

# Nest Population Size and Potential Production of Geese and Spectacled Eiders on the Yukon-Kuskokwim Delta, Alaska, 1985-2013

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**ABSTRACT:** Nest surveys on Alaska's Yukon-Kuskokwim Delta (YKD) provide annual information on egg production, nesting effort, phenology, habitat use, and predation for four focal species including three species of geese (cackling Canada, emperor, and white-fronted) and spectacled eiders. In addition, these surveys provide information on other waterfowl, cranes, loons, gulls, and terns nesting along the coastal zone of the YKD. Numbers of nests of focal species sampled in this ground-based survey are stable or increasing in the short-term (2004-2013), long-term (1985-2013), or both. No significant declines in nest population sizes are apparent. In 2013, the number of spectacled eider nests was down from the previous year, but remained above the long-term average. The proportion of active nests (an index to nest success) indicated that nest success was fair and clutch size was moderate relative to long-term means. Average growth rate in the number of spectacled eider nests indicates a stable population during the most recent decade and over the 29-year span of this survey. In 2013, geese produced high numbers of nests and eggs, and exhibited fair to good nest success; yet clutch size was very low relative to long-term means. Similar to the previous year, cold May temperatures in 2013 delayed snowmelt and breakup of lakes, ponds, sloughs and rivers. Waterfowl responded accordingly with nest initiation and hatch occurring up to eight days later than long-term means. Despite late nesting initiation in 2012 and 2013, average timing of waterfowl nesting has advanced five days since standardized plot data collection began in the 1980s.

The Spectacled Eider Recovery Team identified annual nest surveys as the primary method to assess population status relative to recovery criteria for the YKD subpopulation. Based on these nest surveys, the YKD subpopulation of spectacled eider is close to the benchmark criteria for consideration of delisting from threatened status. We recommend the Spectacled Eider Recovery Team continue analysis of all three subpopulations (YKD, North Slope, and Arctic Russia) to determine if the species meets criteria to be considered for delisting, and to investigate alternative analytical techniques to assess population status.

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## INTRODUCTION

Declines of breeding populations of geese on Alaska's Yukon-Kuskokwim Delta (YKD) between the 1960s and 1980s caused conservation concern throughout the Pacific Flyway (Raveling 1984, Pamplin 1986) and prompted studies to determine if poor production might be contributing to declines. The resulting ground-based surveys in combination with aerial surveys also provided data to assess status of spectacled eiders (*Somateria fischeri*) and identified a significant decline in abundance in western Alaska (Stehn et al. 1993, Ely et al. 1994) that

contributed to the species being listed as threatened under the Endangered Species Act in 1993 (Federal Register 1993). Following listing, a recovery team was established to develop and implement the Spectacled Eider Recovery Plan (U.S. Fish and Wildlife Service 1996). This plan identified criteria for delisting the species that required reaching at least one of the following benchmarks for each of three subpopulations including the YKD, North Slope Alaska, and Arctic Russia: 1) stable or increasing population over 10-15 years and a minimum population exceeding 6,000 breeding pairs; or 2) a population exceeding 10,000 breeding pairs over three consecutive annual surveys; or 3) a population exceeding 25,000 breeding pairs in any one survey (U.S. Fish and Wildlife Service 1996). The Spectacled Eider Recovery Team identified annual ground-based nest surveys as the primary method to assess status relative to recovery criteria for the YKD subpopulation (U.S. Fish and Wildlife Service 1996). Accordingly, annual assessment of spectacled eider status through nest surveys on the YKD is a priority for the USFWS.

In addition to addressing this priority action, annual YKD nesting survey results have also provided information on nest population size, egg production, phenology, habitat use, and predation for a suite of waterbirds including cackling Canada geese (*Branta canadensis minima*), emperor geese (*Chen canagica*), greater white-fronted geese (*Anser albifrons frontalis*), black brant (*Branta bernicla nigricans*), tundra swans (*Cygnus columbianus*), sandhill cranes (*Grus canadensis*), spectacled eider, common eider (*Somateria mollissima*), Pacific loons (*Gavia pacifica*), red-throated loons (*G. stellata*), glaucous gulls (*Larus hyperboreus*), mew gulls (*L. canus*), Sabine's gulls (*Xema sabini*), and Arctic terns (*Sterna paradisaea*). Biologists and managers use these long-term data sets to develop baseline inventory of wildlife resources, implement cooperative waterbird management plans (e.g. goose management plans), assess waterbird distribution across the YKD landscape (Platte and Stehn 2014, Saalfeld et al. 2014), create habitat association models (Saalfeld et al. 2014) and develop vulnerability assessments.

## **METHODS**

### Nest Plot Sampling

We used a ground-based sampling procedure to monitor waterbird nest populations and potential production on the YKD coastal zone from 1985 to 2013. Boundaries of the survey area include lands on the Yukon Delta National Wildlife Refuge (YDNWR) surrounding Hazen Bay (Fig. 1). Prior to 1994 and in 1998-99, randomly located plots were selected from various regions on the Yukon-Kuskokwim coastal zone as we accumulated information on the distribution of waterfowl and other birds. Since 2000, plots have been selected within a consistent area of 716 km<sup>2</sup>, hereafter referred to as the “core nesting area”, that is comprised of medium (>1 observed spectacled eiders/km<sup>2</sup>) and high (>2 observed spectacled eiders/km<sup>2</sup>) density eider nesting habitat as determined by aerial observations on systematic transects in 1988-1994 (USFWS unpubl. data). Data from these aerial surveys indicate the majority of all spectacled eider pairs occur in the core nesting area, yet it represents just 5.6% of the total coastal zone (12,832 km<sup>2</sup>). Several patches of privately owned eider nesting habitat within the core nesting area are excluded from sampling because annual access could not be ensured. In this report our estimates of nest population size and egg production for 1985-2013 are based on data collected on plots within the core nesting area and expanded to the entire coastal zone of the YKD using aerial survey data (see below).

Each year we used Geographic Information Systems (GIS) and custom-written True BASIC computer programs to randomly select 85 plots within the core nesting area (Fig. 1). Selection of plot locations was restricted by excluding points that were sampled in the current or previous five years. Plot size in most years (1988-1994 and 1997-2013) was 402 m by 805 m

(0.324 km<sup>2</sup>). Plot sizes were variable in 1985-1987 (0.16-1.66 km<sup>2</sup>), and were 0.45 km<sup>2</sup> in 1995, and 0.36 km<sup>2</sup> in 1996.

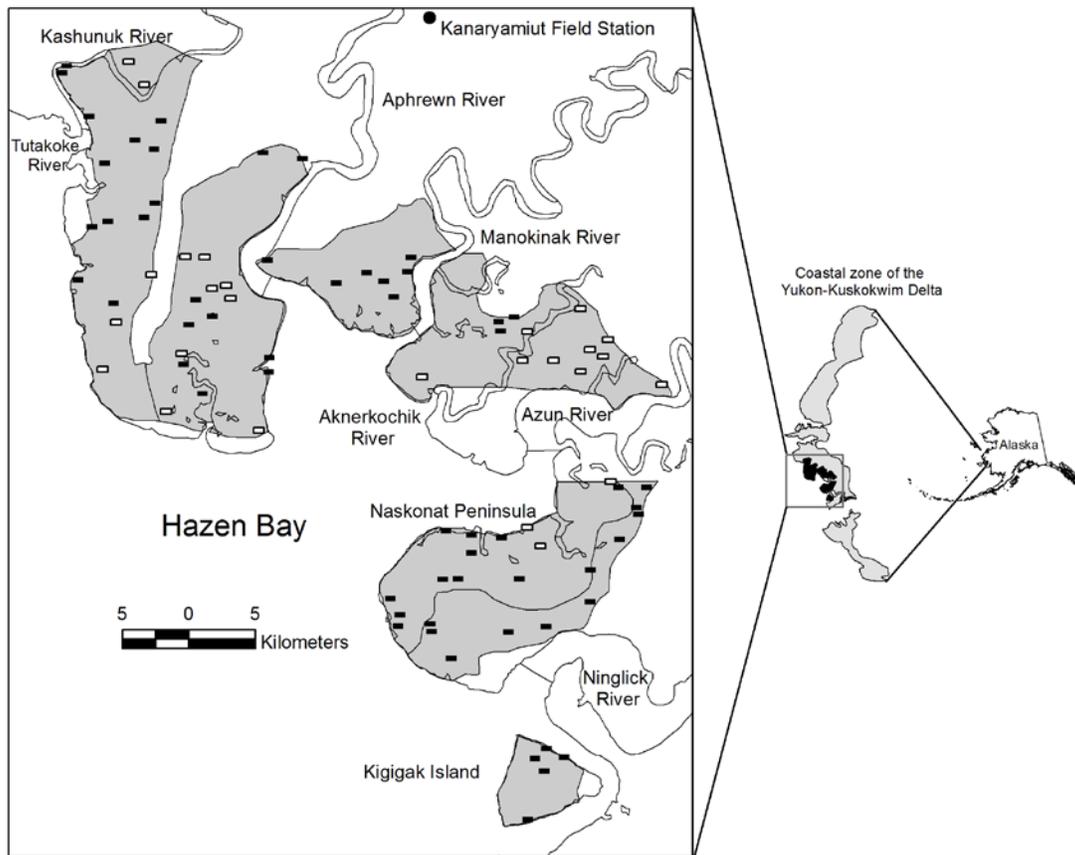


Figure 1. Location of 85 plots in 2013 that were randomly selected within a core nesting area (716 km<sup>2</sup>) located within the Yukon-Kuskokwim Delta coastal zone (12,832 km<sup>2</sup>), Alaska. Sampled plots are represented by 59 solid rectangles. Twenty-six additional plots were selected but not sampled, shown as open rectangles.

Two to four biologists searched each plot for up to 8 hours depending on crew size, available habitat, nest density, and crew experience. Crews used aerial photographs (1985-2007) and IKONOS satellite imagery (2008-2013) at a 1:13,000 scale as field maps (Fig. 2). Access to plots was achieved by float-equipped aircraft and boat. In 2013, two crews, each equipped with an inflatable skiff, were transported to the Naskonat Peninsula via float plane. Three crews used 16'-18' aluminum skiffs to access plots near the Aphrewn, Opagarak, and Kashunuk rivers. Data were collected at 16 plots by collaborating biologists in adjoining scientific camps including Kigigak Island (YDNWR- five plots), Kashunuk River (YDNWR, two plots), Manokinak River (US Geological Survey, five plots), and Tutakoke River (University of Nevada, Reno, four plots).

All nesting habitat within a plot was examined for active and destroyed waterfowl, crane, loon, and gull nests. Nesting records of other species were recorded as encountered but most shorebird and passerine nests were likely missed. At each nest, we recorded 1) species, 2) nest status (active, destroyed, abandoned), 3) nest site habitat (shoreline, island, peninsula, slough bank, grass meadow, palsa, upland, displaced island), 4) stage of incubation, 5) clutch size, and 6) geographic coordinates. Species identification was determined by visual

confirmation of an adult at the nest or by comparing down and contour feathers in the nest bowl with a photographic field guide (Bowman 2008).

### Nesting Phenology

We estimated ages of eggs (days following initiation of incubation) using float angles of up to three eggs per nest (Westerskov 1950). To measure float angle, we gently lowered eggs



Figure 2. Example of a field map to navigate within boundaries of two plots. Plot size was 402 m x 804 m.

into water and compared the angle of the resulting floating or sinking egg to a diagram that indicated nine stages from sinking to very buoyant that corresponded to number of days following start of incubation (Fig. 3). The nine stages equated to **2, 5, 8, 10, 13, 15, 18, 22, 24** days, respectively based on cackling Canada geese (USFWS unpubl. data). We then proportionally adjusted the incubation stage for each species based on the average 25-day incubation period of cackling Canada geese (after Afton and Paulus 1992; Table 1). For example, spectacled eider has an incubation period of

24 days; thus, incubation stage 1 indicates 1.9 days of incubation (calculated as  $2 \cdot [24/25]$ ), where **2** is the estimate of days following initiation of incubation for cackling Canada geese eggs indicated by stage 1, and 24/25 is the proportional adjustment for spectacled eider incubation duration relative to cackling Canada geese (**24**-day incubation period of spectacled eider; **25**-day incubation period of cackling Canada geese). Similarly, a spectacled eider egg in incubation stage 2 indicates 4.8 days of incubation (calculated as  $5 \cdot [24/25]$ ), where **5** is the estimate in days of a cackling Canada goose egg in incubation stage 2; incubation stage 3 indicates 7.7 days following initiation of incubation ( $8 \cdot 24/25$ ); etc. For tundra swan, average incubation is 31 days; thus incubation stage 1 indicates 2.5 days of incubation ( $2 \cdot (31/25)$ ); incubation stage 2 indicates 6.2 days ( $5 \cdot 31/25$ ); incubation stage 3 indicates 9.9 ( $8 \cdot 31/25$ ); etc.

We calculated mean hatch date for each species as the date of the nest visit **plus** total incubation duration for that species (Table 1) **minus** days of incubation at the time of the nest visit, averaged across all nests. We determined nest initiation date (day with first egg laid) as the date of the nest visit **minus** days of incubation at the time of the nest visit, **minus** observed clutch size divided by the laying rate expressed as eggs/day (e.g. 0.75 eggs/day for SPEI, see Table 2-2 in Alisauskas and Ankney 1992), **plus** 1. For example, the nest initiation date for a spectacled eider nest visited on day 171 (20 June) containing 5 eggs with an average float angle category of 5 (12.5 days of incubation; Table 1) was calculated as follows:  $171 - 12.5 - (5/0.75) + 1 = 153$ , or 2 June. We report hatch date and clutch size estimates in 1982-1984 using data collected by Butler (1983) and based on the same techniques described above.

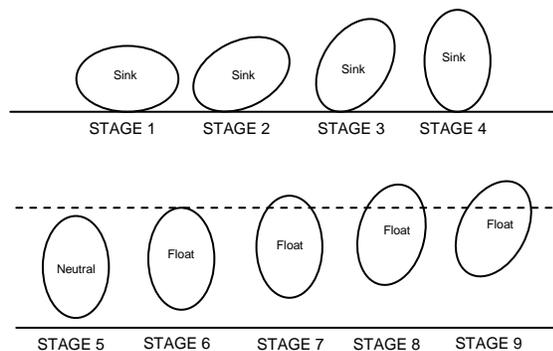


Figure 3. Float angles used to indicate stage of incubation.

### Total Nest and Egg Estimation

To estimate population sizes of total nests, active nests, and eggs, we first calculated density of nests/km<sup>2</sup> as the total number found divided by the total area searched (number of plots \* plot size). For each nest recorded, we also applied a correction factor for imperfect nest detection using a model that includes 1) species; 2) nest status (active, destroyed); 3) observer experience (<150, 150-400, >400 previous nests found); 4) nest site habitat (meadow, slough bank, shoreline, peninsula, island); and 5) down present in nest lining (Bowman and Stehn *manuscript in prep.*). Population size within the core nesting area was then estimated as the detection-corrected density of nests, active nests, and eggs multiplied by the total core nesting area (716 km<sup>2</sup>). We then expanded nest and egg estimates to the total YKD coastal zone based on the inverse proportion of the aerially observed population within the ground sampled area to the entire aerial survey area (12,832 km<sup>2</sup>; Stehn et al. 1993, Taylor et al. 1996). To do this, we annually calculated the ratio of the YKD coastal zone aerial population index outside the ground-sampled area ("OUT") to the aerial index within the ground-sampled area ("IN") for each species. We used "OUT:IN" ratios as expansion factors to determine the number of nests and eggs outside of the core nesting area. We then summed the estimates of nests and eggs outside and inside the ground sampled area to determine the total estimated populations for the coastal zone of the YKD. For most species (geese, ducks, cranes), the aerial population index was based on twice the number of singles plus the number of birds in pairs observed, because observed single geese, cranes and ducks are assumed to be the mates of unobserved females on nests (U.S. Fish and Wildlife Service 1987, Bowman 2014). Flocks were not included in aerial indices for geese, ducks, swans, or cranes but were included for brant, loons, and gulls. For swans, gulls, and loons, the number of observed single birds was not doubled because unlike ducks, both individuals in a pair are highly visible to aerial observers.

Where aerial survey data were unavailable, we substituted the average OUT:IN ratios from the two nearest years where available. For example, aerial survey data were not collected for eiders in 1985-1987, thus for those years, we substituted the average of OUT:IN ratios from 1988-1989. Similarly, for loons, we substituted the average of OUT:IN ratios from 1989-1990 for the years 1985-1988; and for gulls we substituted the average of OUT:IN ratios from 1992-1993 for the years 1985-1991. For eiders, loons and gulls in 2011 we substituted the average of OUT:IN ratios from 2010 and 2012. Standard errors of the OUT:IN ratios were based on the variance of the quotient of the OUT and IN aerial population indices, and each was considered an independent variable with separate variance. Aerial population indices were based on stratified estimates of average densities as determined by standard index ratio procedures (Cochran 1963, p. 158 eq. 6.4). Variance of the nest population in the OUT region included both the variance of nests and variance of the OUT:IN ratio.

Loon data were treated differently from other species because nest identification of red-throated (*Gavia stellata*) and Pacific loons (*Gavia pacifica*) is very difficult. Loons rarely remain near their nest sites when ground crews are present and their nests and eggs are effectively indistinguishable (Bowman 2008). Thus, to determine the relative numbers of Pacific loon nests, we calculated the proportion of Pacific loons to total loons based on aerial observations from transects within the sampled area (Platte and Stehn 2014). We then multiplied this ratio by the total number of loon nests to derive an estimate for Pacific loon nests. We used the same approach to estimate the number of red-throated loon nests.

The estimated total number of nests measures the minimum number of breeding pairs in the population because some pairs may not establish a nest in a given year, and some nests are destroyed or abandoned at an early stage before they can be detected by ground crews. Nest success (nests with at least one egg hatched/total nests) is not directly measured because

crews only visit plots once and do not know the ultimate fate of each nest; thus we report a nest success index (active nests/total nests). Similarly, we do not monitor fledging success or juvenile survival; thus number of eggs reported is an index that represents the maximum potential young that could augment the fall population if they survived through incubation, brood rearing, and the post-fledging periods. Definitions of these terms are summarized in the caption of Figure 4.

We describe 2013 nest and egg estimates relative to short-term (most recent 10-years 2004-2013) and long-term means (all data from this project 1985-2013). We provide qualitative descriptors of these estimates that correspond to quartiles (4<sup>th</sup> quartile = *high*, 3<sup>rd</sup> quartile = *moderate*, 2<sup>nd</sup> quartile = *low*, 1<sup>st</sup> quartile = *very low*) from the long-term data set. We analyzed growth rate at the alpha = 0.10 level; thus, annual growth rate is reported as stable when the 90% confidence interval of the growth rate includes 1.0. We report annual estimates of a nest success index and clutch sizes in 1985-2013, and compare the 2013 estimates to long-term means with qualitative descriptors that correspond to quartiles (4<sup>th</sup> quartile = *excellent*, 3<sup>rd</sup> quartile = *good*, 2<sup>nd</sup> quartile = *fair*, 1<sup>st</sup> quartile = *poor*). Annual nesting phenology is compared to average hatch dates (1982-2013).

Species nomenclature follows the List of Migratory Birds in Title 50 of the Code of Federal Regulations, revised 1 November 2013 (Federal Register 2013).

## RESULTS

In 2013, we searched 59 plots from 11-26 June (Fig. 1) comprising 2.6% of the core nesting area (59 plots x 0.324 km<sup>2</sup>/716 km<sup>2</sup>). We did not visit 26 of the 85 randomly selected plots, primarily due to late river breakup that prevented access to field sites. Together, crews in located 2,866 nests within plot boundaries including 1,135 cackling Canada goose, 258 emperor



Kashunuk River following breakup, 6 June, 2013. USFWS.

goose, 552 greater white-fronted goose, 279 black brant, 83 spectacled eider, 28 common eider, and 531 nests of other species. Calculations of clutch size and hatch date also included an additional 59 nests located outside of plot boundaries.

We present nest population, egg production, and nest success estimates in figures with accompanying tabulated data for each species (Fig. 4). Estimated short-term and long-term annual growth rates, and nest initiation and hatch dates for all species are presented in Tables 2-4.

### Environmental Conditions 2013

Similar to 2012, cold spring temperatures and extensive sea ice in the Bering Sea delayed arrival of summer on the Yukon-Kuskokwim Delta in 2013. Ice extent in the Bering Sea during late winter and spring 2013 was above average (NASA National Snow and Ice Data Center 2013). Mean May and June temperatures in Bethel, located approximately 160 km east of Hazen Bay, were 2 C and 13 C, respectively (NOAA 2013a). At Bethel, Kuskowkim River breakup occurred on 29 May. This date was the latest recorded since this project began in 1985, the second latest since dates were recorded starting in 1924, and 18 days later than the 1985-2012

average (NOAA 2013b). Most freshwater in the core nesting area surrounding Hazen Bay remained frozen throughout May (Brian McCaffery, USFWS, pers comm.).

