicate “no data”.

Year	Plots											Mean	SD
	1	2	3	4	5	6	7	8	9	10	11		
1993	0.30	0.79	0.54	0.68	0.65	-	0.65	0.75	0.43	0.38	-	0.57	0.17
1994	0.60	0.88	0.77	0.95	0.92	-	0.77	0.81	0.83	0.67	0.80	0.80	0.11
1995	0.90	1.00	0.77	1.00	1.00	0.63	0.68	0.84	0.91	1.00	0.83	0.87	0.13
1996	0.65	0.64	0.77	-	0.73	0.71	0.48	0.91	0.91	0.63	0.38	0.68	0.17
1997	1.00	0.70	1.00	-	0.77	0.91	0.68	0.94	0.96	0.83	1.00	0.88	0.13
1998	0.58	0.55	0.69	-	0.42	0.17	0.87	0.78	0.00	0.63	0.95	0.56	0.30
1999	0.73	0.58	0.85	-	0.62	0.80	0.90	0.66	0.74	0.67	0.83	0.74	0.11
2000	0.00	0.21	0.96	-	1.00	1.00	0.81	1.00	0.61	0.83	0.73	0.71	0.35
2001	0.35	0.58	0.85	-	0.92	0.89	0.77	0.94	0.91	0.67	0.88	0.77	0.19
2002	0.83	0.58	0.73	-	0.81	0.66	0.71	0.72	1.00	0.58	0.80	0.74	0.13
2003	0.85	0.58	0.58	-	0.81	0.69	0.77	0.75	0.83	0.54	0.63	0.70	0.12
2004	0.78	0.55	0.77	-	0.12	0.46	0.77	0.47	0.48	0.63	0.55	0.56	0.20
2005	0.38	0.45	0.73	-	0.42	0.11	0.84	0.78	0.70	0.58	0.58	0.56	0.22
2006	0.73	0.58	0.69	-	0.73	0.57	0.74	0.47	0.78	0.75	0.75	0.68	0.10
2007	0.68	0.45	0.81	-	0.54	0.43	0.48	0.53	0.70	0.25	0.78	0.56	0.17
2008	0.70	0.24	0.46	-	0.23	0.23	0.68	0.59	0.70	0.63	0.60	0.51	0.20
2009	0.60	0.18	0.81	-	0.12	0.09	0.65	0.63	0.70	0.54	0.70	0.50	0.27
2010	0.43	0.21	0.73	-	0.65	0.23	0.39	0.53	0.09	0.42	0.50	0.42	0.20
2011	0.35	0.12	0.65	-	0.27	-	0.58	0.38	0.26	0.71	0.50	0.42	0.20
2012	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.58	0.55	0.81	-	0.54	0.51	0.55	0.44	0.43	0.63	0.75	0.58	0.12
2014	-	-	0.62	-	-	-	1.00	-	-	-	0.55	0.72	0.24

Table 32. Proportion of each plot's total nest-sites that had a chick, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	0.55	0.88	0.86	0.81	0.70	-	0.73	0.77	0.44	0.52	-	0.70
1994	0.74	0.83	0.72	0.90	0.89	-	0.80	0.86	0.69	0.70	0.83	0.80
1995	0.93	0.94	0.75	0.81	0.93	0.74	0.78	0.78	0.88	0.89	0.80	0.84
1996	0.75	0.96	0.88	-	0.80	0.90	0.83	0.84	0.88	0.65	0.94	0.84
1997	0.98	0.96	1.00	-	0.80	0.97	0.75	0.86	0.83	0.96	0.89	0.90
1998	0.66	0.88	0.81	-	0.68	-	0.85	0.79	-	0.89	0.93	0.81
1999	0.86	0.86	0.96	-	0.95	0.93	0.91	0.74	0.66	0.90	0.81	0.86
2000	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-
2003	0.98	0.83	0.83	-	0.95	0.83	0.86	0.86	0.81	0.80	1.00	0.87
2004	0.94	0.95	0.76	-	0.45	0.92	0.96	0.81	0.68	0.85	0.91	0.82
2005	0.57	0.81	0.95	-	0.76	0.60	0.96	0.82	0.81	0.84	0.83	0.80
2006	0.94	0.91	0.92	-	1.22	0.92	0.92	0.56	0.83	0.76	0.78	0.88
2007	0.81	0.81	0.72	-	0.58	0.83	0.77	0.82	0.67	0.61	0.87	0.75
2008	0.66	0.69	0.82	-	1.33	0.72	1.00	0.67	0.81	0.71	0.70	0.81
2009	0.78	0.85	0.83	-	0.75	0.64	0.93	0.66	0.84	0.79	0.76	0.78
2010	0.58	0.50	0.67	-	0.74	0.43	0.76	0.50	0.29	0.45	0.69	0.56
2011	0.65	0.43	0.83	-	0.38	0.21	0.62	0.57	0.57	0.95	0.67	0.59
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	0.74	-	-	-	0.86	-	-	-	0.62	0.74

Table 33. Proportion of each plot's total adjusted nest-sites that had an aged fledgling, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	-	-	-	-	-	-	-	-	-	-	-	-
1994	0.74	0.81	0.69	0.81	0.85	-	0.77	0.69	0.62	0.70	0.63	0.73
1995	0.87	0.91	0.68	0.69	0.86	0.63	0.63	0.70	0.73	0.78	0.62	0.74
1996	0.68	0.92	0.74	-	0.72	0.80	0.83	0.68	0.83	0.52	0.76	0.75
1997	0.95	0.91	0.96	-	0.80	0.82	0.68	0.75	0.76	0.75	0.84	0.82
1998	0.62	0.83	0.70	-	0.45	0.04	0.76	0.76		0.74	0.90	0.64
1999	0.83	0.82	0.83	-	0.88	0.80	0.84	0.53	0.62	0.65	0.74	0.75
2000	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-
2003	0.65	0.69	0.41	-	0.70	0.39		0.51	0.53	0.46	0.80	0.57
2004	0.80	0.77	0.65	-	0.19	0.56	0.85	0.57	0.51	0.61	0.59	0.61
2005	0.44		0.75	-	0.59		0.62	0.68		0.67	0.59	0.62
2006	0.82	0.86	0.64	-	0.54	0.50	0.68	0.26	0.66	0.58	0.66	0.62
2007	0.53	0.74	0.58	-	0.44	0.46	0.62	0.52	0.71	0.09	0.64	0.53
2008	0.57	0.55	0.57	-	0.20	0.32	0.68	0.43	0.64	0.54	0.30	0.48
2009	0.64	0.56	0.66	-	0.25	0.19	0.51	0.10		0.34	0.57	0.43
2010	0.43	0.40	0.66	-	0.39	0.23	0.40	0.39		0.35	0.39	0.41
2011	0.49	0.19	0.71	-	0.10	0.00	0.41	0.43	0.29	0.65	0.54	0.38
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.46	0.55	0.74	-	0.82	0.75	-	0.42	0.53	0.58	0.88	0.63
2014	-	-	0.68	-	-	-	0.78	-	-	-	0.45	0.63

Table 34. Proportion of each plot's chicks with hatch dates that had an aged fledged chick, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	0.56	0.87	0.54	1.00	0.64	-	0.69	0.78	0.78	0.43	-	0.70
1994	1.00	0.97	0.95	0.89	0.96	-	0.96	0.80	0.90	1.00	0.76	0.92
1995	0.94	0.97	0.90	0.86	0.92	0.85	0.81	0.89	0.83	0.88	0.77	0.87
1996	0.90	0.96	0.85	-	0.90	0.89	1.00	0.81	0.95	0.80	0.81	0.89
1997	0.98	0.95	0.96	-	1.00	0.84	0.90	0.87	0.91	0.78	0.95	0.92
1998	0.94	0.95	0.86	-	0.67	0.07	0.89	0.96	-	0.82	0.97	0.79
1999	0.97	0.95	0.87	-	0.93	0.86	0.93	0.71	0.94	0.72	0.91	0.88
2000	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	0.77	0.88	1.00	-	0.71		1.00	0.75	1.00	0.67	0.94	0.86
2003	0.70	0.83	0.50	-	0.77	0.47	-	0.60	0.69	0.57	0.88	0.67
2004	0.88	0.77	0.89	-	-	0.61	0.88	0.71	0.71	0.71	0.73	0.77
2005	0.78	-	0.82	-	0.78	-	0.67	0.83	-	0.75	0.71	0.76
2006	0.95	0.94	0.73	-	0.64	0.69	0.74	0.50	0.79	0.76	0.85	0.76
2007	0.76	0.91	0.80	-	-	0.56	0.80	0.63	0.91	0.14	0.73	0.69
2008	0.87	-	0.88	-	0.22	0.44	0.71	0.65	0.79	0.76	0.47	0.64
2009	0.83	0.67	0.80	-	0.33	0.30	0.57	-	-	0.50	0.75	0.59
2010	0.77	-	0.89	-	0.53	0.50	0.60	0.78	-	0.78	-	0.69
2011	0.75	-	0.82	-	-	-	0.67	0.75	0.50	0.68	0.81	0.71
2012	-	-		-	-	-	-	-	-	-	-	-
2013	0.57	0.63	0.81	-	0.87	0.83	-	0.63	0.60	0.69	0.88	0.72
2014	-	-	0.94	-	-	-	0.90	-	-	-	0.73	0.85

Table 35. Proportion of each plot's total nest-sites that had a chick seen >= 10d after plot's estimated mean hatch date, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	0.39	0.81	0.64	0.81	0.63	-	0.67	0.77	0.37	0.36	-	0.61
1994	0.71	0.81	0.69	0.86	0.89	-	0.80	0.74	0.66	0.70	0.76	0.76
1995	0.90	0.92	0.71	0.73	0.87	0.71	0.78	0.73	0.81	0.89	0.73	0.80
1996	0.65	0.84	0.83	-	0.76	0.83	0.83	0.78	0.88	0.58	0.88	0.79
1997	0.98	0.96	1.00	-	0.80	0.97	0.75	0.83	0.76	0.83	0.89	0.88
1998	0.66	0.75	0.67	-	0.44		0.79	0.74		0.79	0.90	0.72
1999	0.83	0.86	0.92	-	0.84	0.93	0.88	0.68	0.59	0.80	0.79	0.81
2000	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-	-	-
2003	0.81	0.79	0.65	-	0.95	0.67	0.83	0.69	0.61	0.65	0.81	0.75
2004	0.89	0.82	0.69	-	0.15	0.67	0.89	0.58	0.50	0.75	0.67	0.66
2005	0.54	0.71	0.86	-	0.65	0.40	0.93	0.76	0.76	0.74	0.66	0.70
2006	0.81	0.86	0.75	-	1.06	0.77	0.88	0.44	0.75	0.72	0.75	0.78
2007	0.75	0.71	0.66	-	0.58	0.65	0.68	0.61	0.76	0.33	0.79	0.65
2008	0.60	0.62	0.71	-	0.50	0.44	0.95	0.53	0.76	0.63	0.73	0.65
2009	0.67	0.46	0.72	-	0.25	0.12	0.74	0.63	0.64	0.68	0.74	0.56
2010	0.43	0.44	0.63	-	0.63	0.35	0.57	0.47	0.29	0.45	0.69	0.49
2011	0.38	0.17	0.74	-	0.29	0.00	0.62	0.57	0.43	0.81	0.61	0.46
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	0.70	-	-	-	0.86	-	-	-	0.56	0.71

Table 36. Proportion of each plot's chicks that had a chick seen >= 10d after plot's estimated mean hatch date, for common murres on productivity plots at East Amatuli Island, Alaska. Dashes indicate “no data”.

Year	Plots											Mean
	1	2	3	4	5	6	7	8	9	10	11	
1993	0.71	0.93	0.74	1.00	0.89	-	0.91	1.00	0.83	0.69	-	0.86
1994	0.96	0.97	0.95	0.95	1.00	-	1.00	0.87	0.95	1.00	0.91	0.96
1995	0.97	0.97	0.95	0.90	0.93	0.96	1.00	0.93	0.91	1.00	0.92	0.95
1996	0.87	0.88	0.95	-	0.95	0.93	1.00	0.94	1.00	0.88	0.94	0.93
1997	1.00	1.00	1.00	-	1.00	1.00	1.00	0.97	0.92	0.87	1.00	0.98
1998	1.00	0.86	0.82	-	0.65	0.35	0.93	0.93	-	0.88	0.97	0.82
1999	0.97	1.00	0.96	-	0.89	1.00	0.97	0.91	0.89	0.89	0.97	0.94
2000	0.00	0.64	1.00	-	0.87	1.00	0.96	1.00	0.82	0.91	0.78	0.80
2001	0.48	1.00	0.88	-	1.00	0.97	1.00	1.00	1.17	0.94	1.03	0.95
2002	0.92	1.00	1.00	-	0.91	0.96	0.79	0.85	1.00	0.82	1.19	0.94
2003	0.83	0.95	0.79	-	1.00	0.80	0.96	0.80	0.76	0.81	0.81	0.85
2004	0.94	0.86	0.91	-	0.33	0.73	0.92	0.71	0.73	0.88	0.73	0.78
2005	0.94	0.88	0.90	-	0.85	0.67	0.96	0.93	0.94	0.88	0.79	0.87
2006	0.85	0.95	0.82	-	0.86	0.83	0.96	0.79	0.90	0.95	0.97	0.89
2007	0.93	0.88	0.91	-	1.00	0.79	0.88	0.74	1.14	0.55	0.91	0.87
2008	0.90	0.89	0.86	-	0.38	0.62	0.95	0.79	0.94	0.88	1.04	0.83
2009	0.86	0.55	0.88	-	0.33	0.19	0.80	0.95	0.76	0.87	0.97	0.71
2010	0.74	0.88	0.95	-	0.85	0.80	0.75	0.94	-	1.00	1.00	0.88
2011	0.58	0.40	0.89	-	0.78	-	1.00	1.00	0.75	0.85	0.91	0.80
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	1.00	0.95	1.00	-	0.78	1.00	0.89	0.78	0.67	0.94	0.91	0.89
2014	-	-	0.94	-	-	-	1.00	-	-	-	0.92	0.95

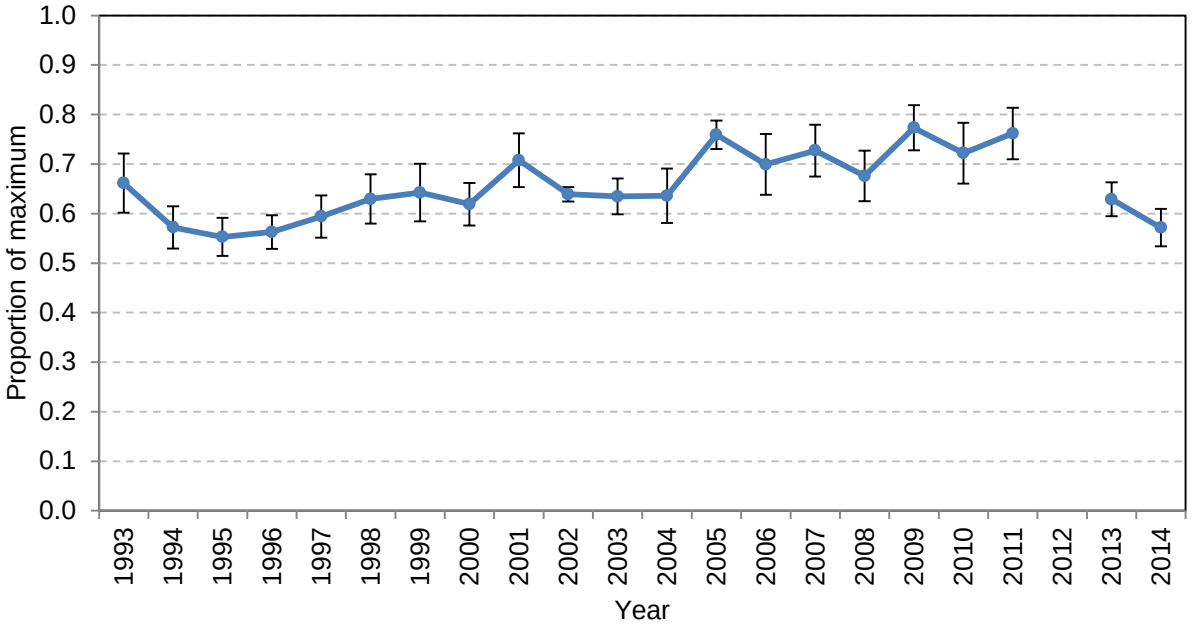

Figure 35. Annual index of counts of adult common murres in productivity plots at East Amatuli Island, Alaska. The index for each year was calculated this way: (1) For each count-day (within the "census period" for that year), counts were summed across all plots counted; (2) that sum was divided by the sum of the among-year maximum counts for those plots; (3) the among-count-day proportion-of-maximum values were averaged for the year. Error bars show one standard deviation from the mean of each year's count-day values.

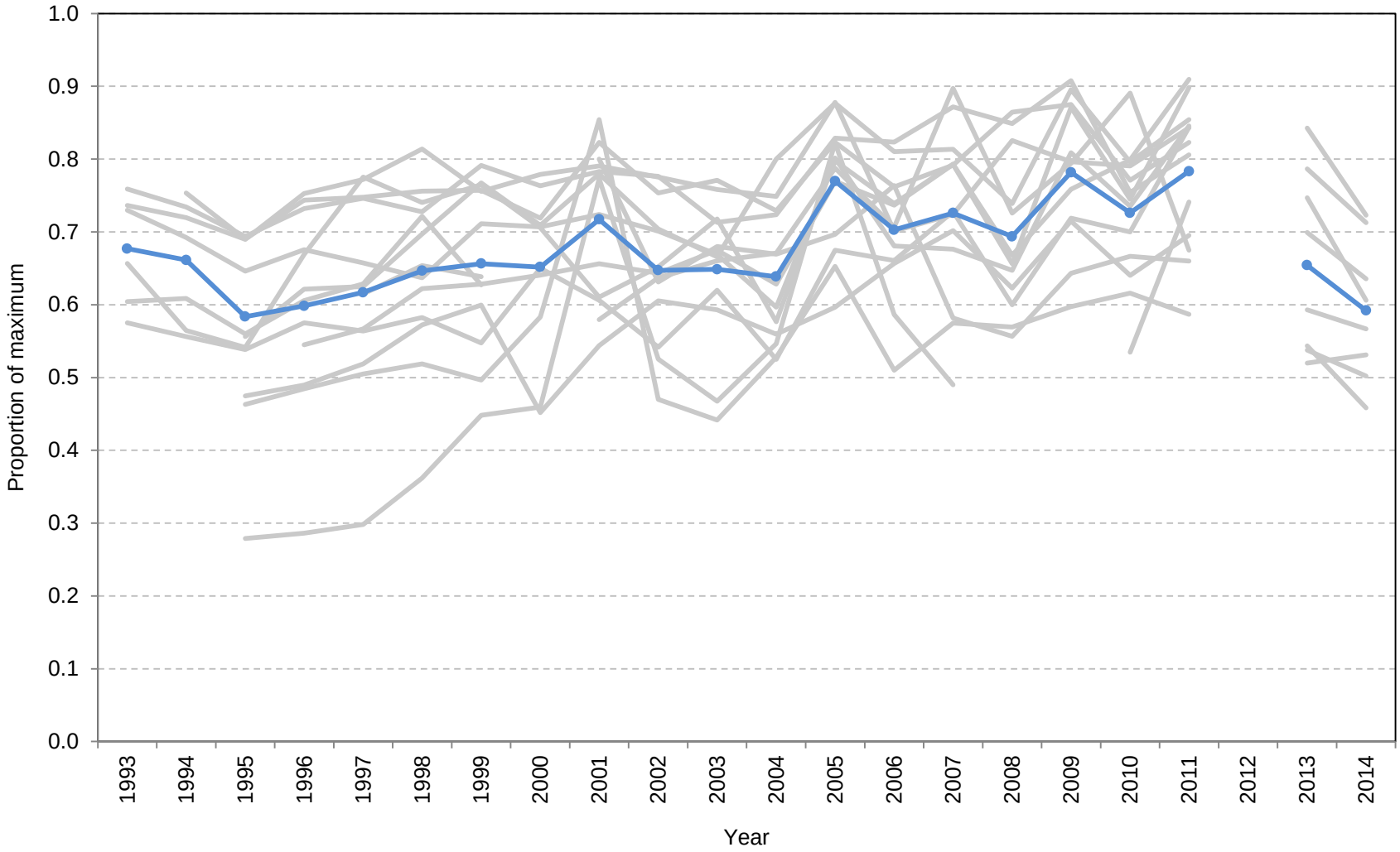

Figure 36. Counts of adult common murres in productivity plots at East Amatuli Island, Alaska. Grey lines show the annual means for each of the 14 plots. For each count-day within a year, the count for a plot was divided by the among-year maximum count for that plot. The among-day proportion-of-maximum counts were averaged to obtain the annual value on this chart. The blue line shows the among-plot means of these values.

Table 37. Counts of adult murres on productivity plots at East Amatuli Island, Alaska as proportion of among-year maximum count for each plot, for common murres on productivity plots at East Amatuli Island, Alaska. “Mean” and standard deviation (“SD”) are among plot proportions. Dashes indicate “no data”.

Year	Plots[a]														Plot mean	Daily sum mean[b]	Daily sum stdev
	1	2	3	4	5	6	7	8	9	10	11	12	13	14			
1993	-	-	-	-	-	0.60	0.73	0.58	0.76	0.74	0.66	-	-	-	0.68	0.66	0.06
1994	-	-	-	-	-	0.61	0.69	0.56	0.73	0.72	0.56	-	-	0.75	0.66	0.57	0.04
1995	-	0.47	0.46	0.28	0.87	0.56	0.65	0.54	0.69	0.69	0.54	0.56	-	0.69	0.58	0.55	0.04
1996	-	0.49	0.48	0.29	-	0.61	0.68	0.58	0.73	0.75	0.67	0.62	0.54	0.74	0.60	0.56	0.03
1997	0.61	0.52	0.51	0.30	-	0.63	0.66	0.56	0.75	0.77	0.78	0.63	0.57	0.75	0.62	0.59	0.04
1998	0.65	0.57	0.52	0.36	-	0.72	0.64	0.58	0.73	0.81	0.74	0.70	0.62	0.76	0.65	0.63	0.05
1999	0.64	0.60	0.50	0.45	-	0.63	0.71	0.55	0.79	0.76	0.76	0.77	0.63	0.76	0.66	0.64	0.06
2000	-	0.45	0.58	0.46	-	-	0.71	0.65	0.76	0.78	0.71	0.71	0.64	0.72	0.65	0.62	0.04
2001	0.58	0.54	0.85	0.77	-	0.80	0.72	0.61	0.78	0.79	0.61	0.78	0.66	0.82	0.72	0.71	0.05
2002	0.64	0.61	0.47	0.53	-	0.63	0.70	0.54	0.78	0.78	0.65	0.70	0.64	0.75	0.65	0.64	0.01
2003	0.66	0.59	0.44	0.47	-	0.68	0.67	0.62	0.71	0.76	0.72	0.67	0.68	0.77	0.65	0.63	0.04
2004	0.67	0.56	0.53	0.55	-	0.67	0.60	0.53	0.72	0.75	0.58	0.80	0.63	0.73	0.64	0.64	0.06
2005	0.79	0.60	0.65	0.82	-	0.70	0.80	0.68	0.83	0.88	0.80	0.88	0.77	0.82	0.77	0.76	0.03
2006	0.71	0.66	0.51	0.59	-	0.76	0.74	0.66	0.82	0.70	0.68	0.81	0.74	0.76	0.70	0.70	0.06
2007	0.90	0.70	0.57	0.49	-	0.58	0.79	0.73	0.87	0.72	0.68	0.81	0.79	0.79	0.73	0.73	0.05
2008	0.73	0.62	0.57	-	-	0.56	0.67	0.60	0.85	0.83	0.65	0.74	0.66	0.86	0.69	0.68	0.05
2009	0.79	0.71	0.60	-	-	0.64	0.76	0.72	0.91	0.80	0.81	0.90	0.87	0.88	0.78	0.77	0.05
2010	0.89	0.64	0.62	0.53	-	0.67	0.80	0.70	0.75	0.79	0.74	0.80	0.74	0.77	0.73	0.72	0.06
2011	0.67	0.70	0.59	0.74	-	0.66	0.91	0.84	0.81	0.84	0.85	0.85	0.90	0.82	0.78	0.76	0.05
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2013	0.54	0.52	0.54	0.59	-	0.44	0.84	0.75	0.71	0.74	0.63	0.71	0.70	0.79	0.65	0.63	0.03
2014	0.50	0.53	0.46	0.57	-	-	0.72	0.61	-	-	-	-	0.64	0.71	0.59	0.57	0.04

[a] Counting plots 1-14 have respective field names M1-LC, M2-LC-93, M3-LC, TB1-LC, M4-LC, M5-LR, M1-F, M1-F-A, M2-F, M3-F, M3-F-A, M4-F, M5-F, and M5-F-A.

[b] As in Figure 35. To obtain this mean, plot counts made in a day were summed and then divided by the sum of the among-year maximum counts for those plots. These by-day proportion-of-maximum values were then averaged for the annual index.

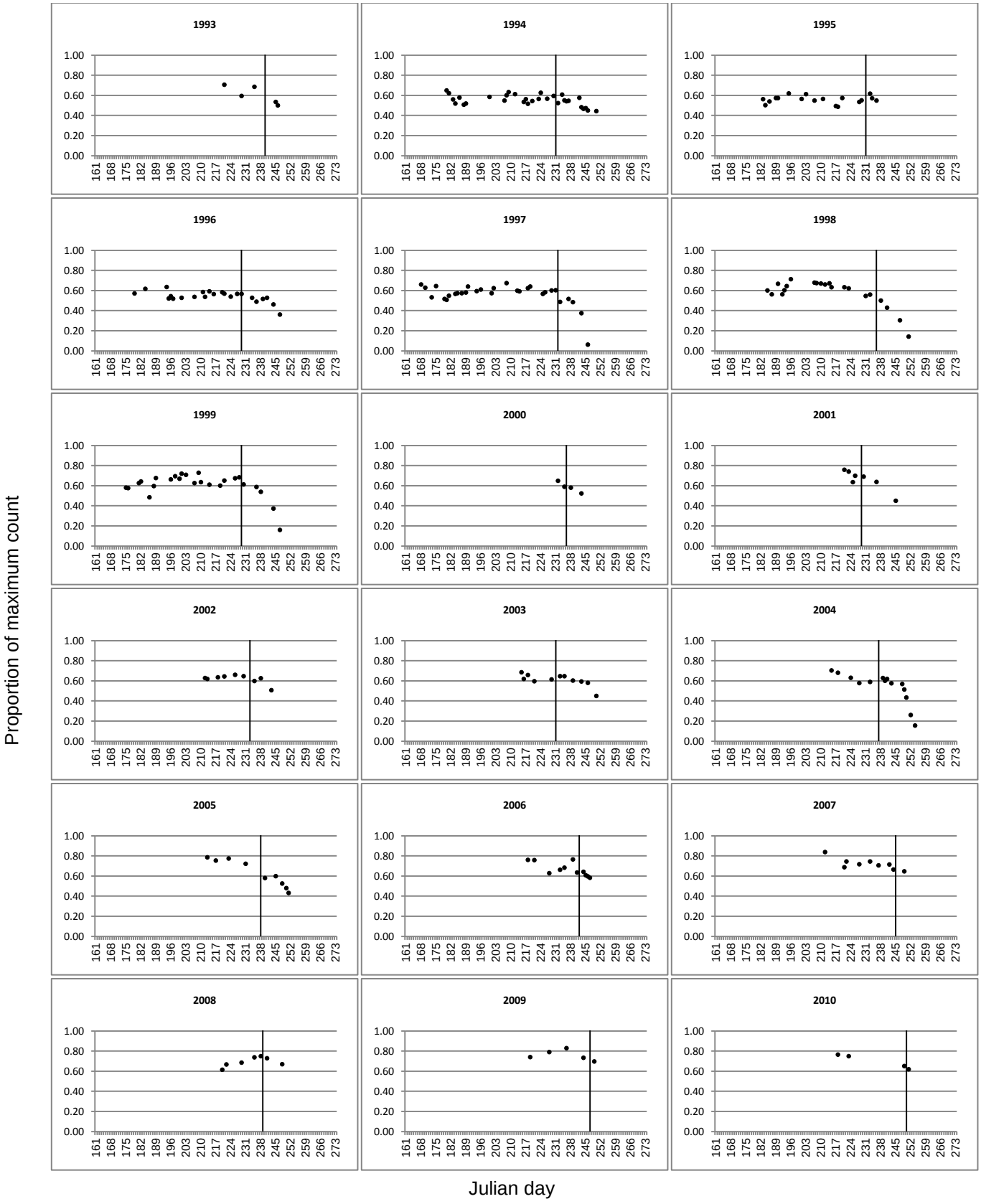

Figure 37. Counts of adult common murres on productivity plots at East Amatuli Island, Alaska. Each count-day's point is calculated by dividing the sum of all plot-counts that day divided by the sum of the among-year maximum counts for those plots. The vertical line in each chart shows the end of the "census period" (the day fledging started) for that year. For reference: Julian Day 182 is 1 July; 213 is 1 August; and 244 is 1 September.

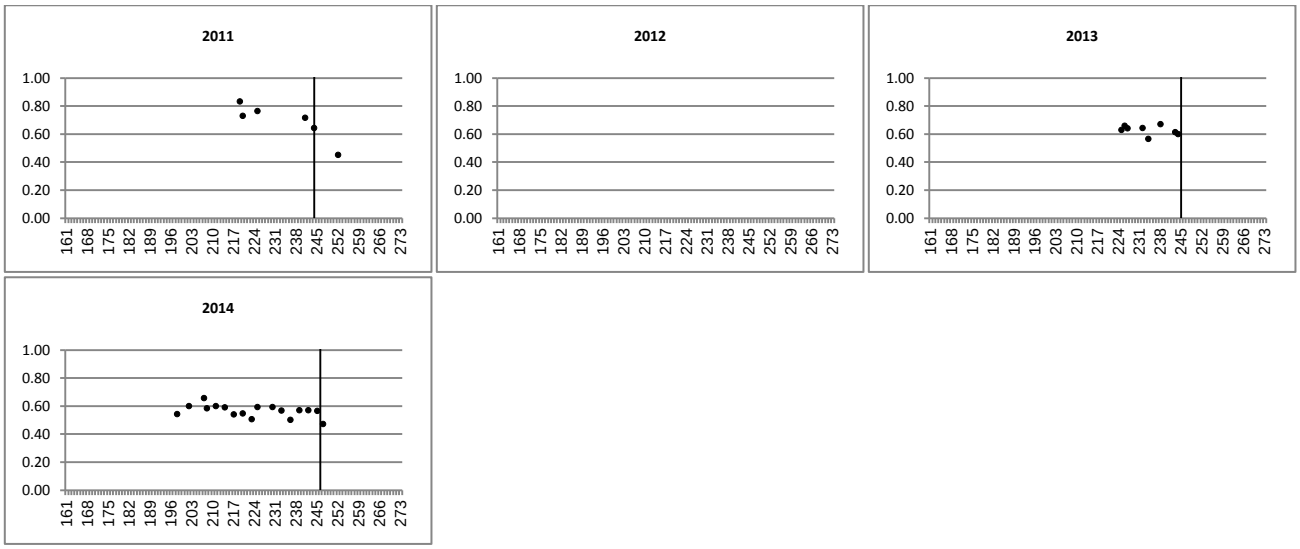

Figure 37 (cont.). Counts of adult common murres on productivity plots at East Amatuli Island, Alaska. Each count-day's point is calculated by dividing the sum of all plot-counts that day divided by the sum of the among-year maximum counts for those plots. The vertical line in each chart shows the end of the "census period" (the day fledging started) for that year. For reference: Julian Day 182 is 1 July; 213 is 1 August; and 244 is 1 September.