Access to the field site by boat or float plane was not possible before mid June because of extensive ice in rivers and lakes (Gabrielson and Spragens 2013). Aerial reconnaissance flights along the coast of Hazen Bay on 6 and 8 June revealed widespread river and lake ice though snow cover was gone in most locations (Kyle Spragens, USFWS, pers. comm.). With the exception of Kigigak Island and the northwest portion of Naskonat Peninsula where data collection began on 11 June, plots were inaccessible to crews until 14 June because of river ice jams. During the 15 days of data collection, weather was variable with occasional periods of heavy rain and wind. Immediately following the completion of data collection, several days of heavy precipitation coupled with a high tide storm surge resulted in significant flooding on 29 June just prior to peak hatch of many nesting species.

### Species Descriptions 2013

Cackling Canada Goose (*Branta canadensis minima*) [Species nomenclature follows the List of Migratory Birds in Title 50 of the Code of Federal Regulations, revised 1 November 2013 [Federal Register 2013]].

The number of cackling Canada goose nests was high (see methods for definition of qualitative descriptors) with estimates 15% and 56% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also high with estimates 0% and 40% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate increasing populations in the short-term (2004-2013) and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was fair (see methods for definition of qualitative descriptors); however, clutch size (active eggs/active nest) was very low relative to the long-term mean (Fig. 4). Average hatch date for cacklers was seven days later than the long-term mean (1982-2013; Table 4).

### Emperor Goose (*Chen canagica*)

The number of emperor goose nests was high with estimates 25% and 41% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also high with estimates 14% and 29% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate increasing populations in the short-term and long-term (Fig. 4, Tables 2-3) with the exception of eggs in the short term which are stable. Nest success (active nests/total nests) was good; however, clutch size (active eggs/active nest) was very low relative to the long-term mean (Fig. 4). Average hatch date for emperor geese was seven days later than the long-term mean (1982-2013; Table 4).



### Greater White-fronted Goose (*Anser albifrons frontalis*)

The number of white-fronted goose nests was high with estimates 31% and 118% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also high with estimates 16% and 91% above short-term and long-term

means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate increasing populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was fair; however, clutch size (active eggs/active nest) was very low relative to the long-term mean (Fig. 4). Average hatch date for white-fronts was seven days later than the long-term mean (1982-2013; Table 4).

#### Black Brant (*Branta bernicla nigricans*)

The number of brant nests was high with estimates 33% and 20% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of



eggs was also high with estimates 33% and 20% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate stable populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was good and clutch size (active eggs/active nest) moderate relative to the long-term means (Fig. 4). Average hatch date for brant was six days later than the long-term mean (1982-2013; Table 4).

#### Tundra Swan (*Cygnus columbianus*)

The number of tundra swan nests was low with estimates 21% and 10% below short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was very low with estimates 36% and 31% below short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs are equivocal with nests stable in the short term and increasing in the long-term; whereas the number of eggs is decreasing in the short term and stable in the long term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was poor and clutch size (active eggs/active nest) low relative to the long-term mean (Fig. 4). Average hatch date for tundra swans was eight days later than the long-term mean (1982-2013; Table 4).

#### Sandhill Crane (*Grus canadensis*)

The number of sandhill crane nests was low with estimates 11% and 10% below short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also low with estimates 18% and 13% below short-term and long-term means, respectively (Fig. 4, Tables 2-3). Numbers of nests and eggs are stable in the short term and increasing in the long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was fair and clutch size (active eggs/active nest) very low relative to the long-term mean (Fig. 4). Average hatch date for sandhill cranes was seven days later than the long-term mean (1982-2013; Table 4).

#### Spectacled Eider (*Somateria fischeri*)

The number of spectacled eider nests was moderate with estimates 3% below and 10% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also moderate with estimates 9% below and 7% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate stable populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success

(active nests/total nests) was fair and clutch size (active eggs/active nest) was moderate relative to the long-term mean (Fig. 4). Average hatch date for spectacled eiders was six days later than the long-term mean (1982-2013; Table 4).

#### Common Eider (*Somateria mollissima*)

The number of common eider nests was moderate with estimates 33% below and 11% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also moderate with estimates 29% below and 18% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate stable populations in the short-term and increasing populations in the long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was good and clutch size (active eggs/active nest) moderate relative to the long-term mean (Fig. 4). Average hatch date for common eiders was six days later than the long-term mean (1982-2013; Table 4).

#### Gulls and Terns

Colonial nesting seabirds including glaucous gulls (*Larus hyperboreus*), Sabine's gulls (*Xema sabini*), mew gulls (*Larus canus*), and Arctic terns (*Sterna paradisaea*) are not monitored with precision by the nest plot survey. Nonetheless, the survey does provide an index of potential production and nest success for these species.

The number of glaucous gull nests was moderate with estimates 1% and 2% below short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The numbers of eggs was also moderate with estimates 4% below and 5% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate stable populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was good and clutch size (active eggs/active nest) moderate relative to the long-term mean (Fig. 4). Average hatch date for glaucous gulls was seven days later than the long-term mean (1982-2013; Table 4).



The number of mew gull nests was high with estimates 2% below and 14% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also moderate with estimates 2% and 21% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate stable populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was

excellent but clutch size (active eggs/active nest) was low relative to the long-term mean (Fig. 4). Average hatch date for mew gulls was five days later than the long-term mean (1982-2013; Table 4).

The number of Sabine's gull nests was high with estimates 295% and 158% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The numbers of eggs was also high with estimates 307% and 169% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate increasing populations in the short-term and long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was excellent but clutch size (active eggs/active nest) was low relative to the long-term

mean (Fig. 4). Average hatch date for Sabine's gulls was seven days later than the long-term mean (1982-2013; Table 4).

The number of Arctic terns nests was high with estimates 42% and 98% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The numbers of eggs was also high with estimates 57% and 104% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Rates of growth in nests and eggs indicate populations that are stable in the short-term but increasing in the long-term (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was excellent but clutch size (active eggs/active nest) was low relative to the long-term mean (Fig. 4). Average hatch date for arctic terns was two days later than the long-term mean (1982-2013; Table 4).

### Loons

The number of red-throated loon (*G. stellata*) nests was moderate with estimates 9% and 8% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The number of eggs was also moderate with estimates 7% and 4% above short-term and long-term means, respectively (Fig. 4, Tables 2-3). Number of nests is declining in the short term, but numbers of eggs are stable. Over the long-term, both nests and eggs are stable (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was fair and clutch size (active eggs/active nest) low relative to the long-term mean (Fig. 4). Average hatch date for red-throated loons was six days later than the long-term mean (1982-2013; Table 4).

The numbers of Pacific loon (*Gavia pacifica*) nests was high with estimates 25% and 32% above short-term (2004-2013) and long-term (1985-2013) means, respectively (Fig. 4, Tables 2-3). The numbers of eggs was also high with estimates 23% and 27% above short-term and long-



term means, respectively (Fig. 4, Tables 2-3). Number of nests is increasing in the short term, but numbers of eggs are stable. Over the long-term, both nests and eggs are stable (Fig. 4, Tables 2-3). Nest success (active nests/total nests) was fair and clutch size (active eggs/active nest) low relative to the long-term mean (Fig. 4). Average hatch date for Pacific loons was six days later than the long-term mean (1982-2013; Table 4).

## **DISCUSSION**

### Overview of abundance, trends, and productivity

The nest plot survey was specifically designed to provide annual abundance and trend estimates of nests and eggs, and to measure nest success and hatching dates for four focal species: cackling Canada geese, emperor geese, greater white-fronted geese, and spectacled eiders. Data on black brant, tundra swans, sandhill cranes, common eiders, loons, gulls, and terns were also collected and reported.

In 2013, production of nests and eggs, rates of nest success, and estimates of clutch size were similar among geese, but varied widely among other species. The three focal goose species all exhibited high production of nests and eggs, and fair to good nest success. However, for these three species, clutch size was very low relative to long-term means. Spectacled eiders had moderate production of nests and eggs, fair nest success and moderate clutch size. One

potential contributing factor to lower than average clutch size is the late timing of breakup and snow melt that may have precluded production of larger clutches.

Numbers of nests of three of the four focal species have increased significantly over the 29-year time span of this survey (1985-2013); the one exception being spectacled eiders whose growth rate is stable. Given the relatively high numbers of spectacled eider nests estimated through the late 1980s followed by 11 years of relatively few nests, positive growth will be required in the years ahead before a long-term positive trend will be significant. The 2013 estimate for spectacled eider nests was the tenth highest since 1987, representing a substantial drop from the previous year. Regardless, the estimate of spectacled eider nests in 2013 is higher than the long-term mean (Table 3).

### Status of Spectacled Eiders

Using criteria defined in the Spectacled Eider Recovery Plan (U.S. Fish and Wildlife Service 1996), the Yukon-Kuskokwim Delta spectacled eider population is approaching the benchmark for consideration of delisting from threatened status. For delisting to occur, each of three spectacled eider populations (Yukon-Kuskokwim Delta, North Slope Alaska, and Arctic Russia) must show stable to significant population growth using data from 10-15 years of annual surveys and have a minimum population that exceeds 6,000 breeding pairs as measured by the lower 95% confidence interval bound (Taylor et al. 1996; U.S. Fish and Wildlife Service 1996). On the Yukon-Kuskokwim Delta, the growth rate of numbers of nests (a proxy for numbers of breeding pairs) using data from the most recent 10 years (2004-2013) is 1.025 and an average of 5617 nests (4,706 – 6,528, 95% confidence interval). Over the most recent 15 years (1999-2013) the growth rate is 1.046 and with an average of 4,917 nests (4,099 – 5,735, 95% confidence interval). Depending on whether the most recent 10 or 15 years are used to evaluate recovery, these results indicate that the Yukon-Kuskokwim Delta subpopulation is within approximately 1,300-1,900 breeding pairs of meeting the abundance criterion for delisting.



The Spectacled Eider Recovery Plan specifies alternative criteria for delisting that include a subpopulation exceeding 10,000 breeding pairs over three consecutive annual surveys; or a population exceeding 25,000 breeding pairs in any one survey (Taylor et al. 1996; U.S. Fish and Wildlife Service 1996). The spectacled eider subpopulation on the Yukon-Kuskokwim Delta does not meet either of these benchmarks.

Delisting of the spectacled eider from threatened status requires that all three populations (Yukon-Kuskokwim Delta, North Slope Alaska, and Arctic Russia) meet delisting criteria outlined above. Breeding and winter population surveys indicate that the Arctic Russia subpopulation is well above the 25,000 breeding pair threshold (Hodges and Eldridge 2001, Larned et al. 2012a). In contrast, the North Slope Alaska spectacled eider subpopulation has remained stable since the initiation of breeding pair surveys in 1992 with no indication of significant positive or negative growth (Larned et al. 2012b, Stehn et al. 2013). Evaluation of

population estimates from the North Slope relative to recovery criteria is currently underway by the Alabama Cooperative Fish and Wildlife Research Unit in Auburn.

### Predation

Mammalian and avian predators are known to destroy nests on the YKD during incubation (Anthony et al. 1991, Bowman and Stehn 2003). In prior studies the proportion of nest loss to foxes at small YKD brant colonies was estimated at 0.61 (Raveling 1989). Data collected in our study provides an indirect measure of Arctic fox (*Alopex lagopus*) presence on plots. Presence of recent fox activity is indicated by fur, scat, tracks, active dens or direct observations, and was noted in 42% of sampled plots in 2013 (Table 5), approximately the same as the long-term mean of 46% (1988-2013). Over the long-term, fox abundance (as measured by the proportion of plots with recent fox activity) is correlated with nest failure (1-nest success index;  $F_{1,24} = 14.52$ ,  $P \leq 0.001$ ; Figs. 5-6) and fox abundance explained 38% of the variation in nest failure in 1988-2013 ( $R^2 = 0.38$ ). In 2013, nest failure was significantly higher in plots with recent fox activity (15% nests failed) than in plots without recent fox activity (8% plots failed;  $F = 6.060$ ;  $P = 0.017$ ). While fox were likely contributors to nest failure in 2013, avian predators likely contributed to egg loss as well. An analysis of nest failure relative to the presence or absence of avian predators would increase understanding of the relative cost of avian and mammalian predation on waterfowl production.

The relationship between voles (*Microtus oeconomus*), foxes, and nesting success is unclear. High egg depredation from foxes in 2001 followed a year of unprecedented numbers of voles (Table 5). One hypothesis for this relationship is that high vole populations in 2000 provided fall and winter food for foxes, thus increasing fox overwinter survival and resulting in above average fox populations in 2001. With a reduced vole population in 2001, foxes may have turned to bird nests as alternative prey. Given the high frequency of voles in 2009 and 2010, we were concerned that fox populations would increase in 2010 and/or 2011 with negative repercussions for avian nest success if vole populations declined. Vole populations did decline in 2011 and remained below average in 2012 and 2013 (Table 5), yet there was little evidence suggesting this change resulted in a higher than average nest failure due to fox predation. One interpretation is that vole populations may have declined in fall 2010 or winter 2010/2011 resulting in low fox survival, thereby reducing predation effects on birds in 2011 and 2012. Alternatively, voles may not play a predictable role in population dynamics of foxes.

### Phenology

Timing of waterfowl nest initiation is correlated with timing of spring breakup (Raveling 1978, Dau and Mickelson 1979). Similar to 2012, the chronology of spring warming along the coast in 2013 was substantially later than recent decades (see Results, "Environmental Conditions 2013") resulting in the latest nest initiation of cackling Canada geese since 1985. Nest initiation of waterfowl in 2013 was up to eight days later than long-term means (1982-2013). Despite the late nesting effort in 2012 and 2013, the timing of nesting efforts has advanced five days since 1982. Since 1982, we estimate that average hatch for cackling geese, for which the most data are available, has occurred 0.163 days earlier each year (Fig. 7). The trend towards earlier nesting is significant at the  $\alpha=0.10$  level ( $F_{1,30} = 3.028$ ,  $P = 0.092$ ,  $R^2 = 0.092$ ).

Long-term increases in spring temperatures and earlier occurrence of spring events, such as river breakup and nest initiation, are predicted in many climate change models (Root et al. 2003, IPCC 2007). Potential effects of climate change on YKD nesting habitat are poorly understood, but may prove to be a significant factor in long-term sustainability of waterfowl

populations. Alteration of habitats through sea level rise (e.g. erosion, inundation, salinization), as a result of melting permafrost, increased river discharge (accelerated sedimentation rates), and storm surges, could influence current nesting areas. To investigate such impacts, data from this study were used to develop habitat selection models for primary nesting species (Saalfeld et al. 2014) that will then be intersected with various storm surge and sea level rise scenarios through collaboration with the University of Alaska, Anchorage. Standardized pond salinity monitoring (H. Wilson, USFWS, unpubl. data) since 2006 also provides baseline and trend information needed to assess changes to the waterfowl nesting habitats of the YKD.

#### Comparison with other Survey Results

The spectacled eider nest success index (number of active nests divided by total nests times 100%, with correction for detection rate) has been variable among years. Plots are visited one time, so the nest success index overestimates actual nest success (number of nests that hatch at least one chick/total nests) because some nests undoubtedly fail prior to hatch. In addition, nests destroyed during egg-laying (before down is added to the nest bowl) are underestimated because they are seldom detected. Nonetheless, nest success indices are measured consistently each year and therefore provide a valid measure. The spectacled eider nest success index generally matches apparent nest success (successful hatched nests/total nests) on Kigigak Island where nests are visited by Yukon Delta National Wildlife Refuge staff every seven days until hatch (Gabrielson and Spragens 2013; Fig. 8). Prior to 2013 the largest difference between estimates from these two surveys was noted in 2001 and 2003, years of very poor production, where many nest failures may have occurred late in nesting.

Alternatively, a localized factor, such as high predator populations, caused low success on Kigigak Island in 2001 and 2003. In 2013, however, spectacled eider nesting success on Kigigak Island was the second lowest in the 22 years that sampling has taken place, whereas nest success as measured in this study was just slightly below the long-term average. Gabrielson and Spragens (2013) offered several possibilities that influenced the divergence of estimates between the two studies including 1) decreased sampling effort and late arrival of crews on Kigigak Island, 2) late nest initiation that precluded late season nest status checks, and 3) inclement weather in late incubation that may have decreased nest success locally. These factors may have been mitigated on the nest plot survey because sampling occurs over a large portion of the nesting range rather than a single island. Despite differences in nest success between the two studies, estimates of clutch size measured on the nest plot survey closely parallel those reported from Kigigak Island (Gabrielson and Spragens 2013; Fig. 9).

In general, nest population trends were similar to those derived from aerial breeding pair surveys (Eldridge et al. 2013, Platte and Stehn 2014). For example, estimates of cackling goose and greater white-fronted goose nests were at record lows in the mid-1980s prior to adoption of the Yukon-Kuskokwim Delta Goose Management Plan that provided protection for nesting and wintering populations of geese (Pamplin 1986). Data from the ground-based plot survey and from aerial breeding pair surveys (Eldridge et al. 2013) show that by the late-1980s, the cackling Canada goose population of nests and pairs increased rapidly, and peaked in the late-1990s. Since 1999, the trend for cackling Canada geese has been generally stable, though estimates from both surveys showed a temporary drop during the mid-2000s (this study, Eldridge et al. 2013). The dramatic increase in population of greater white-fronted geese from the mid-1980s to present is documented by both aerial (growth rate 1.100; Eldridge et al. 2013) and ground surveys (growth rate 1.091 this study). Unlike populations of the other goose species, emperor geese and black brant did not increase markedly after adoption of the Yukon Delta Goose Management Plan. While long-term trends indicate a slow annual increase for

emperor geese in both the ground (growth rate 1.012; this study) and aerial surveys (growth rate 1.017; Eldridge et al. 2013), black brant growth rates show no significant growth or decline as measured by ground or aerial surveys (growth rates 0.996 and 1.008, respectively).

Similar to geese, spectacled eiders are also monitored by aerial survey crews. In 2013, aerial crews detected the highest number of spectacled eiders since the aerial survey began in 1988 (Platte and Stehn 2014). Average long-term and short-term annual growth rates as measured by the aerial survey are 1.068 (1988-2013) and 1.079 (2004-2013). These growth rates are higher than nests estimated from the ground based survey presented in this report. This difference is likely due to the fact that pairs of birds are present on the breeding grounds regardless of whether they breed or not, whereas nest estimates are influenced by the current year nesting effort. The low nesting effort in 2013 influenced the current year nest estimates and hence the short-term and long-term growth rates of spectacled eider nests, but not total birds present on the breeding grounds. If poor production continued over several years, we would expect to see a reduction in the growth rate of total birds estimated from the aerial survey.

Standard aerial surveys and the current ground-sampling methods do not estimate the number of colony nesting brant with precision. To address this, photographic methods were initiated in the 1990s to monitor nest populations in five major brant colonies to improve precision of estimates (Anthony et al. 1995, Wilson 2013). These surveys indicate a decline in brant nest populations since 1992 (Wilson 2013), whereas nest numbers in the ground sampled area (this study) and the fall and winter counts of the entire Pacific population indicate relative stability (Stehn et al. 2010). There are three hypotheses that may contribute to this dichotomy. Stehn et al. (2011) explored the hypothesis that brant are nesting in increasing proportions in small dispersed colonies or satellite colonies outside primary colonies on the YKD. They found that growth rates outside of the primary colonies are positive in some locations but are not sufficient to offset region-wide declines (Stehn et al. 2011). A second hypothesis is that brant populations are increasing on the Arctic Coastal Plain of Alaska, to some degree offsetting declines of YKD colony brant in the overall Pacific population. There is some support for this explanation in aerial surveys of the Alaskan Arctic that show brant have increased significantly since 1986 (Larned et al. 2012b, Stehn et al. 2013). A third hypothesis is that there is bias inherent in the fall and midwinter surveys that mask an actual decline in the Pacific black brant population.

Annual visits to established plots specifically designed to monitor brant throughout the YKD breeding area could reveal trends for small or ephemeral colonies. Annual visits at two small brant colonies on the Naskonat Peninsula indicate variable, and possibly declining nest numbers in that area (Dau, pers. comm., USFWS). Only through a long-term investment in sampling can population change be detected in the light of high variability in nesting.

#### Range of Inference

The number of nests should not be interpreted as direct estimates of species population size. A year with poor nesting conditions may result in fewer nesting attempts (and thus nests), but does not represent a loss of adults from the population. This was particularly apparent in 2001 and 2003 when nesting failures resulted in relatively low estimates of spectacled eider nests and eggs, whereas aerial surveys documented numbers of pairs close to long-term means (Platte and Stehn 2014). Similarly, relatively few spectacled eider nests were constructed in 2011 and 2013, but spectacled eiders were seen by ground crews on 81% and 83% of plots sampled during these years, respectively. We believe the relatively low nest estimates in 2011 and 2013 were the result of either reduced breeding effort or a substantial nesting failure during

early incubation prior to the initiation of field work, both representing only a temporary setback in long-term population growth.