Table 38. Counts of adult common murres on productivity plots at East Amatuli Island, Alaska. Shown are (1) each daily count for each plot counted, (2) the among-day within-"census period" mean count for each plot, (3) the among-year maximum count for that plot, (4) the sum of count-plots for each day, (5) the sum of among-year maximum counts for the plots counted that day, (6) the day's sum divided by the sum of the maxima, and (7) the census-period mean for those proportion-of-maximum-sums. The mean count for each plot divided by its among-year maximum count is the point used to construct the grey lines in Figure 36. The mean proportion-of-maximum-sum is the mean point used in that figure and in Figure 35; the standard deviation in Figure 35 is calculated from the proportion-of-maximum-sums. The table continues on the following pages; one year per page (no data in 2012).

Year: 1993		Plot																
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum[b]	Among-year max[c]	Sum/max[d]
1	09-Aug-93	81	68	37	53	51	54	40	22	63	37	25	53	47		631	895	0.71
2	17-Aug-93	62	62	36	46	44	44	40	21	50	28	18	46	34		531	895	0.59
3	23-Aug-93	74	65	44	65	47	38	47	26	60	30	24	51	43		614	895	0.69
4	02-Sep-93	54	50	42	30	37	37	34	21	45	26	16	43	43		478	895	0.53
5	03-Sep-93	54	60	36	22	42	39	32	17	37	22	15	39	32		447	895	0.50
6																		
7																		
8																		
9																		
10																		
11																		
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28																		
29																		
30																		
31																		
Mean to end of census period (28 Aug 1993):		72	65	39	55	47	45	42	23	58	32	22	50	41			Mean	0.66
Among-year maximum count:		113	114	72	86	53	75	58	40	76	43	34	67	64			St. dev.	0.06

[a] Counting plots 1-14 have respective field names M1-LC, M2-LC-93, M3-LC, TB1-LC, M4-LC, M5-LR, M1-F, M1-F-A, M2-F, M3-F, M3-F-A, M4-F, M5-F, and M5-F-A.

[b] Sum reported only if ≥ 4 plots counted

[c] Among-year maximum count for the plots counted this day

[d] Sum of plot counts for this replicate, divided by the among-year maximum count sum for the same plots, if ≥ 4 plots counted

Table 38(continued).

Year: 1994		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	29-Jun-94	77	68	38	23	43	51	45	25	63	30	22	55	41		581	895	0.65
2	30-Jun-94	77	68	37	18	46	44	40	24	55	35	20	50	43		557	895	0.62
3	02-Jul-94	59	64	31	20	46	40	40	20	56	27	21	42	34		500	895	0.56
4	03-Jul-94	54	56	40	18	31	41	37	17	51	29	15	39	37		465	895	0.52
5	05-Jul-94	63	56	38	23	44	45	34	20	55	33	26	43	37		517	895	0.58
6	07-Jul-94	52	51	29	19	42	46	35	19	52	26	16	37	29		453	895	0.51
7	08-Jul-94	55	50	30	17	42	45	37	17	49	28	22	40	33		465	895	0.52
8	19-Jul-94	65	60	30	16	47	48	41	24	55	35	20	46	37		524	895	0.59
9	26-Jul-94	56	58	32	19	45	40	41	23	52	33	17	43	31		490	895	0.55
10	27-Jul-94	61	61	37	19	42	46	42	25	62	33	19	50	41		538	895	0.60
11	28-Jul-94	68	62	39	22	51	51	46	29	60	34	19	48	38		567	895	0.63
12	31-Jul-94	68	68	40	16	40	51	40	26	65	36	20	46	33		549	895	0.61
13	04-Aug-94	57	54	35	19	37	47	41	20	49	28	17	41	33		478	895	0.53
14	05-Aug-94	55	59	39	17	48	47	40	22	58	32	20	40	27		504	895	0.56
15	06-Aug-94	54	58	39	17	34	43	42	17	53	23	14	39	24	29	486	943	0.52
16	08-Aug-94	53	50	38	17	41	41	40	22	50	33	17	39	33	38	512	943	0.54
17	11-Aug-94	58	55	35	17	43	47	41	21	48	30	17	45	33	43	533	943	0.57
18	12-Aug-94	64	58	35	19	53	42	43	28	68	33	21	50	38	39	591	943	0.63
19	15-Aug-94	60	50	37	18	48	51	36	23	56	27	19	39	37	33	534	943	0.57
20	18-Aug-94	59	57	39	24	41	47	42	23	59	34	22	47	31	35	560	943	0.59
21	20-Aug-94	52	49	38	25	44	43	37	20	50	27	18	37	28		468	895	0.52
22	22-Aug-94	61	64	41	26	50	51	43	20	57	31	19	43	31	37	574	943	0.61
23	23-Aug-94	59	57	31	14	45	42	38	22	52	33	18	41	35	33	520	943	0.55
24	24-Aug-94	61	58	35	20	37	41	37	18	57	26	17	39	32	33	511	943	0.54
25	25-Aug-94	52	51	30	20	48	53	41	18	52	29	18	41	35		488	895	0.55
26	30-Aug-94	63	60	38	14	44	56	39	20	56	27	17	43	33	32	542	943	0.57
27	31-Aug-94	53	51	31	11	44	42	28	13	47	23	16	37	27	32	455	943	0.48
28	01-Sep-94	51	39	31	12	47	40	34	19	45	21	13	35	24	29	440	943	0.47
29	02-Sep-94	45	46	31	15	47	34	29	19	48	25	14	39	28	26	446	943	0.47
30	03-Sep-94	37	45	30	15	41	38	34	16	46	22	15	37	22	27	425	943	0.45
31	07-Sep-94	43	48	28	10	41	33	33	15	40	26	13	34	28	25	417	943	0.44
Mean to end of census period (19 Aug 1994):		61	58	36	19	43	46	40	22	56	31	19	44	35	36		Mean	0.57
Among-year maximum count:		113	114	72	86	53	75	58	40	76	43	34	67	64	48		St. dev.	0.04

Table 38 (continued).

Year: 1995		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	02-Jul-95	50	59	34	26	48	53	37	23	56	30	18	35	27	33	529	943	0.56
2	03-Jul-95	63	58	36	23	46	47	27	14	47	19	13	30	24	26	473	943	0.50
3	05-Jul-95	61	57	33	22	40	46	34	21	50	27	17	39	30	31	508	943	0.54
4	08-Jul-95	66	52	35	23	50	44	38	21	54	29	19	36	37	36	540	943	0.57
5	09-Jul-95	65	47	31	21	48	47	39	23	59	30	20	41	34	36	541	943	0.57
6	14-Jul-95	67	62	33	26	50	45	42	25	62	37	21	41	36	37	584	943	0.62
7	20-Jul-95	61	55	37	23	47	41	41	21	50	32	19	40	33	32	532	943	0.56
8	22-Jul-95	60	55	42	32	48	40	48	27	55	38	21	41	38	32	577	943	0.61
9	26-Jul-95	58	53	39	27	47	38	37	21	50	29	16	39	32	31	517	943	0.55
10	30-Jul-95	55	49	31	20	47	41	38	24	55	34	24	40	36	38	532	943	0.56
11	05-Aug-95	51	52	29	21	43	35	34	18	43	25	19	32	33	31	466	943	0.49
12	06-Aug-95	52	50	28	22	35	34	34	19	50	26	14	31	30	33	458	943	0.49
13	08-Aug-95	51	55	30	25	46	39	41	26	61	35	22	39	32	38	540	943	0.57
14	16-Aug-95	64	56	31	23	45	34	38	19	50	26	19	39	32	29	505	943	0.54
15	17-Aug-95	64	52	31	26	53	46	34	21	49	28	14	36	32	34	520	943	0.55
16	21-Aug-95	66	57	36	26	53	62	37	24	57	32	18	44	32	38	582	943	0.62
17	22-Aug-95	57	60	36	26	49	43	38	21	53	28	21	38	38	31	539	943	0.57
18	24-Aug-95	58	53	30	27	36	46	48	20	47	31	17	36	35	33	517	943	0.55
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (19 Aug 1995):		59	54	33	24	46	42	37	22	53	30	18	37	32	33		Mean	0.55
Among-year maximum count:		113	114	72	86	53	75	58	40	76	43	34	67	64	48		St. dev.	0.04

Table 38 (continued).

Year: 1996		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	28-Jun-96	53	52	38	28		54	38	21	54	34	25	37	40	35	509	890	0.57
2	03-Jul-96	57	56	38	30		45	47	30	55	34	27	49	38	42	548	890	0.62
3	13-Jul-96	57	61	42	24		50	49	26	61	36	31	48	43	38	566	890	0.64
4	14-Jul-96	60	54	35	23		38	34	21	49	29	18	36	34	32	463	890	0.52
5	15-Jul-96	57	59	33	23		43	33	15	53	31	21	41	39	35	483	890	0.54
6	16-Jul-96	50	47	32	22		43	36	23	56	32	22	36	31	32	462	890	0.52
7	20-Jul-96	53	53	36	25		42	35	21	54	28	20	35	34	34	470	890	0.53
8	26-Jul-96	55	55	33	21		46	33	21	53	33	20	45	29	33	477	890	0.54
9	30-Jul-96	57	54	39	24		51	41	22	58	34	26	42	34	39	521	890	0.59
10	31-Jul-96	50	51	32	26		49	36	24	57	30	23	41	29	30	478	890	0.54
11	02-Aug-96	59	57	31	28		45	44	23	57	35	23	41	43	41	527	890	0.59
12	04-Aug-96	54	56	31	28		46	40	23	59	35	21	40	32	38	503	890	0.57
13	08-Aug-96	56	67	31	23		48	41	23	60	33	24	45	31	36	518	890	0.58
14	09-Aug-96	58	58	35	25		41	40	24	58	33	21	43	34	36	506	890	0.57
15	12-Aug-96	53	53	37	20		41	40	25	54	27	20	45	31	33	479	890	0.54
16	15-Aug-96	51	60	35	24		45	40	26	52	34	22	42	36	37	504	890	0.57
17	17-Aug-96	60	57	35	23		44	38	22	58	29	23	43	37	36	505	890	0.57
18	22-Aug-96	54	60	34	20		44	34	25	55	29	15	41	32	26	469	890	0.53
19	24-Aug-96	52	45	33	22		34	31	21	45	31	16	40	32	33	435	890	0.49
20	27-Aug-96	51	50	35	25		41	34	19	52	30	20	41	31	30	459	890	0.52
21	29-Aug-96	60	49	35	24		40	38	21	50	30	23	37	32	30	469	890	0.53
22	01-Sep-96	49	44	34	24		34	32	19	49	21	19	39	22	25	411	890	0.46
23	04-Sep-96	57	49	28	17		15	31	18	35	10	17	23	10	12	322	890	0.36
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (16 Aug 1996):		55	56	35	25		45	39	23	56	32	23	42	35	36		Mean	0.56
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.03

Table 38 (continued).

Year: 1997		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	17-Jun-97	61	36	51	28		61	46	27	70	40	32	52	40	44	588	890	0.66
2	19-Jun-97	70	62	39	22		56	40	24	66	32	33	44	35	36	559	890	0.63
3	22-Jun-97	53	57	31	18		48	31	28	55	32	20	33	32	35	473	890	0.53
4	24-Jun-97	73	73	36	29		57	41	21	63	31	27	54	32	36	573	890	0.64
5	28-Jun-97	57	59	33	20		45	35	18	44	30	23	34	33	29	460	890	0.52
6	29-Jun-97	59	58	32	20		43	33	17	46	28	24	31	28	32	451	890	0.51
7	30-Jun-97	61	55	37	20		43	34	23	57	29	25	42	30	32	488	890	0.55
8	03-Jul-97	67	60	34	20		47	36	20	56	27	28	37	39	33	504	890	0.57
9	04-Jul-97	70	60	38	21		47	37	23	56	31	25	38	34	31	511	890	0.57
10	06-Jul-97	66	56	34	26		44	36	23	54	35	22	43	35	36	510	890	0.57
11	08-Jul-97	73	56	37	24		46	38	22	57	33	25	37	36	33	517	890	0.58
12	09-Jul-97	82	60	40	25		48	41	22	63	35	26	49	38	40	569	890	0.64
13	13-Jul-97	70	62	35	26		48	40	24	51	36	25	42	37	32	528	890	0.59
14	15-Jul-97	68	65	41	27		50	41	23	56	35	23	41	38	34	542	890	0.61
15	20-Jul-97	68	63	32	21		49	38	24	55	31	24	39	36	31	511	890	0.57
16	21-Jul-97	82	61	41	33		46	40	21	54	33	27	42	38	38	556	890	0.62
17	27-Jul-97	77	61	40	32		53	40	27	58	41	32	44	50	45	600	890	0.67
18	01-Aug-97	71	57	36	35		44	39	25	55	34	21	40	38	38	533	890	0.60
19	02-Aug-97	78	59	33	23		44	38	24	50	36	28	33	39	42	527	890	0.59
20	06-Aug-97	69	60	33	27		43	42	25	60	37	34	46	39	40	555	890	0.62
21	07-Aug-97	76	67	34	31		49	36	20	65	35	29	48	44	36	570	890	0.64
22	13-Aug-97	65	65	34	28		43	39	20	49	31	27	37	34	32	504	890	0.57
23	14-Aug-97	69	58	37	27		37	34	22	59	34	29	45	32	35	518	890	0.58
24	17-Aug-97	74	57	36	28		43	39	19	61	33	25	46	36	38	535	890	0.60
25	19-Aug-97	78	51	35	30		45	39	22	58	31	25	50	34	39	537	890	0.60
26	21-Aug-97	58	46	28	21		31	29	21	51	33	19	36	28	32	433	890	0.49
27	25-Aug-97	60	54	31	26		34	30	18	50	32	20	40	34	30	459	890	0.52
28	27-Aug-97	49	45	29	22		39	32	17	55	26	18	37	31	32	432	890	0.49
29	31-Aug-97	35	32	21	7		32	27	16	43	26	17	39	17	22	334	890	0.38
30	03-Sep-97	1	5	0	0		0	12	9	3	1	13	7	1	3	55	890	0.06
31																		
Mean to end of census period (21 Aug 1997):		69	59	36	26		47	38	23	57	33	26	42	36	36		Mean	0.59
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.04

Table 38 (continued).

Year: 1998		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	04-Jul-98	71	64	35	27		56	31	23	51	37	29	39	38	34	535	890	0.60
2	06-Jul-98	64	57	32	29		48	33	18	46	37	25	41	37	33	500	890	0.56
3	09-Jul-98	76	69	41	33		63	40	18	60	34	27	46	46	41	594	890	0.67
4	11-Jul-98	68	54	31	28		48	33	22	51	30	20	45	39	32	501	890	0.56
5	12-Jul-98	78	63	35	28		31	38	24	62	29	27	51	33	38	537	890	0.60
6	13-Jul-98	89	84	38	27		75	34	20	59	24	15	42	32	35	574	890	0.64
7	15-Jul-98	85	71	39	36		56	47	28	60	43	31	54	44	41	635	890	0.71
8	26-Jul-98	85	66	40	38		61	38	20	56	39	28	50	43	40	604	890	0.68
9	27-Jul-98	79	64	35	32		64	42	22	59	41	28	45	48	41	600	890	0.67
10	29-Jul-98	78	59	54	26		54	45	25	60	39	27	46	45	38	596	890	0.67
11	31-Jul-98	78	67	40	36		56	37	25	56	39	25	51	43	35	588	890	0.66
12	02-Aug-98	81	64	39	37		61	35	24	59	36	31	53	39	38	597	890	0.67
13	03-Aug-98	76	69	32	29		53	39	25	53	34	26	46	44	37	563	890	0.63
14	09-Aug-98	70	71	37	29		49	39	27	55	34	25	51	40	36	563	890	0.63
15	11-Aug-98	69	68	38	35		53	33	25	53	33	24	55	34	33	553	890	0.62
16	19-Aug-98	52	61	30	24		46	30	27	52	32	22	37	38	35	486	890	0.55
17	21-Aug-98	57	58	39	35		46	34	23	48	34	18	42	34	30	498	890	0.56
18	26-Aug-98	53	51	34	24		39	29	21	47	28	16	46	26	32	446	890	0.50
19	29-Aug-98	47	48	26	26		31	27	25	41	18	15	28	22	28	382	890	0.43
20	04-Sep-98	49	37	21	22		32	21	13	22	14	13	6	11	9	270	890	0.30
21	08-Sep-98	41	17	9	15		25	4	3	0	4	8	0	1	0	127	890	0.14
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (23 Aug 1998):		74	65	37	31		54	37	23	55	35	25	47	40	36		Mean	0.63
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued).

Year: 1999		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	24-Jun-99	65	67	37	26		46	36	17	52	29	21	51	39	30	516	890	0.58
2	25-Jun-99	62	62	34	29		48	34	20	58	28	22	48	36	31	512	890	0.58
3	30-Jun-99	64	55	38	36		44	43	23	65	38	22	55	36	39	558	890	0.63
4	01-Jul-99	70	74	33	42		55	34	21	66	36	21	53	34	32	571	890	0.64
5	05-Jul-99	66	67	37	31		44	31	14	29	9	15	47	18	23	431	890	0.48
6	07-Jul-99	70	64	35	33		41	33	19	60	27	24	51	33	41	531	890	0.60
7	08-Jul-99	80	79	40	40		48	39	18	67	36	28	50	42	34	601	890	0.68
8	15-Jul-99	69	72	39	37		45	47	21	70	32	33	58	31	36	590	890	0.66
9	17-Jul-99	77	83	34	32		51	48	26	63	32	32	57	44	40	619	890	0.70
10	19-Jul-99	76	67	35	42		52	42	22	59	39	32	47	43	40	596	890	0.67
11	20-Jul-99	74	67	42	44		61	48	26	69	36	31	58	49	36	641	890	0.72
12	22-Jul-99	79	68	35	42		58	50	26	69	36	30	50	46	42	631	890	0.71
13	26-Jul-99	74	72	29	35		42	38	21	55	34	27	49	43	38	557	890	0.63
14	28-Jul-99	79	76	39	57		49	46	28	62	36	33	53	47	43	648	890	0.73
15	29-Jul-99	67	64	33	42		45	43	24	60	33	26	53	40	35	565	890	0.63
16	02-Aug-99	74	56	35	37		44	38	19	58	28	24	49	41	40	543	890	0.61
17	07-Aug-99	70	61	33	36		37	41	21	58	32	21	45	43	37	535	890	0.60
18	09-Aug-99	70	73	36	44		42	44	25	59	33	25	48	45	36	580	890	0.65
19	14-Aug-99	77	73	35	44		49	47	22	59	38	24	54	44	33	599	890	0.67
20	16-Aug-99	80	67	36	42		40	43	25	65	38	29	52	50	41	608	890	0.68
21	18-Aug-99	69	71	36	44		35	39	21	62	33	20	46	36	33	545	890	0.61
22	24-Aug-99	57	69	28	34		40	39	18	63	30	27	48	34	36	523	890	0.59
23	26-Aug-99	54	51	29	29		41	37	16	56	33	21	49	35	29	480	890	0.54
24	01-Sep-99	23	28	19	18		37	30	15	40	30	21	34	22	14	331	890	0.37
25	04-Sep-99	1	0	5	5		31	9	11	29	18	13	14	7	0	143	890	0.16
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (17 Aug 1999):		72	68	36	39		47	41	22	60	33	26	51	40	36		Mean	0.64
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.06

Table 38 (continued).

Year: 2000		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	20-Aug-00	67	51	45	43		49	45	28	62	35	26	52	42	33	578	890	0.65
2	23-Aug-00	68	52	39	36		41	37	24	54	32	22	43	40	36	524	890	0.59
3	26-Aug-00	65	62	40	30		44	39	23	52	28	16	52	29	36	516	890	0.58
4	31-Aug-00	63	29	34	30		36	32	16	65	35	21	38	31	35	465	890	0.52
5																		
6																		
7																		
8																		
9																		
10																		
11																		
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23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (23 Aug 2000):		68	52	42	40		45	41	26	58	34	24	48	41	35		Mean	0.62
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.04

Table 38 (continued).

Year: 2001		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	09-Aug-01	83	54	72	69		62	47	24	63	38	23	55	41	43	674	890	0.76
2	11-Aug-01	61	72	66	79		72	41	22	60	36	22	50	44	33	658	890	0.74
3	13-Aug-01	60	61	45	35		53	43	24	60	29	20	52	39	44	565	890	0.63
4	14-Aug-01	58	61	63	83		53	37	27	55	33	18	52	44	38	622	890	0.70
5	18-Aug-01	57	59	61	82		41	41	22	57	37	20	59	42	36	614	890	0.69
6	24-Aug-01	60	56	62	65		61	38	16	49	30	19	45	38	29	568	890	0.64
7	02-Sep-01	48	45	38	37		34	29	13	38	20	15	32	28	24	401	890	0.45
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
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24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (17 Aug 2001):		66	62	62	67		60	42	24	60	34	21	52	42	40		Mean	0.71
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued).

Year: 2002		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	31-Jul-02	64	72	36	46		58	40	17	61	31	20	45	40	29	559	890	0.63
2	01-Aug-02	75	57	31	47		42	38	22	58	31	22	43	46	40	552	890	0.62
3	06-Aug-02	73	68	35	42		46	39	23	58	31	20	48	39	43	565	890	0.63
4	09-Aug-02	74	64	31	48		48	43	22	57	40	26	49	37	34	573	890	0.64
5	14-Aug-02	79	81	34	45		50	41	23	60	32	21	46	39	37	588	890	0.66
6	18-Aug-02	67	72	36	43		40	43	23	60	35	24	52	46	34	575	890	0.65
7	23-Aug-02	69	66	32	42		38	36	17	56	36	19	47	38	36	532	890	0.60
8	26-Aug-02	69	76	38	40		40	40	20	60	34	23	48	33	36	557	890	0.63
9	31-Aug-02	56	65	33	37		28	30	14	44	31	14	41	30	28	451	890	0.51
10																		
11																		
12																		
13																		
14																		
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18																		
19																		
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25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (20 Aug 2002):		72	69	34	45		47	41	22	59	33	22	47	41	36		Mean	0.64
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.01

Table 38 (continued).

Year: 2003		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	03-Aug-03	77	73	38	40		47	45	25	62	37	30	49	50	37	610	890	0.69
2	04-Aug-03	76	63	27	32		56	38	24	48	34	26	47	43	38	552	890	0.62
3	06-Aug-03	68	72	34	50		49	39	32	51	37	22	48	46	37	585	890	0.66
4	09-Aug-03	78	61	29	42		48	31	20	56	31	21	41	37	36	531	890	0.60
5	17-Aug-03	74	69	31	37		55	41	23	54	24	23	38	40	37	546	890	0.61
6	21-Aug-03	64	71	35	60		45	38	24	57	32	22	47	42	38	575	890	0.65
7	23-Aug-03	75	76	33	55		48	37	23	53	30	23	43	41	39	576	890	0.65
8	27-Aug-03	56	63	33	54		44	42	22	49	34	21	40	40	39	537	890	0.60
9	31-Aug-03	64	62	28	49		50	36	20	53	29	22	40	37	39	529	890	0.59
10	03-Sep-03	61	51	39	42		39	36	19	55	35	22	44	35	39	517	890	0.58
11	07-Sep-03	53	55	35	31		32	31	9	43	28	18	31	12	23	401	890	0.45
12																		
13																		
14																		
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25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (19 Aug 2003):		75	68	32	40		51	39	25	54	33	24	45	43	37		Mean	0.63
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.04

Table 38 (continued).

Year: 2004		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	03-Aug-04	89	76	33	47		54	47	24	57	35	28	56	45	35	626	890	0.70
2	06-Aug-04	79	70	38	49		58	38	22	62	30	20	59	45	35	605	890	0.68
3	12-Aug-04	68	57	41	62		41	38	18	54	35	17	52	36	42	561	890	0.63
4	16-Aug-04	71	55	42	36		51	31	18	46	31	14	54	34	31	514	890	0.58
5	21-Aug-04	72	61	36	41		47	19	23	56	30	19	47	41	32	524	890	0.59
6	27-Aug-04	70	60	43	47		51	32	22	53	33	20	51	40	37	559	890	0.63
7	28-Aug-04	75	52	44	51		39	37	23	54	27	18	49	35	31	535	890	0.60
8	29-Aug-04	80	61	41	49		43	35	20	54	35	20	45	38	31	552	890	0.62
9	31-Aug-04	70	55	41	42		35	30	23	49	35	18	50	35	30	513	890	0.58
10	05-Sep-04	66	61	38	37		39	32	23	52	37	16	45	31	30	507	890	0.57
11	06-Sep-04	59	59	38	28		40	28	12	47	39	20	34	25	28	457	890	0.51
12	07-Sep-04	55	52	31	25		33	21	9	43	27	13	31	17	29	386	890	0.43
13	09-Sep-04	45	36	30	8		14	6	4	27	22	8	21	6	5	232	890	0.26
14	11-Sep-04	21	34	14	0		9	4	0	20	17	8	9	0	2	138	890	0.16
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (24 Aug 2004):		76	64	38	47		50	35	21	55	32	20	54	40	35		Mean	0.64
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.06

Table 38 (continued).

Year: 2005		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	01-Aug-05	98	66	49	79		58	44	28	66	36	29	62	47	38	700	890	0.79
2	05-Aug-05	89	71	48	63		56	44	26	62	38	30	55	50	39	671	890	0.75
3	11-Aug-05	87	69	50	72		50	54	28	62	38	23	64	52	41	690	890	0.78
4	19-Aug-05	82	66	41	69		45	43	26	62	39	27	54	48	40	642	890	0.72
5	28-Aug-05	65	60	39	48		32	32	20	58	32	22	47	33	29	517	890	0.58
6	02-Sep-05	84	67	32	36		39	31	25	53	31	16	49	39	30	532	890	0.60
7	05-Sep-05	69	65	34	36		32	29	16	47	28	18	40	21	33	468	890	0.53
8	07-Sep-05	55	59	32	41		32	21	15	48	25	20	38	16	25	427	890	0.48
9	08-Sep-05	51	52	33	36		31	19	14	46	26	14	35	7	21	385	890	0.43
10																		
11																		
12																		
13																		
14																		
15																		
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17																		
18																		
19																		
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24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (25 Aug 2005):		89	68	47	71		52	46	27	63	38	27	59	49	40		Mean	0.76
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.03

Table 38 (continued).

Year: 2006		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	06-Aug-06	85	83	36	63		64	34	30	73	37	32	54	52	34	677	890	0.76
2	09-Aug-06	78	81	44	55		67	44	30	70	32	20	59	60	35	675	890	0.76
3	16-Aug-06	74	63	30	50		60	42	25	48	31	18	46	38	34	559	890	0.63
4	21-Aug-06	81	59	35	44		51	45	25	62	28	22	53	41	43	589	890	0.66
5	23-Aug-06	87	56	36	49		52	47	23	57	30	22	60	51	38	608	890	0.68
6	27-Aug-06	78	114	41	51		57	48	29	68	33	28	53	46	36	682	890	0.77
7	29-Aug-06	76	68	35	41		50	40	23	60	20	20	55	42	36	566	890	0.64
8	01-Sep-06	70	65	36	50		46	38	27	57	30	24	50	43	35	571	890	0.64
9	02-Sep-06	75	67	32	44		42	39	20	45	33	24	50	35	35	541	890	0.61
10	03-Sep-06	65	66	30	45		47	35	21	55	31	21	49	33	32	530	890	0.60
11	04-Sep-06	65	55	35	54		44	37	17	54	25	22	45	32	33	518	890	0.58
12																		
13																		
14																		
15																		
16																		
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18																		
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25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (30 Aug 2006):		80	75	37	50		57	43	26	63	30	23	54	47	37		Mean	0.70
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.06

Table 38 (continued).

Year: 2007		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	31-Jul-07	105	93	53	57		52	56	29	72	34	30	61	64	40	746	890	0.84
2	09-Aug-07	104	73	40	31		30	45	29	68	32	23	51	48	38	612	890	0.69
3	10-Aug-07	104	78	38	42		42	51	29	72	33	23	51	54	46	663	890	0.74
4	16-Aug-07	102	94	41	26		46	40	29	63	28	21	63	51	34	638	890	0.72
5	21-Aug-07	106	73	44	38		51	42	31	67	31	23	67	48	42	663	890	0.74
6	25-Aug-07	101	81	38	46		42	50	28	65	30	19	50	50	28	628	890	0.71
7	30-Aug-07	101	78	41	48		44	42	31	61	32	23	50	45	40	636	890	0.71
8	01-Sep-07	88	70	36	49		42	42	27	62	29	22	43	46	36	592	890	0.67
9	06-Sep-07	89	72	36	45		46	39	28	54	28	20	44	44	31	576	890	0.65
10																		
11																		
12																		
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27																		
28																		
29																		
31																		
Mean to end of census period (01 Sep 2007):		101	80	41	42		44	46	29	66	31	23	55	51	38		Mean	0.73
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued).

Year: 2008		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	08-Aug-08	89	64	41	33		33	36	22	62	32	19	44	35	37	547	890	0.61
2	10-Aug-08	81	62	43	51		42	40	23	64	37	22	50	38	40	593	890	0.67
3	17-Aug-08	84	84	40	46		41	34	24	66	34	22	50	43	41	609	890	0.68
4	23-Aug-08	74	74	40	62		51	45	27	66	39	25	54	52	48	657	890	0.74
5	26-Aug-08	98	62	42	77		48	39	28	65	34	25	58	50	41	667	890	0.75
6	29-Aug-08	96	66	39	62		51	37	27	65	36	32	50	43	44	648	890	0.73
7	05-Sep-08	94	69	46	55		42	40	27	55	35	16	45	35	36	595	890	0.67
8																		
9																		
10																		
11																		
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28																		
29																		
30																		
31																		
Mean to end of census period (25 Aug 2008):		82	71	41	48		42	39	24	65	36	22	50	42	42		Mean	0.68
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued).