Inter-annual variation in nest population size, as described above, highlights the importance of long-term data collection. Annual changes in nest population size are less informative than long-term trends because of sampling error, changes in observers, distribution of plots, and small sample size for less common species. Only multiple years of consistent declines or increases will indicate a true change in the number of nests and eggs produced on the Yukon-Kuskokwim coastal zone. We believe that a graphical presentation (Fig. 4) enables better interpretation of data than analysis of year-to-year changes in population size. A primary advantage of the random nest plot sampling procedure over intensive local studies is that over the long-term it assures applicability of estimates for the entire core nesting area, not just the immediate areas around biological study camps. Moreover, the single brief visit to scattered plots ensures that the monitoring of populations occurs with minimum disturbance.

### Summary

In 2013, a drop in the number of spectacled eider nests relative to the previous year reduced the short-term and long-term growth rates. Of those birds that did nest, nest success was fair and clutch size was moderate relative to long-term means. Geese (cackling Canada, emperor, and white-fronted) exhibited high production of nests and eggs, and fair to good nest success; yet clutch size was very low relative to long-term means. Data from the focal species sampled in this ground-based survey suggest that numbers of nests on the Yukon-Kuskokwim Delta are stable or increasing in the short-term (2004-2013), long-term (1985-2013), or both. No significant declines in nest population size are apparent. It appears that waterfowl are responding adequately to variability in onset of spring as witnessed by relatively late nest initiation and hatch in 2012-2013 and have stable or increasing population sizes. The pattern towards earlier nesting activity since 1982 was dampened by the late arrival of spring in 2012 and 2013 but the trend is still significant over the long-term.

The Yukon-Kuskokwim Delta spectacled eider subpopulation is close to the benchmark criteria for consideration of delisting from Threatened status, but based on the Spectacled Eider Recovery Plan, no subpopulations can be considered for delisting until all three subpopulations meet minimum thresholds. We recommend the Spectacled Eider Recovery Team continue analysis of abundance and trend data of all three subpopulations to determine if the species meets criteria to be considered for delisting, and to consider alternative analytical techniques to assess population status.

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Figure 4 (Subsequent pages). Population size with  $\pm$  90% confidence intervals and trends of waterbird nests and egg production on the Yukon-Kuskokwim Delta Alaska, 1985-2013, with accompanying tabulated data. Column heading definitions follow:

**Year** = survey year;

**N plots** = number of ground sampled plots used in the analysis;

**Sampled km<sup>2</sup>** = total area searched (N plots\*plot size);

**Nest index IN** = number of nests within the core 716 km<sup>2</sup> ground sampled area uncorrected for nest detection;

**SE nest index IN** = standard error for nest index;

**Avg nest detection rate** = annual proportion of nests detected based on predictive model that includes the covariates of species, nest status, habitat, and observer experience;

**Corrected nests IN** = Nest index in ground sampled area corrected for nest detection;

**Aerial OUT:IN 7 yr ratio** = Average ratio of aerial observations seen out of the ground sampled area vs. in the ground sampled area

**Corrected nests OUT** = number of nests extrapolated beyond the ground sampled area based on the Aerial Out:In ratio, corrected for nest detection rate;

**Total nests IN+OUT** = "Corrected nest IN" + "Corrected nests Out"

**SE total nests** = standard error for total nest estimate;

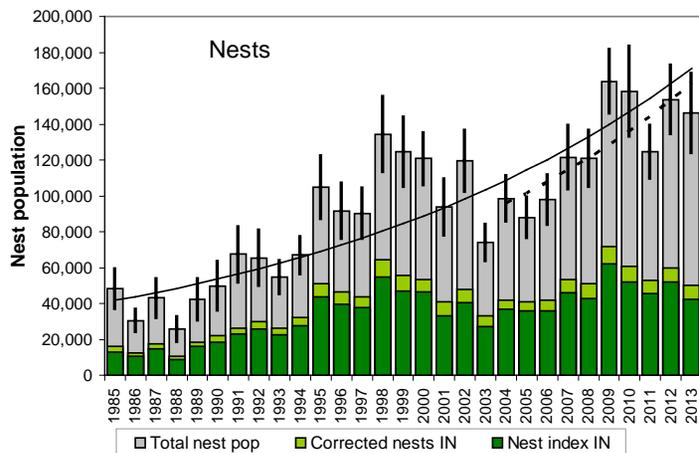
**Total eggs IN+OUT** = total number of viable eggs at time of plot search in the YKD coastal zone, corrected for detection rate;

**SE total eggs** = standard error for total egg estimate;

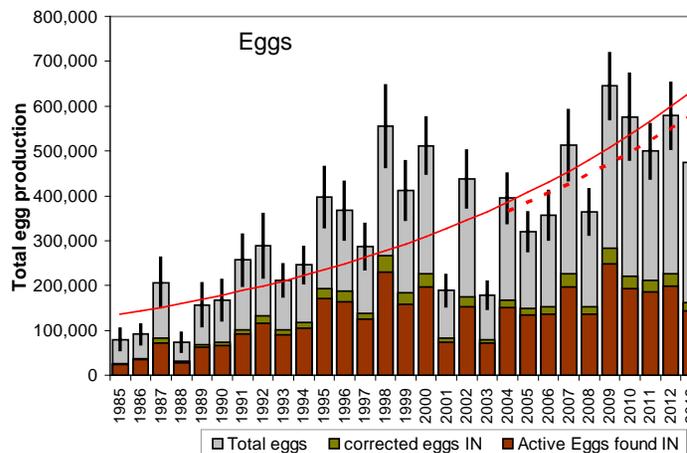
**Total eggs/active nests** = total viable eggs In+Out divided by the nests with eggs In+Out, corrected for detection rate;

**Corrected % nest success index** = number of active nests divided by total nests times 100%, corrected for detection rate

**CCGO Cackling Goose**



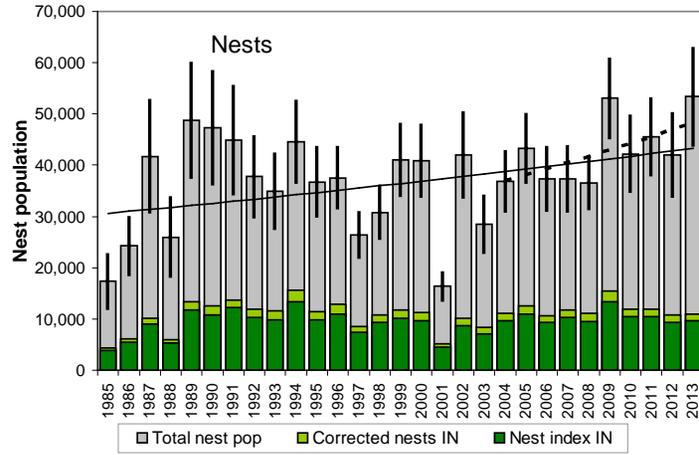
1985-2013 avg annual growth rate= 1.052 (90%c.i.= 1.042-1.062)  
 2004-2013 avg annual growth rate= 1.061 (90%c.i.= 1.035-1.088)



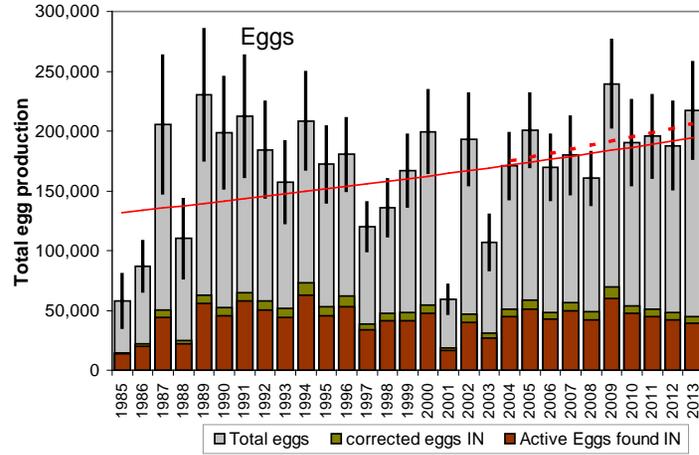
1985-2013 avg annual growth rate= 1.057 (90%c.i.= 1.042-1.071)  
 2004-2013 avg annual growth rate= 1.052 (90%c.i.= 1.016-1.090)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	12,788	1,625	79.2%	16,149	1.995	32,216	<b>48,365</b>	6,676	<b>79,771</b>	13,748	3.91	42%
1986	46	22.16	10,594	1,406	85.0%	12,467	1.444	18,002	<b>30,469</b>	3,818	<b>91,057</b>	13,116	4.89	61%
1987	37	12.67	14,909	2,693	86.1%	17,319	1.483	25,687	<b>43,007</b>	6,544	<b>206,640</b>	32,996	5.12	94%
1988	32	10.48	8,947	1,912	83.2%	10,749	1.397	15,021	<b>25,770</b>	4,315	<b>73,386</b>	12,590	4.52	63%
1989	23	7.45	16,053	3,536	87.3%	18,390	1.294	23,796	<b>42,185</b>	6,998	<b>156,666</b>	28,379	4.85	77%
1990	33	10.70	18,465	3,890	83.9%	21,997	1.264	27,815	<b>49,812</b>	8,200	<b>167,174</b>	26,847	4.55	74%
1991	36	11.66	22,840	3,763	86.5%	26,414	1.553	41,028	<b>67,442</b>	9,355	<b>256,599</b>	34,366	4.64	82%
1992	42	13.39	25,662	4,554	85.3%	30,098	1.173	35,304	<b>65,402</b>	9,342	<b>288,319</b>	42,749	4.82	91%
1993	47	15.23	22,469	2,877	85.4%	26,323	1.076	28,322	<b>54,646</b>	5,626	<b>211,650</b>	21,529	4.51	86%
1994	41	13.27	27,391	3,099	85.5%	32,051	1.090	34,928	<b>66,978</b>	6,242	<b>246,251</b>	24,019	4.58	80%
1995	50	22.56	43,839	5,413	85.9%	51,015	1.058	53,970	<b>104,985</b>	10,605	<b>396,791</b>	39,987	4.46	85%
1996	54	19.44	39,761	4,827	85.3%	46,617	0.964	44,916	<b>91,532</b>	9,373	<b>366,991</b>	39,062	4.49	89%
1997	72	23.31	37,516	4,527	86.1%	43,550	1.070	46,617	<b>90,167</b>	8,526	<b>287,214</b>	29,832	4.03	79%
1998	64	20.71	54,802	6,330	85.1%	64,403	1.088	70,076	<b>134,479</b>	12,779	<b>555,904</b>	54,837	4.47	92%
1999	53	16.97	46,698	5,561	84.1%	55,508	1.244	69,074	<b>124,582</b>	11,784	<b>411,500</b>	39,220	3.89	85%
2000	80	25.86	46,279	3,884	87.0%	53,165	1.270	67,541	<b>120,706</b>	8,677	<b>511,906</b>	37,225	4.50	94%
2001	81	26.23	32,937	3,999	80.7%	40,799	1.299	53,016	<b>93,815</b>	9,398	<b>188,511</b>	20,630	3.64	55%
2002	84	27.15	40,438	3,989	84.3%	47,948	1.492	71,518	<b>119,467</b>	10,248	<b>437,177</b>	37,942	4.42	83%
2003	83	26.87	27,323	2,905	82.6%	33,071	1.233	40,788	<b>73,859</b>	6,179	<b>177,886</b>	17,640	3.96	61%
2004	81	26.22	36,574	3,024	87.5%	41,818	1.356	56,697	<b>98,515</b>	7,627	<b>395,182</b>	32,856	4.72	85%
2005	83	26.87	35,666	3,192	87.2%	40,898	1.153	47,137	<b>88,035</b>	6,772	<b>319,740</b>	25,799	4.27	85%
2006	75	24.28	35,842	3,708	85.9%	41,706	1.348	56,209	<b>97,914</b>	8,389	<b>356,660</b>	32,362	4.43	82%
2007	79	25.58	46,112	4,684	86.2%	53,492	1.273	68,098	<b>121,590</b>	10,680	<b>513,382</b>	46,953	4.60	92%
2008	82	26.55	42,566	3,963	83.7%	50,846	1.375	69,899	<b>120,745</b>	9,473	<b>364,555</b>	30,167	4.06	74%
2009	81	26.24	62,090	4,476	86.5%	71,807	1.282	92,054	<b>163,860</b>	10,753	<b>644,838</b>	43,884	4.34	91%
2010	66	21.37	51,850	5,637	85.2%	60,861	1.602	97,493	<b>158,354</b>	15,223	<b>576,305</b>	57,226	4.21	86%
2011	82	26.55	45,690	3,602	86.5%	52,806	1.363	71,986	<b>124,791</b>	8,938	<b>499,323</b>	36,558	4.35	92%
2012	77	24.94	51,765	4,218	86.5%	59,828	1.570	93,924	<b>153,752</b>	11,650	<b>579,085</b>	44,267	4.08	92%
2013	59	19.12	42,490	3,986	84.7%	50,144	1.917	96,109	<b>146,253</b>	13,465	<b>474,041</b>	45,629	3.86	84%

**EMGO Emperor Goose**



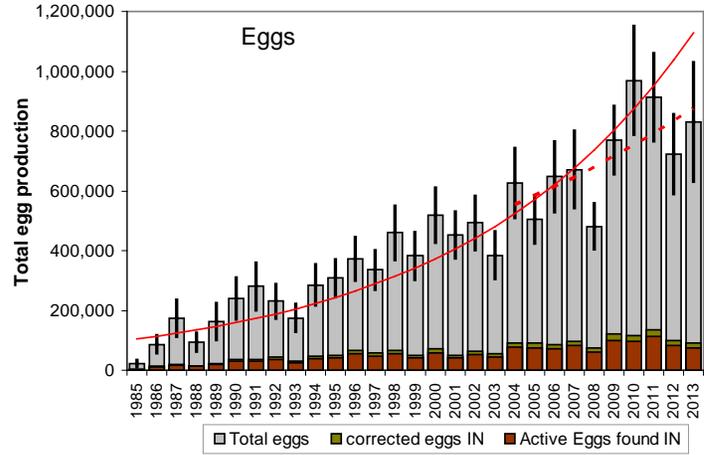
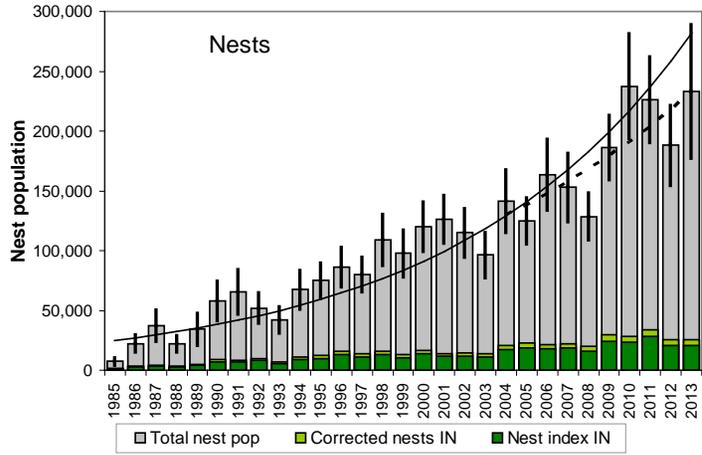
1985-2013 avg annual growth rate= 1.012 (90%c.i.= 1.002-1.023)  
 2004-2013 avg annual growth rate= 1.030 (90%c.i.= 1.008-1.052)



1985-2013 avg annual growth rate= 1.014 (90%c.i.= 1.001-1.027)  
 2004-2013 avg annual growth rate= 1.018 (90%c.i.= 0.997-1.040)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	<b>Total nests IN+OUT</b>	SE total nests	<b>Total eggs IN+OUT</b>	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	3,816	685	86.5%	4,411	2.936	12,950	<b>17,361</b>	3,180	<b>58,000</b>	13,450	5.67	59%
1986	46	22.16	5,426	620	89.0%	6,096	2.974	18,129	<b>24,225</b>	3,387	<b>87,140</b>	12,622	4.93	73%
1987	37	12.67	8,979	1,477	87.9%	10,218	3.084	31,513	<b>41,731</b>	6,635	<b>205,416</b>	34,793	5.12	96%
1988	32	10.48	5,259	981	88.5%	5,942	3.373	20,045	<b>25,988</b>	4,650	<b>110,072</b>	20,064	4.70	90%
1989	23	7.45	11,824	1,769	88.9%	13,306	2.670	35,530	<b>48,836</b>	6,752	<b>230,286</b>	33,092	5.12	92%
1990	33	10.70	10,704	1,299	85.7%	12,490	2.789	34,836	<b>47,326</b>	6,618	<b>198,478</b>	28,050	4.91	85%
1991	36	11.66	12,157	1,812	88.4%	13,758	2.264	31,142	<b>44,900</b>	6,315	<b>212,362</b>	30,669	4.89	97%
1992	42	13.39	10,265	1,372	86.2%	11,906	2.173	25,868	<b>37,774</b>	4,743	<b>184,421</b>	24,253	5.07	96%
1993	47	15.23	9,777	1,116	84.5%	11,571	2.019	23,357	<b>34,928</b>	4,436	<b>157,136</b>	20,569	4.78	94%
1994	41	13.27	13,372	1,647	85.9%	15,561	1.865	29,020	<b>44,581</b>	4,794	<b>208,610</b>	24,345	4.99	94%
1995	50	22.56	9,738	1,127	85.5%	11,389	2.223	25,316	<b>36,706</b>	4,052	<b>172,136</b>	18,985	4.86	96%
1996	54	19.44	11,008	1,105	85.6%	12,866	1.915	24,636	<b>37,502</b>	3,571	<b>180,571</b>	18,272	5.14	94%
1997	72	23.31	7,368	736	87.1%	8,461	2.119	17,926	<b>26,387</b>	2,613	<b>120,153</b>	12,271	4.78	95%
1998	64	20.71	9,295	964	86.7%	10,719	1.874	20,086	<b>30,806</b>	3,089	<b>136,130</b>	14,211	4.64	95%
1999	53	16.97	10,166	875	86.2%	11,794	2.478	29,221	<b>41,015</b>	4,243	<b>166,974</b>	17,931	4.44	92%
2000	80	25.86	9,715	929	86.9%	11,185	2.653	29,672	<b>40,856</b>	4,200	<b>199,499</b>	20,830	4.98	98%
2001	81	26.23	4,503	478	86.4%	5,209	2.148	11,188	<b>16,398</b>	1,608	<b>59,479</b>	7,073	4.81	75%
2002	84	27.15	8,699	942	85.8%	10,142	3.145	31,898	<b>42,040</b>	4,994	<b>193,287</b>	22,998	4.98	92%
2003	83	26.87	7,057	768	84.9%	8,311	2.424	20,149	<b>28,461</b>	3,295	<b>106,667</b>	13,876	4.79	78%
2004	81	26.22	9,690	909	87.7%	11,051	2.336	25,813	<b>36,865</b>	3,521	<b>170,706</b>	16,709	4.88	95%
2005	83	26.87	10,948	812	87.0%	12,588	2.439	30,697	<b>43,285</b>	3,994	<b>200,858</b>	18,428	4.97	93%
2006	75	24.28	9,373	957	88.0%	10,648	2.500	26,624	<b>37,272</b>	3,716	<b>169,471</b>	16,445	4.78	95%
2007	79	25.58	10,241	976	87.6%	11,688	2.190	25,601	<b>37,288</b>	3,814	<b>179,736</b>	19,443	4.98	97%
2008	82	26.55	9,570	782	86.2%	11,103	2.293	25,457	<b>36,561</b>	3,092	<b>160,421</b>	13,264	4.81	91%
2009	81	26.24	13,340	1,137	86.8%	15,369	2.453	37,704	<b>53,073</b>	4,661	<b>239,437</b>	22,032	4.71	96%
2010	66	21.37	10,517	1,118	88.6%	11,873	2.555	30,340	<b>42,213</b>	4,427	<b>190,299</b>	21,493	4.62	98%
2011	82	26.55	10,459	994	87.6%	11,945	2.811	33,576	<b>45,521</b>	4,506	<b>195,615</b>	20,670	4.41	97%
2012	77	24.94	9,412	831	86.7%	10,851	2.869	31,131	<b>41,981</b>	4,859	<b>187,921</b>	21,966	4.59	98%
2013	59	19.12	9,659	828	87.9%	10,993	3.855	42,376	<b>53,369</b>	5,749	<b>217,082</b>	24,411	4.27	95%

**WFGO White-fronted Goose**

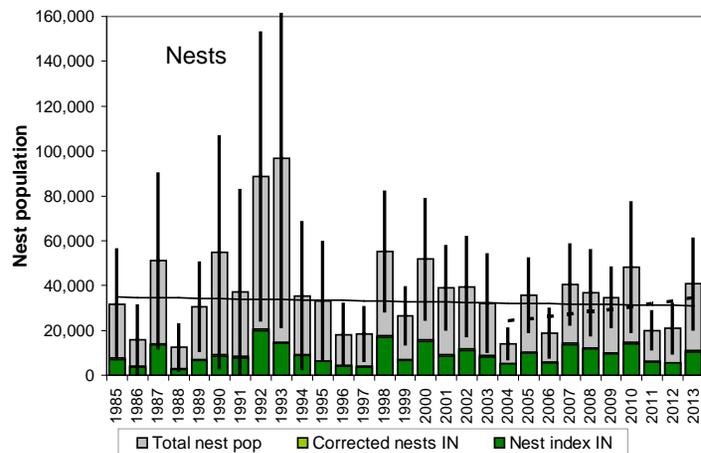


1985-2013 avg annual growth rate= 1.091 (90%c.i.= 1.077-1.104)  
 2004-2013 avg annual growth rate= 1.067 (90%c.i.= 1.038-1.097)

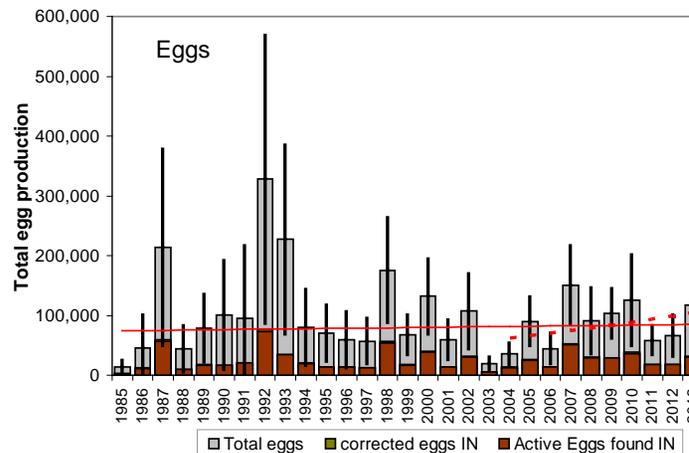
1985-2013 avg annual growth rate= 1.089 (90%c.i.= 1.073-1.105)  
 2004-2013 avg annual growth rate= 1.052 (90%c.i.= 1.017-1.088)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	<b>Total nests IN+OUT</b>	SE total nests	<b>Total eggs IN+OUT</b>	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	1,078	257	81.0%	1,331	4.522	6,019	<b>7,350</b>	1,816	<b>21,715</b>	6,165	4.20	70%
1986	46	22.16	2,907	463	83.2%	3,493	5.376	18,778	<b>22,270</b>	4,424	<b>86,685</b>	18,096	4.37	89%
1987	37	12.67	3,275	629	81.4%	4,026	8.226	33,116	<b>37,141</b>	7,964	<b>174,833</b>	36,910	4.90	96%
1988	32	10.48	2,937	576	83.7%	3,509	5.282	18,533	<b>22,043</b>	4,336	<b>94,499</b>	18,749	4.40	98%
1989	23	7.45	4,037	1,004	84.9%	4,753	6.208	29,507	<b>34,260</b>	8,285	<b>162,572</b>	37,428	5.01	95%
1990	33	10.70	7,025	1,108	81.0%	8,674	5.679	49,263	<b>57,938</b>	10,084	<b>239,146</b>	42,114	4.45	93%
1991	36	11.66	7,184	1,009	86.1%	8,345	6.865	57,291	<b>65,636</b>	11,235	<b>280,870</b>	47,911	4.53	94%
1992	42	13.39	8,019	1,001	82.6%	9,710	4.362	42,355	<b>52,065</b>	7,609	<b>230,387</b>	34,443	4.52	98%
1993	47	15.23	5,641	853	80.4%	7,015	4.997	35,050	<b>42,064</b>	6,757	<b>174,546</b>	27,384	4.27	97%
1994	41	13.27	8,789	1,097	81.3%	10,813	5.228	56,528	<b>67,341</b>	9,708	<b>284,768</b>	41,410	4.34	97%
1995	50	22.56	9,992	1,093	81.0%	12,340	5.074	62,613	<b>74,953</b>	8,961	<b>308,174</b>	37,373	4.26	97%
1996	54	19.44	12,849	1,303	82.6%	15,558	4.534	70,547	<b>86,105</b>	10,025	<b>372,290</b>	43,969	4.49	96%
1997	72	23.31	11,298	1,145	81.7%	13,823	4.772	65,961	<b>79,783</b>	8,786	<b>335,254</b>	38,736	4.28	98%
1998	64	20.71	12,785	1,320	81.7%	15,657	5.956	93,249	<b>108,906</b>	12,884	<b>459,372</b>	55,005	4.33	97%
1999	53	16.97	10,588	1,157	82.4%	12,853	6.597	84,788	<b>97,641</b>	12,114	<b>382,657</b>	47,809	4.17	94%
2000	80	25.86	13,646	1,258	82.9%	16,461	6.285	103,457	<b>119,918</b>	12,431	<b>518,199</b>	55,012	4.45	97%
2001	81	26.23	11,407	935	82.8%	13,775	8.172	112,578	<b>126,353</b>	12,226	<b>453,365</b>	47,101	3.86	93%
2002	84	27.15	11,994	1,001	81.6%	14,694	6.825	100,280	<b>114,974</b>	12,303	<b>493,098</b>	54,715	4.39	98%
2003	83	26.87	11,265	1,151	81.8%	13,773	5.992	82,532	<b>96,305</b>	11,588	<b>384,189</b>	47,536	4.25	94%
2004	81	26.22	17,059	1,465	82.7%	20,638	5.840	120,536	<b>141,174</b>	15,943	<b>626,956</b>	70,447	4.59	97%
2005	83	26.87	18,432	1,472	82.2%	22,421	4.571	102,491	<b>124,912</b>	11,767	<b>505,765</b>	48,443	4.24	96%
2006	75	24.28	17,685	1,571	82.1%	21,537	6.585	141,827	<b>163,363</b>	17,922	<b>647,317</b>	71,213	4.15	96%
2007	79	25.58	18,579	1,518	84.4%	22,017	5.940	130,768	<b>152,785</b>	17,532	<b>671,280</b>	77,831	4.47	98%
2008	82	26.55	16,175	1,124	80.8%	20,010	5.415	108,360	<b>128,370</b>	11,902	<b>480,801</b>	45,934	4.05	92%
2009	81	26.24	24,252	1,481	82.7%	29,327	5.351	156,944	<b>186,271</b>	16,514	<b>770,036</b>	69,065	4.30	96%
2010	66	21.37	23,614	1,738	83.2%	28,397	7.366	209,164	<b>237,561</b>	26,608	<b>969,369</b>	109,908	4.19	97%
2011	82	26.55	28,169	1,575	83.5%	33,736	5.707	192,520	<b>226,256</b>	21,664	<b>913,009</b>	88,336	4.10	98%
2012	77	24.94	21,005	1,794	82.3%	25,518	6.371	162,584	<b>188,102</b>	20,284	<b>723,455</b>	80,323	3.99	96%
2013	59	19.12	20,665	2,137	80.6%	25,637	8.091	207,438	<b>233,074</b>	33,771	<b>830,928</b>	121,066	3.76	95%

**BRAN Black Brant**



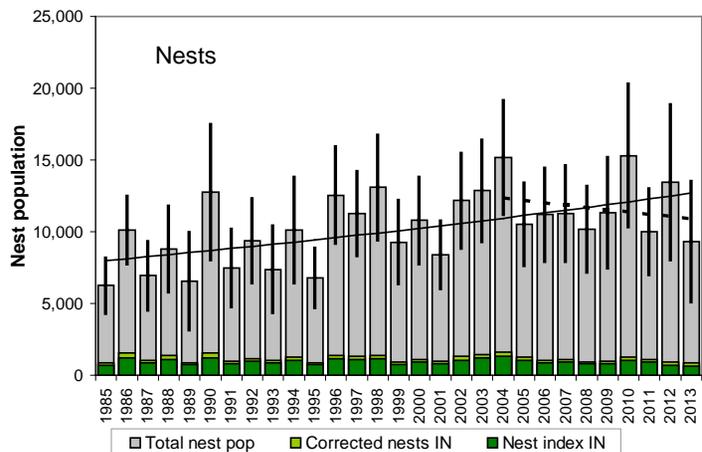
1985-2013 avg annual growth rate= 0.996 (90%c.i.= 0.977-1.015)  
 2004-2013 avg annual growth rate= 1.041 (90%c.i.= 0.963-1.124)



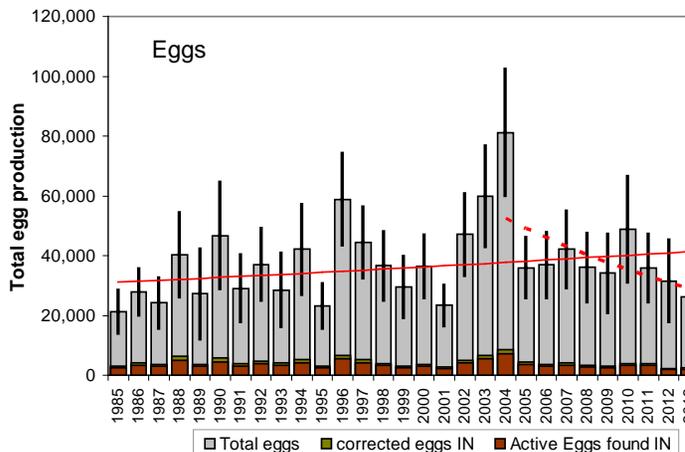
1985-2013 avg annual growth rate= 1.005 (90%c.i.= 0.979-1.031)  
 2004-2013 avg annual growth rate= 1.060 (90%c.i.= 0.975-1.152)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success
														index
1985	49	24.57	7,107	2,569	92.6%	7,675	3.123	23,969	<b>31,643</b>	14,659	<b>13,223</b>	7,031	3.09	14%
1986	46	22.16	3,844	2,304	95.7%	4,017	2.900	11,652	<b>15,669</b>	9,276	<b>46,086</b>	33,315	3.99	74%
1987	37	12.67	13,497	6,158	95.6%	14,117	2.614	36,895	<b>51,012</b>	23,528	<b>213,772</b>	99,671	4.26	98%
1988	32	10.48	2,732	1,554	95.9%	2,848	3.363	9,577	<b>12,425</b>	6,190	<b>44,237</b>	23,815	3.98	89%
1989	23	7.45	6,537	2,701	94.8%	6,893	3.436	23,685	<b>30,578</b>	11,862	<b>78,403</b>	34,288	3.49	73%
1990	33	10.70	8,563	4,710	94.7%	9,047	5.056	45,745	<b>54,792</b>	31,279	<b>100,888</b>	55,075	3.15	58%
1991	36	11.66	7,859	6,513	94.3%	8,335	3.476	28,972	<b>37,306</b>	27,386	<b>94,736</b>	73,994	3.66	69%
1992	42	13.39	19,835	9,859	95.6%	20,742	3.278	67,992	<b>88,734</b>	38,936	<b>327,700</b>	146,550	3.87	95%
1993	47	15.23	14,196	6,832	95.7%	14,838	5.515	81,829	<b>96,668</b>	45,531	<b>227,141</b>	95,855	3.23	73%
1994	41	13.27	8,681	5,693	96.0%	9,047	2.920	26,414	<b>35,461</b>	19,750	<b>79,508</b>	38,549	2.42	93%
1995	50	22.56	6,186	3,119	96.5%	6,410	4.139	26,528	<b>32,937</b>	15,875	<b>70,389</b>	28,704	2.98	72%
1996	54	19.44	4,050	2,022	95.6%	4,235	3.293	13,947	<b>18,182</b>	8,144	<b>58,919</b>	28,632	3.75	87%
1997	72	23.31	3,807	1,423	96.7%	3,938	3.690	14,532	<b>18,470</b>	7,182	<b>57,157</b>	23,004	3.32	93%
1998	64	20.71	16,862	5,452	95.3%	17,702	2.120	37,523	<b>55,226</b>	16,033	<b>175,831</b>	53,390	3.67	87%
1999	53	16.97	6,581	2,064	94.1%	6,991	2.776	19,405	<b>26,396</b>	7,560	<b>67,315</b>	19,900	3.16	81%
2000	80	25.86	15,140	5,069	96.6%	15,679	2.299	36,044	<b>51,723</b>	16,134	<b>131,782</b>	38,190	2.87	89%
2001	81	26.23	8,487	2,391	92.7%	9,156	3.241	29,677	<b>38,833</b>	11,191	<b>59,386</b>	20,271	2.95	52%
2002	84	27.15	11,177	4,344	94.8%	11,792	2.344	27,640	<b>39,431</b>	13,296	<b>107,264</b>	38,318	3.12	87%
2003	83	26.87	8,229	4,048	94.1%	8,741	2.680	23,422	<b>32,163</b>	13,153	<b>18,787</b>	7,291	1.25	47%
2004	81	26.22	4,968	1,710	95.7%	5,192	1.695	8,801	<b>13,993</b>	4,111	<b>35,552</b>	11,191	3.28	77%
2005	83	26.87	10,015	2,732	96.4%	10,385	2.444	25,380	<b>35,765</b>	9,795	<b>89,973</b>	24,835	3.02	83%
2006	75	24.28	5,541	1,993	95.4%	5,810	2.231	12,963	<b>18,773</b>	6,580	<b>44,475</b>	15,437	3.44	69%
2007	79	25.58	13,711	4,083	96.5%	14,214	1.853	26,344	<b>40,557</b>	10,680	<b>150,990</b>	40,220	3.94	95%
2008	82	26.55	11,619	4,337	95.5%	12,169	2.028	24,674	<b>36,843</b>	11,336	<b>91,232</b>	33,649	3.20	77%
2009	81	26.24	9,384	2,276	96.1%	9,769	2.543	24,843	<b>34,612</b>	7,932	<b>103,587</b>	24,886	3.56	84%
2010	66	21.37	13,833	5,850	94.6%	14,618	2.299	33,602	<b>48,219</b>	17,433	<b>125,336</b>	46,374	3.29	79%
2011	82	26.55	6,038	1,550	95.7%	6,307	2.156	13,598	<b>19,906</b>	5,022	<b>58,412</b>	14,608	3.72	79%
2012	77	24.94	5,395	1,693	96.6%	5,583	2.727	15,223	<b>20,806</b>	6,553	<b>66,704</b>	20,880	3.66	88%
2013	59	19.12	10,445	2,799	95.6%	10,923	2.724	29,755	<b>40,678</b>	12,220	<b>117,793</b>	35,461	3.53	82%

TUSW Tundra Swan



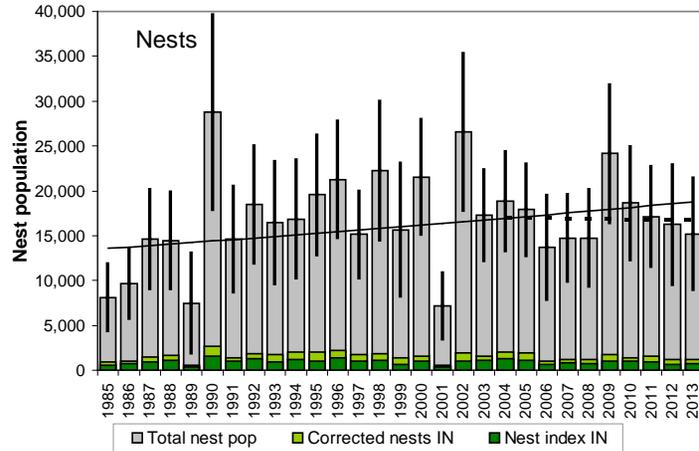
1985-2013 avg annual growth rate= 1.017 (90%c.i.= 1.009-1.024)  
 2004-2013 avg annual growth rate= 0.987 (90%c.i.= 0.955-1.019)



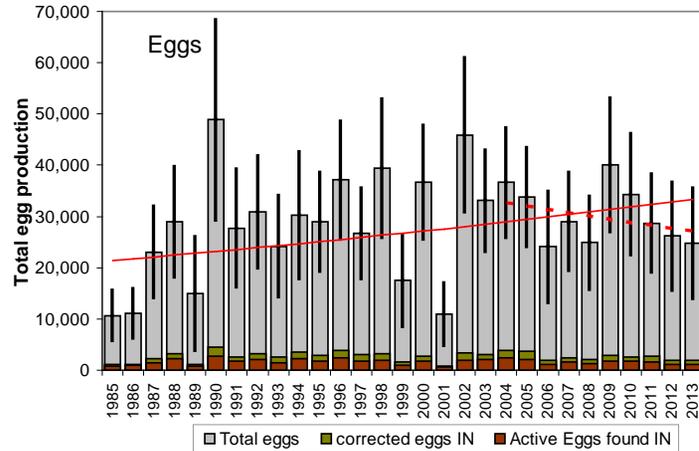
1985-2013 avg annual growth rate= 1.010 (90%c.i.= 0.999-1.022)  
 2004-2013 avg annual growth rate= 0.936 (90%c.i.= 0.896-0.979)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	699	119	81.0%	863	6.234	5,378	6,240	1,176	21,172	4,377	3.93	86%
1986	46	22.16	1,227	166	80.4%	1,527	5.632	8,600	10,126	1,438	27,865	4,616	3.21	86%
1987	37	12.67	847	189	82.5%	1,027	5.753	5,909	6,936	1,454	24,255	5,115	3.50	100%
1988	32	10.48	1,093	237	78.7%	1,388	5.347	7,419	8,807	1,817	40,224	8,528	4.57	100%
1989	23	7.45	769	263	88.5%	869	6.533	5,679	6,549	2,058	27,205	9,158	4.15	100%
1990	33	10.70	1,204	288	76.3%	1,579	7.070	11,165	12,744	2,862	46,708	10,807	3.92	93%
1991	36	11.66	798	178	81.8%	976	6.664	6,505	7,482	1,638	29,087	6,766	4.25	92%
1992	42	13.39	962	174	83.5%	1,152	7.137	8,224	9,376	1,793	37,039	7,262	3.95	100%
1993	47	15.23	846	226	79.6%	1,063	5.947	6,319	7,381	1,827	28,480	7,483	4.07	95%
1994	41	13.27	1,024	231	82.8%	1,237	7.178	8,878	10,115	2,220	42,121	9,092	4.16	100%
1995	50	22.56	730	135	82.1%	889	6.609	5,874	6,763	1,260	23,291	4,539	3.79	91%
1996	54	19.44	1,141	177	82.2%	1,389	8.039	11,162	12,550	2,035	58,878	9,337	4.89	96%
1997	72	23.31	1,074	155	81.0%	1,326	7.491	9,932	11,258	1,774	44,295	7,222	4.20	94%
1998	64	20.71	1,140	182	81.7%	1,396	8.371	11,688	13,084	2,214	36,552	6,880	3.10	90%
1999	53	16.97	759	145	82.2%	924	9.041	8,353	9,276	1,769	29,530	6,259	3.63	88%
2000	80	25.86	913	153	84.2%	1,085	8.938	9,696	10,781	1,835	36,438	6,329	3.62	93%
2001	81	26.23	819	134	83.1%	986	7.536	7,427	8,413	1,435	23,360	4,155	3.38	82%
2002	84	27.15	1,054	166	80.9%	1,303	8.330	10,857	12,160	2,009	47,119	8,296	4.35	89%
2003	83	26.87	1,198	187	82.7%	1,449	7.876	11,408	12,857	2,158	59,861	10,226	4.79	97%
2004	81	26.22	1,337	189	83.2%	1,608	8.427	13,549	15,157	2,416	81,222	12,844	5.48	98%
2005	83	26.87	1,039	150	82.5%	1,259	7.345	9,247	10,506	1,745	35,978	6,102	3.63	94%
2006	75	24.28	884	143	83.3%	1,062	9.546	10,136	11,198	1,973	36,857	6,680	3.54	93%
2007	79	25.58	895	154	83.6%	1,071	9.526	10,205	11,276	2,017	42,169	7,792	3.87	97%
2008	82	26.55	782	127	83.3%	939	9.844	9,242	10,180	1,818	36,128	6,962	3.85	92%
2009	81	26.24	818	155	84.3%	971	10.668	10,360	11,331	2,338	34,102	7,910	3.40	88%
2010	66	21.37	1,038	201	83.5%	1,244	11.293	14,046	15,290	3,021	48,800	10,717	3.87	83%
2011	82	26.55	917	159	84.4%	1,086	8.231	8,939	10,026	1,816	35,867	6,822	3.81	94%
2012	77	24.94	717	158	77.6%	924	13.553	12,522	13,446	3,288	31,543	8,302	3.05	77%
2013	59	19.12	636	140	73.3%	868	9.703	8,421	9,289	2,554	26,159	6,412	3.59	78%

**SACR Sandhill Crane**



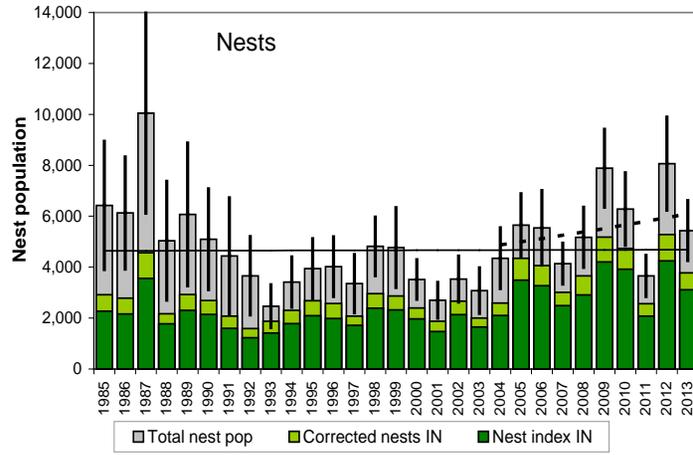
1985-2013 avg annual growth rate= 1.012 (90%c.i.= 1.000-1.024)  
 2004-2013 avg annual growth rate= 0.998 (90%c.i.= 0.967-1.030)