Year: 2009		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	07-Aug-09	102	80	15	58		52	46	29	62	35	26	59	56	38	658	890	0.74
2	16-Aug-09	92	77	44	86		49	43	28	68	35	26	61	52	43	704	890	0.79
3	24-Aug-09	87	81	66	71		42	46	30	76	37	33	61	61	47	738	890	0.83
4	01-Sep-09	78	88	47	43		50	41	28	70	30	25	59	54	40	653	890	0.73
5	06-Sep-09	73	89	34	58		39	37	22	68	34	27	54	47	39	621	890	0.70
6																		
7																		
8																		
9																		
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28																		
29																		
30																		
31																		
Mean to end of census period (03 Sep 2009):		90	82	43	65		48	44	29	69	34	28	60	56	42		Mean	0.77
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued).

Year: 2010		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	06-Aug-10	100	83	47	48		54	52	31	57	35	31	56	48	39	681	890	0.77
2	11-Aug-10	113	72	46	39		49	46	29	63	34	24	56	59	37	667	890	0.75
3	06-Sep-10	89	64	40	51		47	41	24	52	33	20	48	36	35	580	890	0.65
4	08-Sep-10	76	54	41	46		45	35	22	53	37	26	46	36	35	552	890	0.62
5																		
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30																		
31																		
Mean to end of census period (07 Sep 2010):		101	73	44	46		50	46	28	57	34	25	53	48	37		Mean	0.72
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.06

Table 38 (continued).

Year: 2011		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	07-Aug-11	88	73	50	71		54	58	40	73	37	30	63	61	44	742	890	0.83
2	08-Aug-11	65	90	38	61		49	53	33	53	36	29	50	57	37	651	890	0.73
3	13-Aug-11	78	72	42	69		50	55	37	56	33	33	63	56	37	681	890	0.77
4	29-Aug-11	74	82	39	54		45	45	25	63	39	23	53	56	40	638	890	0.72
5	01-Sep-11	70	68	42	46		36	37	24	56	33	30	47	47	37	573	890	0.64
6	09-Sep-11	58	48	39	33		37	30	8	37	24	21	27	20	20	402	890	0.45
7																		
8																		
9																		
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25																		
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27																		
28																		
29																		
30																		
31																		
Mean to end of census period (31 Aug 2011):		76	79	42	64		50	53	34	61	36	29	57	58	40		Mean	0.76
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.05

Table 38 (continued) (no data in 2012).

Year: 2012		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	No data in 2012																	
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
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22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period ():																		
Among-year maximum count:																		

Table 38 (continued).

Year: 2013		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	13-Aug-13	62	69	38	52		34	49	29	48	33	22	48	41	36	561	890	0.63
2	14-Aug-13	64	56	34	47		33	54	36	66	35	26	46	48	42	587	890	0.66
3	15-Aug-13	62	47	43	55		37	49	31	63	31	20	46	47	41	572	890	0.64
4	20-Aug-13	58	62	46	56		31	50	31	54	31	17	52	51	35	574	890	0.64
5	22-Aug-13	48	57	32	44		26	48	29	48	31	20	47	35	39	504	890	0.57
6	26-Aug-13	71	64	41	53		37	51	33	49	32	25	51	49	42	598	890	0.67
7	31-Aug-13	64	59	40	50		37	48	24	47	33	22	46	43	33	546	890	0.61
8	01-Sep-13	57	60	39	51		31	42	26	59	28	20	43	44	34	534	890	0.60
9																		
10																		
11																		
12																		
13																		
14																		
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27																		
28																		
29																		
30																		
31																		
Mean to end of census period (01 Sep 2013):		61	59	39	51		33	49	30	54	32	22	47	45	38		Mean	0.63
Among-year maximum count:		113	114	72	86		75	58	40	76	43	34	67	64	48		St. dev.	0.03

Table 38 (continued).

Year: 2014		Plot															Among-	Sum/
Replicate	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Sum	year max	max
1	17-Jul-14	58	68	0	57			39	23					40	39	324	595	0.54
2	21-Jul-14	59	63	39	46			43	28					44	35	357	595	0.60
3	26-Jul-14	62	71	37	63			46	28						42	349	531	0.66
4	27-Jul-14	58	52	33	57			42	29					46	30	348	595	0.58
5	30-Jul-14	57	57	37	54			44	25					49	34	357	595	0.60
6	02-Aug-14	60	62	40	46			44	25					42	34	353	595	0.59
7	05-Aug-14	60	51	36	40			39	23					41	33	322	595	0.54
8	08-Aug-14	56	60	35	43			41	21					36	34	326	595	0.55
9	11-Aug-14	54	51	31	42			41	23					26	34	302	595	0.51
10	13-Aug-14	58	62	38	49			41	24					43	38	354	595	0.59
11	18-Aug-14	56	62	31	49			49	24					44	38	354	595	0.59
12	21-Aug-14	57	56	39	44			37	26					43	36	338	595	0.57
13	24-Aug-14	47	50	33	44			45	23					30	27	300	595	0.50
14	27-Aug-14	53	65	32	44			45	27					39	34	339	595	0.57
15	30-Aug-14	51	65	37	49			40	24					41	33	340	595	0.57
16	02-Sep-14	60	71	30	53			35	15					46	28	337	595	0.57
17	04-Sep-14	48	50	31	33			36	20					38	25	281	595	0.47
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
Mean to end of census period (03 Sep 2014):		57	61	33	49			42	24					41	34		Mean	0.57
Among-year maximum count:		113	114	72	86			58	40					64	48		St. dev.	0.04

Table 39. Proportion-of-maximum-count of adult common murres in productivity plots at East Amatuli Island, Alaska. Each plot-value was calculated by dividing the mean of all census-period counts for that plot that year by the among-year maximum count for that plot. The "Total" value for each year was the mean among count-days that year of plot-sum percent-of-maximum values (rather than the mean of the annual plot-values shown in this table). Each count-day plot-sum value was the sum of the counts for all plots counted that day divided by the sum of the among-year maximum counts for those plots.

Year	Plot														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total[a]
1993	0.64	0.57	0.54	0.64	0.89	0.60	0.73	0.58	0.76	0.74	0.66	0.75	0.65	-	0.66
1994	0.54	0.51	0.50	0.22	0.82	0.61	0.69	0.56	0.73	0.72	0.56	0.66	0.54	0.75	0.57
1995	0.52	0.47	0.46	0.28	0.87	0.56	0.65	0.54	0.69	0.69	0.54	0.56	0.51	0.69	0.55
1996	0.49	0.49	0.48	0.29	-	0.61	0.68	0.58	0.73	0.75	0.67	0.62	0.54	0.74	0.56
1997	0.61	0.52	0.51	0.30	-	0.63	0.66	0.56	0.75	0.77	0.78	0.63	0.57	0.75	0.59
1998	0.65	0.57	0.52	0.36	-	0.72	0.64	0.58	0.73	0.81	0.74	0.70	0.62	0.76	0.63
1999	0.64	0.60	0.50	0.45	-	0.63	0.71	0.55	0.79	0.76	0.76	0.77	0.63	0.76	0.64
2000	0.60	0.45	0.58	0.46	-	0.60	0.71	0.65	0.76	0.78	0.71	0.71	0.64	0.72	0.62
2001	0.58	0.54	0.85	0.77	-	0.80	0.72	0.61	0.78	0.79	0.61	0.78	0.66	0.82	0.71
2002	0.64	0.61	0.47	0.53	-	0.63	0.70	0.54	0.78	0.78	0.65	0.70	0.64	0.75	0.64
2003	0.66	0.59	0.44	0.47	-	0.68	0.67	0.62	0.71	0.76	0.72	0.67	0.68	0.77	0.63
2004	0.67	0.56	0.53	0.55	-	0.67	0.60	0.53	0.72	0.75	0.58	0.80	0.63	0.73	0.64
2005	0.79	0.60	0.65	0.82	-	0.70	0.80	0.68	0.83	0.88	0.80	0.88	0.77	0.82	0.76
2006	0.71	0.66	0.51	0.59	-	0.76	0.74	0.66	0.82	0.70	0.68	0.81	0.74	0.76	0.70
2007	0.90	0.70	0.57	0.49	-	0.58	0.79	0.73	0.87	0.72	0.68	0.81	0.79	0.79	0.73
2008	0.73	0.62	0.57	0.56	-	0.56	0.67	0.60	0.85	0.83	0.65	0.74	0.66	0.86	0.68
2009	0.79	0.71	0.60	0.75	-	0.64	0.76	0.72	0.91	0.80	0.81	0.90	0.87	0.88	0.77
2010	0.89	0.64	0.62	0.53	-	0.67	0.80	0.70	0.75	0.79	0.74	0.80	0.74	0.77	0.72
2011	0.67	0.70	0.59	0.74	-	0.66	0.91	0.84	0.81	0.84	0.85	0.85	0.90	0.82	0.76
2012					-	-	-	-	-	-	-	-	-	-	-
2013	0.54	0.52	0.54	0.59	-	0.44	0.84	0.75	0.71	0.74	0.63	0.71	0.70	0.79	0.63
2014	0.50	0.53	0.46	0.57	-	-	0.72	0.61	-	-	-	-	0.64	0.71	0.57

[a] Only the replicates made during the year's "census period" are used for the mean.

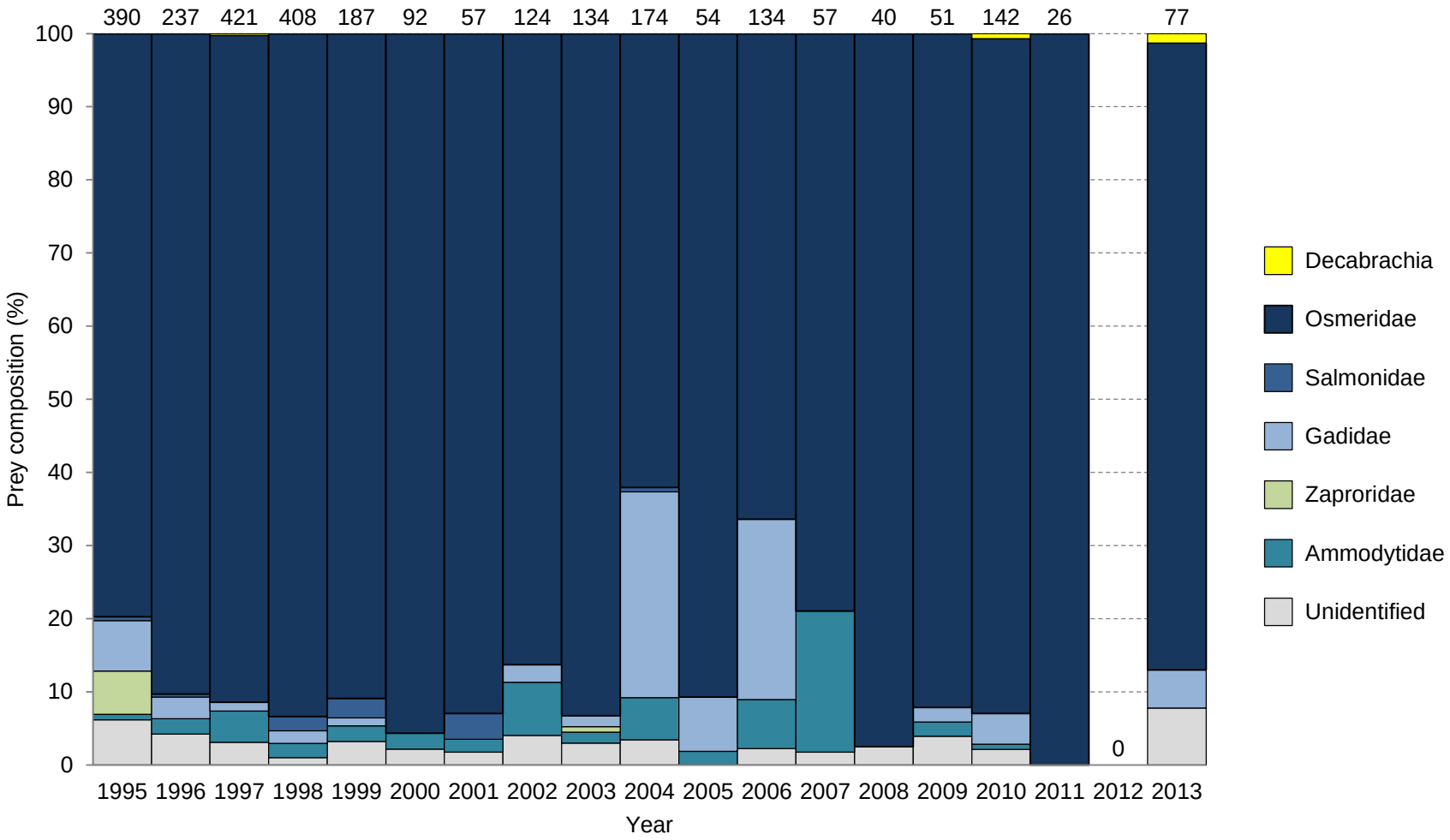

Figure 38. Prey composition (for each prey type, percentage of the total number of prey items) for observations of murre bill-loads at East Amatuli Island, Alaska. Sample sizes are above columns. Observations were not made in 2012 and 2014.

Table 40. Prey composition (for each prey type, percentage of the total number of items of all prey types) for observations of murre bill-loads at East Amatuli Island, Alaska. (Continued on next page.)

Prey	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	(cont.)
No. samples	390	237	421	408	187	92	57	124	134	174	
Invertebrates	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Cephalopoda	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Decabrachia	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	
Unid. squid	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fish	**93.8**	**95.8**	**96.7**	**99.0**	**96.8**	**97.8**	**98.2**	**96.0**	**97.0**	**96.6**	
Osmeridae	**79.7**	**90.3**	**91.2**	**93.4**	**90.9**	**95.7**	**93.0**	**86.3**	**93.3**	**62.1**	
Mallotus villosus	79.7	90.3	91.2	93.4	90.9	95.7	93.0	86.3	93.3	62.1	
Salmonidae	**0.5**	**0.4**	**0.0**	**2.0**	**2.7**	**0.0**	**3.5**	**0.0**	**0.0**	**0.6**	
Unid. salmonid	0.5	0.4	0.0	2.0	2.7	0.0	3.5	0.0	0.0	0.6	
Gadidae	**6.9**	**3.0**	**1.2**	**1.7**	**1.1**	**0.0**	**0.0**	**2.4**	**1.5**	**28.2**	
Unid. gadid	6.9	3.0	1.2	1.7	1.1	0.0	0.0	2.4	1.5	28.2	
Zaproridae	**5.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.0**	
Zaprora silenus	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	
Ammodytidae	**0.8**	**2.1**	**4.3**	**2.0**	**2.1**	**2.2**	**1.8**	**7.3**	**1.5**	**5.7**	
Ammodytes personatus	0.8	2.1	4.3	2.0	2.1	2.2	1.8	7.3	1.5	5.7	
Unidentified	**6.2**	**4.2**	**3.1**	**1.0**	**3.2**	**2.2**	**1.8**	**4.0**	**3.0**	**3.4**	

Table 41 (continued with additional years).

Prey	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
No. samples	54	134	57	40	51	142	26	0	77	0
Invertebrates	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.0**	**-**	**1.3**	**-**
Cephalopoda	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.0**	**-**	**1.3**	**-**
Decabrachia	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.0**	**-**	**1.3**	**-**
Unid. squid	0.0	0.0	0.0	0.0	0.0	0.7	0.0	-	1.3	-
Fish	**100.0**	**97.8**	**98.2**	**97.5**	**96.1**	**97.2**	**100.0**	**-**	**90.9**	**-**
Osmeridae	**90.7**	**66.4**	**78.9**	**97.5**	**92.2**	**92.3**	**100.0**	**-**	**85.7**	**-**
Mallotus villosus	90.7	66.4	78.9	97.5	92.2	92.3	100.0	-	85.7	-
Salmonidae	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-**	**0.0**	**-**
Unid. salmonid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-
Gadidae	**7.4**	**24.6**	**0.0**	**0.0**	**2.0**	**4.2**	**0.0**	**-**	**5.2**	**-**
Unid. gadid	7.4	24.6	0.0	0.0	2.0	4.2	0.0	-	5.2	-
Zaproridae	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-**	**0.0**	**-**
Zaprora silenus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	-
Ammodytidae	**1.9**	**6.7**	**19.3**	**0.0**	**2.0**	**0.7**	**0.0**	**-**	**0.0**	**-**
Ammodytes personatus	1.9	6.7	19.3	0.0	2.0	0.7	0.0	-	0.0	-
Unidentified	**0.0**	**2.2**	**1.8**	**2.5**	**3.9**	**2.1**	**0.0**	**-**	**7.8**	**-**

Table 42. Common murre parameter abbreviations used in report tables, the number of sample years for each parameter, and the parameter's description.

Description	Parameter
Hatch date determined from egg-to-chick observations	hd_obs
Hatch date determined by subtracting a standard nestling period (21 days) from the chick disappearance date	hd_dd21
"Fledged-disappeared-date": hdd_dd21 for chicks that were known by chick age (as in "fldg_obs" below) to have fledged	fdd
Hatch date determined by subtracting a standard nestling period (21 days) from the chick disappearance date, for chicks that were seen at least ten days after their plot's mean hatch date	hd_dd21_10
Hatch date by "htchd_obs" (above) when possible, or "hd_dd21_10"	hd_obs_or_dd21_10
Sites with eggs, seen during productivity observations	egg
Combined egg-sites and (where an egg was not previously seen) chick-sites seen early in the hatching period	egg_or_ch
Chick count	chick
Count of chicks at sites where an egg was previously sighted	ch_w_egg
Fledgling count from observed egg-to-aged-fledgling method (chicks fledged if they were 15 or more days old when they disappeared)	fldg_obs
Fledgling count from chick-10-date method (chick seen at least 10 days after its plot's mean hatch date)	fldg_10
Fledglings ("fldg_10") divided by eggsites ("egg")	fldg_10/egg
Fledglings ("fldg_10") divided by chicks ("chick")	fldg_10/ch
Egg count ("egg") minus [the count of egg-only (no-chick) sites] multiplied by [the proportion of chicks excluded from ageing analysis because of hatch date imprecision (see "Data Analysis..." methods)][a]	egg_adj
Fledglings ("fldg_obs") divided by adjusted eggsites ("egg_adj")	fldg_obs/egg_adj
Chick count ("chick") minus chicks excluded from ageing because of inadequate hatch data[b]	ch_adj
Fledglings ("fldg_obs") divided by adjusted chicks ("ch_adj")	fldg_obs/ch_adj
Adult counts on productivity plots, proportion of among-year maximum counts	pop_prod
Percentage by number of capelin in chicks' diet	osmerid
Percentage by number of salmonid in chicks' diet	salmonid
Percentage by number of gadids (usually pollock or pacific cod) in chicks' diet	gadid
Percentage by number of sand lance in chicks' diet	sand lance

Table 43. Monitoring years at East Amatuli Island, Alaska for common murre breeding parameters used in this report by the Alaska Maritime National Wildlife Refuge. Parameter abbreviations are explained in Table 42. A blank cell indicates inadequate data for that parameter that year.

Parameter	Year																					
	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
htchd_obs		✓	✓	✓	✓	✓	✓															✓
htchd_dd21	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
fdd	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
htchd_dd21_10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
hd_obs_or_dd21_10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
egg	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
egg_or_ch	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
chick	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
ch_w_egg	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
fldg_obs		✓	✓	✓	✓	✓	✓															✓
fldg_10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
fldg10/egg	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
fldg10/chick	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
egg_adj	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
fldg_obs/egg_adj	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
ch_adj	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
fldg_obs/ch_adj	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
pop_prod	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
osmerid			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
salmonid			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
gadid			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
sand lance			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	

Table 44. Correlation results between pairs of common murre biological parameters for data from the monitoring years with the longest field seasons: 1993-1999. Parameter abbreviations are explained in Table 42. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years. The table columns continue on following pages. p-values <0.001 are displayed as zeros.

PARA_93_99_lag 0	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
hd_obs	1 (0)/6	0.984 (0)/6	0.896 (0.016)/6	0.931 (0.007)/6	1 (0)/6	0.372/6	0.347/6	-0.21/6	-0.403/6
hd_dd21	0.984 (0)/6	1 (0)/7	0.967 (0)/7	0.969 (0)/7	0.984 (0)/7	0.217/7	0.238/7	-0.404/7	-0.342/6
hd_dd21_10	0.896 (0.016)/6	0.967 (0)/7	1 (0)/7	0.988 (0)/7	0.936 (0.002)/7	0.318/7	0.357/7	-0.243/7	-0.037/6
fdd	0.931 (0.007)/6	0.969 (0)/7	0.988 (0)/7	1 (0)/7	0.953 (0.001)/7	0.207/7	0.241/7	-0.348/7	-0.098/6
hd_obs_or_dd21_10	1 (0)/6	0.984 (0)/7	0.936 (0.002)/7	0.953 (0.001)/7	1 (0)/7	0.045/7	0.071/7	-0.542/7	-0.403/6
egg	0.372/6	0.217/7	0.318/7	0.207/7	0.045/7	1 (0)/7	0.992 (0)/7	0.768 (0.044)/7	0.161/6
egg_or_ch	0.347/6	0.238/7	0.357/7	0.241/7	0.071/7	0.992 (0)/7	1 (0)/7	0.774 (0.041)/7	0.248/6
chick	-0.21/6	-0.404/7	-0.243/7	-0.348/7	-0.542/7	0.768 (0.044)/7	0.774 (0.041)/7	1 (0)/7	0.657/6
ch_w_egg	-0.403/6	-0.342/6	-0.037/6	-0.098/6	-0.403/6	0.161/6	0.248/6	0.657/6	1 (0)/6
fldg_obs	-0.341/6	-0.191/6	0.102/6	-0.036/6	-0.341/6	0.626/6	0.671/6	0.953 (0.003)/6	0.795/6
fldg_10	-0.276/6	-0.428/7	-0.254/7	-0.361/7	-0.558/7	0.728/7	0.745/7	0.995 (0)/7	0.716/6
fldg_10/egg	-0.827 (0.042)/6	-0.849 (0.016)/7	-0.748/7	-0.794 (0.033)/7	-0.926 (0.003)/7	0.307/7	0.283/7	0.804 (0.029)/7	0.681/6
fldg_10/ch	-0.427/6	-0.52/7	-0.312/7	-0.385/7	-0.593/7	0.419/7	0.468/7	0.86 (0.013)/7	0.963 (0.002)/6
fldg_obs/egg_adj	-0.73/6	-0.641/6	-0.376/6	-0.465/6	-0.73/6	0.149/6	0.203/6	0.724/6	0.867 (0.025)/6
fldg_obs/ch_adj	-0.376/6	-0.674/7	-0.53/7	-0.552/7	-0.759 (0.048)/7	0.323/7	0.325/7	0.779 (0.039)/7	0.994 (0)/6
pop_prod	-0.258/6	0.214/7	0.115/7	0.129/7	0.317/7	-0.504/7	-0.479/7	-0.671/7	-0.497/6
Osmerid	-0.32/5	-0.436/5	-0.606/5	-0.414/5	-0.32/5	-0.728/5	-0.753/5	-0.636/5	-0.24/5
Salmonid	0.13/5	0.031/5	-0.222/5	-0.185/5	0.13/5	-0.413/5	-0.394/5	-0.562/5	-0.518/5
Gadid	0.551/5	0.63/5	0.752/5	0.641/5	0.551/5	0.637/5	0.634/5	0.417/5	0.037/5
Sand.lance	-0.742/5	-0.697/5	-0.59/5	-0.59/5	-0.742/5	-0.146/5	-0.142/5	0.202/5	0.406/5

PARA_93_99_lag 0	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
hd_obs	-0.341/6	-0.276/6	-0.827 (0.042)/6	-0.427/6	-0.73/6	-0.376/6	-0.258/6	-0.32/5	0.13/5
hd_dd21	-0.191/6	-0.428/7	-0.849 (0.016)/7	-0.52/7	-0.641/6	-0.674/7	0.214/7	-0.436/5	0.031/5
hd_dd21_10	0.102/6	-0.254/7	-0.748/7	-0.312/7	-0.376/6	-0.53/7	0.115/7	-0.606/5	-0.222/5
fdd	-0.036/6	-0.361/7	-0.794 (0.033)/7	-0.385/7	-0.465/6	-0.552/7	0.129/7	-0.414/5	-0.185/5
hd_obs_or_dd21_10	-0.341/6	-0.558/7	-0.926 (0.003)/7	-0.593/7	-0.73/6	-0.759 (0.048)/7	0.317/7	-0.32/5	0.13/5
egg	0.626/6	0.728/7	0.307/7	0.419/7	0.149/6	0.323/7	-0.504/7	-0.728/5	-0.413/5
egg_or_ch	0.671/6	0.745/7	0.283/7	0.468/7	0.203/6	0.325/7	-0.479/7	-0.753/5	-0.394/5
chick	0.953 (0.003)/6	0.995 (0)/7	0.804 (0.029)/7	0.86 (0.013)/7	0.724/6	0.779 (0.039)/7	-0.671/7	-0.636/5	-0.562/5
ch_w_egg	0.795/6	0.716/6	0.681/6	0.963 (0.002)/6	0.867 (0.025)/6	0.994 (0)/6	-0.497/6	-0.24/5	-0.518/5
fldg_obs	1 (0)/6	0.968 (0.002)/6	0.799/6	0.897 (0.015)/6	0.851 (0.032)/6	0.817 (0.047)/6	-0.469/6	-0.416/5	-0.636/5
fldg_10	0.968 (0.002)/6	1 (0)/7	0.805 (0.029)/7	0.895 (0.007)/7	0.774/6	0.785 (0.036)/7	-0.631/7	-0.584/5	-0.525/5
fldg_10/egg	0.799/6	0.805 (0.029)/7	1 (0)/7	0.769 (0.043)/7	0.953 (0.003)/6	0.897 (0.006)/7	-0.573/7	-0.137/5	-0.515/5
fldg_10/ch	0.897 (0.015)/6	0.895 (0.007)/7	0.769 (0.043)/7	1 (0)/7	0.906 (0.013)/6	0.844 (0.017)/7	-0.632/7	-0.408/5	-0.521/5
fldg_obs/egg_adj	0.851 (0.032)/6	0.774/6	0.953 (0.003)/6	0.906 (0.013)/6	1 (0)/6	0.859 (0.029)/6	-0.333/6	-0.166/5	-0.561/5
fldg_obs/ch_adj	0.817 (0.047)/6	0.785 (0.036)/7	0.897 (0.006)/7	0.844 (0.017)/7	0.859 (0.029)/6	1 (0)/7	-0.72/7	-0.187/5	-0.549/5
pop_prod	-0.469/6	-0.631/7	-0.573/7	-0.632/7	-0.333/6	-0.72/7	1 (0)/7	0.693/5	0.849/5
Osmerid	-0.416/5	-0.584/5	-0.137/5	-0.408/5	-0.166/5	-0.187/5	0.693/5	1 (0)/5	0.363/5
Salmonid	-0.636/5	-0.525/5	-0.515/5	-0.521/5	-0.561/5	-0.549/5	0.849/5	0.363/5	1 (0)/5
Gadid	0.191/5	0.344/5	-0.11/5	0.172/5	-0.058/5	-0.018/5	-0.758/5	-0.948 (0.014)/5	-0.396/5
Sand.lance	0.457/5	0.252/5	0.643/5	0.332/5	0.578/5	0.491/5	0.226/5	0.608/5	-0.291/5

Table 45 (columns continued)

PARA_93_99_lag 0	Gadid	Sand.lance
hd_obs	0.551/5	-0.742/5
hd_dd21	0.63/5	-0.697/5
hd_dd21_10	0.752/5	-0.59/5
fdd	0.641/5	-0.59/5
hd_obs_or_dd21_10	0.551/5	-0.742/5
egg	0.637/5	-0.146/5
egg_or_ch	0.634/5	-0.142/5
chick	0.417/5	0.202/5
ch_w_egg	0.037/5	0.406/5
fldg_obs	0.191/5	0.457/5
fldg_10	0.344/5	0.252/5
fldg_10/egg	-0.11/5	0.643/5
fldg_10/ch	0.172/5	0.332/5
fldg_obs/egg_adj	-0.058/5	0.578/5
fldg_obs/ch_adj	-0.018/5	0.491/5
pop_prod	-0.758/5	0.226/5
Osmerid	-0.948 (0.014)/5	0.608/5
Salmonid	-0.396/5	-0.291/5
Gadid	1 (0)/5	-0.719/5
Sand.lance	-0.719/5	1 (0)/5

Table 46. Correlation results between pairs of common murre biological parameters for the years 1993-2014. Parameter abbreviations are explained in Table 11. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years. The table columns continue on following pages. p-values <0.001 are displayed as zeros.

PARA_93_14_lag 0	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
hd_obs	1 (0)/12	0.957 (0)/12	0.99 (0)/12	0.959 (0)/12	1 (0)/12	-0.581 (0.047)/12	-0.485/12	-0.751 (0.005)/12	-0.835 (0.001)/12
hd_dd21	0.957 (0)/12	1 (0)/21	0.97 (0)/21	0.993 (0)/19	0.943 (0)/21	-0.454/17	-0.197/21	-0.673 (0.001)/21	-0.392/17
hd_dd21_10	0.99 (0)/12	0.97 (0)/21	1 (0)/21	0.966 (0)/19	0.988 (0)/21	-0.534 (0.027)/17	-0.288/21	-0.718 (0)/21	-0.456/17
fdd	0.959 (0)/12	0.993 (0)/19	0.966 (0)/19	1 (0)/19	0.939 (0)/19	-0.468/17	-0.398/19	-0.64 (0.003)/19	-0.422/17
hd_obs_or_dd21_10	1 (0)/12	0.943 (0)/21	0.988 (0)/21	0.939 (0)/19	1 (0)/21	-0.596 (0.012)/17	-0.36/21	-0.751 (0)/21	-0.522 (0.032)/17
egg	-0.581 (0.047)/12	-0.454/17	-0.534 (0.027)/17	-0.468/17	-0.596 (0.012)/17	1 (0)/17	0.98 (0)/17	0.826 (0)/17	0.661 (0.005)/16
egg_or_ch	-0.485/12	-0.197/21	-0.288/21	-0.398/19	-0.36/21	0.98 (0)/17	1 (0)/21	0.652 (0.001)/21	0.608 (0.01)/17
chick	-0.751 (0.005)/12	-0.673 (0.001)/21	-0.718 (0)/21	-0.64 (0.003)/19	-0.751 (0)/21	0.826 (0)/17	0.652 (0.001)/21	1 (0)/21	0.436/17
ch_w_egg	-0.835 (0.001)/12	-0.392/17	-0.456/17	-0.422/17	-0.522 (0.032)/17	0.661 (0.005)/16	0.608 (0.01)/17	0.436/17	1 (0)/17
ch.egg	-0.755 (0.005)/12	-0.683 (0.002)/17	-0.662 (0.004)/17	-0.668 (0.003)/17	-0.659 (0.004)/17	0.396/17	0.421/17	0.806 (0)/17	0.233/16
fldg_obs	-0.43/7	-0.37/7	-0.39/7	-0.323/7	-0.433/7	0.547/7	0.51/7	0.939 (0.002)/7	0.783 (0.037)/7
fldg_10	-0.744 (0.006)/12	-0.666 (0.001)/21	-0.723 (0)/21	-0.648 (0.003)/19	-0.756 (0)/21	0.856 (0)/17	0.669 (0.001)/21	0.966 (0)/21	0.536 (0.026)/17
fldg_10.egg	-0.878 (0)/12	-0.762 (0)/17	-0.785 (0)/17	-0.766 (0)/17	-0.791 (0)/17	0.641 (0.006)/17	0.623 (0.008)/17	0.899 (0)/17	0.543 (0.03)/16
fldg_10.ch	-0.473/12	-0.406/21	-0.465 (0.034)/21	-0.469 (0.043)/19	-0.484 (0.026)/21	0.643 (0.005)/17	0.439 (0.046)/21	0.534 (0.013)/21	0.62 (0.008)/17
fldg_obs.egg_adj	-0.926 (0)/12	-0.825 (0)/17	-0.885 (0)/17	-0.832 (0)/17	-0.883 (0)/17	0.694 (0.003)/16	0.551 (0.022)/17	0.843 (0)/17	0.557 (0.02)/17
fldg_obs.ch_adj	-0.81 (0.001)/12	-0.639 (0.003)/19	-0.736 (0)/19	-0.65 (0.003)/19	-0.765 (0)/19	0.657 (0.004)/17	0.537 (0.018)/19	0.675 (0.002)/19	0.766 (0)/17
pop_prod	0.665 (0.018)/12	0.388/21	0.486 (0.025)/21	0.523 (0.022)/19	0.54 (0.012)/21	-0.819 (0)/17	-0.643 (0.002)/21	-0.686 (0.001)/21	-0.741 (0.001)/17
Osmerid	-0.198/10	-0.145/18	-0.077/18	-0.036/16	-0.115/18	-0.154/14	-0.23/18	-0.191/18	-0.075/15
Salmonid	-0.523/10	-0.556 (0.017)/18	-0.507 (0.032)/18	-0.489/16	-0.503 (0.033)/18	0.303/14	0.085/18	0.241/18	0.495/15
Gadid	0.193/10	0.224/18	0.161/18	0.12/16	0.184/18	-0.055/14	0.098/18	0.031/18	0.019/15
Sand.lance	0.32/10	0.045/18	0.047/18	-0.007/16	0.121/18	-0.004/14	0.076/18	0.059/18	-0.129/15

PARA_93_14_lag 0	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
hd_obs	-0.43/7	-0.744 (0.006)/12	-0.878 (0)/12	-0.473/12	-0.926 (0)/12	-0.81 (0.001)/12	0.665 (0.018)/12	-0.198/10	-0.523/10
hd_dd21	-0.37/7	-0.666 (0.001)/21	-0.762 (0)/17	-0.406/21	-0.825 (0)/17	-0.639 (0.003)/19	0.388/21	-0.145/18	-0.556 (0.017)/18
hd_dd21_10	-0.39/7	-0.723 (0)/21	-0.785 (0)/17	-0.465 (0.034)/21	-0.885 (0)/17	-0.736 (0)/19	0.486 (0.025)/21	-0.077/18	-0.507 (0.032)/18
fdd	-0.323/7	-0.648 (0.003)/19	-0.766 (0)/17	-0.469 (0.043)/19	-0.832 (0)/17	-0.65 (0.003)/19	0.523 (0.022)/19	-0.036/16	-0.489/16
hd_obs_or_dd21_10	-0.433/7	-0.756 (0)/21	-0.791 (0)/17	-0.484 (0.026)/21	-0.883 (0)/17	-0.765 (0)/19	0.54 (0.012)/21	-0.115/18	-0.503 (0.033)/18
egg	0.547/7	0.856 (0)/17	0.641 (0.006)/17	0.643 (0.005)/17	0.694 (0.003)/16	0.657 (0.004)/17	-0.819 (0)/17	-0.154/14	0.303/14
egg_or_ch	0.51/7	0.669 (0.001)/21	0.623 (0.008)/17	0.439 (0.046)/21	0.551 (0.022)/17	0.537 (0.018)/19	-0.643 (0.002)/21	-0.23/18	0.085/18
chick	0.939 (0.002)/7	0.966 (0)/21	0.899 (0)/17	0.534 (0.013)/21	0.843 (0)/17	0.675 (0.002)/19	-0.686 (0.001)/21	-0.191/18	0.241/18
ch_w_egg	0.783 (0.037)/7	0.536 (0.026)/17	0.543 (0.03)/16	0.62 (0.008)/17	0.557 (0.02)/17	0.766 (0)/17	-0.741 (0.001)/17	-0.075/15	0.495/15
ch.egg	0.603/7	0.723 (0.001)/17	0.885 (0)/17	0.283/17	0.734 (0.001)/16	0.406/17	-0.468/17	-0.321/14	0.244/14
fldg_obs	1 (0)/7	0.952 (0.001)/7	0.813 (0.026)/7	0.79 (0.034)/7	0.837 (0.019)/7	0.828 (0.021)/7	-0.36/7	-0.416/5	-0.636/5
fldg_10	0.952 (0.001)/7	1 (0)/21	0.908 (0)/17	0.721 (0)/21	0.89 (0)/17	0.769 (0)/19	-0.711 (0)/21	-0.167/18	0.298/18
fldg_10.egg	0.813 (0.026)/7	0.908 (0)/17	1 (0)/17	0.68 (0.003)/17	0.939 (0)/16	0.729 (0.001)/17	-0.705 (0.002)/17	-0.25/14	0.33/14
fldg_10.ch	0.79 (0.034)/7	0.721 (0)/21	0.68 (0.003)/17	1 (0)/21	0.759 (0)/17	0.815 (0)/19	-0.555 (0.009)/21	-0.047/18	0.291/18
fldg_obs.egg_adj	0.837 (0.019)/7	0.89 (0)/17	0.939 (0)/16	0.759 (0)/17	1 (0)/17	0.894 (0)/17	-0.76 (0)/17	-0.238/15	0.352/15
fldg_obs.ch_adj	0.828 (0.021)/7	0.769 (0)/19	0.729 (0.001)/17	0.815 (0)/19	0.894 (0)/17	1 (0)/19	-0.745 (0)/19	-0.159/16	0.408/16
pop_prod	-0.36/7	-0.711 (0)/21	-0.705 (0.002)/17	-0.555 (0.009)/21	-0.76 (0)/17	-0.745 (0)/19	1 (0)/21	0.133/18	-0.074/18
Osmerid	-0.416/5	-0.167/18	-0.25/14	-0.047/18	-0.238/15	-0.159/16	0.133/18	1 (0)/18	0.111/18
Salmonid	-0.636/5	0.298/18	0.33/14	0.291/18	0.352/15	0.408/16	-0.074/18	0.111/18	1 (0)/18
Gadid	0.191/5	-0.032/18	0.114/14	-0.133/18	0.078/15	0.063/16	-0.024/18	-0.882 (0)/18	-0.142/18
Sand.lance	0.457/5	0.082/18	0.082/14	0.076/18	0.098/15	0.014/16	0.152/18	-0.496 (0.036)/18	-0.147/18

(columns continued).

Table 46: columns continued.

PARA_93_14_lag 0	Gadid	Sand.lance
hd_obs	0.193/10	0.32/10
hd_dd21	0.224/18	0.045/18
hd_dd21_10	0.161/18	0.047/18
fdd	0.12/16	-0.007/16
hd_obs_or_dd21_10	0.184/18	0.121/18
egg	-0.055/14	-0.004/14
egg_or_ch	0.098/18	0.076/18
chick	0.031/18	0.059/18
ch_w_egg	0.019/15	-0.129/15
ch_w_egg/egg	0.228/14	0.091/14
fldg_obs	0.191/5	0.457/5
fldg_10	-0.032/18	0.082/18
fldg_10/egg	0.114/14	0.082/14
fldg_10/ch	-0.133/18	0.076/18
fldg_obs/egg_adj	0.078/15	0.098/15
fldg_obs/ch_adj	0.063/16	0.014/16
pop_prod	-0.024/18	0.152/18
Osmerid	-0.882 (0)/18	-0.496 (0.036)/18
Salmonid	-0.142/18	-0.147/18
Gadid	1 (0)/18	0.145/18
Sand.lance	0.145/18	1 (0)/18

Table 47. Correlation results between pairs of common murre biological parameters for the years 1993-2014. Parameters in columns have been matched with the previous year's ("lag 1" at upper left) parameters in rows. Parameter abbreviations are explained in Table 11. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years. The table columns continue on following pages. p-values <0.001 are displayed as zeros.

PARA_93_14_lag 1	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
hd_obs	0.843 (0.017)/7	0.893 (0)/12	0.907 (0)/12	0.895 (0)/12	0.877 (0)/12	-0.591/11	-0.498/12	-0.423/12	-0.794 (0.006)/10
hd_dd21	0.867 (0.001)/11	0.851 (0)/19	0.862 (0)/19	0.863 (0)/17	0.832 (0)/19	-0.679 (0.005)/15	-0.407/19	-0.607 (0.006)/19	-0.742 (0.002)/15
hd_dd21_10	0.886 (0)/11	0.853 (0)/19	0.875 (0)/19	0.851 (0)/17	0.862 (0)/19	-0.674 (0.006)/15	-0.442/19	-0.598 (0.007)/19	-0.758 (0.001)/15
fdd	0.834 (0.003)/10	0.824 (0)/17	0.864 (0)/17	0.829 (0)/16	0.84 (0)/17	-0.727 (0.003)/14	-0.539 (0.025)/17	-0.599 (0.011)/17	-0.698 (0.005)/14
hd_obs_or_dd21_10	0.853 (0.001)/11	0.817 (0)/19	0.845 (0)/19	0.816 (0)/17	0.835 (0)/19	-0.651 (0.009)/15	-0.411/19	-0.55 (0.015)/19	-0.768 (0.001)/15
egg	-0.755 (0.012)/10	-0.51 (0.043)/16	-0.586 (0.017)/16	-0.451/16	-0.604 (0.013)/16	0.514/14	0.227/16	0.347/16	0.573 (0.032)/14
egg_or_ch	-0.562/11	-0.197/19	-0.288/19	-0.296/17	-0.307/19	0.381/15	0.12/19	0.134/19	0.354/15
chick	-0.797 (0.003)/11	-0.728 (0)/19	-0.758 (0)/19	-0.71 (0.001)/17	-0.736 (0)/19	0.444/15	0.159/19	0.475 (0.04)/19	0.529 (0.043)/15
ch_w_egg	-0.631/10	-0.077/17	-0.228/17	-0.215/16	-0.272/17	0.635 (0.015)/14	0.384/17	0.128/17	0.55 (0.042)/14
ch.egg	-0.764 (0.01)/10	-0.817 (0)/16	-0.767 (0.001)/16	-0.831 (0)/16	-0.705 (0.002)/16	0.344/14	0.254/16	0.505 (0.046)/16	0.396/14
fldg_obs	0.357/5	-0.174/7	-0.106/7	-0.167/7	-0.05/7	-0.637/6	-0.077/7	-0.341/7	0.07/5
fldg_10	-0.763 (0.006)/11	-0.661 (0.002)/19	-0.707 (0.001)/19	-0.61 (0.009)/17	-0.695 (0.001)/19	0.461/15	0.164/19	0.438/19	0.569 (0.027)/15
fldg_10.egg	-0.866 (0.001)/10	-0.771 (0)/16	-0.816 (0)/16	-0.76 (0.001)/16	-0.789 (0)/16	0.497/14	0.317/16	0.525 (0.037)/16	0.546 (0.043)/14
fldg_10.ch	-0.474/11	-0.25/19	-0.334/19	-0.088/17	-0.343/19	0.369/15	0.051/19	0.202/19	0.335/15
fldg_obs.egg_adj	-0.885 (0.001)/10	-0.741 (0.001)/17	-0.794 (0)/17	-0.703 (0.002)/16	-0.796 (0)/17	0.627 (0.016)/14	0.369/17	0.563 (0.019)/17	0.654 (0.011)/14
fldg_obs.ch_adj	-0.787 (0.007)/10	-0.447/17	-0.544 (0.024)/17	-0.398/16	-0.575 (0.016)/17	0.634 (0.015)/14	0.344/17	0.348/17	0.625 (0.017)/14
pop_prod	0.783 (0.004)/11	0.435/19	0.536 (0.018)/19	0.492 (0.045)/17	0.57 (0.011)/19	-0.797 (0)/15	-0.456/19	-0.491 (0.033)/19	-0.567 (0.027)/15
Osmerid	0.253/11	0.053/17	0.022/17	0.077/15	0.026/17	-0.028/14	-0.128/17	-0.213/17	0.323/15
Salmonid	-0.455/11	-0.354/17	-0.374/17	-0.387/15	-0.375/17	0.511/14	0.186/17	0.33/17	0.371/15
Gadid	-0.109/11	0.084/17	0.106/17	0.003/15	0.109/17	-0.123/14	-0.015/17	0.036/17	-0.508/15
Sand.lance	-0.009/11	-0.052/17	-0.026/17	0.019/15	-0.026/17	-0.056/14	0.035/17	0.148/17	-0.04/15

PARA_93_14_lag 1	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
hd_obs	0.844/5	-0.511/12	-0.522/11	-0.575/12	-0.824 (0.003)/10	-0.772 (0.003)/12	0.78 (0.003)/12	-0.288/10	-0.631/10
hd_dd21	0.79/6	-0.619 (0.005)/19	-0.651 (0.009)/15	-0.411/19	-0.832 (0)/15	-0.792 (0)/17	0.571 (0.011)/19	-0.15/17	-0.517 (0.033)/17
hd_dd21_10	0.822 (0.045)/6	-0.626 (0.004)/19	-0.635 (0.011)/15	-0.452/19	-0.81 (0)/15	-0.787 (0)/17	0.643 (0.003)/19	-0.186/17	-0.57 (0.017)/17
fdd	0.9 (0.037)/5	-0.655 (0.004)/17	-0.626 (0.017)/14	-0.579 (0.015)/17	-0.819 (0)/14	-0.795 (0)/16	0.603 (0.01)/17	-0.006/15	-0.58 (0.024)/15
hd_obs_or_dd21_10	0.726/6	-0.6 (0.007)/19	-0.586 (0.022)/15	-0.489 (0.034)/19	-0.781 (0.001)/15	-0.787 (0)/17	0.695 (0.001)/19	-0.245/17	-0.53 (0.029)/17
egg	0.097/5	0.455/16	0.449/14	0.594 (0.015)/16	0.739 (0.003)/14	0.592 (0.016)/16	-0.569 (0.021)/16	0.317/14	0.123/14
egg_or_ch	0.084/6	0.246/19	0.317/15	0.464 (0.045)/19	0.604 (0.017)/15	0.418/17	-0.418/19	0.255/17	-0.114/17
chick	-0.429/6	0.522 (0.022)/19	0.593 (0.02)/15	0.522 (0.022)/19	0.796 (0)/15	0.669 (0.003)/17	-0.602 (0.006)/19	0.209/17	0.397/17
ch_w_egg	-0.669/5	0.226/17	0.339/14	0.348/17	0.409/14	0.396/16	-0.492 (0.045)/17	0.215/15	-0.012/15
ch.egg	-0.736/5	0.524 (0.037)/16	0.699 (0.005)/14	0.511 (0.043)/16	0.747 (0.002)/14	0.636 (0.008)/16	-0.556 (0.025)/16	-0.068/14	0.322/14
fldg_obs	-0.503/5	-0.357/7	-0.477/6	-0.147/7	-0.298/5	0.038/7	-0.149/7	0.153/5	0.223/5
fldg_10	-0.468/6	0.471 (0.042)/19	0.53 (0.042)/15	0.437/19	0.767 (0.001)/15	0.641 (0.006)/17	-0.587 (0.008)/19	0.157/17	0.39/17
fldg_10.egg	-0.695/5	0.558 (0.025)/16	0.682 (0.007)/14	0.519 (0.039)/16	0.842 (0)/14	0.746 (0.001)/16	-0.665 (0.005)/16	-0.116/14	0.458/14
fldg_10.ch	-0.395/6	0.191/19	0.145/15	0.089/19	0.414/15	0.339/17	-0.313/19	-0.107/17	0.215/17
fldg_obs.egg_adj	-0.673/5	0.586 (0.014)/17	0.636 (0.014)/14	0.492 (0.045)/17	0.789 (0.001)/14	0.693 (0.003)/16	-0.654 (0.004)/17	-0.002/15	0.578 (0.024)/15
fldg_obs/ch_adj	-0.663/5	0.388/17	0.395/14	0.358/17	0.586 (0.028)/14	0.505 (0.046)/16	-0.593 (0.012)/17	0.079/15	0.498/15
pop_prod	-0.333/6	-0.599 (0.007)/19	-0.543 (0.037)/15	-0.604 (0.006)/19	-0.763 (0.001)/15	-0.566 (0.018)/17	0.634 (0.004)/19	-0.146/17	-0.271/17
Osmerid	-0.127/6	-0.115/17	-0.251/14	-0.009/17	-0.034/15	0.09/15	-0.062/17	0.012/16	0.118/16
Salmonid	-0.151/6	0.232/17	0.369/14	-0.145/17	0.306/15	0.285/15	-0.358/17	0.322/16	-0.003/16
Gadid	0.387/6	-0.065/17	0.034/14	-0.141/17	-0.104/15	-0.227/15	0.136/17	0.096/16	-0.207/16
Sand.lance	-0.37/6	0.109/17	0.315/14	0.121/17	0.06/15	-0.025/15	0.184/17	-0.385/16	0.046/16

Table 47: columns continued.

PARA_93_14_lag 1	Gadid	Sand.lance
hd_obs	0.268/10	0.266/10
hd_dd21	0.214/17	0.018/17
hd_dd21_10	0.201/17	0.179/17
fdd	0.12/15	-0.068/15
hd_obs_or_dd21_10	0.261/17	0.228/17
egg	-0.304/14	-0.319/14
egg_or_ch	-0.251/17	-0.231/17
chick	-0.23/17	-0.176/17
ch_w_egg	-0.277/15	-0.201/15
ch.egg	-0.019/14	0.16/14
fldg_obs	0.001/5	-0.169/5
fldg_10	-0.172/17	-0.185/17
fldg_10.egg	0.044/14	0.007/14
fldg_10.ch	0.085/17	-0.128/17
fldg_obs.egg_adj	-0.021/15	-0.221/15
fldg_obs.ch_adj	-0.05/15	-0.422/15
pop_prod	0.35/17	0.118/17
Osmerid	-0.192/16	0.208/16
Salmonid	-0.261/16	-0.153/16
Gadid	0.06/16	-0.203/16
Sand.lance	0.519 (0.04)/16	-0.018/16

Table 48. Correlation results between pairs of common murre biological parameters for the years 1993-2014. Parameters in columns have been matched with the 2-years-previous parameters in rows. Parameter abbreviations are explained in Table 11. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years. The table columns continue on following pages. p-values <0.001 are displayed as zeros.

PARA_93_14_lag 2	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
hd_obs	0.915 (0.004)/7	0.631/10	0.723 (0.018)/10	0.631/10	0.771 (0.009)/10	-0.892 (0.001)/9	-0.818 (0.004)/10	-0.721 (0.019)/10	-0.8 (0.01)/9
hd_dd21	0.932 (0)/10	0.715 (0.001)/18	0.83 (0)/18	0.759 (0.001)/16	0.856 (0)/18	-0.785 (0.001)/15	-0.598 (0.009)/18	-0.683 (0.002)/18	-0.702 (0.004)/15
hd_dd21_10	0.933 (0)/10	0.695 (0.001)/18	0.81 (0)/18	0.758 (0.001)/16	0.841 (0)/18	-0.837 (0)/15	-0.631 (0.005)/18	-0.679 (0.002)/18	-0.726 (0.002)/15
fdd	0.948 (0)/8	0.721 (0.002)/16	0.828 (0)/16	0.725 (0.003)/14	0.855 (0)/16	-0.844 (0)/13	-0.63 (0.009)/16	-0.8 (0)/16	-0.645 (0.017)/13
hd_obs_or_dd21_10	0.91 (0)/10	0.643 (0.004)/18	0.764 (0)/18	0.691 (0.003)/16	0.801 (0)/18	-0.852 (0)/15	-0.662 (0.003)/18	-0.657 (0.003)/18	-0.745 (0.001)/15
egg	-0.741 (0.036)/8	-0.452/14	-0.502/14	-0.437/13	-0.495/14	0.419/12	0.245/14	0.167/14	0.696 (0.012)/12
egg_or_ch	-0.3/10	-0.39/18	-0.392/18	-0.336/16	-0.357/18	0.398/15	0.248/18	0.309/18	0.442/15
chick	-0.665 (0.036)/10	-0.633 (0.005)/18	-0.69 (0.002)/18	-0.623 (0.01)/16	-0.668 (0.002)/18	0.675 (0.006)/15	0.428/18	0.462/18	0.636 (0.011)/15
ch_w_egg	-0.887 (0.003)/8	-0.077/15	-0.295/15	-0.416/13	-0.371/15	0.564/12	0.582 (0.023)/15	0.265/15	0.724 (0.008)/12
ch.egg	-0.535/8	-0.598 (0.024)/14	-0.693 (0.006)/14	-0.605 (0.028)/13	-0.647 (0.012)/14	0.67 (0.017)/12	0.494/14	0.653 (0.011)/14	0.515/12
fldg_obs	0.269/4	0.511/5	0.474/5	0.337/5	0.41/5	0.655/5	0.663/5	0.24/5	-0.579/4
fldg_10	-0.726 (0.017)/10	-0.585 (0.011)/18	-0.65 (0.004)/18	-0.611 (0.012)/16	-0.643 (0.004)/18	0.672 (0.006)/15	0.479 (0.044)/18	0.467/18	0.693 (0.004)/15
fldg_10.egg	-0.766 (0.027)/8	-0.621 (0.018)/14	-0.721 (0.004)/14	-0.687 (0.009)/13	-0.714 (0.004)/14	0.75 (0.005)/12	0.623 (0.017)/14	0.684 (0.007)/14	0.666 (0.018)/12
fldg_10.ch	-0.569/10	-0.301/18	-0.34/18	-0.354/16	-0.384/18	0.455/15	0.414/18	0.363/18	0.527 (0.043)/15
fldg_obs.egg_adj	-0.849 (0.008)/8	-0.631 (0.012)/15	-0.744 (0.001)/15	-0.76 (0.003)/13	-0.749 (0.001)/15	0.816 (0.001)/12	0.593 (0.02)/15	0.712 (0.003)/15	0.675 (0.016)/12
fldg_obs.ch_adj	-0.843 (0.009)/8	-0.45/16	-0.584 (0.017)/16	-0.652 (0.011)/14	-0.635 (0.008)/16	0.767 (0.002)/13	0.633 (0.008)/16	0.557 (0.025)/16	0.625 (0.022)/13
pop_prod	0.639 (0.047)/10	0.455/18	0.51 (0.031)/18	0.438/16	0.533 (0.023)/18	-0.572 (0.026)/15	-0.405/18	-0.265/18	-0.727 (0.002)/15
Osmerid	-0.228/10	0.093/18	0.124/18	0.191/16	0.04/18	0.246/15	0.259/18	0.056/18	0.252/15
Salmonid	-0.723 (0.018)/10	-0.462/18	-0.577 (0.012)/18	-0.64 (0.008)/16	-0.609 (0.007)/18	0.261/15	0.235/18	0.316/18	0.553 (0.033)/15
Gadid	0.358/10	-0.04/18	-0.05/18	-0.132/16	0.013/18	-0.17/15	-0.146/18	0.009/18	-0.248/15
Sand.lance	-0.025/10	-0.074/18	-0.106/18	-0.106/16	-0.032/18	-0.297/15	-0.353/18	-0.001/18	-0.365/15

PARA_93_14_lag 2	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
hd_obs	-0.839/4	-0.747 (0.013)/10	-0.515/9	-0.647 (0.043)/10	-0.822 (0.007)/9	-0.724 (0.018)/10	0.819 (0.004)/10	0.037/8	-0.483/8
hd_dd21	-0.025/6	-0.702 (0.001)/18	-0.685 (0.005)/15	-0.498 (0.035)/18	-0.783 (0.001)/15	-0.751 (0.001)/16	0.708 (0.001)/18	-0.063/16	-0.49/16
hd_dd21_10	-0.693/6	-0.694 (0.001)/18	-0.626 (0.012)/15	-0.481 (0.044)/18	-0.78 (0.001)/15	-0.76 (0.001)/16	0.78 (0)/18	-0.116/16	-0.367/16
fdd	-0.976 (0.024)/4	-0.796 (0)/16	-0.705 (0.007)/13	-0.555 (0.026)/16	-0.848 (0)/13	-0.748 (0.002)/14	0.774 (0)/16	0.027/14	-0.222/14
hd_obs_or_dd21_10	-0.813 (0.049)/6	-0.682 (0.002)/18	-0.579 (0.024)/15	-0.476 (0.046)/18	-0.743 (0.002)/15	-0.729 (0.001)/16	0.763 (0)/18	-0.086/16	-0.367/16
egg	-0.207/4	0.279/14	0.106/12	0.37/14	0.645 (0.024)/12	0.406/13	-0.418/14	-0.019/12	0.492/12
egg_or_ch	0.504/6	0.376/18	0.24/15	0.363/18	0.631 (0.012)/15	0.322/16	-0.388/18	-0.343/16	0.316/16
chick	0.041/6	0.511 (0.03)/18	0.367/15	0.436/18	0.682 (0.005)/15	0.594 (0.015)/16	-0.526 (0.025)/18	-0.116/16	0.553 (0.026)/16
ch_w_egg	0.755/4	0.354/15	0.323/12	0.313/15	0.637 (0.026)/12	0.613 (0.026)/13	-0.555 (0.032)/15	-0.218/13	-0.2/13
ch.egg	0.606/4	0.676 (0.008)/14	0.583 (0.047)/12	0.629 (0.016)/14	0.768 (0.004)/12	0.705 (0.007)/13	-0.552 (0.041)/14	-0.466/12	0.352/12
fldg_obs	0.483/4	0.22/5	-0.237/5	-0.195/5	-0.088/4	-0.421/5	0.195/5	-0.877/3	0.256/3
fldg_10	0.393/6	0.517 (0.028)/18	0.384/15	0.44/18	0.667 (0.007)/15	0.586 (0.017)/16	-0.564 (0.015)/18	-0.07/16	0.449/16
fldg_10.egg	0.624/4	0.707 (0.005)/14	0.603 (0.038)/12	0.621 (0.018)/14	0.803 (0.002)/12	0.722 (0.005)/13	-0.718 (0.004)/14	-0.288/12	0.319/12
fldg_10.ch	0.782/6	0.36/18	0.28/15	0.233/18	0.325/15	0.36/16	-0.447/18	0.126/16	0.106/16
fldg_obs.egg_adj	0.667/4	0.702 (0.004)/15	0.581 (0.048)/12	0.472/15	0.841 (0.001)/12	0.734 (0.004)/13	-0.81 (0)/15	0.024/13	0.059/13
fldg_obs.ch_adj	0.713/4	0.548 (0.028)/16	0.409/13	0.319/16	0.656 (0.015)/13	0.622 (0.018)/14	-0.78 (0)/16	0.132/14	-0.136/14
pop_prod	-0.187/6	-0.344/18	-0.142/15	-0.424/18	-0.512/15	-0.563 (0.023)/16	0.532 (0.023)/18	-0.097/16	-0.262/16
Osmerid	-0.922 (0.009)/6	0.071/18	0.233/15	0.004/18	-0.201/15	-0.146/16	0.042/18	0.283/16	0.215/16
Salmonid	0.227/6	0.425/18	0.558 (0.031)/15	0.518 (0.028)/18	0.606 (0.017)/15	0.602 (0.014)/16	-0.388/18	0.144/16	0.267/16
Gadid	0.438/6	-0.045/18	-0.255/15	-0.078/18	0.12/15	0.051/16	-0.105/18	-0.366/16	-0.191/16

Table 48: columns continued.

PARA_93_14_lag 2	Gadid	Sand.lance
hd_obs	0.18/8	0.031/8
hd_dd21	0.104/16	0.269/16
hd_dd21_10	0.18/16	0.266/16
fdd	0.003/14	0.266/14
hd_obs_or_dd21_10	0.186/16	0.215/16
egg	-0.057/12	-0.239/12
egg_or_ch	0.186/16	0.05/16
chick	0.005/16	-0.072/16
ch_w_egg	0.258/13	-0.311/13
ch_w_egg/egg	0.319/12	0.163/12
fldg_obs	0.742/3	-0.462/3
fldg_10	0.012/16	-0.213/16
fldg_10/egg	0.252/12	-0.193/12
fldg_10/ch	0.052/16	-0.628 (0.009)/16
fldg_obs/egg_adj	-0.033/13	-0.294/13
fldg_obs/ch_adj	-0.104/14	-0.449/14
pop_prod	0.05/16	0.36/16
Osmerid	-0.309/16	-0.142/16
Salmonid	-0.201/16	-0.066/16
Gadid	0.347/16	0.191/16
Sand.lance	0.171/16	-0.04/16

Table 49. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise t-tests to identify significantly different year-pairs for common murre egg counts on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Eggs; proportion-of-maximum arcsine-transformed; plots pooled.