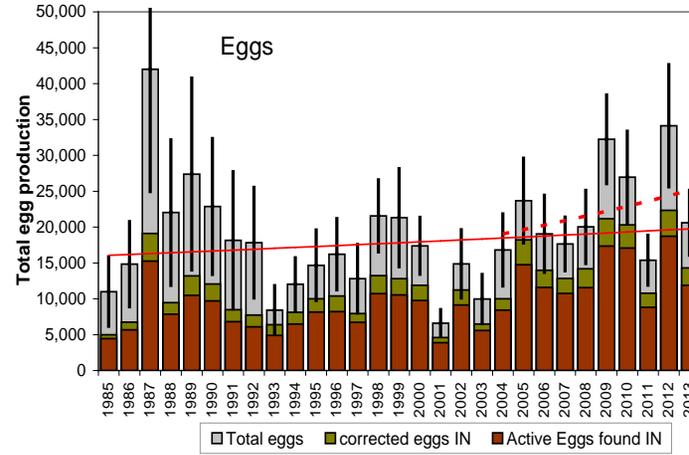
1985-2013 avg annual growth rate= 1.016 (90%c.i.= 1.002-1.030)  
 2004-2013 avg annual growth rate= 0.979 (90%c.i.= 0.948-1.012)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	<b>Total nests IN+OUT</b>	SE total nests	<b>Total eggs IN+OUT</b>	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	553	145	63.3%	875	8.300	7,261	<b>8,136</b>	2,238	<b>10,666</b>	2,989	1.63	80%
1986	46	22.16	775	188	74.5%	1,040	8.300	8,634	<b>9,674</b>	2,385	<b>11,127</b>	2,933	1.48	78%
1987	37	12.67	904	192	62.8%	1,439	9.155	13,172	<b>14,610</b>	3,368	<b>23,060</b>	5,430	1.58	100%
1988	32	10.48	1,093	220	67.2%	1,627	7.901	12,855	<b>14,482</b>	3,296	<b>28,965</b>	6,592	2.14	94%
1989	23	7.45	385	178	73.2%	526	13.234	6,955	<b>7,481</b>	3,391	<b>14,962</b>	6,781	2.00	100%
1990	33	10.70	1,606	305	59.5%	2,696	9.673	26,080	<b>28,777</b>	6,605	<b>48,875</b>	11,873	1.79	95%
1991	36	11.66	982	222	72.8%	1,350	9.846	13,295	<b>14,645</b>	3,579	<b>27,740</b>	7,024	1.89	100%
1992	42	13.39	1,283	267	68.2%	1,881	8.818	16,587	<b>18,468</b>	3,984	<b>30,904</b>	6,654	1.75	96%
1993	47	15.23	893	227	51.8%	1,723	8.569	14,766	<b>16,489</b>	4,137	<b>24,218</b>	6,012	1.67	88%
1994	41	13.27	1,240	254	62.0%	2,001	7.422	14,854	<b>16,855</b>	3,986	<b>30,240</b>	7,508	1.79	100%
1995	50	22.56	983	154	49.1%	2,003	8.768	17,560	<b>19,562</b>	4,055	<b>28,993</b>	5,850	1.92	77%
1996	54	19.44	1,362	213	62.2%	2,191	8.705	19,074	<b>21,265</b>	3,947	<b>37,096</b>	7,028	1.88	93%
1997	72	23.31	1,044	187	59.8%	1,746	7.671	13,394	<b>15,140</b>	2,923	<b>26,731</b>	5,403	1.77	100%
1998	64	20.71	1,071	175	58.2%	1,839	11.096	20,407	<b>22,246</b>	4,676	<b>39,392</b>	8,214	1.77	100%
1999	53	16.97	633	162	44.7%	1,416	10.069	14,256	<b>15,672</b>	4,503	<b>17,485</b>	5,420	1.69	66%
2000	80	25.86	969	139	62.0%	1,563	12.791	19,991	<b>21,554</b>	3,898	<b>36,639</b>	6,767	1.84	92%
2001	81	26.23	355	111	65.4%	542	12.172	6,599	<b>7,141</b>	2,235	<b>10,937</b>	3,674	1.70	90%
2002	84	27.15	1,054	149	54.6%	1,933	12.754	24,648	<b>26,581</b>	5,324	<b>45,911</b>	9,164	2.00	86%
2003	83	26.87	1,092	155	67.9%	1,608	9.759	15,690	<b>17,298</b>	3,084	<b>33,073</b>	6,033	1.96	97%
2004	81	26.22	1,256	161	62.7%	2,003	8.416	16,856	<b>18,859</b>	3,377	<b>36,623</b>	6,491	1.94	100%
2005	83	26.87	1,145	164	58.4%	1,962	8.123	15,940	<b>17,902</b>	3,115	<b>33,814</b>	5,849	1.89	100%
2006	75	24.28	648	141	61.6%	1,052	12.023	12,646	<b>13,697</b>	3,523	<b>24,119</b>	6,604	1.76	100%
2007	79	25.58	811	147	66.8%	1,215	11.117	13,510	<b>14,725</b>	2,938	<b>28,983</b>	5,826	1.97	100%
2008	82	26.55	728	136	60.7%	1,199	11.303	13,554	<b>14,753</b>	3,260	<b>24,879</b>	5,539	1.76	96%
2009	81	26.24	1,009	143	57.0%	1,771	12.639	22,378	<b>24,149</b>	4,671	<b>40,043</b>	7,940	1.85	89%
2010	66	21.37	971	157	68.3%	1,423	12.104	17,223	<b>18,646</b>	3,822	<b>34,327</b>	7,217	1.93	95%
2011	82	26.55	890	145	55.3%	1,609	9.660	15,540	<b>17,149</b>	3,401	<b>28,724</b>	5,832	1.80	93%
2012	77	24.94	660	127	56.9%	1,159	13.009	15,080	<b>16,239</b>	4,035	<b>26,171</b>	6,438	1.88	86%
2013	59	19.12	711	144	59.7%	1,192	11.762	14,016	<b>15,207</b>	3,764	<b>24,807</b>	6,583	1.74	94%

**SPEI Spectacled Eider**



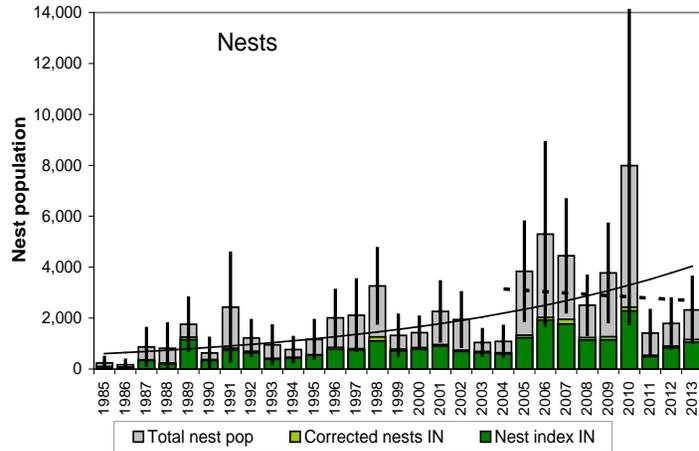
1985-2013 avg annual growth rate= 1.000 (90%c.i.= 0.988-1.013)  
 2004-2013 avg annual growth rate= 1.025 (90%c.i.= 0.977-1.075)



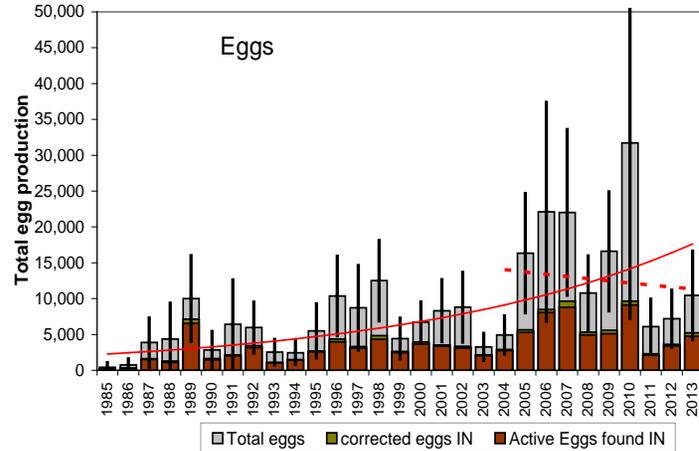
1985-2013 avg annual growth rate= 1.007 (90%c.i.= 0.992-1.023)  
 2004-2013 avg annual growth rate= 1.031 (90%c.i.= 0.982-1.083)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	OUT:IN	Aerial ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	2,272	489	77.8%	2,919	1.200	3,502	<b>6,422</b>	1,528	<b>10,988</b>	2,931	3.84	45%	
1986	46	22.16	2,164	366	77.7%	2,786	1.200	3,342	<b>6,128</b>	1,337	<b>14,828</b>	3,597	4.40	55%	
1987	37	12.67	3,558	758	77.9%	4,568	1.200	5,481	<b>10,049</b>	2,388	<b>42,015</b>	10,371	5.06	83%	
1988	32	10.48	1,776	484	82.0%	2,166	1.325	2,871	<b>5,037</b>	1,417	<b>22,026</b>	6,159	4.81	91%	
1989	23	7.45	2,307	751	78.8%	2,927	1.074	3,144	<b>6,071</b>	1,704	<b>27,380</b>	8,124	4.99	90%	
1990	33	10.70	2,141	552	79.6%	2,689	0.896	2,410	<b>5,098</b>	1,201	<b>22,863</b>	5,756	5.03	89%	
1991	36	11.66	1,596	491	76.9%	2,075	1.141	2,368	<b>4,443</b>	1,381	<b>18,150</b>	5,803	5.27	77%	
1992	42	13.39	1,230	308	77.5%	1,587	1.307	2,075	<b>3,662</b>	932	<b>17,820</b>	4,681	5.43	90%	
1993	47	15.23	1,410	348	75.3%	1,874	0.317	593	<b>2,467</b>	510	<b>8,430</b>	2,070	4.27	80%	
1994	41	13.27	1,779	344	77.4%	2,300	0.483	1,110	<b>3,410</b>	598	<b>12,017</b>	2,246	4.65	76%	
1995	50	22.56	2,094	417	78.0%	2,684	0.468	1,257	<b>3,941</b>	714	<b>14,667</b>	2,991	4.88	76%	
1996	54	19.44	1,988	377	77.3%	2,573	0.563	1,447	<b>4,020</b>	711	<b>16,213</b>	3,013	5.06	80%	
1997	72	23.31	1,719	404	82.7%	2,079	0.612	1,273	<b>3,353</b>	692	<b>12,791</b>	2,895	4.38	87%	
1998	64	20.71	2,384	374	80.6%	2,956	0.629	1,858	<b>4,815</b>	699	<b>21,548</b>	3,053	4.87	92%	
1999	53	16.97	2,320	532	81.0%	2,864	0.665	1,905	<b>4,769</b>	951	<b>21,306</b>	4,144	4.96	90%	
2000	80	25.86	1,965	295	82.0%	2,398	0.465	1,114	<b>3,512</b>	469	<b>17,382</b>	2,407	5.34	93%	
2001	81	26.23	1,474	275	78.7%	1,873	0.440	824	<b>2,698</b>	425	<b>6,609</b>	1,134	4.18	59%	
2002	84	27.15	2,135	407	80.1%	2,664	0.326	868	<b>3,532</b>	547	<b>14,872</b>	2,883	5.26	80%	
2003	83	26.87	1,651	350	82.7%	1,998	0.540	1,079	<b>3,077</b>	543	<b>9,956</b>	2,082	4.41	73%	
2004	81	26.22	2,102	387	81.1%	2,590	0.679	1,758	<b>4,349</b>	723	<b>16,796</b>	3,051	4.97	78%	
2005	83	26.87	3,489	538	80.3%	4,346	0.301	1,308	<b>5,654</b>	743	<b>23,682</b>	3,584	4.69	89%	
2006	75	24.28	3,272	641	80.6%	4,061	0.366	1,485	<b>5,545</b>	889	<b>19,059</b>	3,252	4.50	76%	
2007	79	25.58	2,490	340	82.7%	3,013	0.373	1,124	<b>4,136</b>	485	<b>17,640</b>	2,275	5.06	84%	
2008	82	26.55	2,911	482	79.5%	3,662	0.412	1,509	<b>5,170</b>	715	<b>20,017</b>	3,089	5.04	77%	
2009	81	26.24	4,201	576	81.2%	5,176	0.523	2,707	<b>7,883</b>	928	<b>32,227</b>	3,752	4.50	91%	
2010	66	21.37	3,919	646	82.8%	4,735	0.327	1,547	<b>6,282</b>	863	<b>26,946</b>	3,883	4.98	86%	
2011	82	26.55	2,076	329	81.0%	2,562	0.427	1,094	<b>3,655</b>	487	<b>15,376</b>	2,107	4.77	88%	
2012	77	24.94	4,247	757	80.5%	5,278	0.527	2,783	<b>8,062</b>	1,110	<b>34,111</b>	5,174	4.98	85%	
2013	59	19.12	3,107	489	82.3%	3,775	0.440	1,660	<b>5,435</b>	713	<b>20,598</b>	2,741	4.91	77%	

**COEI Common Eider**



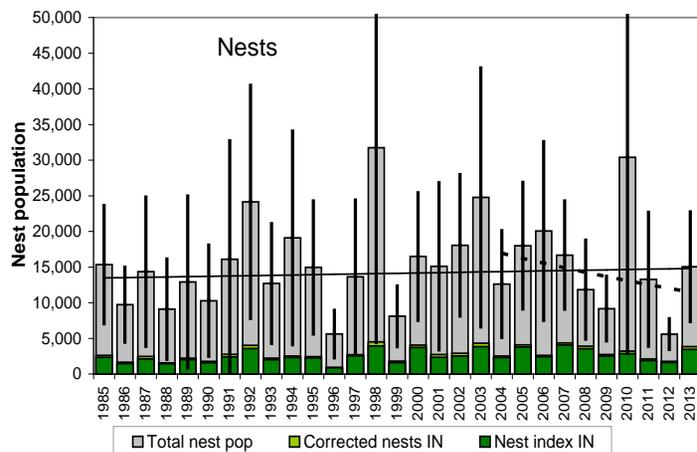
1985-2013 avg annual growth rate= 1.070 (90%c.i.= 1.046-1.095)  
 2004-2013 avg annual growth rate= 0.983 (90%c.i.= 0.872-1.107)



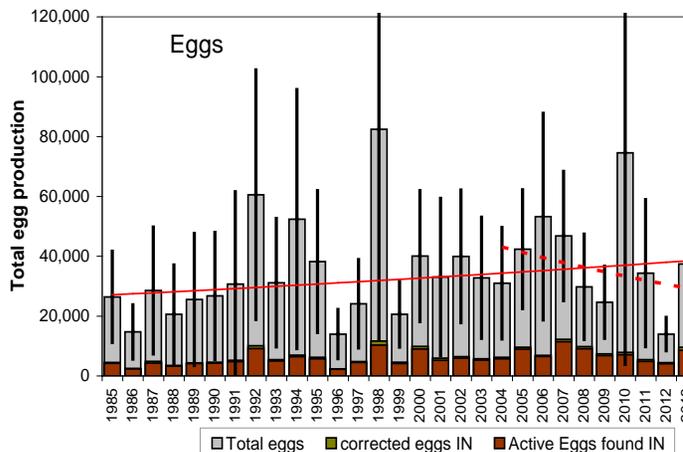
1985-2013 avg annual growth rate= 1.076 (90%c.i.= 1.049-1.104)  
 2004-2013 avg annual growth rate= 0.977 (90%c.i.= 0.869-1.098)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	87	47	90.2%	97	1.422	138	235	133	431	373	6.00	31%
1986	46	22.16	65	45	94.2%	69	1.422	98	166	111	751	503	4.52	100%
1987	37	12.67	339	152	94.7%	358	1.422	509	866	442	3,877	2,077	5.41	83%
1988	32	10.48	205	150	86.3%	237	2.442	580	817	576	4,373	3,033	5.35	100%
1989	23	7.45	1,154	456	91.9%	1,256	0.402	504	1,760	622	10,001	3,631	5.68	100%
1990	33	10.70	335	216	91.2%	367	0.717	263	630	348	2,838	1,566	4.50	100%
1991	36	11.66	737	381	90.6%	814	1.989	1,618	2,432	1,288	6,415	3,768	4.76	55%
1992	42	13.39	642	254	91.9%	698	0.742	518	1,217	416	5,959	2,157	5.38	91%
1993	47	15.23	376	203	89.5%	420	1.258	529	949	448	2,526	1,086	4.43	60%
1994	41	13.27	431	205	92.7%	465	0.635	296	761	291	2,453	988	3.73	86%
1995	50	22.56	539	247	95.1%	567	1.047	594	1,161	449	5,508	2,287	5.08	93%
1996	54	19.44	773	271	91.4%	846	1.375	1,164	2,010	656	10,354	3,360	5.44	95%
1997	72	23.31	737	285	92.1%	800	1.641	1,312	2,112	842	8,719	3,574	4.53	91%
1998	64	20.71	1,106	299	87.7%	1,261	1.590	2,005	3,266	887	12,506	3,405	5.01	76%
1999	53	16.97	717	296	91.7%	782	0.690	539	1,321	481	4,432	1,723	4.47	75%
2000	80	25.86	775	212	92.6%	837	0.705	590	1,427	368	6,712	1,715	4.90	96%
2001	81	26.23	900	292	93.6%	962	1.352	1,300	2,262	704	8,317	2,627	4.10	90%
2002	84	27.15	685	191	92.6%	740	1.625	1,203	1,943	640	8,800	2,957	4.72	96%
2003	83	26.87	639	225	92.9%	688	0.512	352	1,040	307	3,256	1,141	4.28	73%
2004	81	26.22	600	212	94.3%	637	0.699	445	1,082	359	4,940	1,602	4.80	95%
2005	83	26.87	1,225	298	92.4%	1,325	1.893	2,509	3,835	1,177	16,331	5,050	4.93	86%
2006	75	24.28	1,916	751	94.4%	2,030	1.610	3,268	5,298	2,182	22,107	9,269	4.81	87%
2007	79	25.58	1,763	540	90.5%	1,948	1.281	2,496	4,444	1,338	22,016	7,018	5.22	95%
2008	82	26.55	1,132	329	91.9%	1,232	1.032	1,271	2,504	693	10,787	3,135	4.82	89%
2009	81	26.24	1,146	295	90.5%	1,266	1.979	2,506	3,772	1,162	16,601	5,040	4.91	90%
2010	66	21.37	2,278	976	93.8%	2,428	2.290	5,560	7,988	3,767	31,729	14,878	4.86	82%
2011	82	26.55	485	146	90.5%	536	1.640	880	1,416	533	6,087	2,331	4.89	88%
2012	77	24.94	832	316	92.6%	898	0.990	889	1,788	586	7,213	2,406	4.59	88%
2013	59	19.12	1,048	409	90.4%	1,159	1.002	1,162	2,321	777	10,468	3,723	4.90	92%

**GLGU Glaucous Gull**



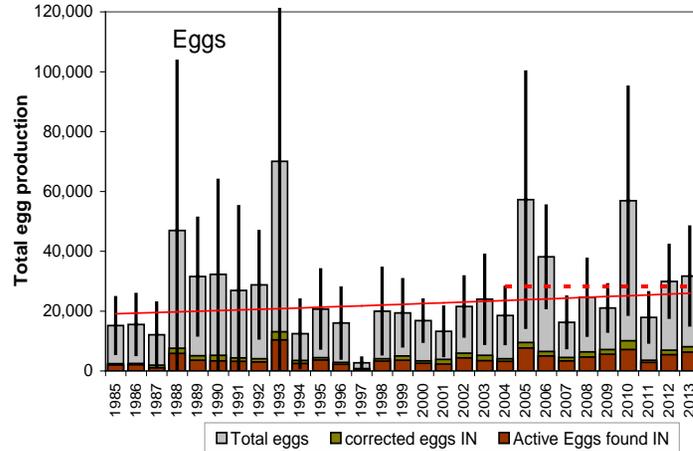
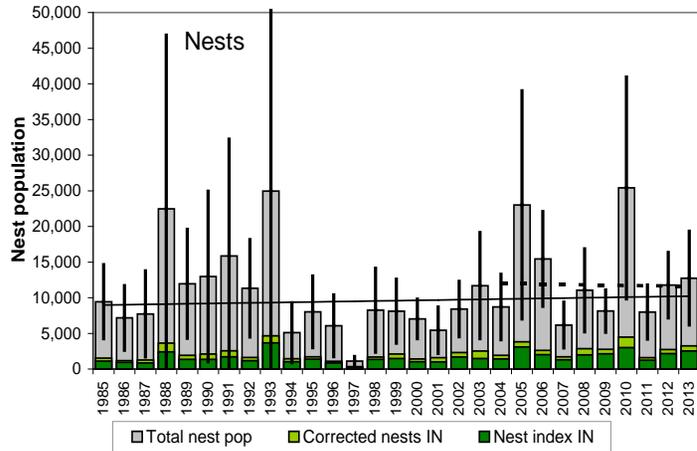
1985-2013 avg annual growth rate= 1.003 (90%c.i.= 0.988-1.019)  
 2004-2013 avg annual growth rate= 0.958 (90%c.i.= 0.880-1.042)