Eggs,proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	-	-	-	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	0.027(+)	x	x	x	x	-	-	-	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	0.001(+)	x	x	x	x	-	-	-	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	-	-	-	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	x	x	x	-	-	-	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.012(+)	x	x	x	x	-	-	-	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	0.021(+)	x	x	x	x	-	-	-	x	x	x	x	x	x	--	--	--	--	--
2010	x	x	0.026(+)	x	x	x	x	-	-	-	x	x	x	x	x	x	x	--	--	--	--
2011	x	x	0.008(+)	x	x	x	x	-	-	-	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--
2014	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x	x	x	x	x	-	-

Table 50. Treatment means for significantly different year-pairs for common murre egg counts on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 49). Means are separated by a slash; the column-year is first. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Eggs, proportion-of-maximum, plots pooled.

Eggs,proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	-	-	-	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	0.92/0.72	x	x	x	x	-	-	-	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	0.92/0.65	x	x	x	x	-	-	-	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	-	-	-	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	x	x	x	-	-	-	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.92/0.67	x	x	x	x	-	-	-	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	0.92/0.71	x	x	x	x	-	-	-	x	x	x	x	x	x	--	--	--	--	--
2010	x	x	0.92/0.70	x	x	x	x	-	-	-	x	x	x	x	x	x	x	--	--	--	--
2011	x	x	0.92/0.69	x	x	x	x	-	-	-	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--
2014	x	x	x	x	x	x	x	-	-	-	x	x	x	x	x	x	x	x	x	-	-

Table 51. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise paired t-tests to identify significantly different year-pairs for common murre egg counts on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Eggs; raw counts; plots paired.

Eggs, raw counts, plots paired																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	-	-	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	-	-	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-	-	x	x	x	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--
2003	-	-	x	x	x	-	x	-	-	-	--	--	--	--	--	--	--	--	--	--	--
2004	-	-	x	x	x	-	x	-	-	-	x	--	--	--	--	--	--	--	--	--	--
2005	-	-	x	x	x	-	x	-	-	-	x	x	--	--	--	--	--	--	--	--	--
2006	-	-	x	x	x	-	x	-	-	-	x	x	x	--	--	--	--	--	--	--	--
2007	-	-	x	x	x	-	x	-	-	-	x	x	x	x	--	--	--	--	--	--	--
2008	-	-	x	x	x	-	x	-	-	-	x	x	x	x	x	--	--	--	--	--	--
2009	-	-	x	x	x	-	x	-	-	-	x	x	x	x	x	x	--	--	--	--	--
2010	-	-	x	x	x	-	x	-	-	-	x	x	x	x	x	x	x	--	--	--	--
2011	-	-	x	x	x	-	x	-	-	-	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 52. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise t-tests to identify significantly different year-pairs for common murre chick counts on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Chicks; proportion-of-maximum arcsine-transformed; plots pooled.

Chicks, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	x	x	0.016(+)	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	0.031(+)	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.022(+)	x	0.006(+)	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	x	0.035(+)	<0.001(+)	x	<0.001(+)	x	x	<0.001(+)	0.020(+)	x	0.002(+)	x	x	x	x	x	x	--	--	--	--
2011	x	x	<0.001(+)	x	<0.001(+)	x	x	<0.001(+)	0.037(+)	x	0.004(+)	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	x	x	0.035(+)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	--
2014	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	x

Table 53. Treatment means for significantly different year-pairs for common murre chick counts on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 52). Means are separated by a slash; the column-year is first. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Chicks; proportion-of-maximum; plots pooled.

Eggs, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	x	x	0.88/0.61	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	0.88/0.62	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.87/0.59	x	0.88/0.59	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	x	0.79/0.46	0.87/0.46	x	0.88/0.46	x	x	0.81/0.46	0.79/0.46	x	0.81/0.46	x	x	x	x	x	x	--	--	--	--
2011	x	x	0.87/0.47	x	0.88/0.47	x	x	0.81/0.47	0.79/0.47	x	0.81/0.47	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	x	x	0.88/0.63	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--
2014	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 54. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise paired t-tests to identify significantly different year-pairs for common murre chick counts on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An “x” indicates that the difference was not significant. Plots were the sample units. This test: Chicks; raw counts; plots paired.

Chicks, raw counts, plots paired																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	-	-	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	-	-	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	-	-	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-	-	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--
2003	-	-	x	x	x	x	x	x	x	-	--	--	--	--	--	--	--	--	--	--	--
2004	-	-	x	x	x	x	x	x	x	-	x	--	--	--	--	--	--	--	--	--	--
2005	-	-	x	x	x	x	x	x	x	-	x	x	--	--	--	--	--	--	--	--	--
2006	-	-	x	x	x	x	x	x	x	-	x	x	x	--	--	--	--	--	--	--	--
2007	-	-	x	x	0.007(+)	x	x	x	x	-	x	x	x	x	--	--	--	--	--	--	--
2008	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	--	--	--	--	--	--
2009	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	x	--	--	--	--	--
2010	-	-	0.046(+)	x	0.046(+)	x	x	x	0.032(+)	-	x	x	x	x	x	x	x	--	--	--	--
2011	-	-	x	x	0.046(+)	x	x	x	x	-	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	--
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 55. Treatment means for significantly different year-pairs for proportion-of-maximum common murre chick counts on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 54). Means are separated by a slash and the column-year is first. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Plots were the sample units. This table: Chicks; raw counts; plots paired.

Chicks, raw counts, plots paired																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	-	-	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	-	-	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	-	-	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-	-	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	-	-	-	-	-	-	-	--	--	--	--	--	--	--	--	--	--	--	--
2003	-	-	x	x	x	x	x	x	x	-	--	--	--	--	--	--	--	--	--	--	--
2004	-	-	x	x	x	x	x	x	x	-	x	--	--	--	--	--	--	--	--	--	--
2005	-	-	x	x	x	x	x	x	x	-	x	x	--	--	--	--	--	--	--	--	--
2006	-	-	x	x	x	x	x	x	x	-	x	x	x	--	--	--	--	--	--	--	--
2007	-	-	x	x	28/20	x	x	x	x	-	x	x	x	x	--	--	--	--	--	--	--
2008	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	--	--	--	--	--	--
2009	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	x	--	--	--	--	--
2010	-	-	28/15	x	28/15	x	x	x	25/15	-	x	x	x	x	x	x	x	--	--	--	--
2011	-	-	x	x	28/15	x	x	x	x	-	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	--
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 56. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise, non-paired ("(A)",with proportion-of-maximum arcsine-transformed counts) and paired ("(B)", with raw counts) t-tests to identify significantly different year-pairs for common murre aged-fledgling counts on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An "x" indicates that the difference was not significant. Plots were the sample units.

(A)

flg_obs, proportion, not paired						
Year	1994	1995	1996	1997	1998	1999
1995	x	--	--	--	--	--
1996	x	x	--	--	--	--
1997	x	x	0.028(-)[a]	--	--	--
1998	x	x	x	0.002(+)[b]	--	--
1999	x	x	x	x	x	--

[a] 1996 mean: 0.70; 1997 mean: 0.91
[b] 1997 mean: 0.91; 1998 mean: 0.60

(B)

flg_obs, raw, paired						
Year	1994	1995	1996	1997	1998	1999
1995	x	--	--	--	--	--
1996	x	x	--	--	--	--
1997	x	x	x	--	--	--
1998	x	x	x	x	--	--
1999	x	x	x	x	x	--

Table 57. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise t-tests to identify significantly different year-pairs for counts of common murre chicks seen at least 10 days after their plots' mean hatch date, on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An "x" indicates that the difference was not significant. A single dash indicates "no data". Plots were the sample units. This table: Chicks seen at least 10 days after their plots' mean hatch dates; proportion-of-maximum arcsine transformed; plots pooled.

Ch_10, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	0.040(-)	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	0.036(+)	x	0.010(+)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	0.046(+)	x	0.013(+)	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	0.046(+)	x	0.013(+)	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	0.020(+)	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.007(+)	x	0.002(+)	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	0.004(+)	x	0.001(+)	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	x	x	<0.001(+)	x	<0.001(+)	x	x	x	0.042(+)	x	x	x	x	x	x	x	x	--	--	--	--
2011	x	x	<0.001(+)	x	<0.001(+)	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	x	x	0.032(+)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--
2014	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 58. Treatment means for significantly different year-pairs for counts of common murre chicks seen at least 10 days after their plots' mean hatch date, on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 57). Means are separated by a slash; the column-year is first. An "x" indicates that the difference was not significant. A single dash indicates "no data". Plots were the sample units. This table: Chicks seen at least 10 days after their plots' mean hatch dates; proportion-of-maximum; plots pooled.

Ch_10, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	0.56/0.88	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	x	0.86/0.56	x	0.88/0.56	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	0.86/0.56	x	0.88/0.56	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	x	0.86/0.56	x	0.88/0.56	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	x	x	x	0.88/0.56	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	x	x	0.86/0.51	x	0.88/0.51	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	x	0.86/0.50	x	0.88/0.50	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	x	x	0.86/0.42	x	0.88/0.42	x	x	x	0.77/0.42	x	x	x	x	x	x	x	x	--	--	--	--
2011	x	x	0.86/0.42	x	0.88/0.42	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	x	x	0.88/0.58	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--
2014	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 59. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise paired t-tests to identify significantly different year-pairs for counts of common murre chicks seen at least 10 days after their plots' mean hatch date, on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An "x" indicates that the difference was not significant. A single dash indicates "no data". Plots were the sample units. This table: Chicks seen at least 10 days after their plots' mean hatch dates; raw counts; plots paired.

Ch_10, raw counts, plots paired																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	-	-	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	-	-	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	-	-	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-	-	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	-	-	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	-	-	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	-	-	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	-	-	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	-	-	x	x	0.006(+)	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	-	-	x	x	0.050(+)	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	-	-	0.022(+)	x	0.018(+)	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	x	x	0.030(+)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 60. Treatment means for significantly different year-pairs for common murre chicks seen at least 10 days after their plots' mean hatch date, on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 59). Means are separated by a slash; the column-year is first. An "x" indicates that the difference was not significant. A single dash indicates "no data". Plots were the sample units. Chicks seen at least 10 days after their plots' mean hatch dates; raw counts; plots paired.

Ch_10, raw counts, plots paired																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	-	-	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	-	-	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	-	-	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	-	-	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-	-	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	-	-	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	-	-	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	-	-	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	-	-	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	-	-	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	-	-	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--
2006	-	-	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	-	-	x	x	27/18	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--
2008	-	-	x	x	27/16	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--
2010	-	-	26/13	x	27/13	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	-	-	x	x	27/18	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	--
2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 61. Adjusted p-values (Holm method in R) from post-hoc ANOVA pairwise t-tests to identify significantly different year-pairs for counts of common murre adults on productivity plots at East Amatuli Island, Alaska. Signs in parentheses indicate that the column-year is higher or lower than the row-year. An "x" indicates that the difference was not significant. A single dash indicates "no data". Daily summary counts were the sample units. This table: Adults; proportion-of-maximum arcsine-transformed; dates pooled.

Adult counts, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	0.028(+)	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	0.049(-)	0.001(-)	0.017(-)	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	<0.001(-)	<0.001(-)	<0.001(-)	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	0.028(-)	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	0.043(-)	x	0.004(-)	0.005(-)	0.006(-)	--	--	--	--	--	--	--	--	--
2006	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	0.001(-)	x	x	0.030(-)	0.045(-)	0.048(-)	x	x	--	--	--	--	--	--	--
2008	x	0.010(-)	<0.001(-)	0.004(-)	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	0.011(-)	x	<0.001(-)	<0.001(-)	<0.001(-)	x	x	x	x	--	--	--	--	--
2010	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--
2011	x	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	<0.001(-)	0.031(-)	x	0.002(-)	0.003(-)	0.004(-)	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	0.044(-)	x	x	x	x	x	x	x	x	x	<0.001(+)	x	0.002(+)	x	<0.001(+)	x	<0.001(+)	x	--
2014	x	x	x	x	x	x	0.001(+)	x	<0.001(+)	x	x	x	<0.001(+)	<0.001(+)	<0.001(+)	0.010(+)	<0.001(+)	<0.001(+)	<0.001(+)	x	x

Table 62. Treatment means for significantly different year-pairs for proportion-of-maximum counts of common murre adults on productivity plots at East Amatuli Island, Alaska (p-values are listed in Table 61). Means are separated by a slash; the column-year is first. An “x” indicates that the difference was not significant. A single dash indicates “no data”. Daily summary counts were the sample units. This table: Adults; proportion-of-maximum; dates pooled.

Adult counts, proportion, plots pooled																					
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1994	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	0.66/0.55	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998	x	0.57/0.63	0.55/0.63	0.56/0.63	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	x	0.57/0.64	0.55/0.64	0.56/0.64	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2001	x	0.57/0.71	0.55/0.71	0.56/0.71	0.59/0.71	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--	--
2002	x	x	0.55/0.64	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--	--
2003	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--	--
2004	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--	--	--
2005	x	0.57/0.76	0.55/0.76	0.56/0.76	0.59/0.76	0.63/0.76	0.64/0.76	0.62/0.76	x	0.64/0.76	0.64/0.76	0.64/0.76	--	--	--	--	--	--	--	--	--
2006	x	0.57/0.70	0.55/0.70	0.56/0.70	0.59/0.70	x	x	x	x	x	x	x	x	--	--	--	--	--	--	--	--
2007	x	0.57/0.73	0.55/0.73	0.56/0.73	0.59/0.73	0.63/0.73	0.64/0.73	x	x	0.64/0.73	0.64/0.73	0.64/0.73	x	x	--	--	--	--	--	--	--
2008	x	0.57/0.68	0.55/0.68	0.56/0.68	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--	--	--
2009	x	0.57/0.77	0.55/0.77	0.56/0.77	0.59/0.77	0.63/0.77	0.64/0.77	0.62/0.77	x	0.64/0.77	0.64/0.77	0.64/0.77	x	x	x	x	--	--	--	--	--
2010	x	0.57/0.72	0.55/0.72	0.56/0.72	0.59/0.72	x	x	x	x	x	x	x	x	x	x	x	x	--	--	--	--
2011	x	0.57/0.76	0.55/0.76	0.56/0.76	0.59/0.76	0.63/0.76	0.64/0.76	0.62/0.76	x	0.64/0.76	0.64/0.76	0.64/0.76	x	x	x	x	x	x	--	--	--
2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	--	--
2013	x	x	0.55/0.63	x	x	x	x	x	x	x	x	x	0.76/0.63	x	0.73/0.63	x	0.77/0.63	x	0.76/0.63	x	--
2014	x	x	x	x	x	x	0.64/0.57	x	0.71/0.57	x	x	x	0.76/0.57	0.70/0.57	0.73/0.57	0.68/0.57	0.77/0.57	0.72/0.57	0.76/0.57	x	x

Table 63. Environmental variables used in this report and the number of months of data available for each year.

Variable	Year																																										
	76	77	78	80	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Seldovia SST monthly anomaly	12	9	8	7	12	12	12	12	12	12	12	12	12	11	12	8	7	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
NOAA buoy 46001 SST monthly anomaly	6	12	10	11	12	12	12	7	12	12	12	12	9	12	12	12	8	12	12	12	12	12	12	12	12	12	9	12	12	7	12	12	12	12	12	12	12
GAK1 moored buoy SST monthly anomaly																					10	1	12	12	12	12	8	12	12	12	12	12	12	12	12	12	2
East Amatuli Island SST monthly anomaly																				3	7	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	9
North Pacific Index (monthly)									12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Pacific Decadal Oscillation (monthly)									12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Table 64. Correlation coefficient, sample size, p-value, and significance indicator for comparisons of sea surface temperature (SST) monthly anomaly at paired locations near East Amatuli Island, Alaska. Sample size is the number of years with data previous to and including 2014; years are listed in Table 63.

Seldovia and Amatuli Cove

Month	r	n	P	<0.5
Jan	0.930	16	<0.001	Y
Feb	0.914	16	<0.001	Y
Mar	0.889	16	<0.001	Y
Apr	0.901	16	<0.001	Y
May	0.937	16	<0.001	Y
Jun	0.894	17	<0.001	Y
Jul	0.705	18	0.001	Y
Aug	0.919	18	<0.001	Y
Sep	0.748	18	0.001	Y
Oct	0.681	16	0.004	Y
Nov	0.820	16	<0.001	Y
Dec	0.826	16	<0.001	Y

Seldovia and Buoy 46001

Month	r	n	P	<0.5
Jan	0.491	35	0.003	Y
Feb	0.688	33	<0.001	Y
Mar	0.65	34	<0.001	Y
Apr	0.7	33	<0.001	Y
May	0.576	33	<0.001	Y
Jun	0.613	34	<0.001	Y
Jul	0.363	37	0.027	Y
Aug	0.427	38	0.007	Y
Sep	0.177	36	0.303	-
Oct	0.468	35	0.005	Y
Nov	0.613	36	<0.001	Y
Dec	0.623	35	<0.001	Y

Table 64 (rows continued)

Seldovia and GAK1 mooring

Month	r	n	P	<0.5
Jan	0.93	14	<0.001	Y
Feb	0.915	14	<0.001	Y
Mar	0.83	14	<0.001	Y
Apr	0.917	14	<0.001	Y
May	0.949	15	<0.001	Y
Jun	0.556	15	0.031	Y
Jul	0.528	15	0.043	Y
Aug	0.29	15	0.294	-
Sep	0.252	15	0.365	-
Oct	0.146	14	0.618	-
Nov	0.707	14	0.005	Y
Dec	0.719	15	0.003	Y

Amatuli Cove and Buoy 46001

Month	r	n	P	<0.5
Jan	0.753	15	0.001	Y
Feb	0.747	14	0.002	Y
Mar	0.76	14	0.002	Y
Apr	0.696	14	0.006	Y
May	0.574	15	0.025	Y
Jun	0.452	16	0.079	-
Jul	0.433	17	0.082	-
Aug	0.621	18	0.006	Y
Sep	0.565	18	0.015	Y
Oct	0.258	16	0.336	-
Nov	0.557	16	0.025	Y
Dec	0.729	15	0.002	Y

Table 64 (rows continued)

Amatuli Cove and GAK1 mooring

Month	r	n	P	<0.5
Jan	0.951	14	<0.001	Y
Feb	0.964	14	<0.001	Y
Mar	0.947	13	<0.001	Y
Apr	0.926	13	<0.001	Y
May	0.933	14	<0.001	Y
Jun	0.627	15	0.012	Y
Jul	0.513	15	0.05	-
Aug	0.155	15	0.58	-
Sep	0.188	15	0.502	-
Oct	-0.065	14	0.824	-
Nov	0.567	14	0.035	Y
Dec	0.833	15	<0.001	Y

GAK1 mooring and Buoy 46001

Month	r	n	P	<0.5
Jan	0.705	13	0.007	Y
Feb	0.755	13	0.003	Y
Mar	0.812	13	0.001	Y
Apr	0.766	13	0.002	Y
May	0.487	14	0.077	-
Jun	0.265	14	0.359	-
Jul	-0.354	14	0.214	-
Aug	-0.326	15	0.236	-
Sep	-0.669	15	0.006	Y
Oct	-0.353	14	0.216	-
Nov	0.267	14	0.357	-
Dec	0.584	14	0.028	Y

Table 65. Correlation coefficient, sample size, p-value, and significance indicator for comparisons of monthly values for the Pacific Decadal Oscillation (PDO) and the North Pacific Index (NPI) with sea surface temperature (SST) monthly anomaly at locations near East Amatuli Island, Alaska. Sample size is the number of years with data previous to and including 2014; years are listed in Table 63.

PDO and Amatuli Cove mooring

Month	r	n	P	<0.5
Jan	0.748	16	0.001	Y
Feb	0.806	16	<0.001	Y
Mar	0.829	16	<0.001	Y
Apr	0.706	16	0.002	Y
May	0.746	16	0.001	Y
Jun	0.591	17	0.012	Y
Jul	0.592	18	0.01	Y
Aug	0.618	18	0.006	Y
Sep	0.567	18	0.014	Y
Oct	0.187	16	0.488	-
Nov	0.639	16	0.008	Y
Dec	0.768	16	0.001	Y

PDO and Seldovia

Month	r	n	P	<0.5
Jan	0.689	29	<0.001	Y
Feb	0.762	29	<0.001	Y
Mar	0.585	29	0.001	Y
Apr	0.453	29	0.014	Y
May	0.543	28	0.003	Y
Jun	0.499	30	0.005	Y
Jul	0.482	30	0.007	Y
Aug	0.442	30	0.014	Y
Sep	0.221	29	0.25	-
Oct	0.313	29	0.099	-
Nov	0.723	29	<0.001	Y
Dec	0.738	29	<0.001	Y

Table 65 (rows continued).

PDO and Buoy 46001

Month	r	n	P	<0.5
Jan	0.628	28	<0.001	Y
Feb	0.708	27	<0.001	Y
Mar	0.688	27	<0.001	Y
Apr	0.635	26	<0.001	Y
May	0.681	28	<0.001	Y
Jun	0.565	28	0.002	Y
Jul	0.242	29	0.206	-
Aug	0.346	30	0.061	-
Sep	0.477	30	0.008	Y
Oct	0.511	30	0.004	Y
Nov	0.851	30	<0.001	Y
Dec	0.825	29	<0.001	Y

PDO and GAK1 mooring

Month	r	n	P	<0.5
Jan	0.842	14	<0.001	Y
Feb	0.861	14	<0.001	Y
Mar	0.856	14	<0.001	Y
Apr	0.762	14	0.002	Y
May	0.683	15	0.005	Y
Jun	0.503	15	0.056	-
Jul	0.357	15	0.192	-
Aug	0.205	15	0.463	-
Sep	-0.237	15	0.395	-
Oct	-0.055	14	0.853	-
Nov	0.567	14	0.034	Y
Dec	0.608	15	0.016	Y

Table 65 (rows continued).

NPI and Seldovia

Month	r	n	P	<0.5
Jan	-0.548	20	0.012	Y
Feb	-0.257	20	0.275	-
Mar	-0.497	20	0.026	Y
Apr	0.037	20	0.876	-
May	0.096	20	0.688	-
Jun	-0.085	20	0.721	-
Jul	0.141	20	0.553	-
Aug	0.038	20	0.873	-
Sep	0.204	20	0.388	-
Oct	-0.527	20	0.017	Y
Nov	-0.409	20	0.073	-
Dec	-0.328	20	0.158	-

NPI and Amatuli Cove mooring

Month	r	n	P	<0.5
Jan	-0.691	16	0.003	Y
Feb	-0.15	16	0.579	-
Mar	-0.471	16	0.065	-
Apr	-0.204	16	0.448	-
May	-0.086	16	0.751	-
Jun	0.171	17	0.511	-
Jul	0.156	18	0.537	-
Aug	0.031	18	0.904	-
Sep	0.191	18	0.447	-
Oct	0.033	16	0.904	-
Nov	-0.201	16	0.455	-
Dec	-0.482	16	0.059	-

Table 65 (rows continued).

NPI and GAK1 mooring

Month	r	n	P	<0.5
Jan	-0.711	14	0.004	Y
Feb	-0.009	14	0.974	-
Mar	-0.479	14	0.083	-
Apr	0.012	14	0.968	-
May	-0.036	15	0.899	-
Jun	-0.045	15	0.875	-
Jul	0.451	15	0.092	-
Aug	0.462	15	0.083	-
Sep	-0.287	15	0.299	-
Oct	0.077	14	0.795	-
Nov	-0.249	14	0.391	-
Dec	-0.215	15	0.441	-

NPI and PDO

Month	r	n	P	<0.5
Jan	-0.638	20	0.002	Y
Feb	-0.349	20	0.132	-
Mar	-0.535	20	0.015	Y
Apr	-0.578	20	0.008	Y
May	-0.295	20	0.206	-
Jun	-0.014	20	0.952	-
Jul	-0.332	20	0.153	-
Aug	-0.042	20	0.861	-
Sep	-0.174	20	0.464	-
Oct	-0.441	20	0.052	-
Nov	-0.094	20	0.694	-
Dec	-0.445	20	0.049	Y

Table 66. Results of correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the NOAA tide station in Seldovia, Alaska (59°26'25" N, 151°43'13" W; see Figure 2). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

SELD_93_14_lag 0

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.232/11	0.041/20	0.074/20	0.134/18	0.042/20	0.109/16	0.083/20	-0.011/20	-0.111/16
Feb	0.258/11	-0.013/20	0.03/20	0.08/18	0.032/20	0.253/16	0.18/20	0.092/20	-0.164/16
Mar	-0.025/11	-0.198/20	-0.155/20	-0.082/18	-0.158/20	-0.027/16	-0.095/20	-0.013/20	-0.027/16
Apr	0.036/11	-0.163/20	-0.128/20	-0.089/18	-0.133/20	0.199/16	0.199/20	0.027/20	0.041/16
May	0.136/11	-0.035/20	-0.027/20	0.034/18	-0.032/20	0.084/16	0.142/20	0.045/20	-0.135/16
Jun	-0.077/12	-0.113/21	-0.128/21	-0.067/19	-0.124/21	0.097/17	0.136/21	0.097/21	-0.178/17
Jul	-0.298/12	-0.267/21	-0.303/21	-0.299/19	-0.252/21	-0.003/17	0.042/21	0.168/21	-0.292/17
Aug	0.088/12	-0.024/21	-0.061/21	-0.125/19	-0.057/21	0.058/17	0.247/21	0.184/21	-0.096/17
Sep	0.09/12	0.096/20	0.091/20	0.01/18	0.055/20	0.046/16	0.219/20	0.06/20	-0.068/17
Oct	0.339/12	0.422/20	0.39/20	0.352/18	0.365/20	0.027/16	0.132/20	-0.098/20	-0.523 (0.031)/17
Nov	0.146/12	-0.016/20	-0.067/20	-0.016/18	-0.071/20	0.314/16	0.094/20	0.198/20	-0.09/17
Dec	0.443/12	0.278/20	0.221/20	0.25/18	0.218/20	-0.069/16	-0.032/20	0.004/20	-0.379/17

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	-0.56/6	0.034/20	-0.107/16	0.322/20	-0.11/16	0.012/18	0.053/20	0.171/18	0.3/18
Feb	-0.222/6	0.044/20	-0.062/16	0.003/20	-0.114/16	-0.102/18	-0.095/20	0.089/18	0.031/18
Mar	-0.655/6	-0.072/20	-0.033/16	-0.06/20	-0.019/16	-0.004/18	-0.099/20	0.311/18	0.26/18
Apr	-0.679/6	-0.003/20	-0.027/16	0.054/20	-0.052/16	0.029/18	-0.084/20	0.251/18	0.292/18
May	-0.638/6	-0.023/20	-0.014/16	-0.036/20	-0.056/16	0.009/18	-0.075/20	0.185/18	0.114/18
Jun	-0.343/7	0.051/21	0.036/17	0.035/21	0.074/17	0.071/19	-0.015/21	0.103/18	0.145/18
Jul	0.052/7	0.115/21	0.238/17	0.017/21	0.22/17	0.068/19	0.042/21	-0.125/18	0.06/18
Aug	-0.098/7	0.2/21	0.327/17	0.257/21	0.269/17	0.248/19	-0.029/21	-0.165/18	0.088/18
Sep	-0.192/7	0.12/20	0.225/16	0.286/20	0.077/17	0.067/18	0.191/20	-0.098/18	0.246/18
Oct	-0.105/7	-0.157/20	-0.251/16	-0.228/20	-0.323/17	-0.373/18	0.326/20	-0.073/18	-0.2/18
Nov	-0.292/7	0.202/20	0.087/16	0.137/20	0.218/17	0.118/18	-0.265/20	0.111/18	-0.052/18
Dec	-0.232/7	-0.074/20	-0.245/16	-0.193/20	-0.05/17	-0.069/18	0.026/20	-0.04/18	-0.522 (0.026)/18

Month	Gadid	Sand.lance
Jan	0.007/18	-0.426/18
Feb	0.006/18	-0.123/18
Mar	0.015/18	-0.539 (0.021)/18
Apr	-0.016/18	-0.349/18
May	0.076/18	-0.315/18
Jun	0.151/18	-0.311/18
Jul	0.287/18	-0.114/18
Aug	0.269/18	0.128/18
Sep	0.07/18	0.237/18
Oct	0.173/18	-0.137/18
Nov	-0.34/18	0.279/18
Dec	0.021/18	0.237/18

Table 67. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the NOAA tide station in Seldovia, Alaska (59°26'25" N, 151°43'13" W; see Figure 2). Murre parameter values have been matched with the previous years' SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

SELD_93_14_lag 1

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.012/11	-0.089/20	-0.146/20	-0.264/18	-0.118/20	0.168/16	0.322/20	0.155/20	-0.034/16
Feb	-0.218/11	-0.13/20	-0.173/20	-0.388/18	-0.157/20	-0.044/16	0.073/20	-0.049/20	0.114/16
Mar	-0.347/11	-0.262/20	-0.358/20	-0.307/18	-0.357/20	0.293/16	0.291/20	0.337/20	0.061/16
Apr	-0.451/11	-0.35/20	-0.424/20	-0.448/18	-0.396/20	0.223/16	0.161/20	0.213/20	0.266/16
May	-0.28/11	-0.256/20	-0.311/20	-0.313/18	-0.27/20	0.1/16	0.084/20	0.114/20	0.205/16
Jun	-0.215/12	-0.233/21	-0.298/21	-0.334/19	-0.25/21	0.212/17	0.245/21	0.165/21	0.219/17
Jul	-0.075/12	-0.24/21	-0.253/21	-0.278/19	-0.185/21	0.033/17	0.114/21	0.084/21	0.172/17
Aug	-0.107/12	-0.157/21	-0.173/21	-0.302/19	-0.104/21	-0.147/17	0.013/21	-0.025/21	-0.085/17
Sep	0.197/11	0.019/20	0.015/20	-0.192/18	0.081/20	-0.326/16	-0.049/20	-0.096/20	-0.198/16
Oct	0.499/11	0.313/20	0.331/20	0.218/18	0.381/20	-0.351/16	-0.095/20	-0.36/20	-0.105/16
Nov	-0.107/11	-0.223/20	-0.163/20	-0.282/18	-0.176/20	-0.05/16	0.093/20	0.011/20	0.028/16
Dec	0.559/11	-0.027/20	0.091/20	0.037/18	0.123/20	-0.191/16	0.086/20	-0.128/20	-0.359/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.238/6	0.084/20	-0.055/16	-0.057/20	0.21/16	0.203/18	-0.097/20	-0.477/17	-0.226/17
Feb	-0.445/6	-0.034/20	0.03/16	0.051/20	0.229/16	0.266/18	0.009/20	-0.393/17	0.36/17
Mar	0.192/6	0.344/20	0.228/16	0.196/20	0.396/16	0.393/18	0.048/20	-0.426/17	0.401/17
Apr	0.284/6	0.252/20	0.197/16	0.213/20	0.447/16	0.397/18	-0.074/20	-0.509 (0.037)/17	0.382/17
May	0.426/6	0.156/20	0.129/16	0.192/20	0.331/16	0.324/18	0.066/20	-0.62 (0.008)/17	0.33/17
Jun	0.288/7	0.193/21	0.175/17	0.219/21	0.38/17	0.345/19	-0.062/21	-0.699 (0.001)/18	0.207/18
Jul	0.087/7	0.066/21	0.137/17	0.053/21	0.222/17	0.212/19	0.035/21	-0.611 (0.007)/18	0.159/18
Aug	-0.162/7	-0.078/21	0.154/17	-0.184/21	0.1/17	0.003/19	0.219/21	-0.524 (0.026)/18	-0.026/18
Sep	-0.526/6	-0.168/20	0.081/16	-0.287/20	-0.005/16	-0.106/18	0.118/20	-0.311/18	-0.291/18
Oct	-0.697/6	-0.399/20	-0.294/16	-0.206/20	-0.315/16	-0.156/18	0.166/20	-0.476 (0.046)/18	-0.044/18
Nov	-0.665/6	-0.035/20	0.051/16	-0.022/20	-0.024/16	0.012/18	-0.067/20	0.31/18	0.425/18
Dec	-0.932 (0.007)/6	-0.174/20	-0.18/16	-0.124/20	-0.397/16	-0.403/18	0.279/20	0.027/18	0.296/18

Month	Gadid	Sand.lance
Jan	0.388/17	0.489 (0.046)/17
Feb	0.388/17	0.146/17
Mar	0.358/17	0.258/17
Apr	0.387/17	0.328/17
May	0.605 (0.01)/17	0.255/17
Jun	0.698 (0.001)/18	0.286/18
Jul	0.642 (0.004)/18	0.408/18
Aug	0.601 (0.008)/18	0.344/18
Sep	0.268/18	0.524 (0.026)/18
Oct	0.517 (0.028)/18	0.296/18
Nov	-0.087/18	-0.344/18
Dec	0.152/18	-0.096/18

Table 68. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the NOAA tide station in Seldovia, Alaska (59°26'25" N, 151°43'13" W; see Figure 2). Murre parameter values have been matched with two-years-previous SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

SELD_93_14_lag 2

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.085/11	-0.174/20	-0.095/20	-0.174/18	-0.029/20	-0.082/16	-0.153/20	0.092/20	-0.197/16
Feb	-0.443/11	-0.108/20	-0.151/20	-0.294/18	-0.109/20	-0.125/16	-0.067/20	0.225/20	-0.328/16
Mar	0.243/11	-0.226/20	-0.201/20	-0.292/18	-0.112/20	0.057/16	-0.047/20	0.202/20	-0.164/16
Apr	-0.203/11	-0.272/20	-0.271/20	-0.358/18	-0.225/20	0.299/16	0.143/20	0.406/20	-0.033/16
May	-0.096/11	-0.224/19	-0.229/19	-0.347/17	-0.169/19	0.154/15	0.109/19	0.269/19	-0.102/16
Jun	-0.212/12	-0.267/21	-0.263/21	-0.363/19	-0.215/21	0.201/17	0.181/21	0.344/21	0.052/17
Jul	-0.159/12	-0.361/21	-0.306/21	-0.377/19	-0.241/21	0.025/17	0.079/21	0.306/21	-0.043/17
Aug	0.065/12	-0.139/21	-0.074/21	-0.153/19	-0.006/21	-0.128/17	0.043/21	0.106/21	-0.134/17
Sep	0.222/11	0.101/20	0.217/20	0.177/18	0.261/20	-0.309/16	-0.2/20	-0.207/20	-0.34/16
Oct	0.157/11	0.102/20	0.157/20	0.12/18	0.208/20	-0.403/16	-0.373/20	-0.187/20	-0.231/16
Nov	-0.262/11	-0.231/20	-0.288/20	-0.259/18	-0.245/20	-0.03/16	0.054/20	0.183/20	-0.264/16
Dec	0.043/11	0.02/20	-0.019/20	-0.043/18	0.049/20	-0.169/16	-0.131/20	-0.068/20	-0.129/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.542/6	0.065/20	0.267/16	0.036/20	0.077/16	-0.081/18	-0.054/20	-0.043/17	-0.155/17
Feb	0.461/6	0.133/20	0.445/16	-0.077/20	0.326/16	0.127/18	-0.108/20	-0.074/17	-0.417/17
Mar	-0.25/6	0.164/20	0.299/16	0.128/20	0.259/16	0.138/18	-0.228/20	-0.147/17	-0.191/17
Apr	0.169/6	0.367/20	0.503 (0.047)/16	0.211/20	0.442/16	0.27/18	-0.415/20	0.017/17	-0.251/17
May	-0.146/6	0.249/19	0.388/15	0.191/19	0.363/16	0.237/17	-0.197/19	-0.089/17	-0.228/17
Jun	0.202/7	0.339/21	0.46/17	0.275/21	0.378/17	0.302/19	-0.229/21	-0.214/18	-0.16/18
Jul	0.259/7	0.297/21	0.404/17	0.176/21	0.305/17	0.207/19	0.019/21	-0.212/18	0.075/18
Aug	0.015/7	0.088/21	0.246/17	-0.026/21	0.005/17	-0.07/19	0.232/21	-0.241/18	0.134/18
Sep	0.307/6	-0.247/20	-0.197/16	-0.366/20	-0.439/16	-0.605 (0.008)/18	0.453 (0.045)/20	0.132/17	0.092/17
Oct	0.952 (0.003)/6	-0.182/20	-0.134/16	-0.094/20	-0.155/16	-0.228/18	0.322/20	-0.086/17	-0.448/17
Nov	0.29/6	0.057/20	-0.035/16	-0.358/20	0.159/16	0.006/18	0.125/20	-0.338/17	0.055/17
Dec	0.593/6	-0.077/20	-0.18/16	-0.142/20	0.068/16	0.034/18	0.175/20	-0.644 (0.005)/17	-0.284/17

Month	Gadid	Sand.lance
Jan	0.062/17	-0.01/17
Feb	0.14/17	0.008/17
Mar	0.076/17	0.183/17
Apr	-0.11/17	0.08/17
May	-0.051/17	0.349/17
Jun	0.014/18	0.433/18
Jul	0.039/18	0.504 (0.033)/18
Aug	0.032/18	0.62 (0.006)/18
Sep	-0.221/17	0.145/17
Oct	0.068/17	0.202/17
Nov	0.382/17	0.11/17
Dec	0.533 (0.028)/17	0.486 (0.048)/17

Table 69. Results of correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at Amatuli Cove, Alaska (58°55'10" N, 152° 0'19" W; see Figure 2). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

Barr_93_14_lag 0

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.258/7	-0.161/15	-0.176/15	-0.187/13	-0.234/15	0.456/11	0.396/15	0.237/15	0.077/12
Feb	0.471/7	-0.183/15	-0.129/15	-0.033/13	-0.118/15	0.351/11	0.283/15	0.326/15	-0.178/12
Mar	-0.01/7	-0.368/15	-0.338/15	-0.25/13	-0.343/15	0.247/11	0.176/15	0.383/15	-0.06/12
Apr	0.176/7	-0.256/15	-0.224/15	-0.066/13	-0.223/15	0.326/11	0.329/15	0.35/15	-0.156/12
May	0.223/7	-0.149/15	-0.129/15	-0.019/13	-0.119/15	0.232/11	0.284/15	0.278/15	-0.15/12
Jun	-0.357/8	-0.379/16	-0.4/16	-0.338/14	-0.391/16	0.327/12	0.291/16	0.335/16	-0.024/13
Jul	-0.255/9	-0.365/17	-0.401/17	-0.366/15	-0.383/17	0.42/13	0.405/17	0.494 (0.044)/17	0.139/14
Aug	-0.262/9	-0.105/17	-0.174/17	-0.181/15	-0.2/17	0.314/13	0.337/17	0.372/17	0.034/14
Sep	-0.269/9	-0.178/17	-0.21/17	-0.292/15	-0.243/17	0.568 (0.043)/13	0.557 (0.02)/17	0.54 (0.025)/17	0.153/14
Oct	-0.446/7	-0.129/15	-0.102/15	-0.31/13	-0.11/15	0.102/11	0.26/15	0.056/15	-0.365/12
Nov	-0.265/7	-0.494/15	-0.526 (0.044)/15	-0.465/13	-0.505/15	0.634 (0.036)/11	0.28/15	0.525 (0.044)/15	-0.228/12
Dec	0.027/7	-0.293/15	-0.346/15	-0.378/13	-0.3/15	-0.058/11	-0.097/15	0.288/15	-0.506/12

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	- (-)/2	0.266/15	0.258/11	0.363/15	0.15/12	0.243/13	-0.129/15	0.077/14	0.364/14
Feb	- (-)/2	0.277/15	0.145/11	0.19/15	0.028/12	-0.014/13	-0.281/15	-0.098/14	0.064/14
Mar	- (-)/2	0.352/15	0.295/11	0.281/15	0.218/12	0.211/13	-0.327/15	0.05/14	0.236/14
Apr	- (-)/2	0.299/15	0.268/11	0.167/15	0.08/12	0.102/13	-0.099/15	-0.044/14	0.243/14
May	- (-)/2	0.215/15	0.303/11	0.094/15	0.072/12	0.095/13	-0.112/15	-0.063/14	0.118/14
Jun	-0.946/3	0.286/16	0.415/12	0.093/16	0.304/13	0.268/14	-0.209/16	-0.001/15	0.341/15
Jul	0.083/4	0.507 (0.038)/17	0.555 (0.049)/13	0.419/17	0.559 (0.038)/14	0.534 (0.041)/15	-0.419/17	-0.11/16	0.207/16
Aug	0.181/4	0.411/17	0.505/13	0.402/17	0.484/14	0.45/15	-0.248/17	-0.082/16	0.075/16
Sep	0.283/4	0.603 (0.01)/17	0.682 (0.01)/13	0.588 (0.013)/17	0.551 (0.041)/14	0.449/15	-0.448/17	0.014/16	0.16/16
Oct	- (-)/2	0.049/15	0.354/11	0.12/15	0.137/12	0.023/13	0.317/15	0.035/15	0.18/15
Nov	- (-)/2	0.519 (0.047)/15	0.332/11	0.265/15	0.474/12	0.298/13	-0.596 (0.019)/15	0.225/15	0.11/15
Dec	- (-)/2	0.22/15	0.076/11	-0.074/15	0.434/12	0.238/13	-0.344/15	0.148/15	-0.264/15

Month	Gadid	Sand.lance
Jan	0.127/14	-0.441/14
Feb	0.219/14	-0.203/14
Mar	0.184/14	-0.46/14
Apr	0.227/14	-0.22/14
May	0.277/14	-0.225/14
Jun	0.19/15	-0.259/15
Jul	0.208/16	-0.057/16
Aug	0.174/16	-0.062/16
Sep	-0.07/16	0.079/16
Oct	0.111/15	-0.119/15
Nov	-0.291/15	-0.073/15
Dec	-0.173/15	0.019/15

Table 70. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at Amatuli Cove, Alaska (58°55'10" N, 152° 0'19" W; see Figure 2). Murre parameter values have been matched with the previous years' SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

Barr_93_14_lag 1

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.474/6	-0.239/14	-0.331/14	-0.508/12	-0.279/14	0.099/10	0.276/14	0.194/14	0.155/11
Feb	-0.579/6	-0.25/14	-0.306/14	-0.567/12	-0.273/14	-0.039/10	0.13/14	0.11/14	0.11/11
Mar	-0.681/6	-0.395/14	-0.492/14	-0.547/12	-0.475/14	0.129/10	0.268/14	0.361/14	0.041/11
Apr	-0.623/6	-0.384/14	-0.459/14	-0.548/12	-0.387/14	-0.22/10	-0.155/14	0.109/14	0.082/11
May	-0.694/6	-0.341/14	-0.401/14	-0.42/12	-0.339/14	-0.249/10	-0.16/14	0.076/14	0.131/11
Jun	-0.726/7	-0.506/15	-0.605 (0.017)/15	-0.612 (0.026)/13	-0.565 (0.028)/15	0.032/11	0.006/15	0.295/15	0.299/12
Jul	-0.668/8	-0.58 (0.019)/16	-0.63 (0.009)/16	-0.662 (0.01)/14	-0.599 (0.014)/16	0.114/12	0.11/16	0.349/16	0.177/13
Aug	-0.445/8	-0.197/16	-0.284/16	-0.457/14	-0.259/16	0.31/12	0.416/16	0.243/16	0.262/13
Sep	-0.493/8	-0.284/16	-0.336/16	-0.525/14	-0.313/16	0.273/12	0.442/16	0.329/16	0.262/13
Oct	-0.388/7	-0.049/15	-0.133/15	-0.47/13	-0.068/15	0.007/11	0.259/15	0.09/15	0.121/12
Nov	-0.728/7	-0.503/15	-0.526 (0.044)/15	-0.634 (0.02)/13	-0.555 (0.032)/15	0.516/11	0.5/15	0.52 (0.047)/15	0.366/12
Dec	-0.571/7	-0.302/15	-0.266/15	-0.345/13	-0.302/15	0.451/11	0.481/15	0.354/15	0.044/12

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	- (-)/1	0.114/14	0.127/10	-0.106/14	0.513/11	0.507/12	-0.073/14	-0.51/13	-0.139/13
Feb	- (-)/1	0.079/14	0.144/10	0.014/14	0.493/11	0.494/12	0.042/14	-0.503/13	0.154/13
Mar	- (-)/1	0.306/14	0.316/10	0.032/14	0.614 (0.045)/11	0.536/12	0.021/14	-0.556 (0.049)/13	0.194/13
Apr	- (-)/1	0.129/14	0.141/10	0.15/14	0.489/11	0.513/12	0.106/14	-0.655 (0.015)/13	0.192/13
May	- (-)/1	0.095/14	0.165/10	0.122/14	0.4/11	0.442/12	0.23/14	-0.679 (0.011)/13	0.26/13
Jun	- (-)/2	0.344/15	0.443/11	0.292/15	0.613 (0.034)/12	0.621 (0.024)/13	-0.013/15	-0.581 (0.029)/14	0.412/14
Jul	-0.148/3	0.333/16	0.503/12	0.134/16	0.542/13	0.443/14	0.034/16	-0.473/15	0.369/15
Aug	-0.548/3	0.248/16	0.575/12	0.143/16	0.509/13	0.41/14	-0.07/16	-0.585 (0.022)/15	0.08/15
Sep	-0.734/3	0.21/16	0.508/12	-0.234/16	0.49/13	0.294/14	-0.237/16	-0.572 (0.026)/15	0.042/15
Oct	- (-)/2	0.047/15	0.393/11	-0.103/15	0.449/12	0.301/13	0.028/15	-0.752 (0.002)/14	-0.224/14
Nov	- (-)/2	0.491/15	0.49/11	0.234/15	0.514/12	0.475/13	-0.431/15	-0.228/14	0.523/14
Dec	- (-)/2	0.329/15	0.509/11	0.187/15	0.158/12	0.057/13	-0.039/15	-0.06/14	0.447/14

Month	Gadid	Sand.lance
Jan	0.462/13	0.495/13
Feb	0.464/13	0.394/13
Mar	0.52/13	0.419/13
Apr	0.579 (0.038)/13	0.453/13
May	0.648 (0.017)/13	0.41/13
Jun	0.514/14	0.323/14
Jul	0.447/15	0.293/15
Aug	0.589 (0.021)/15	0.317/15
Sep	0.6 (0.018)/15	0.282/15
Oct	0.702 (0.005)/14	0.496/14
Nov	0.273/14	-0.081/14
Dec	0.227/14	-0.293/14

Table 71. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at Amatuli Cove, Alaska (58°55'10" N, 152° 0'19" W; see Figure 2). Murre parameter values have been matched with two-years-previous SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

Barr_93_14_lag 2

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.277/6	-0.42/13	-0.338/13	-0.422/12	-0.241/13	-0.36/10	-0.397/13	0.075/13	-0.434/11
Feb	-0.542/6	-0.265/13	-0.275/13	-0.631 (0.028)/12	-0.183/13	-0.268/10	-0.134/13	0.163/13	-0.516/11
Mar	-0.228/6	-0.435/13	-0.416/13	-0.645 (0.024)/12	-0.283/13	-0.193/10	-0.158/13	0.231/13	-0.443/11
Apr	-0.353/6	-0.349/13	-0.337/13	-0.644 (0.024)/12	-0.27/13	0.038/10	0.098/13	0.354/13	-0.344/11
May	-0.136/6	-0.317/13	-0.302/13	-0.586 (0.045)/12	-0.214/13	-0.007/10	0.073/13	0.278/13	-0.323/11
Jun	-0.291/6	-0.512/14	-0.503/14	-0.635 (0.027)/12	-0.432/14	0.113/10	0.132/14	0.502/14	-0.222/11
Jul	-0.465/7	-0.522 (0.046)/15	-0.508/15	-0.674 (0.011)/13	-0.427/15	0.181/11	0.294/15	0.504/15	-0.069/12
Aug	-0.309/7	-0.26/15	-0.228/15	-0.417/13	-0.152/15	0.073/11	0.177/15	0.14/15	0.057/12
Sep	-0.396/7	-0.358/15	-0.318/15	-0.424/13	-0.24/15	-0.223/11	-0.02/15	0.083/15	-0.303/12
Oct	0.119/6	-0.019/14	0.077/14	-0.023/12	0.174/14	-0.349/10	-0.299/14	-0.166/14	-0.353/11
Nov	-0.479/6	-0.509/14	-0.587 (0.027)/14	-0.679 (0.015)/12	-0.515/14	-0.245/10	-0.096/14	0.365/14	-0.45/11
Dec	-0.3/6	-0.22/14	-0.319/14	-0.443/12	-0.222/14	-0.255/10	-0.083/14	0.065/14	-0.12/11

Month									
Jan	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Feb	- (-)/1	0.058/13	0.41/10	0.053/13	0.096/11	-0.214/12	0.205/13	0.042/12	0.112/12
Mar	- (-)/1	0.105/13	0.586/10	-0.01/13	0.408/11	0.014/12	0.095/13	-0.137/12	-0.351/12
Apr	- (-)/1	0.24/13	0.558/10	0.221/13	0.431/11	0.069/12	0.055/13	-0.214/12	-0.129/12
May	- (-)/1	0.343/13	0.694 (0.026)/10	0.241/13	0.489/11	0.117/12	-0.035/13	-0.019/12	-0.232/12
Jun	- (-)/1	0.313/13	0.611/10	0.3/13	0.471/11	0.129/12	0.078/13	-0.049/12	-0.24/12
Jul	- (-)/1	0.484/14	0.714 (0.02)/10	0.203/14	0.564/11	0.225/12	-0.164/14	-0.035/13	-0.13/13
Aug	- (-)/2	0.501/15	0.752 (0.008)/11	0.208/15	0.641 (0.025)/12	0.278/13	-0.111/15	-0.243/14	0.097/14
Sep	- (-)/2	0.147/15	0.423/11	0.028/15	0.2/12	0.044/13	0.13/15	-0.162/14	0.084/14
Oct	- (-)/2	0.082/15	0.347/11	-0.048/15	0.143/12	-0.066/13	0.376/15	0.031/14	0.283/14
Nov	- (-)/1	-0.217/14	0.209/10	-0.236/14	-0.257/11	-0.466/12	0.33/14	0.069/13	-0.191/13
Dec	- (-)/1	0.24/14	0.341/10	-0.207/14	0.579/11	0.321/12	-0.09/14	-0.243/13	-0.086/13

Month	Gadid	Sand.lance
Jan	-0.014/12	-0.02/12
Feb	0.21/12	0.056/12
Mar	0.143/12	0.297/12
Apr	-0.074/12	0.309/12
May	-0.132/12	0.504/12
Jun	-0.112/13	0.443/13
Jul	0.033/14	0.604 (0.022)/14
Aug	-0.101/14	0.696 (0.006)/14
Sep	-0.154/14	0.376/14
Oct	-0.177/13	0.321/13
Nov	0.266/13	0.19/13
Dec	0.459/13	0.57 (0.042)/13

Table 72. Results of correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the GAK1 moored station near Resurrection Bay, Alaska (59° 50.7' N, 149° 28.0' W; see Figure 2). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

GAK1_93_14_lag 0

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.227/5	-0.231/13	-0.224/13	-0.36/11	-0.258/13	0.401/9	0.397/13	0.291/13	0.031/10
Feb	-0.072/5	-0.244/13	-0.233/13	-0.215/11	-0.251/13	0.558/9	0.476/13	0.369/13	0.105/10
Mar	-0.529/5	-0.408/13	-0.401/13	-0.391/11	-0.41/13	0.606/9	0.509/13	0.376/13	0.171/10
Apr	-0.54/5	-0.414/13	-0.434/13	-0.438/11	-0.438/13	0.642/9	0.582 (0.037)/13	0.377/13	0.206/10
May	-0.566/6	-0.381/14	-0.4/14	-0.464/12	-0.393/14	0.567/10	0.526/14	0.3/14	0.007/11
Jun	-0.244/6	-0.433/14	-0.418/14	-0.645 (0.024)/12	-0.375/14	0.545/10	0.551 (0.041)/14	0.376/14	-0.062/11
Jul	0.098/6	-0.35/14	-0.371/14	-0.522/12	-0.339/14	0.589/10	0.568 (0.034)/14	0.445/14	-0.306/11
Aug	-0.302/6	-0.353/14	-0.341/14	-0.632 (0.028)/12	-0.333/14	0.627/10	0.691 (0.006)/14	0.42/14	0.051/11
Sep	-0.406/6	-0.44/14	-0.374/14	-0.548/12	-0.416/14	0.538/10	0.606 (0.022)/14	0.351/14	0.2/11
Oct	-0.097/6	-0.065/13	-0.044/13	0.133/11	-0.109/13	0.494/9	0.295/13	0.041/13	0.327/10
Nov	-0.161/6	-0.016/13	-0.107/13	0.091/11	-0.146/13	0.58/9	-0.007/13	0.14/13	0.035/10
Dec	-0.184/7	-0.211/14	-0.292/14	-0.306/12	-0.281/14	0.263/10	0.071/14	0.241/14	-0.248/11

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	- (-)/1	0.338/13	0.451/9	0.474/13	0.311/10	0.3/11	-0.147/13	-0.042/12	0.349/12
Feb	- (-)/1	0.408/13	0.421/9	0.469/13	0.206/10	0.228/11	-0.262/13	-0.126/12	0.343/12
Mar	- (-)/1	0.388/13	0.527/9	0.308/13	0.279/10	0.254/11	-0.362/13	0.03/13	0.469/13
Apr	- (-)/1	0.372/13	0.494/9	0.263/13	0.318/10	0.336/11	-0.367/13	0.005/13	0.391/13
May	- (-)/1	0.272/14	0.47/10	0.14/14	0.286/11	0.264/12	-0.23/14	0.091/14	0.34/14
Jun	- (-)/1	0.439/14	0.54/10	0.494/14	0.48/11	0.359/12	-0.303/14	0.116/14	0.099/14
Jul	- (-)/1	0.507/14	0.449/10	0.457/14	0.478/11	0.277/12	-0.316/14	0.126/14	-0.028/14
Aug	- (-)/1	0.455/14	0.601/10	0.404/14	0.467/11	0.283/12	-0.284/14	0.06/14	-0.083/14
Sep	- (-)/1	0.348/14	0.304/10	0.209/14	0.179/11	0.066/12	-0.191/14	0.375/14	0.09/14
Oct	- (-)/1	0.156/13	-0.137/9	0.323/13	-0.168/10	-0.091/11	0.025/13	0.317/13	0.26/13
Nov	- (-)/1	0.218/13	-0.305/9	0.177/13	0.16/10	0.117/11	-0.446/13	0.07/13	0.22/13
Dec	- (-)/2	0.144/14	-0.05/10	-0.244/14	0.343/11	0.194/12	-0.421/14	0.003/14	-0.086/14

Month	Gadid	Sand.lance
Jan	0.326/12	-0.345/12
Feb	0.29/12	-0.183/12
Mar	0.239/13	-0.363/13
Apr	0.252/13	-0.285/13
May	0.064/14	-0.207/14
Jun	-0.119/14	0.067/14
Jul	-0.177/14	0.063/14
Aug	-0.068/14	0.096/14
Sep	-0.361/14	-0.069/14
Oct	-0.414/13	-0.05/13
Nov	-0.241/13	-0.08/13
Dec	-0.104/14	0.116/14

Table 73. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the GAK1 moored station near Resurrection Bay, Alaska (59° 50.7' N, 149° 28.0' W; see Figure 2). Murre parameter values have been matched with the previous years' SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

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Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.556/6	-0.183/12	-0.297/12	-0.544/11	-0.24/12	0.097/9	0.282/12	0.204/12	-0.006/10
Feb	-0.563/6	-0.326/12	-0.4/12	-0.564/11	-0.339/12	-0.027/9	0.109/12	0.188/12	0.16/10
Mar	-0.612/7	-0.464/13	-0.558 (0.048)/13	-0.588 (0.044)/12	-0.519/13	0.087/10	0.201/13	0.291/13	0.263/11
Apr	-0.637/7	-0.528/13	-0.606 (0.028)/13	-0.614 (0.034)/12	-0.559 (0.047)/13	0.069/10	0.105/13	0.3/13	0.289/11
May	-0.696/7	-0.493/14	-0.58 (0.03)/14	-0.585 (0.036)/13	-0.533/14	-0.031/11	-0.035/14	0.259/14	0.319/12
Jun	-0.562/7	-0.376/14	-0.393/14	-0.484/13	-0.373/14	0.105/11	0.104/14	0.345/14	0.155/12
Jul	-0.377/7	-0.213/14	-0.21/14	-0.28/13	-0.193/14	0.176/11	0.076/14	0.193/14	0.133/12
Aug	-0.34/7	-0.214/14	-0.191/14	-0.291/13	-0.153/14	0.172/11	0.182/14	0.261/14	-0.006/12
Sep	-0.368/7	-0.295/14	-0.289/14	-0.298/13	-0.262/14	0.17/11	0.136/14	0.303/14	-0.101/12
Oct	-0.001/6	-0.09/13	-0.078/13	-0.17/12	-0.095/13	0.375/10	0.31/13	0.073/13	0.283/11
Nov	-0.041/6	-0.034/13	-0.077/13	-0.19/12	-0.142/13	0.47/10	0.442/13	0.131/13	0.33/11
Dec	-0.594/6	-0.279/14	-0.274/14	-0.471/12	-0.299/14	0.349/10	0.444/14	0.242/14	0.103/11

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	- (-)/1	0.098/12	0.218/9	-0.184/12	0.517/10	0.415/11	-0.012/12	-0.641 (0.033)/11	-0.217/11
Feb	- (-)/1	0.114/12	0.131/9	-0.093/12	0.475/10	0.457/11	-0.082/12	-0.554/11	-0.012/11
Mar	- (-)/2	0.259/13	0.267/10	0.044/13	0.556/11	0.543/12	-0.005/13	-0.49/12	0.28/12
Apr	- (-)/2	0.278/13	0.307/10	0.084/13	0.522/11	0.52/12	-0.028/13	-0.5/12	0.36/12
May	- (-)/2	0.237/14	0.362/11	0.073/14	0.507/12	0.506/13	-0.08/14	-0.634 (0.02)/13	0.337/13
Jun	- (-)/2	0.197/14	0.343/11	-0.266/14	0.284/12	0.102/13	-0.208/14	-0.571 (0.041)/13	0.118/13
Jul	- (-)/2	0.061/14	0.128/11	-0.252/14	0.068/12	-0.017/13	-0.286/14	-0.416/13	0.044/13
Aug	- (-)/2	0.114/14	0.213/11	-0.375/14	0.075/12	-0.153/13	-0.13/14	-0.476/13	0.078/13
Sep	- (-)/2	0.188/14	0.097/11	-0.319/14	0.112/12	-0.138/13	-0.165/14	-0.286/13	0.227/13
Oct	- (-)/2	0.113/13	-0.201/10	0.103/13	0.027/11	0.117/12	-0.335/13	0.317/12	0.137/12
Nov	- (-)/2	0.167/13	-0.011/10	0.316/13	0.17/11	0.407/12	-0.537/13	0.682 (0.015)/12	0.168/12
Dec	- (-)/2	0.276/14	0.481/10	0.297/14	0.291/11	0.227/12	-0.119/14	0.24/13	0.434/13

Month	Gadid	Sand.lance
Jan	0.528/11	0.599/11
Feb	0.429/11	0.559/11
Mar	0.365/12	0.494/12
Apr	0.362/12	0.477/12
May	0.596 (0.032)/13	0.275/13
Jun	0.5/13	0.251/13
Jul	0.371/13	0.106/13
Aug	0.267/13	0.464/13
Sep	0.055/13	0.321/13
Oct	-0.699 (0.011)/12	0.286/12
Nov	-0.603 (0.038)/12	-0.349/12
Dec	-0.034/13	-0.344/13

Table 74. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at the GAK1 moored station near Resurrection Bay, Alaska (59° 50.7' N, 149° 28.0' W; see Figure 2). Murre parameter values have been matched with two-years-previous SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

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Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.176/5	-0.355/11	-0.205/11	-0.38/11	-0.066/11	-0.305/9	-0.276/11	0.03/11	-0.376/10
Feb	-0.352/5	-0.505/11	-0.388/11	-0.514/11	-0.296/11	-0.271/9	-0.221/11	0.235/11	-0.517/10
Mar	-0.029/5	-0.676 (0.016)/12	-0.563/12	-0.625 (0.04)/11	-0.458/12	-0.289/9	-0.216/12	0.313/12	-0.506/10
Apr	-0.31/5	-0.716 (0.009)/12	-0.625 (0.03)/12	-0.661 (0.027)/11	-0.534/12	-0.241/9	-0.19/12	0.423/12	-0.42/10
May	-0.272/6	-0.59 (0.034)/13	-0.552/13	-0.494/12	-0.482/13	-0.052/10	-0.059/13	0.461/13	-0.357/11
Jun	-0.035/6	-0.3/13	-0.277/13	-0.273/12	-0.191/13	-0.197/10	-0.113/13	0.257/13	-0.408/11
Jul	-0.222/6	-0.255/13	-0.249/13	-0.322/12	-0.205/13	-0.193/10	-0.019/13	0.164/13	-0.158/11
Aug	0.087/6	-0.2/13	-0.129/13	-0.203/12	-0.04/13	-0.508/10	-0.398/13	-0.07/13	-0.282/11
Sep	0.329/6	-0.186/13	-0.16/13	-0.125/12	-0.107/13	-0.444/10	-0.5/13	-0.106/13	-0.327/11
Oct	0.151/6	-0.231/12	-0.157/12	-0.102/11	-0.195/12	-0.279/9	-0.37/12	-0.029/12	-0.286/10
Nov	-0.613/6	-0.452/12	-0.494/12	-0.315/11	-0.548/12	-0.028/9	0.025/12	0.284/12	-0.024/10
Dec	-0.538/6	-0.269/13	-0.371/13	-0.348/11	-0.321/13	-0.301/9	-0.141/13	0.119/13	-0.103/10

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	- (-)/1	0.011/11	0.543/9	0.029/11	0.091/10	-0.215/11	0.139/11	-0.05/10	0/10
Feb	- (-)/1	0.2/11	0.634/9	0.052/11	0.277/10	-0.14/11	0.09/11	0.074/10	-0.116/10
Mar	- (-)/1	0.284/12	0.539/9	0.067/12	0.296/10	-0.083/11	0.009/12	0.168/11	-0.211/11
Apr	- (-)/1	0.405/12	0.655/9	0.123/12	0.448/10	0.054/11	-0.108/12	0.096/11	-0.155/11
May	- (-)/1	0.465/13	0.645 (0.044)/10	0.186/13	0.495/11	0.173/12	-0.075/13	0.037/12	-0.213/12
Jun	- (-)/1	0.234/13	0.434/10	-0.028/13	0.368/11	0.08/12	-0.045/13	-0.096/12	0.228/12
Jul	- (-)/1	0.116/13	0.294/10	-0.076/13	0.369/11	0.262/12	-0.068/13	-0.102/12	0.465/12
Aug	- (-)/1	-0.104/13	0.105/10	-0.156/13	0.116/11	-0.037/12	0.008/13	0.066/12	0.339/12
Sep	- (-)/1	-0.131/13	-0.108/10	-0.087/13	0.042/11	-0.001/12	-0.159/13	0.295/12	0.252/12
Oct	- (-)/1	-0.162/12	-0.293/9	-0.389/12	-0.262/10	-0.328/11	-0.242/12	0.577/11	0.119/11
Nov	- (-)/1	0.066/12	-0.019/9	-0.478/12	0.063/10	0.096/11	-0.189/12	-0.059/11	0.513/11
Dec	- (-)/1	-0.053/13	-0.083/9	-0.476/13	0.193/10	0.186/11	0.036/13	-0.466/12	-0.238/12

Month	Gadid	Sand.lance
Jan	0.082/10	0.075/10
Feb	-0.003/10	-0.057/10
Mar	-0.167/11	0.07/11
Apr	-0.113/11	0.095/11
May	-0.132/12	0.289/12
Jun	0.063/12	0.182/12
Jul	0.166/12	0.089/12
Aug	0.04/12	-0.152/12
Sep	-0.118/12	-0.488/12
Oct	-0.364/11	-0.726 (0.011)/11
Nov	0.346/11	-0.454/11
Dec	0.538/12	0.179/12

Table 75. Results of correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at NOAA Buoy 46001, east of Kodiak Island (56°18'16" N 147°55'13" W; see Figure 2). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years. Years of data available for comparison are shown in Tables 11 and 12.