1985-2013 avg annual growth rate= 1.013 (90%c.i.= 0.996-1.029)  
 2004-2013 avg annual growth rate= 0.958 (90%c.i.= 0.881-1.042)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	2,330	487	88.8%	2,625	4.844	12,715	<b>15,340</b>	5,043	<b>26,437</b>	9,264	2.08	83%
1986	46	22.16	1,486	316	89.3%	1,663	4.844	8,057	<b>9,720</b>	3,185	<b>14,722</b>	5,510	2.15	70%
1987	37	12.67	2,089	766	85.0%	2,457	4.844	11,901	<b>14,359</b>	6,352	<b>28,538</b>	12,864	2.15	93%
1988	32	10.48	1,434	622	92.2%	1,556	4.844	7,536	<b>9,092</b>	4,271	<b>20,598</b>	10,017	2.53	89%
1989	23	7.45	2,019	1,106	91.4%	2,208	4.844	10,693	<b>12,901</b>	7,325	<b>25,526</b>	13,396	2.27	87%
1990	33	10.70	1,606	689	91.3%	1,758	4.844	8,515	<b>10,273</b>	4,737	<b>26,741</b>	12,891	2.91	90%
1991	36	11.66	2,395	1,501	86.9%	2,754	4.844	13,340	<b>16,094</b>	10,090	<b>30,666</b>	18,772	2.99	64%
1992	42	13.39	3,582	1,211	88.9%	4,027	4.992	20,105	<b>24,132</b>	9,930	<b>60,560</b>	25,328	2.71	92%
1993	47	15.23	2,021	703	90.7%	2,228	4.695	10,462	<b>12,690</b>	5,100	<b>31,152</b>	13,025	2.53	97%
1994	41	13.27	2,319	1,103	91.6%	2,532	6.538	16,555	<b>19,087</b>	9,102	<b>52,398</b>	26,289	2.83	97%
1995	50	22.56	2,252	643	92.8%	2,428	5.154	12,512	<b>14,940</b>	5,674	<b>38,178</b>	14,398	2.56	100%
1996	54	19.44	884	241	94.0%	940	4.965	4,666	<b>5,606</b>	2,022	<b>13,971</b>	4,984	2.49	100%
1997	72	23.31	2,548	1,188	93.8%	2,716	4.023	10,924	<b>13,640</b>	6,527	<b>24,126</b>	8,958	1.79	99%
1998	64	20.71	3,939	1,749	87.6%	4,495	6.063	27,252	<b>31,747</b>	16,589	<b>82,465</b>	42,716	2.67	97%
1999	53	16.97	1,603	387	88.9%	1,804	3.487	6,290	<b>8,094</b>	2,583	<b>20,577</b>	6,657	2.72	94%
2000	80	25.86	3,709	974	91.5%	4,054	3.064	12,422	<b>16,475</b>	5,432	<b>40,042</b>	13,272	2.50	97%
2001	81	26.23	2,347	955	86.3%	2,718	4.557	12,386	<b>15,104</b>	7,117	<b>33,055</b>	15,954	2.36	93%
2002	84	27.15	2,531	580	86.7%	2,917	5.189	15,138	<b>18,056</b>	6,026	<b>39,955</b>	13,472	2.59	85%
2003	83	26.87	3,835	1,748	88.4%	4,338	4.709	20,427	<b>24,765</b>	11,030	<b>32,803</b>	12,305	1.64	81%
2004	81	26.22	2,320	717	91.5%	2,534	3.980	10,088	<b>12,622</b>	4,542	<b>30,963</b>	11,312	2.49	99%
2005	83	26.87	3,782	1,049	92.6%	4,084	3.406	13,911	<b>17,995</b>	5,397	<b>42,366</b>	12,042	2.41	98%
2006	75	24.28	2,446	742	94.1%	2,600	6.715	17,458	<b>20,058</b>	7,619	<b>53,238</b>	20,945	2.69	99%
2007	79	25.58	4,057	1,101	93.0%	4,360	2.823	12,311	<b>16,671</b>	4,610	<b>46,762</b>	13,125	2.83	99%
2008	82	26.55	3,558	1,156	91.2%	3,901	2.032	7,926	<b>11,828</b>	4,222	<b>29,782</b>	10,688	2.67	94%
2009	81	26.24	2,537	688	92.8%	2,735	2.353	6,436	<b>9,171</b>	2,754	<b>24,621</b>	7,295	2.72	99%
2010	66	21.37	2,847	1,429	88.8%	3,206	8.478	27,180	<b>30,386</b>	16,706	<b>74,570</b>	42,993	2.54	96%
2011	82	26.55	1,887	621	89.8%	2,102	5.321	11,186	<b>13,288</b>	5,700	<b>34,363</b>	14,931	2.63	98%
2012	77	24.94	1,636	293	92.5%	1,769	2.165	3,830	<b>5,598</b>	1,312	<b>13,965</b>	3,369	2.60	96%
2013	59	19.12	3,444	960	89.5%	3,847	2.913	11,207	<b>15,054</b>	4,677	<b>37,445</b>	12,326	2.58	96%

**MEGU Mew Gull**

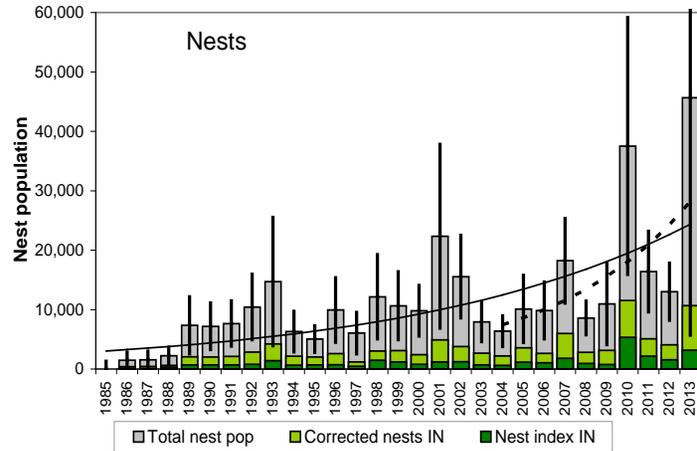


1985-2013 avg annual growth rate= 1.005 (90%c.i.= 0.982-1.028)  
 2004-2013 avg annual growth rate= 0.996 (90%c.i.= 0.912-1.089)

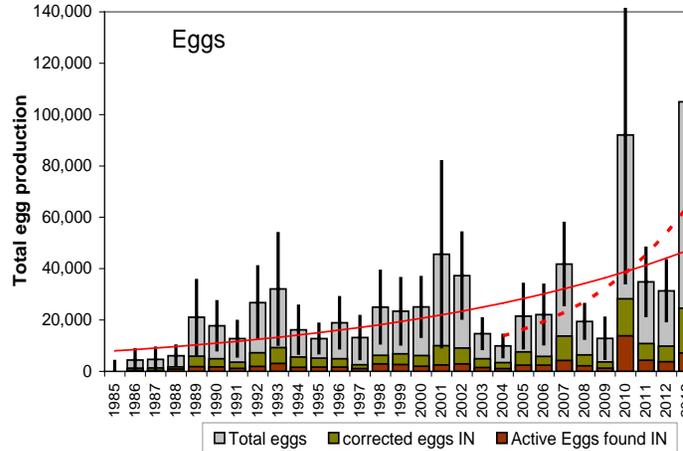
1985-2013 avg annual growth rate= 1.011 (90%c.i.= 0.988-1.034)  
 2004-2013 avg annual growth rate= 1.001 (90%c.i.= 0.916-1.093)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Corrected %	
													Total eggs / active nests	nest success index
1985	49	24.57	1,107	270	72.6%	1,525	5.191	7,915	9,439	3,152	15,181	5,645	1.95	82%
1986	46	22.16	937	286	80.9%	1,157	5.191	6,008	7,166	2,749	15,529	6,103	2.29	95%
1987	37	12.67	847	385	67.8%	1,249	5.191	6,483	7,732	3,653	12,073	6,467	1.56	100%
1988	32	10.48	2,390	1,793	65.9%	3,629	5.191	18,840	22,469	14,808	46,912	34,371	2.47	85%
1989	23	7.45	1,346	385	69.7%	1,930	5.191	10,017	11,946	4,634	31,522	11,864	2.64	100%
1990	33	10.70	1,338	814	63.9%	2,095	5.191	10,873	12,968	7,265	32,282	19,094	2.68	93%
1991	36	11.66	1,719	1,037	67.1%	2,562	5.191	13,302	15,865	9,935	26,875	17,015	2.37	72%
1992	42	13.39	1,176	323	72.9%	1,612	6.025	9,715	11,327	4,148	28,795	10,818	2.69	95%
1993	47	15.23	3,667	2,931	78.7%	4,661	4.358	20,309	24,970	17,627	70,045	49,845	2.81	100%
1994	41	13.27	1,024	547	70.7%	1,450	2.515	3,645	5,094	2,544	12,435	6,848	2.65	92%
1995	50	22.56	1,396	403	81.2%	1,719	3.655	6,285	8,004	3,048	20,713	7,927	2.59	100%
1996	54	19.44	847	241	78.2%	1,083	4.599	4,983	6,066	2,622	16,007	7,121	2.64	100%
1997	72	23.31	276	85	85.6%	323	2.416	780	1,103	387	2,707	974	2.45	100%
1998	64	20.71	1,348	446	80.0%	1,685	3.892	6,558	8,244	3,577	20,000	8,690	2.43	100%
1999	53	16.97	1,476	399	70.7%	2,089	2.877	6,011	8,101	2,724	19,413	6,720	2.48	97%
2000	80	25.86	1,024	189	72.4%	1,414	3.967	5,610	7,024	1,673	16,840	4,169	2.59	93%
2001	81	26.23	982	300	61.8%	1,588	2.428	3,857	5,446	1,973	13,252	4,905	2.43	100%
2002	84	27.15	1,687	378	73.2%	2,305	2.645	6,098	8,403	2,351	21,531	6,017	2.68	96%
2003	83	26.87	1,465	387	57.8%	2,535	3.612	9,159	11,694	4,516	23,961	8,933	2.58	79%
2004	81	26.22	1,419	326	73.4%	1,934	3.498	6,765	8,699	2,780	18,505	5,697	2.45	87%
2005	83	26.87	3,090	1,366	81.0%	3,813	5.035	19,202	23,015	9,725	57,251	25,942	2.49	100%
2006	75	24.28	2,004	507	76.4%	2,623	4.884	12,813	15,437	4,030	38,157	10,306	2.47	100%
2007	79	25.58	1,287	252	75.5%	1,705	2.614	4,458	6,163	1,941	16,237	5,134	2.63	100%
2008	82	26.55	1,968	520	68.7%	2,866	2.854	8,178	11,043	3,529	24,629	7,698	2.49	90%
2009	81	26.24	2,128	370	77.2%	2,755	1.948	5,368	8,124	1,796	21,039	4,680	2.65	98%
2010	66	21.37	3,015	960	67.1%	4,489	4.657	20,908	25,397	9,451	56,889	23,053	2.56	87%
2011	82	26.55	1,240	261	77.2%	1,605	3.977	6,385	7,990	2,299	17,918	4,999	2.33	96%
2012	77	24.94	2,152	423	78.6%	2,737	3.297	9,024	11,761	2,782	29,946	7,270	2.55	100%
2013	59	19.12	2,508	706	77.1%	3,253	2.917	9,491	12,744	3,983	31,724	9,936	2.49	100%

**SAGU Sabine's Gull**



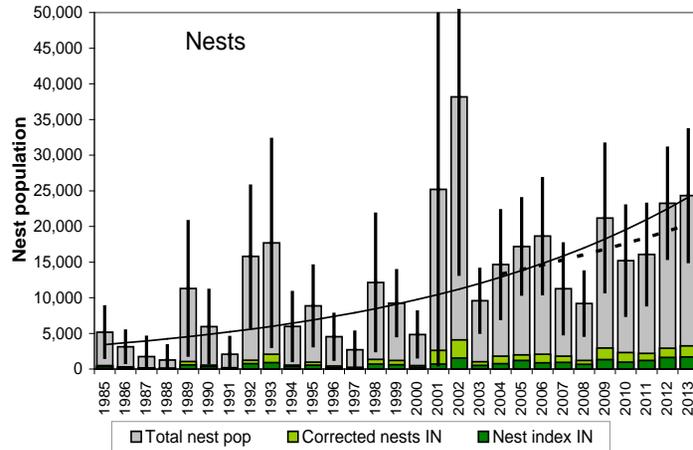
1985-2013 avg annual growth rate= 1.077 (90%c.i.= 1.056-1.099)  
 2004-2013 avg annual growth rate= 1.160 (90%c.i.= 1.064-1.264)



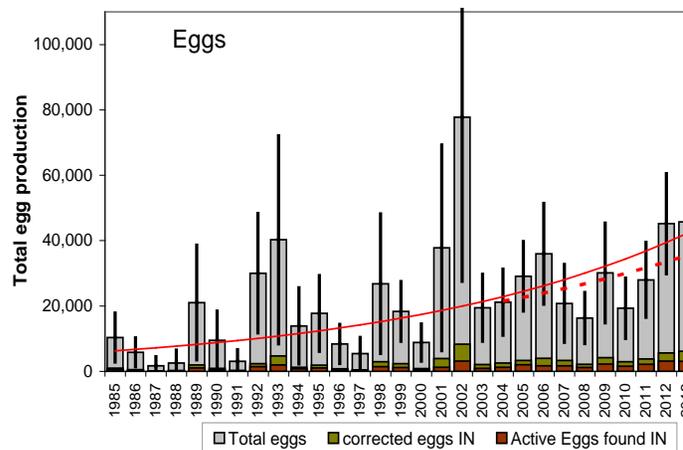
1985-2013 avg annual growth rate= 1.065 (90%c.i.= 1.043-1.088)  
 2004-2013 avg annual growth rate= 1.186 (90%c.i.= 1.063-1.323)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	0	78	0.0%	0	2.581	0	0	783	0	2,350		0%
1986	46	22.16	129	78	31.5%	410	2.581	1,058	1,468	821	4,405	2,464	3.00	100%
1987	37	12.67	113	76	25.9%	436	2.581	1,125	1,561	871	4,681	2,614	3.00	100%
1988	32	10.48	341	142	54.3%	628	2.581	1,622	2,250	849	6,126	2,275	2.72	100%
1989	23	7.45	673	291	32.8%	2,053	2.581	5,300	7,353	2,917	21,064	8,676	2.86	100%
1990	33	10.70	669	223	33.3%	2,007	2.581	5,180	7,187	2,368	17,724	5,679	2.47	100%
1991	36	11.66	675	192	31.6%	2,134	2.581	5,509	7,643	2,312	12,723	4,079	1.66	100%
1992	42	13.39	802	291	28.3%	2,833	2.680	7,592	10,425	3,343	26,736	8,469	2.56	100%
1993	47	15.23	1,410	724	33.4%	4,225	2.482	10,487	14,712	6,556	32,109	13,088	2.41	91%
1994	41	13.27	647	220	29.7%	2,179	1.892	4,123	6,302	2,069	16,207	5,561	2.57	100%
1995	50	22.56	698	185	34.5%	2,024	1.486	3,009	5,033	1,341	12,772	3,378	2.54	100%
1996	54	19.44	736	216	28.4%	2,591	2.834	7,344	9,935	3,293	18,924	5,912	2.42	79%
1997	72	23.31	460	136	38.5%	1,196	4.048	4,843	6,039	2,115	13,196	4,969	2.18	100%
1998	64	20.71	1,486	720	49.1%	3,026	3.018	9,132	12,159	4,307	25,018	8,463	2.06	100%
1999	53	16.97	1,181	560	37.9%	3,113	2.421	7,536	10,648	3,477	23,394	7,727	2.20	100%
2000	80	25.86	775	182	32.2%	2,408	3.074	7,402	9,810	2,588	25,109	6,950	2.56	100%
2001	81	26.23	1,201	423	24.4%	4,915	3.544	17,420	22,335	9,401	45,608	21,888	2.30	89%
2002	84	27.15	1,239	404	32.8%	3,774	3.120	11,776	15,549	4,215	37,289	10,066	2.40	100%
2003	83	26.87	692	186	26.1%	2,656	1.979	5,257	7,913	2,001	14,667	3,489	2.18	85%
2004	81	26.22	600	148	27.3%	2,199	1.897	4,172	6,371	1,566	9,889	2,508	1.99	78%
2005	83	26.87	1,145	256	32.0%	3,579	1.824	6,529	10,108	3,420	21,495	7,494	2.13	100%
2006	75	24.28	1,061	372	40.6%	2,616	2.766	7,236	9,853	2,907	22,111	6,918	2.24	100%
2007	79	25.58	1,819	398	30.4%	5,992	2.041	12,230	18,222	4,323	41,809	9,622	2.29	100%
2008	82	26.55	944	151	33.5%	2,819	2.046	5,768	8,588	1,720	19,461	3,969	2.27	100%
2009	81	26.24	764	187	24.4%	3,130	2.497	7,817	10,947	4,155	12,882	4,760	1.76	67%
2010	66	21.37	5,326	3,366	46.2%	11,524	2.256	25,999	37,523	13,128	92,069	35,001	2.56	96%
2011	82	26.55	2,156	830	42.4%	5,091	2.220	11,305	16,397	4,109	34,847	7,970	2.22	96%
2012	77	24.94	1,550	383	37.9%	4,085	2.185	8,925	13,010	2,915	31,380	7,074	2.41	100%
2013	59	19.12	3,182	1,392	29.8%	10,681	3.275	34,980	45,661	24,298	104,995	55,168	2.34	98%

ARTE Arctic Tern



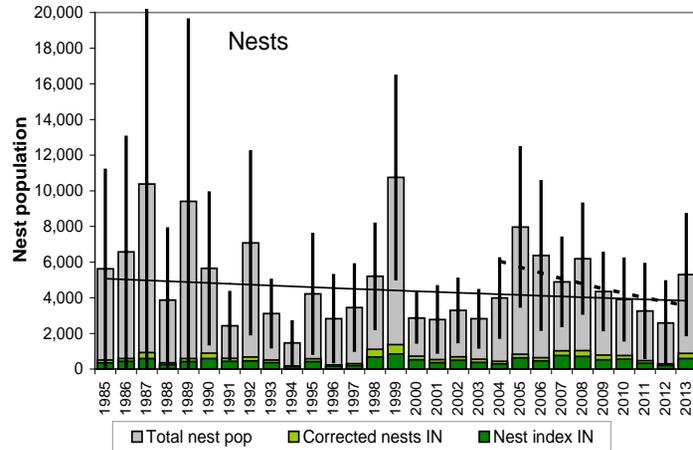
1985-2013 avg annual growth rate= 1.072 (90%c.i.= 1.047-1.098)  
 2004-2013 avg annual growth rate= 1.048 (90%c.i.= 0.994-1.104)