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Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.234/10	0.265/19	0.289/19	0.272/17	0.278/19	-0.164/15	-0.003/19	-0.129/19	-0.254/15
Feb	0.613/9	0.437/18	0.469/18	0.471/16	0.461/18	-0.021/14	0.036/18	-0.26/18	-0.223/14
Mar	0.43/9	0.236/18	0.273/18	0.32/16	0.266/18	0.098/14	0.122/18	-0.098/18	-0.047/14
Apr	0.148/9	0.153/18	0.122/18	0.047/16	0.103/18	0.153/14	0.238/18	-0.118/18	0.135/14
May	0.084/11	0.197/20	0.087/20	0.063/18	0.063/20	0.212/16	0.342/20	0.147/20	0.125/16
Jun	-0.08/11	-0.04/20	-0.096/20	-0.028/18	-0.108/20	0.132/16	0.148/20	0.221/20	-0.014/16
Jul	-0.069/11	0.04/20	0.01/20	0.043/18	-0.015/20	0.061/16	0.063/20	0.092/20	-0.045/16
Aug	-0.072/12	-0.074/21	-0.088/21	-0.05/19	-0.092/21	0.083/17	0.011/21	0.138/21	0.096/17
Sep	0.044/12	0.144/21	0.034/21	0.056/19	0.014/21	0.258/17	0.252/21	0.242/21	0.181/17
Oct	0.375/12	0.207/21	0.167/21	0.104/19	0.163/21	0.227/17	0.372/21	0.193/21	-0.154/17
Nov	0.214/12	0.107/21	0.041/21	-0.021/19	0.028/21	0.337/17	0.306/21	0.225/21	-0.168/17
Dec	0.428/11	0.22/20	0.152/20	0.089/18	0.15/20	0.208/16	0.201/20	0.054/20	-0.107/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	-0.211/6	-0.207/19	-0.119/15	-0.156/19	-0.303/15	-0.246/17	0.3/19	-0.167/17	-0.118/17
Feb	0.002/6	-0.263/18	-0.333/14	-0.031/18	-0.451/14	-0.266/16	0.219/18	0.038/16	-0.203/16
Mar	-0.151/6	-0.1/18	-0.092/14	0.084/18	-0.253/14	-0.121/16	0.104/18	-0.027/16	-0.021/16
Apr	-0.56/6	-0.081/18	0.05/14	0.173/18	-0.032/14	0.159/16	-0.048/18	0.118/16	0.142/16
May	0.027/7	0.138/20	0.173/16	0.152/20	0.241/16	0.381/18	-0.268/20	-0.351/17	-0.331/17
Jun	0.279/7	0.225/20	0.213/16	0.227/20	0.28/16	0.305/18	-0.077/20	-0.062/17	-0.26/17
Jul	0.178/7	0.067/20	0.047/16	-0.008/20	0.107/16	0.114/18	0.013/20	-0.113/17	-0.03/17
Aug	0.173/7	0.12/21	0.142/17	0.081/21	0.218/17	0.183/19	-0.198/21	-0.098/18	0.069/18
Sep	0.435/7	0.286/21	0.267/17	0.332/21	0.362/17	0.382/19	-0.359/21	-0.357/18	-0.304/18
Oct	0.15/7	0.127/21	-0.037/17	0.005/21	0.06/17	0.046/19	-0.133/21	-0.485 (0.042)/18	-0.411/18
Nov	-0.08/7	0.218/21	0.173/17	0.221/21	0.254/17	0.08/19	-0.194/21	-0.215/18	-0.409/18
Dec	-0.282/7	0.064/20	-0.033/16	0.177/20	0.163/16	0.084/18	-0.229/20	-0.181/17	-0.406/17

Month	Gadid	Sand.lance
Jan	0.335/17	-0.019/17
Feb	0.159/16	-0.307/16
Mar	0.239/16	-0.142/16
Apr	0.087/16	-0.143/16
May	0.446/17	0.453/17
Jun	0.129/17	0.373/17
Jul	0.167/17	0.181/17
Aug	0.161/18	0.033/18
Sep	0.354/18	0.162/18
Oct	0.567 (0.014)/18	0.154/18
Nov	0.168/18	0.231/18
Dec	0.167/17	0.198/17

Table 76. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at NOAA Buoy 46001, east of Kodiak Island (56°18'16" N 147°55'13" W; see Figure 2). Murre parameter values have been matched with the previous years' SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

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Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.468/10	0.088/19	0.089/19	-0.026/17	0.169/19	-0.21/15	0.078/19	-0.019/19	-0.042/15
Feb	0.226/10	0.106/18	0.088/18	-0.098/16	0.103/18	-0.333/14	0.086/18	-0.232/18	0.202/14
Mar	0/10	-0.064/18	-0.1/18	-0.292/16	-0.07/18	-0.111/14	0.167/18	-0.059/18	0.246/14
Apr	-0.426/10	-0.243/18	-0.317/18	-0.466/16	-0.3/18	0.062/14	0.238/18	0.126/18	0.439/14
May	-0.296/11	-0.168/20	-0.187/20	-0.381/18	-0.165/20	0.154/16	0.32/20	0.109/20	0.204/16
Jun	-0.104/11	-0.133/20	-0.152/20	-0.344/18	-0.134/20	0.322/16	0.366/20	0.172/20	0.151/16
Jul	-0.09/11	-0.103/20	-0.156/20	-0.342/18	-0.126/20	-0.018/16	0.193/20	0.026/20	-0.058/16
Aug	-0.246/12	-0.156/21	-0.216/21	-0.294/19	-0.215/21	0.131/17	0.242/21	0.242/21	-0.016/17
Sep	-0.138/12	-0.01/21	-0.034/21	-0.157/19	-0.048/21	0.114/17	0.21/21	-0.008/21	0.107/17
Oct	0.127/12	0.025/21	0.071/21	-0.039/19	0.121/21	-0.21/17	-0.045/21	-0.105/21	-0.31/17
Nov	0.158/12	0.118/21	0.13/21	-0.042/19	0.145/21	0.184/17	0.282/21	0.024/21	-0.017/17
Dec	-0.049/11	0.026/20	0.054/20	-0.037/18	0.047/20	0.124/16	0.25/20	0.083/20	-0.034/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.167/6	-0.031/19	0.046/15	-0.03/19	0.09/15	0.12/17	0.123/19	-0.787 (0)/16	-0.149/16
Feb	-0.822 (0.044)/6	-0.228/18	-0.168/14	-0.054/18	-0.04/14	0.189/16	0.114/18	-0.534 (0.04)/15	0.015/15
Mar	-0.51/6	-0.02/18	0.051/14	0.078/18	0.215/14	0.314/16	0.076/18	-0.558 (0.031)/15	0.171/15
Apr	0.031/6	0.14/18	0.325/14	0.083/18	0.377/14	0.39/16	-0.054/18	-0.503/15	0.218/15
May	0.159/7	0.161/20	0.413/16	0.221/20	0.238/16	0.26/18	0.015/20	-0.326/17	0.16/17
Jun	-0.251/7	0.223/20	0.423/16	0.262/20	0.288/16	0.202/18	-0.06/20	-0.407/17	0.252/17
Jul	-0.726/7	0.05/20	0.299/16	0.13/20	0.29/16	0.211/18	0.018/20	-0.255/17	0.194/17
Aug	-0.348/7	0.229/21	0.364/17	0.128/21	0.366/17	0.324/19	-0.067/21	-0.234/18	0.187/18
Sep	-0.392/7	-0.005/21	0.188/17	0.048/21	0.075/17	0.196/19	-0.017/21	-0.022/18	0.073/18
Oct	-0.322/7	-0.149/21	0.013/17	-0.113/21	-0.126/17	-0.092/19	0.198/21	-0.301/18	0.042/18
Nov	-0.343/7	-0.012/21	0.116/17	-0.045/21	-0.051/17	-0.075/19	-0.115/21	-0.283/18	0.062/18
Dec	-0.121/7	0.012/20	0.087/16	-0.074/20	-0.079/16	-0.045/18	-0.038/20	-0.091/17	0.106/17

Month	Gadid	Sand.lance
Jan	0.707 (0.002)/16	0.637 (0.008)/16
Feb	0.55 (0.034)/15	0.35/15
Mar	0.461/15	0.511/15
Apr	0.486/15	0.288/15
May	0.374/17	0.078/17
Jun	0.367/17	0.196/17
Jul	0.38/17	0.013/17
Aug	0.39/18	-0.11/18
Sep	0.167/18	-0.066/18
Oct	0.319/18	0.268/18
Nov	0.211/18	0.336/18
Dec	0.224/17	-0.031/17

Table 77. Results of lagged correlation analysis between annual biological parameters of common murres and monthly anomaly of sea-surface temperature at NOAA Buoy 46001, east of Kodiak Island (56°18'16" N 147°55'13" W; see Figure 2). Murre parameter values have been matched with two-years-previous SST values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

B460 lag2yr

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.069/11	0.137/19	0.196/19	0.113/17	0.235/19	-0.383/15	-0.398/19	-0.172/19	-0.463/15
Feb	-0.248/10	0.061/18	0.055/18	-0.03/16	0.089/18	-0.279/14	-0.336/18	-0.032/18	-0.438/14
Mar	-0.211/10	-0.055/18	-0.036/18	-0.179/16	0.006/18	-0.159/14	-0.186/18	0.077/18	-0.398/14
Apr	-0.212/10	-0.197/18	-0.179/18	-0.152/16	-0.123/18	0.064/14	-0.093/18	0.203/18	-0.15/14
May	-0.332/12	-0.173/20	-0.216/20	-0.343/18	-0.183/20	-0.128/16	-0.043/20	0.056/20	0.159/16
Jun	-0.188/12	-0.019/20	-0.072/20	-0.306/18	-0.045/20	-0.051/16	0.059/20	0.056/20	0.025/16
Jul	-0.197/12	0.018/20	-0.041/20	-0.094/18	-0.016/20	0.046/16	0.068/20	0.149/20	-0.032/16
Aug	-0.158/12	-0.073/21	-0.121/21	-0.145/19	-0.096/21	0.032/17	0.079/21	0.212/21	-0.098/17
Sep	-0.359/12	-0.189/21	-0.241/21	-0.387/19	-0.235/21	-0.01/17	0.166/21	0.152/21	0.205/17
Oct	0.037/12	0.072/21	0.054/21	-0.136/19	0.092/21	-0.213/17	-0.046/21	0.047/21	-0.033/17
Nov	0/12	0.032/21	0.018/21	-0.183/19	0.051/21	-0.124/17	0.072/21	-0.01/21	0.033/17
Dec	0.043/11	-0.018/20	-0.06/20	-0.152/18	-0.014/20	0.057/16	0.176/20	0.177/20	0.015/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.259/6	-0.164/19	0.135/15	-0.071/19	-0.149/15	-0.345/17	0.366/19	0.002/16	-0.276/16
Feb	0.689/6	-0.034/18	0.317/14	-0.034/18	0.081/14	-0.17/16	0.175/18	0.076/15	-0.438/15
Mar	0.307/6	0.046/18	0.366/14	-0.068/18	0.105/14	-0.199/16	0.058/18	0.166/15	-0.354/15
Apr	0.057/6	0.168/18	0.407/14	-0.055/18	0.215/14	-0.1/16	-0.037/18	0.064/15	-0.092/15
May	-0.311/7	0.034/20	0.374/16	-0.079/20	0.249/16	0.163/18	0.005/20	-0.356/17	-0.018/17
Jun	-0.289/7	0.033/20	0.307/16	-0.085/20	0.192/16	0.08/18	-0.084/20	-0.282/17	-0.07/17
Jul	0.297/7	0.122/20	0.322/16	-0.029/20	0.108/16	0.014/18	0.077/20	-0.396/17	-0.156/17
Aug	-0.159/7	0.183/21	0.37/17	0.074/21	0.187/17	0.101/19	0.052/21	-0.461/18	0.048/18
Sep	-0.2/7	0.162/21	0.434/17	0.092/21	0.293/17	0.232/19	0.036/21	-0.417/18	0.3/18
Oct	0.632/7	0.054/21	0.269/17	0.054/21	0.175/17	0.058/19	0.049/21	-0.647 (0.004)/18	-0.344/18
Nov	0.254/7	-0.05/21	0.055/17	-0.2/21	0.087/17	0.027/19	-0.062/21	-0.377/18	-0.087/18
Dec	0.287/7	0.142/20	0.152/16	-0.071/20	0.223/16	0.149/18	-0.102/20	-0.704 (0.002)/17	-0.039/17

Month	Gadid	Sand.lance
Jan	-0.064/16	0.129/16
Feb	-0.159/15	0.106/15
Mar	-0.279/15	0.081/15
Apr	-0.292/15	0.269/15
May	0.206/17	0.457/17
Jun	0.044/17	0.499 (0.041)/17
Jul	0.217/17	0.428/17
Aug	0.317/18	0.349/18
Sep	0.309/18	0.328/18
Oct	0.633 (0.005)/18	0.223/18
Nov	0.417/18	0.027/18
Dec	0.633 (0.006)/17	0.208/17

Table 78. Results of correlation analysis between annual biological parameters of common murres and monthly values of the Pacific Decadal Oscillation (PDO). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

PDOX lag0yr_

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.015/12	-0.069/21	-0.092/21	-0.232/19	-0.075/21	0.302/17	0.318/21	0.163/21	0.035/17
Feb	-0.048/12	-0.107/21	-0.123/21	-0.245/19	-0.107/21	0.347/17	0.383/21	0.175/21	0.136/17
Mar	-0.33/12	-0.301/21	-0.336/21	-0.393/19	-0.33/21	0.43/17	0.42/21	0.308/21	0.268/17
Apr	-0.278/12	-0.157/21	-0.255/21	-0.31/19	-0.253/21	0.506 (0.038)/17	0.475 (0.03)/21	0.278/21	0.372/17
May	-0.325/12	-0.052/21	-0.164/21	-0.224/19	-0.189/21	0.467/17	0.468 (0.033)/21	0.247/21	0.375/17
Jun	-0.38/12	-0.139/21	-0.231/21	-0.305/19	-0.252/21	0.503 (0.04)/17	0.554 (0.009)/21	0.35/21	0.265/17
Jul	-0.451/12	-0.189/21	-0.288/21	-0.426/19	-0.294/21	0.598 (0.011)/17	0.641 (0.002)/21	0.472 (0.031)/21	0.253/17
Aug	-0.312/12	-0.16/21	-0.239/21	-0.33/19	-0.241/21	0.406/17	0.443 (0.044)/21	0.361/21	0.007/17
Sep	-0.277/12	-0.036/21	-0.139/21	-0.206/19	-0.177/21	0.452/17	0.453 (0.039)/21	0.402/21	0.095/17
Oct	-0.103/12	0.074/21	-0.012/21	-0.058/19	-0.07/21	0.492 (0.045)/17	0.538 (0.012)/21	0.373/21	0.04/17
Nov	0.005/12	-0.009/21	-0.082/21	-0.103/19	-0.111/21	0.45/17	0.354/21	0.357/21	0.012/17
Dec	0.084/12	-0.009/21	-0.073/21	-0.073/19	-0.091/21	0.314/17	0.263/21	0.361/21	-0.131/17

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	-0.245/7	0.221/21	0.363/17	0.415/21	0.3/17	0.271/19	-0.201/21	-0.278/18	0.145/18
Feb	-0.414/7	0.2/21	0.373/17	0.297/21	0.244/17	0.242/19	-0.307/21	-0.214/18	0.123/18
Mar	-0.487/7	0.311/21	0.433/17	0.304/21	0.403/17	0.403/19	-0.459 (0.036)/21	-0.038/18	0.209/18
Apr	-0.123/7	0.317/21	0.407/17	0.4/21	0.462/17	0.5 (0.029)/19	-0.528 (0.014)/21	-0.195/18	-0.039/18
May	0.225/7	0.296/21	0.396/17	0.381/21	0.467/17	0.464 (0.046)/19	-0.482 (0.027)/21	-0.226/18	-0.157/18
Jun	0.539/7	0.382/21	0.442/17	0.325/21	0.505 (0.039)/17	0.347/19	-0.332/21	-0.247/18	-0.248/18
Jul	0.656/7	0.484 (0.026)/21	0.568 (0.017)/17	0.313/21	0.641 (0.006)/17	0.371/19	-0.434/21	-0.397/18	-0.205/18
Aug	0.532/7	0.361/21	0.344/17	0.184/21	0.518 (0.033)/17	0.2/19	-0.254/21	-0.305/18	-0.164/18
Sep	0.502/7	0.392/21	0.344/17	0.18/21	0.473/17	0.239/19	-0.389/21	-0.358/18	-0.313/18
Oct	0.383/7	0.344/21	0.225/17	0.166/21	0.303/17	0.137/19	-0.358/21	-0.281/18	-0.407/18
Nov	0.018/7	0.342/21	0.284/17	0.222/21	0.386/17	0.15/19	-0.43/21	-0.195/18	-0.347/18
Dec	-0.099/7	0.31/21	0.259/17	0.134/21	0.352/17	0.148/19	-0.304/21	-0.231/18	-0.394/18

Month	Gadid	sand.lance
Jan	0.288/18	0.122/18
Feb	0.257/18	0.016/18
Mar	0.121/18	-0.124/18
Apr	0.204/18	0.049/18
May	0.268/18	-0.05/18
Jun	0.218/18	0.141/18
Jul	0.231/18	0.341/18
Aug	0.144/18	0.378/18
Sep	0.2/18	0.203/18
Oct	0.234/18	0.041/18
Nov	0.075/18	0.134/18
Dec	0.135/18	0.215/18

Table 79. Results of lagged correlation analysis between annual biological parameters of common murres and monthly values of the Pacific Decadal Oscillation (PDO), Murre parameter values have been matched with the previous years' PDO values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

PDOX lag1yr_

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.258/12	-0.089/21	-0.153/21	-0.48 (0.038)/19	-0.133/21	0.161/17	0.35/21	0.169/21	0.186/17
Feb	-0.54/12	-0.274/21	-0.346/21	-0.571 (0.011)/19	-0.332/21	0.058/17	0.22/21	0.156/21	0.394/17
Mar	-0.735 (0.007)/12	-0.562 (0.008)/21	-0.629 (0.002)/21	-0.716 (0.001)/19	-0.619 (0.003)/21	0.244/17	0.329/21	0.392/21	0.475/17
Apr	-0.799 (0.002)/12	-0.489 (0.025)/21	-0.541 (0.011)/21	-0.655 (0.002)/19	-0.547 (0.01)/21	0.382/17	0.386/21	0.366/21	0.666 (0.004)/17
May	-0.759 (0.004)/12	-0.369/21	-0.446 (0.043)/21	-0.598 (0.007)/19	-0.454 (0.039)/21	0.461/17	0.526 (0.014)/21	0.29/21	0.704 (0.002)/17
Jun	-0.511/12	-0.266/21	-0.322/21	-0.536 (0.018)/19	-0.304/21	0.375/17	0.422/21	0.114/21	0.561 (0.019)/17
Jul	-0.477/12	-0.32/21	-0.336/21	-0.52 (0.023)/19	-0.303/21	0.236/17	0.332/21	0.106/21	0.478/17
Aug	-0.218/12	-0.197/21	-0.214/21	-0.426/19	-0.176/21	0.165/17	0.315/21	0.027/21	0.216/17
Sep	-0.185/12	-0.114/21	-0.144/21	-0.334/19	-0.128/21	0.149/17	0.305/21	-0.023/21	0.207/17
Oct	-0.07/12	0.035/21	-0.017/21	-0.193/19	0.01/21	0.172/17	0.217/21	-0.138/21	0.162/17
Nov	-0.128/12	-0.017/21	-0.04/21	-0.179/19	-0.04/21	0.251/17	0.281/21	-0.009/21	0.12/17
Dec	0.045/12	-0.077/21	-0.042/21	-0.136/19	-0.015/21	0.12/17	0.194/21	0.06/21	-0.08/17

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.459/7	0.124/21	0.304/17	-0.047/21	0.327/17	0.303/19	-0.166/21	-0.479 (0.044)/18	-0.204/18
Feb	0.304/7	0.161/21	0.394/17	0.091/21	0.445/17	0.435/19	-0.128/21	-0.476 (0.046)/18	0.099/18
Mar	0.301/7	0.401/21	0.573 (0.016)/17	0.258/21	0.634 (0.006)/17	0.568 (0.011)/19	-0.214/21	-0.426/18	0.381/18
Apr	0.532/7	0.414/21	0.608 (0.01)/17	0.382/21	0.595 (0.012)/17	0.61 (0.006)/19	-0.37/21	-0.324/18	0.32/18
May	0.429/7	0.36/21	0.58 (0.015)/17	0.39/21	0.606 (0.01)/17	0.62 (0.005)/19	-0.349/21	-0.317/18	0.171/18
Jun	-0.084/7	0.188/21	0.432/17	0.257/21	0.439/17	0.439/19	-0.302/21	-0.298/18	0.223/18
Jul	-0.071/7	0.138/21	0.405/17	0.139/21	0.389/17	0.319/19	-0.319/21	-0.219/18	0.168/18
Aug	-0.253/7	0.033/21	0.239/17	0.034/21	0.247/17	0.21/19	-0.221/21	-0.111/18	0.136/18
Sep	-0.326/7	0.005/21	0.232/17	0.102/21	0.221/17	0.229/19	-0.239/21	0.029/18	0.052/18
Oct	-0.292/7	-0.097/21	0.049/17	0.054/21	0.133/17	0.151/19	-0.217/21	-0.168/18	0.038/18
Nov	-0.271/7	0.005/21	0.099/17	0.067/21	0.106/17	0.071/19	-0.208/21	0.02/18	0.2/18
Dec	-0.231/7	0.059/21	0.203/17	0.111/21	0.059/17	-0.056/19	-0.056/21	-0.112/18	0.208/18

Month	Gadid	Sand.lance
Jan	0.407/18	0.389/18
Feb	0.427/18	0.329/18
Mar	0.409/18	0.191/18
Apr	0.292/18	0.143/18
May	0.316/18	0.189/18
Jun	0.233/18	0.292/18
Jul	0.251/18	0.138/18
Aug	0.256/18	-0.007/18
Sep	0.115/18	-0.05/18
Oct	0.196/18	0.127/18
Nov	0.008/18	0.066/18
Dec	0.144/18	0.143/18

Table 80. Results of lagged correlation analysis between annual biological parameters of common murres and monthly values of the Pacific Decadal Oscillation (PDO). Murre parameter values have been matched with two-years-previous PDO values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

PDOX lag2yr_

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	-0.312/12	-0.198/21	-0.141/21	-0.204/19	-0.108/21	-0.276/17	-0.122/21	0.108/21	-0.123/17
Feb	-0.456/12	-0.304/21	-0.282/21	-0.35/19	-0.244/21	-0.047/17	0.027/21	0.287/21	-0.074/17
Mar	-0.566/12	-0.518 (0.016)/21	-0.521 (0.016)/21	-0.588 (0.008)/19	-0.461 (0.035)/21	0.179/17	0.127/21	0.466 (0.033)/21	0.029/17
Apr	-0.728 (0.007)/12	-0.491 (0.024)/21	-0.537 (0.012)/21	-0.589 (0.008)/19	-0.525 (0.015)/21	0.303/17	0.258/21	0.542 (0.011)/21	0.267/17
May	-0.699 (0.011)/12	-0.468 (0.032)/21	-0.524 (0.015)/21	-0.638 (0.003)/19	-0.514 (0.017)/21	0.375/17	0.35/21	0.421/21	0.403/17
Jun	-0.7 (0.011)/12	-0.339/21	-0.395/21	-0.561 (0.012)/19	-0.411/21	0.306/17	0.345/21	0.362/21	0.461/17
Jul	-0.763 (0.004)/12	-0.423/21	-0.482 (0.027)/21	-0.574 (0.01)/19	-0.493 (0.023)/21	0.346/17	0.432/21	0.395/21	0.405/17
Aug	-0.584 (0.046)/12	-0.295/21	-0.357/21	-0.448/19	-0.358/21	0.267/17	0.389/21	0.298/21	0.269/17
Sep	-0.66 (0.02)/12	-0.263/21	-0.351/21	-0.497 (0.03)/19	-0.359/21	0.291/17	0.409/21	0.2/21	0.401/17
Oct	-0.624 (0.03)/12	-0.137/21	-0.232/21	-0.477 (0.039)/19	-0.254/21	0.294/17	0.411/21	0.164/21	0.491 (0.046)/17
Nov	-0.356/12	-0.162/21	-0.237/21	-0.43/19	-0.233/21	0.259/17	0.42/21	0.196/21	0.317/17
Dec	-0.087/12	-0.059/21	-0.11/21	-0.329/19	-0.079/21	0.099/17	0.306/21	0.118/21	0.107/17

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	-0.223/7	0.022/21	0.4/17	-0.189/21	0.048/17	-0.034/19	0.049/21	-0.043/18	0.025/18
Feb	0.087/7	0.223/21	0.561 (0.019)/17	-0.048/21	0.283/17	0.118/19	-0.058/21	0.057/18	-0.096/18
Mar	0.223/7	0.422/21	0.674 (0.003)/17	0.129/21	0.555 (0.021)/17	0.344/19	-0.205/21	-0.06/18	-0.016/18
Apr	0.001/7	0.517 (0.016)/21	0.751 (0.001)/17	0.2/21	0.667 (0.003)/17	0.472 (0.041)/19	-0.354/21	-0.112/18	0.115/18
May	0.22/7	0.45 (0.041)/21	0.672 (0.003)/17	0.247/21	0.567 (0.018)/17	0.456/19	-0.313/21	-0.098/18	0.153/18
Jun	0.374/7	0.389/21	0.599 (0.011)/17	0.196/21	0.488 (0.047)/17	0.443/19	-0.284/21	-0.01/18	0.134/18
Jul	0.579/7	0.427/21	0.559 (0.02)/17	0.189/21	0.49 (0.046)/17	0.431/19	-0.169/21	-0.089/18	0.214/18
Aug	0.424/7	0.293/21	0.381/17	0.045/21	0.318/17	0.286/19	-0.057/21	-0.296/18	0.212/18
Sep	0.512/7	0.23/21	0.342/17	0.08/21	0.341/17	0.337/19	-0.053/21	-0.281/18	0.19/18
Oct	0.536/7	0.21/21	0.385/17	0.181/21	0.4/17	0.446/19	-0.222/21	-0.209/18	0.05/18
Nov	0.288/7	0.181/21	0.227/17	-0.003/21	0.342/17	0.363/19	-0.218/21	-0.29/18	0.086/18
Dec	0.424/7	0.094/21	0.097/17	-0.092/21	0.22/17	0.234/19	-0.062/21	-0.463/18	-0.078/18

Month	Gadid	Sand.lance
Jan	0.125/18	0.005/18
Feb	-0.082/18	0.169/18
Mar	-0.091/18	0.348/18
Apr	-0.058/18	0.269/18
May	-0.117/18	0.301/18
Jun	-0.146/18	0.123/18
Jul	-0.024/18	0.132/18
Aug	0.233/18	0.083/18
Sep	0.269/18	0.06/18
Oct	0.282/18	-0.131/18
Nov	0.38/18	-0.079/18
Dec	0.436/18	0.273/18

Table 81. Results of correlation analysis between annual biological parameters of common murres and monthly values of the North Pacific Index (NPI). Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