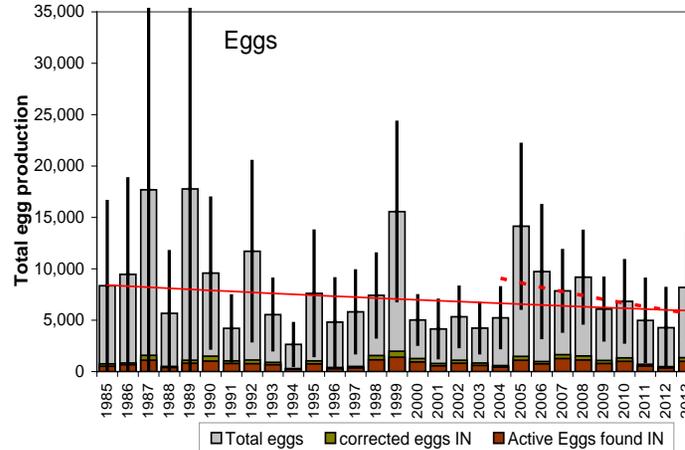
1985-2013 avg annual growth rate= 1.070 (90%c.i.= 1.043-1.099)  
 2004-2013 avg annual growth rate= 1.057 (90%c.i.= 0.995-1.123)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	<b>Total nests IN+OUT</b>	SE total nests	<b>Total eggs IN+OUT</b>	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	291	110	0.0%	483	9.726	4,695	<b>5,177</b>	2,140	<b>10,355</b>	4,529	2.00	0%
1986	46	22.16	194	77	66.6%	291	9.726	2,832	<b>3,123</b>	1,335	<b>5,831</b>	2,669	1.87	100%
1987	37	12.67	113	112	70.1%	161	9.726	1,566	<b>1,727</b>	1,647	<b>1,727</b>	1,647	1.00	100%
1988	32	10.48	68	68	57.9%	118	9.726	1,147	<b>1,264</b>	1,207	<b>2,529</b>	2,413	2.00	100%
1989	23	7.45	577	284	54.7%	1,054	9.726	10,248	<b>11,301</b>	5,684	<b>21,055</b>	10,658	1.86	100%
1990	33	10.70	335	168	60.3%	554	9.726	5,391	<b>5,946</b>	3,078	<b>9,513</b>	5,422	1.60	100%
1991	36	11.66	123	85	63.3%	194	9.726	1,886	<b>2,080</b>	1,419	<b>3,069</b>	2,174	1.48	100%
1992	42	13.39	748	235	61.1%	1,225	11.886	14,557	<b>15,782</b>	5,991	<b>30,033</b>	11,084	1.90	100%
1993	47	15.23	893	482	43.2%	2,066	7.567	15,630	<b>17,696</b>	8,817	<b>40,266</b>	19,339	2.28	100%
1994	41	13.27	323	163	59.5%	544	9.990	5,430	<b>5,973</b>	2,895	<b>13,911</b>	7,065	2.33	100%
1995	50	22.56	539	165	56.1%	961	8.226	7,902	<b>8,862</b>	3,402	<b>17,724</b>	7,011	2.00	100%
1996	54	19.44	221	85	52.5%	421	9.757	4,103	<b>4,524</b>	1,903	<b>8,392</b>	3,628	1.86	100%
1997	72	23.31	154	78	64.6%	238	10.407	2,472	<b>2,710</b>	1,497	<b>5,419</b>	2,994	2.00	100%
1998	64	20.71	691	193	51.3%	1,348	8.013	10,798	<b>12,146</b>	5,816	<b>26,828</b>	12,973	2.21	100%
1999	53	16.97	591	170	49.6%	1,190	6.756	8,039	<b>9,229</b>	2,768	<b>18,358</b>	5,543	1.99	100%
2000	80	25.86	277	90	58.6%	473	9.253	4,372	<b>4,844</b>	1,902	<b>8,825</b>	3,450	1.82	100%
2001	81	26.23	682	269	26.0%	2,623	8.605	22,568	<b>25,190</b>	14,950	<b>37,812</b>	19,126	1.92	78%
2002	84	27.15	1,529	434	37.4%	4,091	8.330	34,080	<b>38,172</b>	15,117	<b>77,797</b>	30,528	2.04	100%
2003	83	26.87	506	136	49.2%	1,028	8.306	8,537	<b>9,565</b>	2,678	<b>19,442</b>	6,215	2.03	100%
2004	81	26.22	737	137	41.2%	1,789	7.183	12,851	<b>14,640</b>	4,595	<b>21,152</b>	6,135	1.77	82%
2005	83	26.87	1,199	258	60.4%	1,985	7.655	15,197	<b>17,182</b>	4,061	<b>29,096</b>	6,463	1.69	100%
2006	75	24.28	884	175	42.4%	2,087	7.935	16,558	<b>18,645</b>	4,903	<b>35,987</b>	9,352	1.93	100%
2007	79	25.58	923	169	51.1%	1,806	5.231	9,446	<b>11,252</b>	3,821	<b>20,788</b>	7,218	1.85	100%
2008	82	26.55	647	170	53.4%	1,213	6.572	7,970	<b>9,182</b>	2,696	<b>16,288</b>	4,743	1.77	100%
2009	81	26.24	1,309	463	44.3%	2,956	6.166	18,228	<b>21,184</b>	6,284	<b>30,114</b>	9,260	1.75	81%
2010	66	21.37	971	216	42.1%	2,305	5.595	12,894	<b>15,198</b>	4,657	<b>19,298</b>	5,595	1.74	73%
2011	82	26.55	1,213	244	55.2%	2,199	6.305	13,865	<b>16,064</b>	4,281	<b>27,997</b>	6,941	1.84	95%
2012	77	24.94	1,607	243	55.4%	2,900	7.016	20,344	<b>23,244</b>	4,692	<b>45,182</b>	9,286	1.94	100%
2013	59	19.12	1,685	435	51.7%	3,257	6.464	21,055	<b>24,313</b>	5,616	<b>45,723</b>	10,458	1.88	100%

RTLO Red-throated Loon



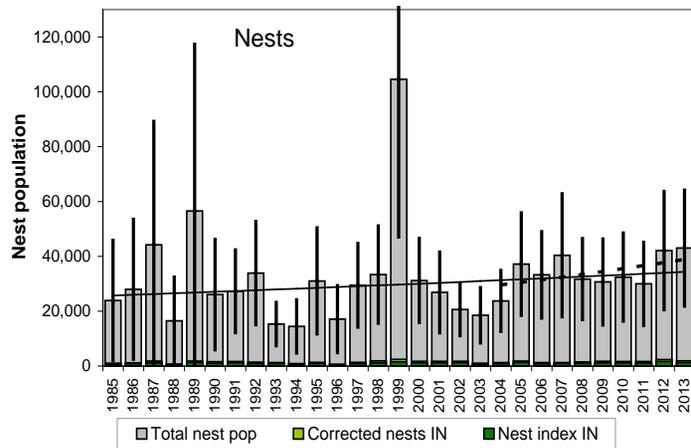
1985-2013 avg annual growth rate= 0.990 (90%c.i.= 0.973-1.007)  
 2004-2013 avg annual growth rate= 0.943 (90%c.i.= 0.892-0.996)



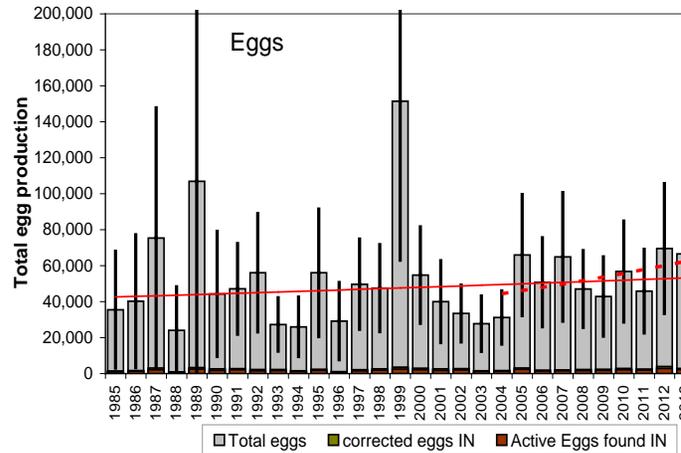
1985-2013 avg annual growth rate= 0.988 (90%c.i.= 0.971-1.005)  
 2004-2013 avg annual growth rate= 0.950 (90%c.i.= 0.892-1.011)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	344	149	68.7%	500	10.242	5,119	<b>5,618</b>	3,359	<b>8,345</b>	4,977	1.64	90%
1986	46	22.16	435	189	74.4%	585	10.242	5,990	<b>6,575</b>	3,906	<b>9,459</b>	5,650	1.64	88%
1987	37	12.67	590	276	63.9%	924	10.242	9,459	<b>10,383</b>	6,784	<b>17,692</b>	11,003	1.95	88%
1988	32	10.48	253	121	73.5%	344	10.242	3,528	<b>3,873</b>	2,419	<b>5,661</b>	3,653	1.66	88%
1989	23	7.45	426	229	72.9%	584	15.093	8,820	<b>9,405</b>	6,187	<b>17,773</b>	11,715	1.89	100%
1990	33	10.70	588	243	66.6%	883	5.391	4,762	<b>5,645</b>	2,572	<b>9,586</b>	4,437	1.82	93%
1991	36	11.66	433	180	71.9%	603	3.033	1,828	<b>2,431</b>	1,129	<b>4,199</b>	1,922	1.86	93%
1992	42	13.39	453	162	66.8%	678	9.441	6,403	<b>7,081</b>	3,098	<b>11,717</b>	5,295	1.86	89%
1993	47	15.23	365	123	71.8%	508	5.125	2,602	<b>3,110</b>	1,129	<b>5,545</b>	2,083	1.92	93%
1994	41	13.27	129	58	77.2%	168	7.764	1,302	<b>1,469</b>	711	<b>2,640</b>	1,233	1.80	100%
1995	50	22.56	420	165	73.0%	575	6.324	3,638	<b>4,213</b>	2,022	<b>7,609</b>	3,680	1.81	100%
1996	54	19.44	164	69	71.6%	229	11.351	2,596	<b>2,825</b>	1,465	<b>4,817</b>	2,556	1.71	100%
1997	72	23.31	192	64	63.7%	301	10.455	3,145	<b>3,446</b>	1,455	<b>5,812</b>	2,420	1.91	88%
1998	64	20.71	677	204	61.5%	1,100	3.724	4,097	<b>5,198</b>	1,777	<b>7,412</b>	2,453	1.87	76%
1999	53	16.97	845	229	61.8%	1,367	6.863	9,380	<b>10,746</b>	3,453	<b>15,568</b>	5,276	1.81	80%
2000	80	25.86	514	134	71.2%	722	2.961	2,138	<b>2,860</b>	822	<b>5,021</b>	1,437	1.89	93%
2001	81	26.23	361	126	68.4%	528	4.271	2,253	<b>2,781</b>	1,116	<b>4,147</b>	1,699	1.62	92%
2002	84	27.15	487	140	71.7%	680	3.834	2,607	<b>3,286</b>	1,063	<b>5,324</b>	1,753	1.72	94%
2003	83	26.87	367	115	66.4%	553	4.103	2,268	<b>2,821</b>	960	<b>4,224</b>	1,455	1.73	86%
2004	81	26.22	283	76	64.9%	436	8.129	3,548	<b>3,985</b>	1,332	<b>5,234</b>	1,766	1.72	76%
2005	83	26.87	623	175	74.8%	833	8.571	7,136	<b>7,969</b>	2,701	<b>14,141</b>	4,844	1.81	98%
2006	75	24.28	462	142	72.0%	642	8.925	5,727	<b>6,369</b>	2,516	<b>9,726</b>	3,898	1.72	89%
2007	79	25.58	752	203	73.4%	1,023	3.776	3,864	<b>4,888</b>	1,491	<b>7,857</b>	2,379	1.74	92%
2008	82	26.55	712	183	69.2%	1,029	5.020	5,163	<b>6,192</b>	1,861	<b>9,179</b>	2,711	1.64	91%
2009	81	26.24	517	134	66.3%	780	4.579	3,570	<b>4,350</b>	1,301	<b>6,078</b>	1,825	1.73	81%
2010	66	21.37	551	174	72.3%	762	4.121	3,141	<b>3,903</b>	1,376	<b>6,835</b>	2,407	1.85	95%
2011	82	26.55	323	111	69.0%	468	5.957	2,788	<b>3,256</b>	1,587	<b>4,980</b>	2,430	1.84	83%
2012	77	24.94	205	81	69.9%	294	7.793	2,288	<b>2,581</b>	1,401	<b>4,266</b>	2,326	1.83	90%
2013	59	19.12	589	171	66.8%	881	5.012	4,416	<b>5,298</b>	2,046	<b>8,193</b>	3,142	1.75	88%

PALO Pacific Loon



1985-2013 avg annual growth rate= 1.010 (90%c.i.= 0.995-1.026)  
 2004-2013 avg annual growth rate= 1.031 (90%c.i.= 1.000-1.063)



1985-2013 avg annual growth rate= 1.008 (90%c.i.= 0.993-1.024)  
 2004-2013 avg annual growth rate= 1.038 (90%c.i.= 0.994-1.085)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Corrected % nest success index
1985	49	24.57	676	283	68.7%	984	23.321	22,936	<b>23,920</b>	13,337	<b>35,528</b>	19,749	1.64	90%
1986	46	22.16	857	358	74.4%	1,151	23.321	26,840	<b>27,991</b>	15,488	<b>40,271</b>	22,427	1.64	88%
1987	37	12.67	1,161	525	63.9%	1,818	23.321	42,387	<b>44,204</b>	27,337	<b>75,319</b>	43,990	1.95	88%
1988	32	10.48	498	231	73.5%	678	23.321	15,809	<b>16,487</b>	9,678	<b>24,102</b>	14,691	1.66	88%
1989	23	7.45	1,304	706	72.9%	1,789	30.597	54,751	<b>56,540</b>	36,923	<b>106,852</b>	69,927	1.89	100%
1990	33	10.70	1,018	414	66.6%	1,528	16.045	24,523	<b>26,051</b>	12,228	<b>44,238</b>	21,127	1.82	93%
1991	36	11.66	1,163	352	71.9%	1,617	15.857	25,647	<b>27,265</b>	9,150	<b>47,093</b>	15,297	1.86	93%
1992	42	13.39	937	285	66.8%	1,402	23.174	32,482	<b>33,884</b>	11,457	<b>56,069</b>	20,006	1.86	89%
1993	47	15.23	905	274	71.8%	1,260	11.160	14,064	<b>15,324</b>	4,799	<b>27,320</b>	8,990	1.92	93%
1994	41	13.27	679	276	77.2%	880	15.429	13,579	<b>14,459</b>	5,881	<b>25,978</b>	10,033	1.80	100%
1995	50	22.56	976	312	73.0%	1,337	22.194	29,676	<b>31,013</b>	11,746	<b>56,014</b>	21,502	1.81	100%
1996	54	19.44	462	177	71.6%	645	25.534	16,468	<b>17,113</b>	7,397	<b>29,179</b>	13,033	1.71	100%
1997	72	23.31	821	223	63.7%	1,289	21.841	28,152	<b>29,441</b>	9,268	<b>49,654</b>	15,239	1.91	88%
1998	64	20.71	1,154	307	61.5%	1,876	16.753	31,437	<b>33,313</b>	10,776	<b>47,505</b>	14,666	1.87	76%
1999	53	16.97	1,517	421	61.8%	2,454	41.593	102,080	<b>104,534</b>	34,941	<b>151,443</b>	53,702	1.81	80%
2000	80	25.86	1,202	299	71.2%	1,687	17.469	29,479	<b>31,167</b>	9,325	<b>54,720</b>	16,287	1.89	93%
2001	81	26.23	1,194	341	68.4%	1,745	14.381	25,096	<b>26,842</b>	8,953	<b>40,032</b>	13,816	1.62	92%
2002	84	27.15	1,226	297	71.7%	1,711	11.046	18,905	<b>20,617</b>	5,771	<b>33,398</b>	9,615	1.72	94%
2003	83	26.87	698	202	66.4%	1,052	16.595	17,465	<b>18,517</b>	6,133	<b>27,727</b>	9,325	1.73	86%
2004	81	26.22	836	202	64.9%	1,287	17.427	22,428	<b>23,715</b>	6,738	<b>31,149</b>	8,972	1.72	76%
2005	83	26.87	1,322	329	74.8%	1,767	20.019	35,375	<b>37,142</b>	11,345	<b>65,908</b>	20,422	1.81	98%
2006	75	24.28	894	227	72.0%	1,241	25.778	31,991	<b>33,232</b>	9,556	<b>50,749</b>	15,008	1.72	89%
2007	79	25.58	927	251	73.4%	1,263	30.971	39,102	<b>40,365</b>	13,621	<b>64,884</b>	21,714	1.74	92%
2008	82	26.55	1,040	246	69.2%	1,503	20.081	30,191	<b>31,694</b>	8,953	<b>46,987</b>	12,950	1.64	91%
2009	81	26.24	1,147	298	66.3%	1,730	16.730	28,944	<b>30,674</b>	9,517	<b>42,866</b>	13,365	1.73	81%
2010	66	21.37	1,190	314	72.3%	1,646	18.691	30,758	<b>32,404</b>	9,755	<b>56,752</b>	17,046	1.85	95%
2011	82	26.55	1,106	291	69.0%	1,602	17.702	28,356	<b>29,958</b>	9,194	<b>45,820</b>	14,113	1.84	83%
2012	77	24.94	1,660	438	69.9%	2,376	16.712	39,716	<b>42,092</b>	13,107	<b>69,559</b>	21,922	1.83	90%
2013	59	19.12	1,246	312	66.8%	1,865	22.053	41,137	<b>43,002</b>	12,839	<b>66,505</b>	19,586	1.75	88%

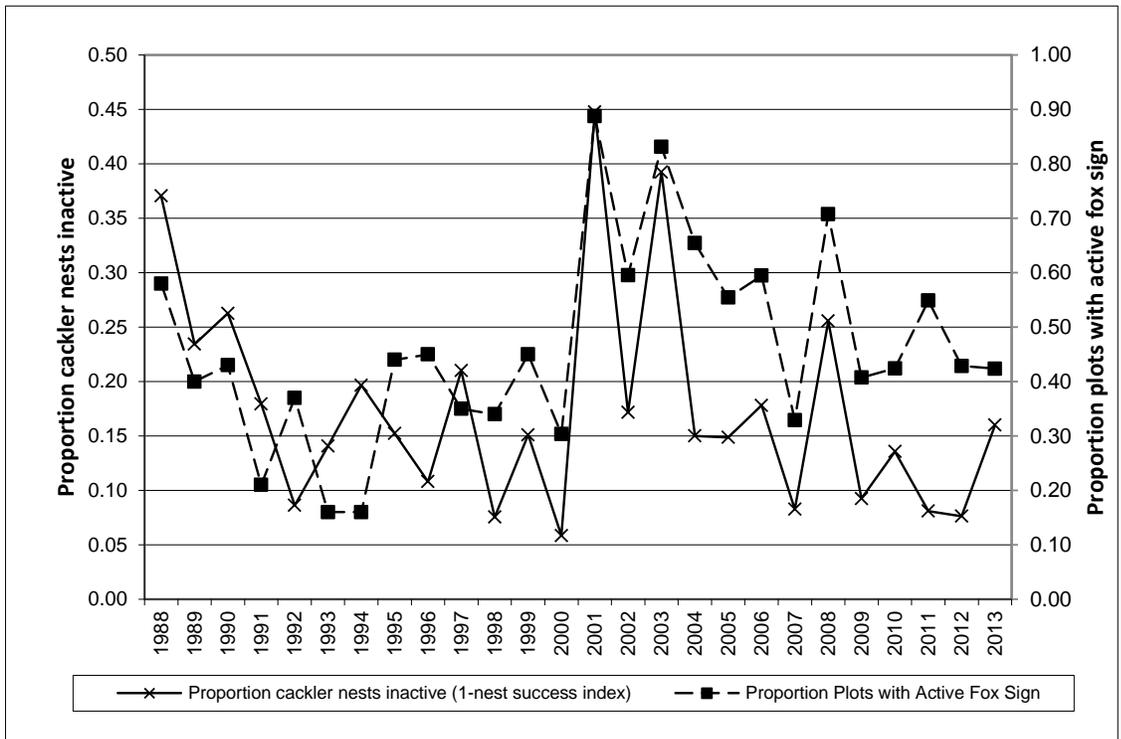


Figure 5. Trends in fox abundance (proportion of plots with observed fox, scat, fur, tracks, and/or active dens) and inactive (failed) cackling Canada goose nests (1-nest success index).

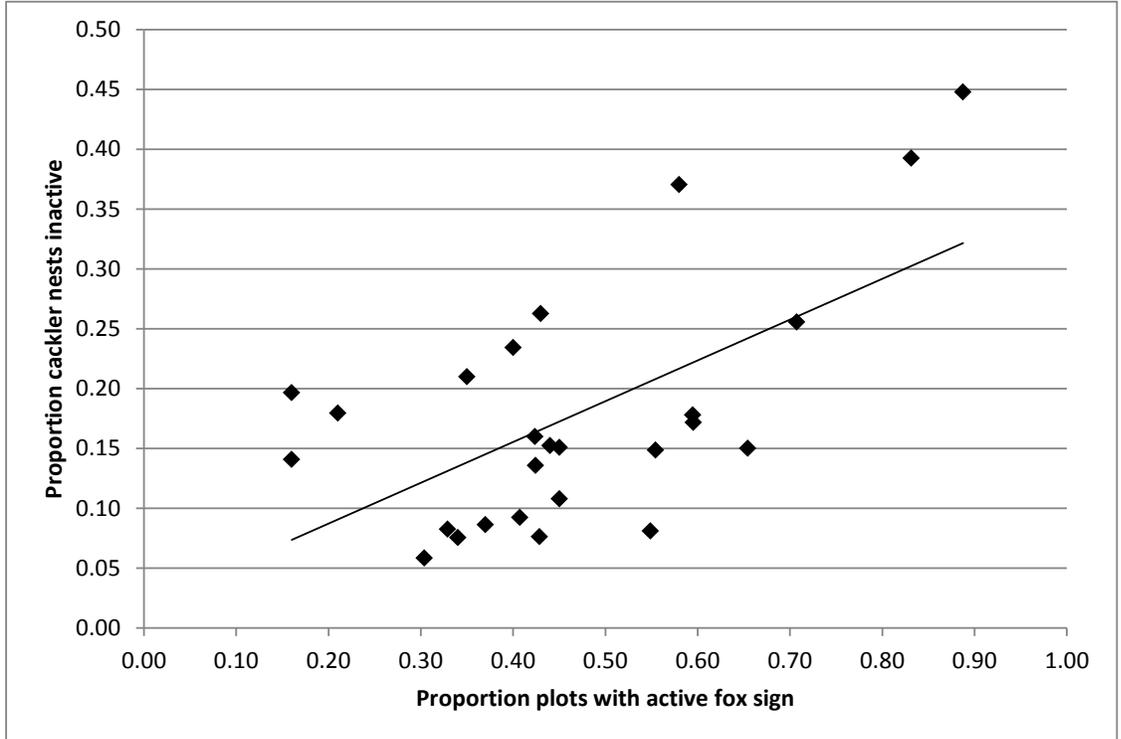


Figure 6. Relationship between fox abundance (proportion of plots with observed fox, scat, fur, tracks, and/or active dens) and inactive (failed) cackling Canada goose nests (1-nest success index). Fox abundance explained 38% of the variation in nest failure.  $F_{1,24} = 14.52, P \leq 0.001, R^2 = 0.38$ .