NPIX lag0yr_

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.106/11	0.017/19	0.019/19	0.12/17	0.031/19	-0.291/15	-0.236/19	0.052/19	-0.013/16
Feb	0.106/11	0.283/19	0.291/19	0.344/17	0.254/19	-0.307/15	-0.196/19	-0.258/19	-0.34/16
Mar	0.149/11	0.293/19	0.242/19	0.228/17	0.198/19	0.138/15	0.201/19	0.113/19	-0.021/16
Apr	0.162/11	0.02/19	0.066/19	0.11/17	0.054/19	-0.159/15	-0.188/19	-0.083/19	-0.233/16
May	0.409/11	0.245/19	0.25/19	0.398/17	0.23/19	0.072/15	0.027/19	-0.103/19	0.068/16
Jun	0.277/11	-0.038/19	0.04/19	0.035/17	0.089/19	-0.17/15	-0.218/19	-0.247/19	0.322/16
Jul	-0.157/11	-0.055/19	-0.097/19	-0.049/17	-0.143/19	0.168/15	0.013/19	-0.038/19	0.257/16
Aug	0.02/11	-0.128/19	-0.14/19	-0.076/17	-0.152/19	0.39/15	0.391/19	0.186/19	0.195/16
Sep	0.219/11	0.08/19	0.072/19	0.039/17	0.115/19	-0.475/15	-0.322/19	-0.196/19	-0.221/16
Oct	-0.381/11	-0.276/19	-0.214/19	-0.275/17	-0.215/19	0.021/15	0.042/19	0.053/19	0.601 (0.014)/16
Nov	0.159/11	0.503 (0.028)/19	0.466 (0.044)/19	0.383/17	0.415/19	-0.093/15	0.044/19	-0.245/19	-0.136/16
Dec	0.382/11	0.294/19	0.33/19	0.233/17	0.327/19	-0.249/15	-0.221/19	-0.509 (0.026)/19	0.334/16

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	-0.244/6	-0.022/19	0.027/15	-0.215/19	0.037/16	-0.062/17	-0.003/19	-0.089/18	-0.219/18
Feb	0.294/6	-0.244/19	-0.339/15	-0.074/19	-0.348/16	-0.338/17	0.526 (0.021)/19	0.006/18	-0.174/18
Mar	0.678/6	0.152/19	0.112/15	0.11/19	0.099/16	-0.052/17	0.004/19	-0.43/18	-0.152/18
Apr	-0.355/6	-0.089/19	-0.248/15	-0.071/19	-0.182/16	-0.234/17	0.208/19	0.327/18	0.193/18
May	-0.921 (0.009)/6	-0.167/19	-0.222/15	-0.231/19	-0.305/16	-0.259/17	-0.054/19	-0.105/18	0.174/18
Jun	-0.589/6	-0.21/19	0.001/15	-0.025/19	-0.086/16	-0.029/17	-0.053/19	-0.212/18	0.227/18
Jul	-0.733/6	0.037/19	0.051/15	0.327/19	0.084/16	0.216/17	-0.284/19	0.518 (0.028)/18	0.323/18
Aug	-0.482/6	0.176/19	0.122/15	0.103/19	0.084/16	0.164/17	-0.234/19	0.086/18	0.011/18
Sep	-0.714/6	-0.247/19	-0.007/15	-0.168/19	0.03/16	-0.003/17	0.199/19	-0.258/18	0.094/18
Oct	-0.341/6	0.117/19	0.453/15	0.24/19	0.173/16	0.226/17	-0.162/19	0.006/18	0.398/18
Nov	0.061/6	-0.289/19	-0.122/15	-0.189/19	-0.375/16	-0.342/17	0.057/19	-0.01/18	-0.36/18
Dec	-0.533/6	-0.414/19	-0.298/15	-0.043/19	-0.313/16	-0.155/17	0.024/19	0.15/18	0.148/18

Month	Gadid	Sand.lance
Jan	0.005/18	0.266/18
Feb	0.003/18	0.031/18
Mar	0.293/18	0.251/18
Apr	-0.183/18	-0.444/18
May	0.075/18	0.054/18
Jun	0.242/18	0.116/18
Jul	-0.363/18	-0.634 (0.005)/18
Aug	-0.098/18	0.018/18
Sep	0.394/18	0.238/18
Oct	0.024/18	-0.035/18
Nov	0.241/18	-0.432/18
Dec	-0.137/18	0.028/18

Table 82. Results of lagged correlation analysis between annual biological parameters of common murres and monthly values of the North Pacific Index (NPI). Murre parameter values have been matched with the previous years' NPI values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.514/10	0.057/18	0.185/18	0.469/16	0.191/18	0.014/14	-0.095/18	0.107/18	-0.361/15
Feb	0.797 (0.006)/10	0.482 (0.043)/18	0.499 (0.035)/18	0.377/16	0.535 (0.022)/18	0.07/14	0.189/18	-0.191/18	-0.19/15
Mar	0.571/10	0.591 (0.01)/18	0.559 (0.016)/18	0.462/16	0.573 (0.013)/18	-0.125/14	-0.091/18	-0.467/18	-0.419/15
Apr	0.435/10	0.21/18	0.208/18	0.392/16	0.2/18	0.025/14	0.011/18	0.03/18	-0.415/15
May	0.295/10	0.071/18	0.116/18	0.22/16	0.139/18	-0.182/14	-0.34/18	-0.147/18	-0.002/15
Jun	-0.418/10	-0.14/18	-0.174/18	-0.25/16	-0.206/18	-0.025/14	0.045/18	0.083/18	0.056/15
Jul	-0.392/10	-0.157/18	-0.245/18	-0.008/16	-0.3/18	0.491/14	0.196/18	0.383/18	0.468/15
Aug	-0.499/10	-0.35/18	-0.332/18	-0.387/16	-0.324/18	0.135/14	-0.043/18	0.01/18	0.419/15
Sep	0.234/10	0.17/18	0.175/18	0.198/16	0.22/18	-0.096/14	-0.092/18	0.106/18	-0.425/15
Oct	-0.563/10	-0.276/18	-0.316/18	-0.197/16	-0.328/18	0.103/14	0.01/18	0.312/18	0.101/15
Nov	0.334/10	0.459/18	0.379/18	0.438/16	0.371/18	-0.051/14	0/18	-0.263/18	0.307/15
Dec	-0.147/10	0.209/18	0.171/18	0.199/16	0.11/18	-0.114/14	-0.13/18	-0.197/18	-0.067/15

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.631/5	0.136/18	-0.102/14	0.089/18	-0.328/15	-0.481/16	0.196/18	0.304/17	0.036/17
Feb	0.199/5	-0.171/18	-0.274/14	-0.02/18	-0.28/15	-0.26/16	-0.063/18	-0.228/17	-0.635 (0.006)/17
Mar	-0.558/5	-0.466/18	-0.425/14	-0.271/18	-0.433/15	-0.433/16	0.023/18	0.213/17	-0.555 (0.021)/17
Apr	-0.488/5	-0.08/18	-0.374/14	-0.258/18	-0.314/15	-0.325/16	0.113/18	-0.029/17	-0.06/17
May	0.61/5	-0.053/18	-0.329/14	0.177/18	-0.137/15	0.005/16	0.062/18	0.211/17	0.041/17
Jun	0.537/5	0.171/18	0.162/14	0.183/18	0.221/15	0.179/16	0.232/18	0.239/17	0.16/17
Jul	0.652/5	0.342/18	0.117/14	0.12/18	0.269/15	0.416/16	-0.385/18	-0.117/17	0.059/17
Aug	0.564/5	0.142/18	0.098/14	0.338/18	0.182/15	0.249/16	-0.041/18	0.09/17	0.424/17
Sep	0.521/5	0.103/18	0.14/14	0.007/18	-0.047/15	-0.26/16	0.368/18	-0.257/17	-0.227/17
Oct	0.733/5	0.313/18	0.276/14	-0.019/18	0.312/15	0.153/16	-0.001/18	0.083/17	0.065/17
Nov	0.083/5	-0.246/18	-0.191/14	-0.115/18	-0.132/15	0.114/16	0.025/18	-0.602 (0.011)/17	-0.195/17
Dec	0.179/5	-0.223/18	-0.313/14	-0.333/18	-0.255/15	-0.183/16	0.212/18	0.54 (0.025)/17	-0.075/17

Month	Gadid	Sand.lance
Jan	-0.383/17	-0.037/17
Feb	0.057/17	0.483/17
Mar	-0.231/17	0.026/17
Apr	-0.061/17	0.082/17
May	-0.334/17	0.082/17
Jun	-0.378/17	0.198/17
Jul	0.085/17	-0.036/17
Aug	-0.302/17	0.19/17
Sep	0.217/17	0.202/17
Oct	-0.283/17	0.288/17
Nov	0.582 (0.014)/17	0.347/17
Dec	-0.461/17	-0.307/17

Table 83. Results of lagged correlation analysis between annual biological parameters of common murres and monthly values of the North Pacific Index (NPI). Murre parameter values have been matched with two-years-previous NPI values. Results with greyed text have p-values ≥ 0.05. Significant results are presented as: correlation coefficient (p-value)/sample size in years.

NPIX lag2yr_

Month	hd_obs	hd_dd21	hd_dd21_10	fdd	hd_obs_or_dd21_10	egg	egg_or_ch	chick	ch_w_egg
Jan	0.514/10	0.057/18	0.185/18	0.469/16	0.191/18	0.014/14	-0.095/18	0.107/18	-0.361/15
Feb	0.797 (0.006)/10	0.482 (0.043)/18	0.499 (0.035)/18	0.377/16	0.535 (0.022)/18	0.07/14	0.189/18	-0.191/18	-0.19/15
Mar	0.571/10	0.591 (0.01)/18	0.559 (0.016)/18	0.462/16	0.573 (0.013)/18	-0.125/14	-0.091/18	-0.467/18	-0.419/15
Apr	0.435/10	0.21/18	0.208/18	0.392/16	0.2/18	0.025/14	0.011/18	0.03/18	-0.415/15
May	0.295/10	0.071/18	0.116/18	0.22/16	0.139/18	-0.182/14	-0.34/18	-0.147/18	-0.002/15
Jun	-0.418/10	-0.14/18	-0.174/18	-0.25/16	-0.206/18	-0.025/14	0.045/18	0.083/18	0.056/15
Jul	-0.392/10	-0.157/18	-0.245/18	-0.008/16	-0.3/18	0.491/14	0.196/18	0.383/18	0.468/15
Aug	-0.499/10	-0.35/18	-0.332/18	-0.387/16	-0.324/18	0.135/14	-0.043/18	0.01/18	0.419/15
Sep	0.234/10	0.17/18	0.175/18	0.198/16	0.22/18	-0.096/14	-0.092/18	0.106/18	-0.425/15
Oct	-0.563/10	-0.276/18	-0.316/18	-0.197/16	-0.328/18	0.103/14	0.01/18	0.312/18	0.101/15
Nov	0.334/10	0.459/18	0.379/18	0.438/16	0.371/18	-0.051/14	0/18	-0.263/18	0.307/15
Dec	-0.147/10	0.209/18	0.171/18	0.199/16	0.11/18	-0.114/14	-0.13/18	-0.197/18	-0.067/15

Month	fldg_obs	fldg_10	fldg_10.egg	fldg_10.ch	fldg_obs.egg_adj	fldg_obs.ch_adj	pop_prod	Osmerid	Salmonid
Jan	0.631/5	0.136/18	-0.102/14	0.089/18	-0.328/15	-0.481/16	0.196/18	0.304/17	0.036/17
Feb	0.199/5	-0.171/18	-0.274/14	-0.02/18	-0.28/15	-0.26/16	-0.063/18	-0.228/17	-0.635 (0.006)/17
Mar	-0.558/5	-0.466/18	-0.425/14	-0.271/18	-0.433/15	-0.433/16	0.023/18	0.213/17	-0.555 (0.021)/17
Apr	-0.488/5	-0.08/18	-0.374/14	-0.258/18	-0.314/15	-0.325/16	0.113/18	-0.029/17	-0.06/17
May	0.61/5	-0.053/18	-0.329/14	0.177/18	-0.137/15	0.005/16	0.062/18	0.211/17	0.041/17
Jun	0.537/5	0.171/18	0.162/14	0.183/18	0.221/15	0.179/16	0.232/18	0.239/17	0.16/17
Jul	0.652/5	0.342/18	0.117/14	0.12/18	0.269/15	0.416/16	-0.385/18	-0.117/17	0.059/17
Aug	0.564/5	0.142/18	0.098/14	0.338/18	0.182/15	0.249/16	-0.041/18	0.09/17	0.424/17
Sep	0.521/5	0.103/18	0.14/14	0.007/18	-0.047/15	-0.26/16	0.368/18	-0.257/17	-0.227/17
Oct	0.733/5	0.313/18	0.276/14	-0.019/18	0.312/15	0.153/16	-0.001/18	0.083/17	0.065/17
Nov	0.083/5	-0.246/18	-0.191/14	-0.115/18	-0.132/15	0.114/16	0.025/18	-0.602 (0.011)/17	-0.195/17
Dec	0.179/5	-0.223/18	-0.313/14	-0.333/18	-0.255/15	-0.183/16	0.212/18	0.54 (0.025)/17	-0.075/17

Month	Gadid	Sand.lance
Jan	-0.383/17	-0.037/17
Feb	0.057/17	0.483/17
Mar	-0.231/17	0.026/17
Apr	-0.061/17	0.082/17
May	-0.334/17	0.082/17
Jun	-0.378/17	0.198/17
Jul	0.085/17	-0.036/17
Aug	-0.302/17	0.19/17
Sep	0.217/17	0.202/17
Oct	-0.283/17	0.288/17
Nov	0.582 (0.014)/17	0.347/17
Dec	-0.461/17	-0.307/17

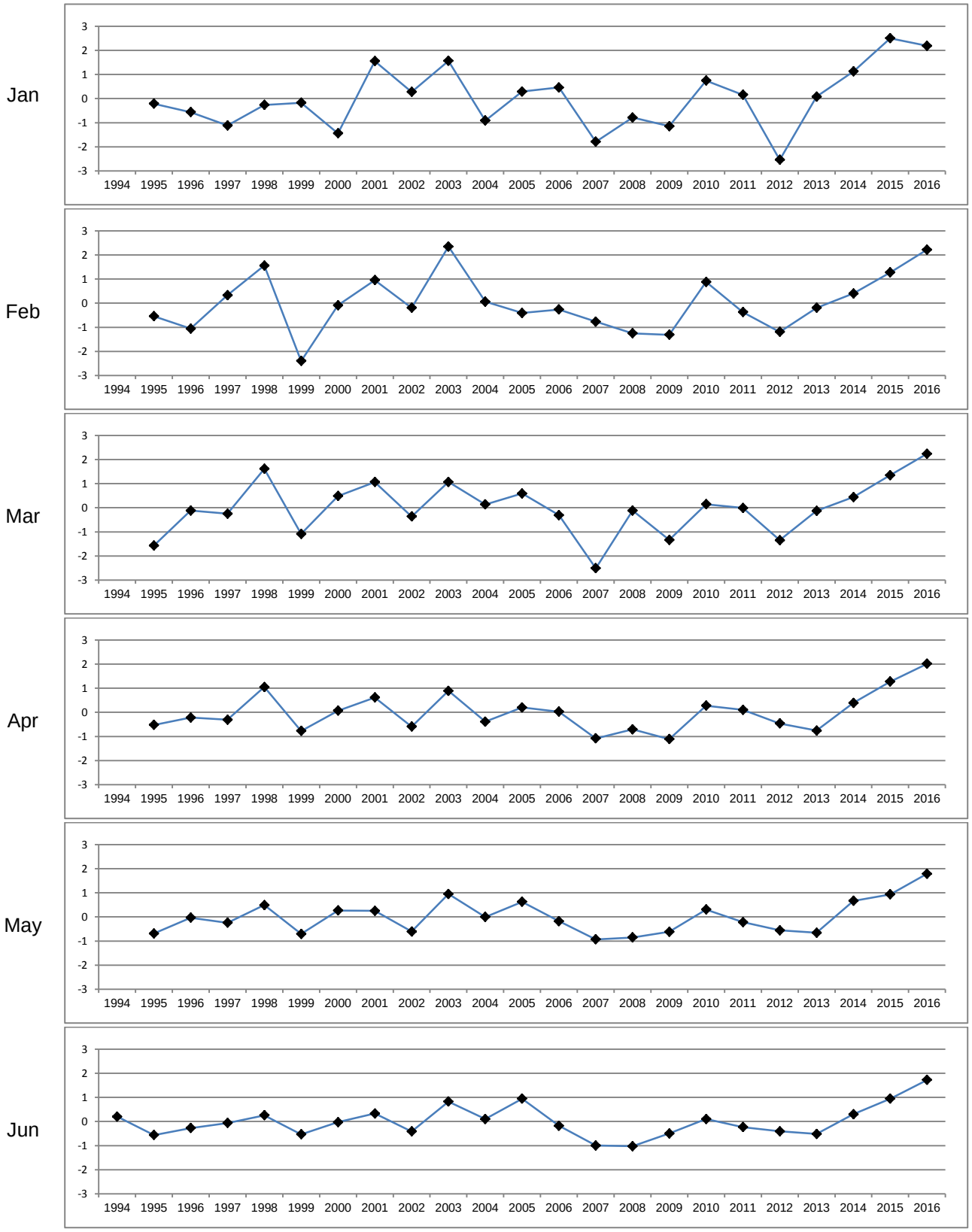

Figure 39. SST anomaly at the NOAA tide station in Seldovia, Alaska

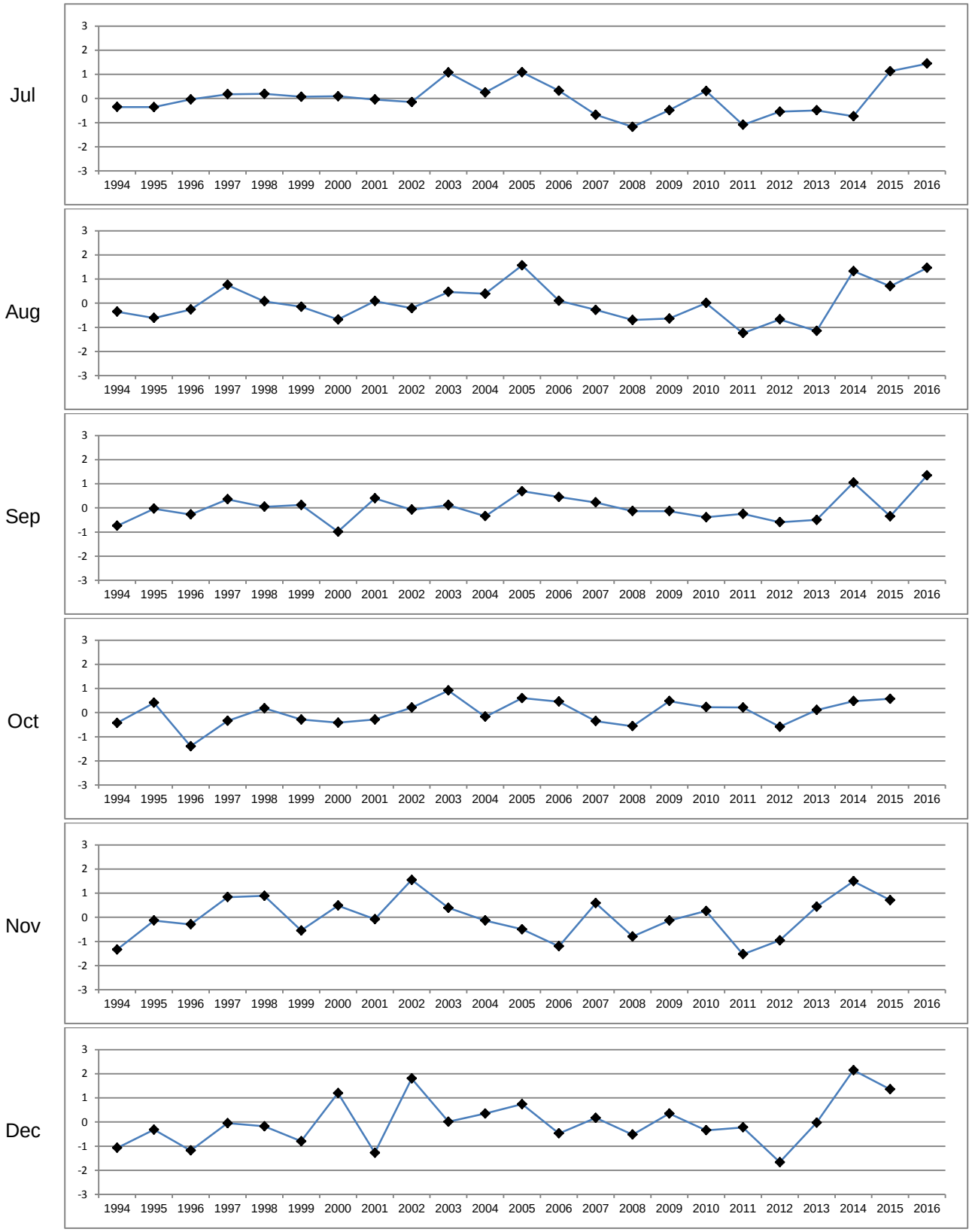

Figure 39 (continued). SST anomaly at the NOAA tide station in Seldovia, Alaska

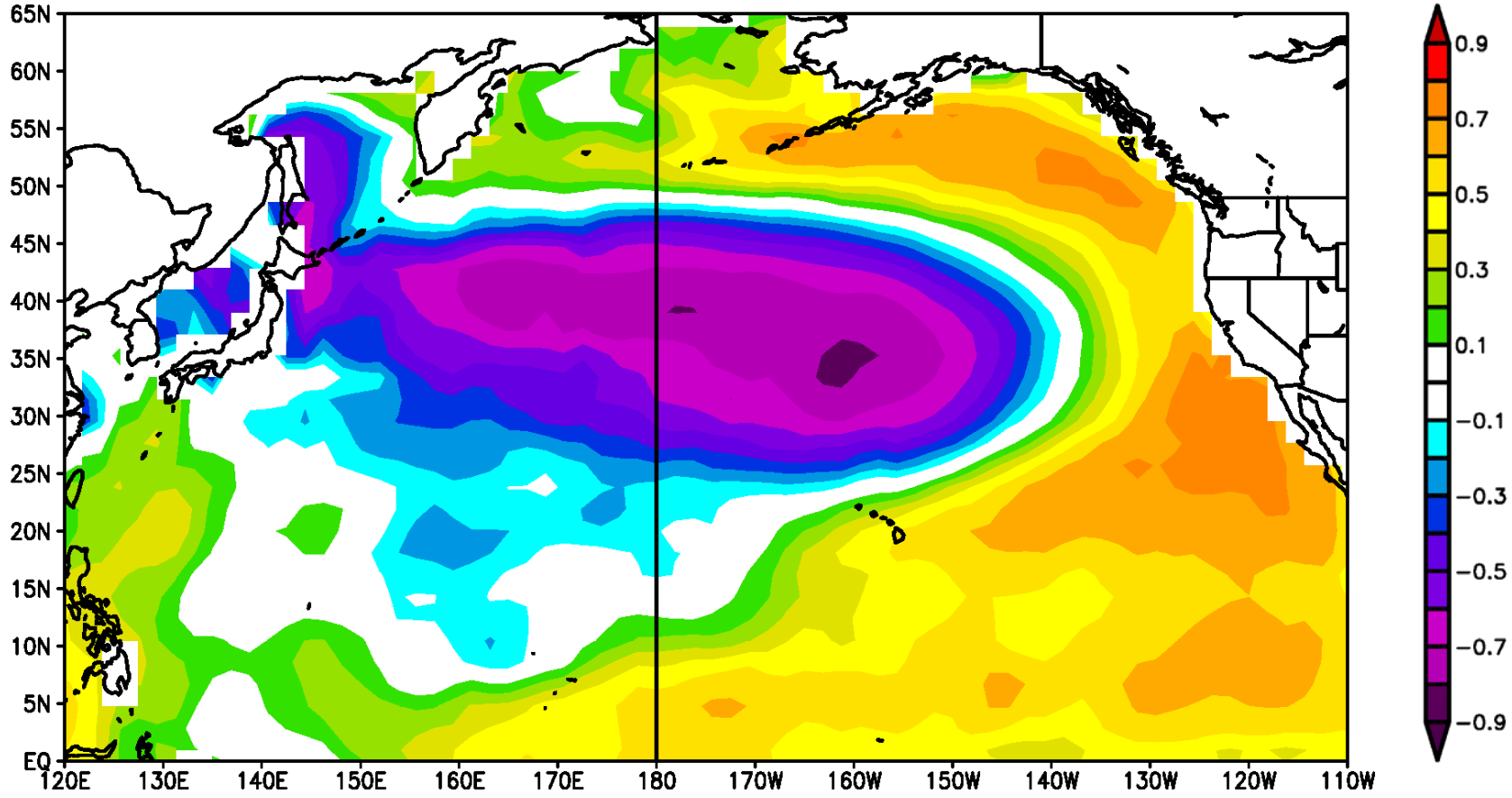

Figure 40. Map of correlation coefficient from comparison of gridded sea-surface temperature with PDO index values, 1993-2014. Positive PDO values occur with warm coastal water and cool water in the central North Pacific.

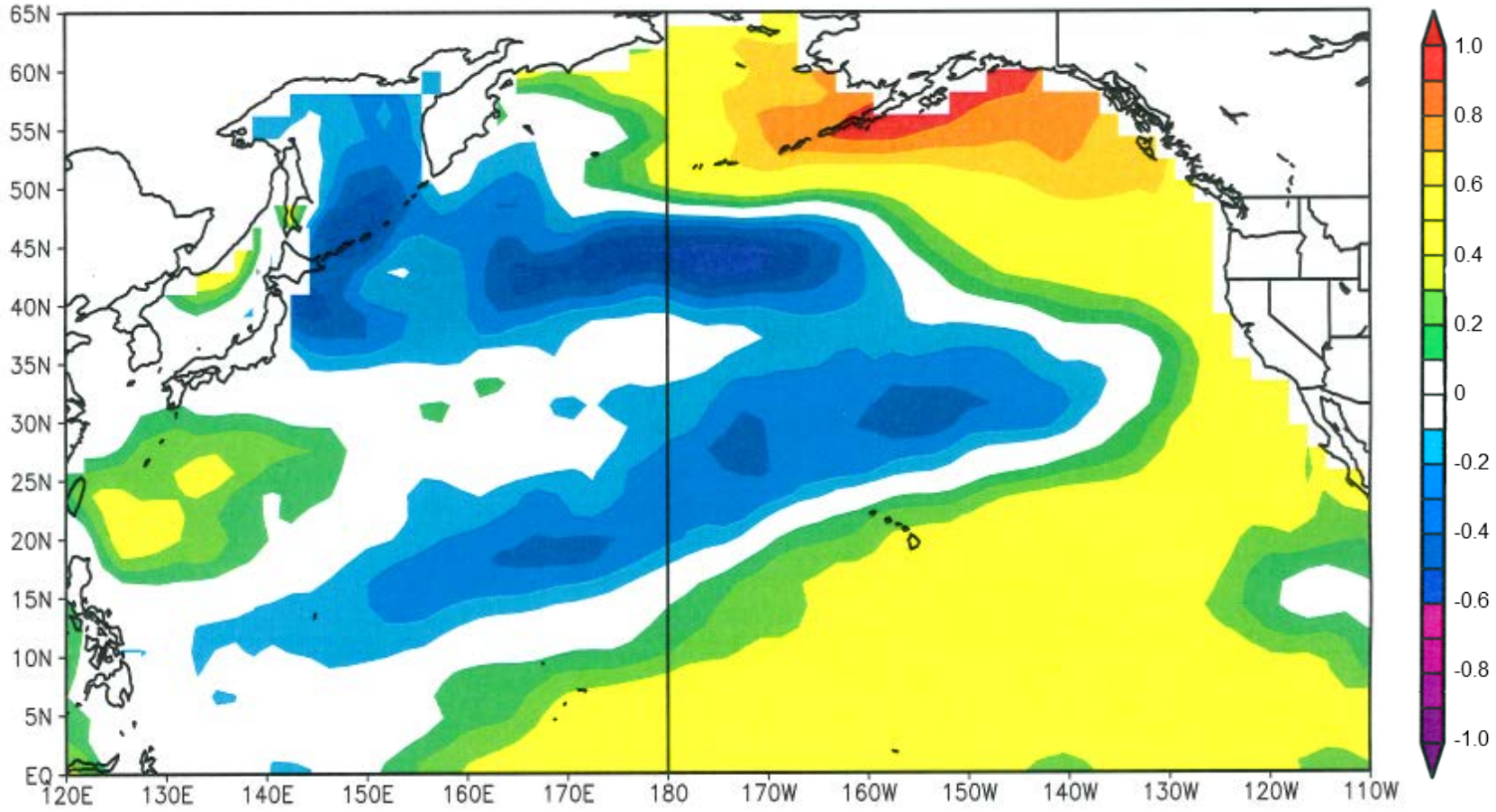

Figure 41. Map of correlation coefficient from comparison of sea surface temperature (SST) annual anomaly values at the NOAA tide station at Seldovia, Alaska with values gridded across the North Pacific, 1993-2014. This illustrates that SST anomaly in the central North Pacific tends to be opposite that at Seldovia.

APPENDIX

Appendix 1. Field crew members (Biological Science Technicians and volunteers) at East Amatuli Island, Alaska during common murre monitoring years 1993-2014. ABK was present as field team leader each year except 2014.

Year	Field crew			
1993	Mary Jensen	Margi Blanding	-	-
1994	Kurt Johnson	Margi Blanding	-	-
1995	Stephanie Zuniga	Mitch Eaton	Bill Stahl	Margi Blanding
1996	Stephanie Zuniga	Carrie Alley	Jon Maletta	Margi Blanding
1997	Stephanie Zuniga	Lena Wilensky	John Hoover	Margi Blanding
1998	Stephanie Zuniga	Gavin Brady	Tammy Steeves	Margi Blanding
1999	Erica Sommer	Jessica Bussler	Chris Wrobel	Margi Blanding
2000	Courtney Redmond	Kyra Riley	Darren Moe	Julie Snorek
2001	Jessica Bussler	Mari Ortwerth	Michelle Wada	-
2002	Rachael Orben	Greg Thomson	Amie Baton	-
2003	Kelly Wallis	Michelle Schuiteman	Jeremy Mizel	-
2004	Wendy Fair	Valerie Steen	Marcy Okada	-
2005	Joshua Boadway	Kelly Boadway	Laura Kennedy	-
2006	Kathryn Peiman	Emily Weiser	Megan McClellan	-
2007	Trevor Watts	Meaghan Conway	Leah Yandow	-
2008	Emily McKeever	Gina Peters	Kathryn Frens	-
2009	Amy Kearns	Kristina Raum	Frank Mayer	-
2010	Sarah Bastarache	Abram Fleishman	Sarah Youngren	-
2011	Sarah Youngren	Margaret Lambert	Dan Rapp	-
2013	Sonia Kumar	Serina Brady	Charles Ylijoki	-
2014	Naomi Bargmann	Stephanie Winnard	-	-