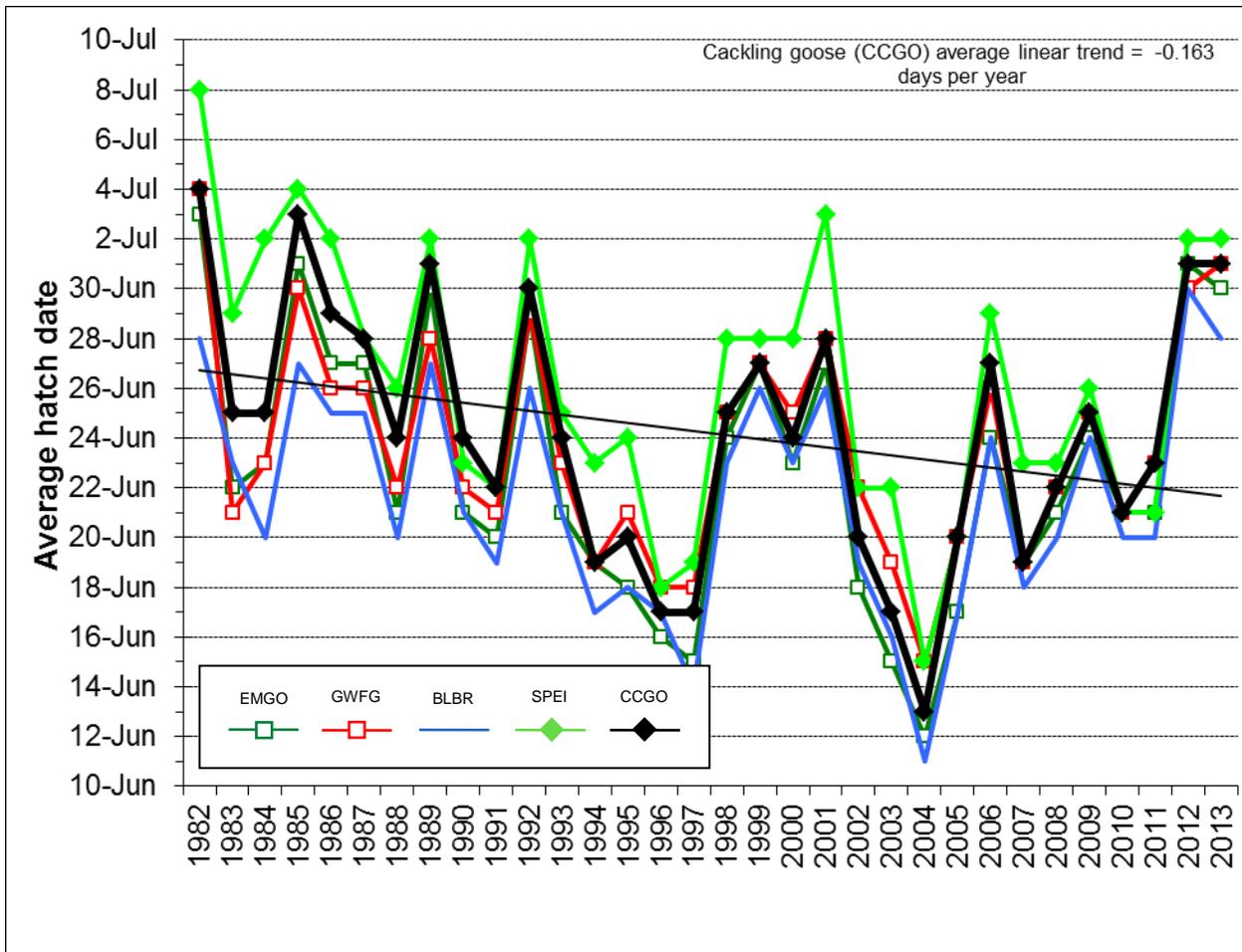


Figure 7. Estimated average hatch dates of emperor geese (EMGO), greater white-fronted geese (GWFG), black brant (BLBR), spectacled eiders (SPEI), and cackling geese (CCGO), based on egg float angles, 1982-2013. Linear regression on cackling goose hatch date indicates an average linear advance of 0.163 days per year since 1982.

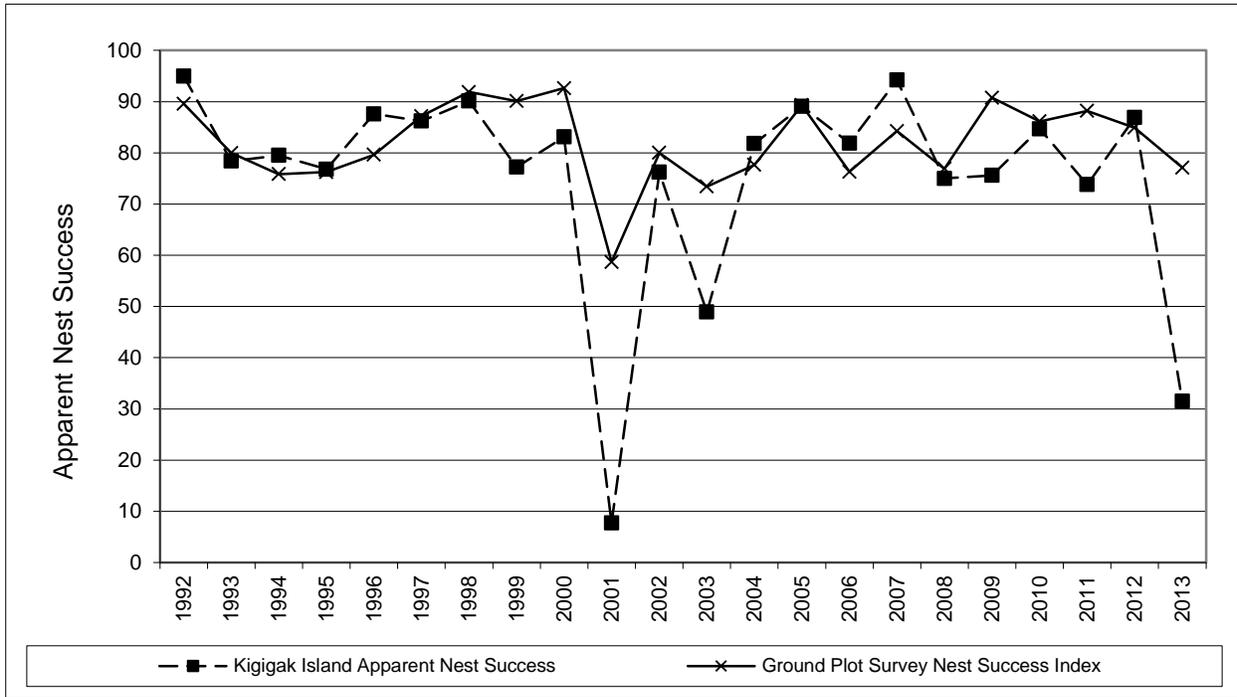


Figure 8. Comparison of spectacled eider apparent nest success measures at Kigigak Island (successful hatched nests/total nests; Gabrielson and Spragens 2013) and the Yukon-Kuskokwim Delta nest plot survey (active nests at time of search/total active nests, corrected for nest detection rate), 1992-2013.

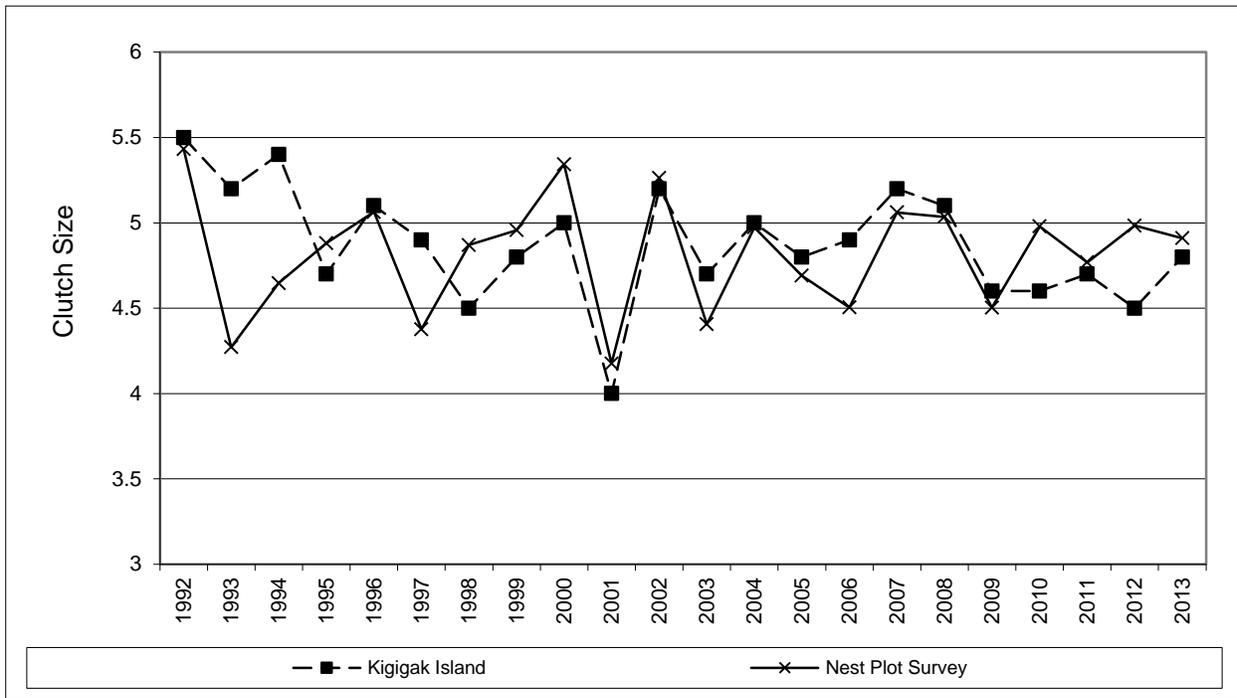


Figure 9. Comparison of spectacled eider clutch size on Kigigak Island (Gabrielson and Spragens 2013) and the Yukon-Kuskokwim Delta nest plot survey 1992-2013.

Table 1. Estimates used to calculate nest initiation and hatch dates: average incubation duration, laying rate (Afton and Paulus 1992, Alisauskas and Ankney 1992), and age of eggs in days per incubation stage category. See methods section for details on nest initiation and hatch date calculation procedures.

Species	average incubation (days)	eggs laid/day	Incubation Stage								
			1	2	3	4	5	6	7	8	9
Cackling Canada Goose	25	0.77	<b>2</b>	<b>5</b>	<b>8</b>	<b>10</b>	<b>13</b>	<b>15</b>	<b>18</b>	<b>22</b>	<b>24</b>
Emperor Goose	24	0.77	1.9	4.8	7.7	9.6	12.5	14.4	17.3	21.1	23.0
White-fronted Goose	25	0.77	2.0	5.0	8.0	10.0	13.0	15.0	18.0	22.0	24.0
Black Brant	23	0.80	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Tundra Swan	31	0.50	2.5	6.2	9.9	12.4	16.1	18.6	22.3	27.3	29.8
Sandhill Crane	30	0.50	2.4	6.0	9.6	12.0	15.6	18.0	21.6	26.4	28.8
Spectacled Eider	24	0.75	1.9	4.8	7.7	9.6	12.5	14.4	17.3	21.1	23.0
Common Eider	25	0.75	2.0	5.0	8.0	10.0	13.0	15.0	18.0	22.0	24.0
Loon (Pacific, red-throated)	27	0.50	2.2	5.4	8.6	10.8	14.0	16.2	19.4	23.8	25.9
Glaucous Gull	23	0.75	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Mew Gull	23	0.75	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Sabine's Gull	23	0.75	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Arctic Tern	23	0.75	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Long-tailed Duck	25	0.67	2.0	5.0	8.0	10.0	13.0	15.0	18.0	22.0	24.0
Dabbling Duck	23	1.00	1.8	4.6	7.4	9.2	12.0	13.8	16.6	20.2	22.1
Small Shorebirds	21	0.75	1.7	4.2	6.7	8.4	10.9	12.6	15.1	18.5	20.2

Table 2. Estimated 10-year average (2004-2013) population sizes and growth rates (90% CI) of nests and eggs on the YKD coastal zone (12,832 km<sup>2</sup>). Nest and egg estimates are corrected for average nest detection rate. Growth rates significantly different from zero are indicated by bold italics font.

Species	Mean Nest Population	Nest Population Growth Rate (90% CI)	Mean Egg Population	Egg Population Growth Rate (90% CI)
Cackling Goose	127,381	<b>1.061 (1.035-1.088)</b>	472,311	<b>1.052 (1.016-1.090)</b>
Emperor Goose	42,743	<b>1.030 (1.008-1.052)</b>	191,155	1.018 (0.997-1.040)
White-fronted Goose	178,187	<b>1.067 (1.038-1.097)</b>	713,892	<b>1.052 (1.017-1.088)</b>
Black Brant	31,015	1.041 (0.963-1.124)	88,406	1.060 (0.975-1.152)
Tundra Swan	11,770	0.987 (0.955-1.019)	40,883	<b>0.936 (0.896-0.979)</b>
Sandhill Crane	17,133	0.998 (0.967-1.030)	30,249	0.979 (0.948-1.012)
Spectacled Eider	5,617	1.025 (0.977-1.075)	22,645	1.031 (0.982-1.083)
Common Eider	3,445	0.983 (0.872-1.107)	14,828	0.977 (0.869-1.098)
Glaucous Gull	15,267	0.958 (0.880-1.042)	38,808	0.958 (0.881-1.042)
Mew Gull	13,037	0.996 (0.912-1.089)	31,230	1.001 (0.916-1.093)
Sabine's Gull	17,668	<b>1.116 (1.064-1.264)</b>	39,094	<b>1.186 (1.063-1.323)</b>
Arctic Tern	17,090	1.048 (0.994-1.104)	29,163	1.057 (0.995-1.123)
Red-throated Loon	4,879	<b>0.943 (0.892-0.996)</b>	7,649	0.950 (0.892-1.011)
Pacific Loon	34,428	<b>1.031 (1.000-1.063)</b>	54,118	1.038 (0.994-1.085)

Table 3. Estimated 29-year average (1985-2013) population sizes and growth rates (90% CI) of nests and eggs on the YKD coastal zone (12,832 km<sup>2</sup>). Nest and egg estimates are corrected for average nest detection rate. Growth rates significantly different from zero are indicated by bold italics font.

Species	Mean Nest Population	Nest Population Growth Rate (90% CI)	Mean Egg Population	Egg Population Growth Rate (90% CI)
Cackling Goose	93,844	<b>1.052 (1.042-1.062)</b>	339,121	<b>1.057 (1.042-1.071)</b>
Emperor Goose	37,767	<b>1.012 (1.002-1.023)</b>	168,909	<b>1.014 (1.001-1.027)</b>
White-fronted Goose	106,721	<b>1.091 (1.077-1.104)</b>	434,429	<b>1.089 (1.073-1.105)</b>
Black Brant	37,166	0.996 (0.977-1.015)	98,503	1.005 (0.979-1.031)
Tundra Swan	10,365	<b>1.017 (1.009-1.024)</b>	37,666	1.010 (0.999-1.022)
Sandhill Crane	16,807	<b>1.012 (1.000-1.024)</b>	28,604	<b>1.016 (1.002-1.030)</b>
Spectacled Eider	4,920	1.000 (0.988-1.013)	19,252	1.007 (0.992-1.023)
Common Eider	2,097	<b>1.070 (1.046-1.095)</b>	8,845	<b>1.076 (1.049-1.104)</b>
Glaucous Gull	15,338	1.003 (0.988-1.019)	35,538	1.013 (0.996-1.029)
Mew Gull	11,153	1.005 (0.982-1.028)	26,151	1.011 (0.988-1.034)
Sabine's Gull	11,552	<b>1.077 (1.056-1.099)</b>	25,817	<b>1.065 (1.043-1.088)</b>
Arctic Tern	12,283	<b>1.072 (1.047-1.098)</b>	22,431	<b>1.070 (1.043-1.099)</b>
Red-throated Loon	4,916	0.990 (0.973-1.007)	7,898	0.988 (0.971-1.005)
Pacific Loon	32,516	1.010 (0.995-1.026)	52,194	1.008 (0.993-1.024)

Table 4. Estimated nest initiation and hatch date based on egg float angles (1982-2013). Means calculated using nest as sample unit. Years with fewer than 3 nests per species not included in calculations. 90% confidence interval of 1982-2013 mean is based on standard deviation of annual point estimates.

**Cackling Goose**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	5-Jun	9.3	4-Jul	6.8	170
1983	25-May	9.5	24-Jun	8.2	428
1984	29-May	9.4	27-Jun	8.5	328
1985	4-Jun	8.0	2-Jul	6.3	278
1986	31-May	8.1	30-Jun	6.3	347
1987	30-May	8.0	28-Jun	6.3	209
1988	26-May	10.7	24-Jun	9.0	88
1989	1-Jun	8.1	1-Jul	6.5	55
1990	25-May	7.8	24-Jun	6.9	195
1991	24-May	7.7	22-Jun	6.5	356
1992	1-Jun	7.1	1-Jul	6.0	397
1993	26-May	7.1	24-Jun	6.0	358
1994	21-May	7.8	19-Jun	6.5	409
1995	22-May	7.0	20-Jun	6.2	725
1996	20-May	7.7	18-Jun	6.7	755
1997	19-May	7.3	17-Jun	6.7	812
1998	27-May	6.1	25-Jun	5.2	889
1999	29-May	7.3	27-Jun	6.4	772
2000	27-May	6.8	25-Jun	6.0	1014
2001	31-May	6.3	28-Jun	5.8	522
2002	22-May	6.4	21-Jun	5.3	930
2003	19-May	9.1	17-Jun	7.9	562
2004	16-May	7.9	14-Jun	7.1	964
2005	22-May	8.4	20-Jun	7.4	957
2006	29-May	6.4	27-Jun	5.3	845
2007	21-May	7.1	19-Jun	6.2	1027
2008	25-May	6.1	23-Jun	5.2	906
2009	27-May	6.4	25-Jun	5.6	1374
2010	23-May	6.5	21-Jun	5.7	773
2011	25-May	6.7	23-Jun	5.8	902
2012	2-Jun	6.3	1-Jul	5.6	519
2013	2-Jun	5.2	1-Jul	4.4	683
Mean	26-May	1.5	24-Jun	1.5	

**Emperor Goose**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	5-Jun	8.2	4-Jul	6.4	71
1983	22-May	9.3	20-Jun	7.7	177
1984	26-May	10.3	24-Jun	8.2	161
1985	2-Jun	7.6	1-Jul	5.7	107
1986	29-May	7.4	27-Jun	5.6	197
1987	30-May	7.3	27-Jun	5.5	142
1988	24-May	8.9	22-Jun	6.8	102
1989	1-Jun	8.1	30-Jun	6.0	63
1990	23-May	8.6	21-Jun	6.5	100
1991	22-May	7.2	20-Jun	6.0	263
1992	1-Jun	6.5	30-Jun	5.0	184
1993	24-May	7.2	21-Jun	5.9	139
1994	21-May	7.4	19-Jun	5.8	192
1995	21-May	7.4	18-Jun	6.0	188
1996	19-May	6.3	17-Jun	5.1	185
1997	18-May	7.5	15-Jun	5.8	153
1998	27-May	6.5	24-Jun	5.2	215
1999	30-May	6.5	27-Jun	5.6	188
2000	26-May	7.2	24-Jun	5.9	280
2001	29-May	7.5	27-Jun	5.4	104
2002	20-May	6.6	18-Jun	5.3	249
2003	18-May	8.6	15-Jun	6.8	153
2004	15-May	7.7	13-Jun	6.2	253
2005	19-May	9.4	17-Jun	7.2	303
2006	27-May	6.3	24-Jun	5.0	253
2007	21-May	7.0	19-Jun	5.4	275
2008	24-May	6.9	22-Jun	5.2	240
2009	26-May	6.5	24-Jun	5.1	349
2010	23-May	6.4	20-Jun	5.2	189
2011	24-May	6.6	21-Jun	5.0	206
2012	2-Jun	6.5	1-Jul	5.2	119
2013	1-Jun	5.9	30-Jun	5.0	162
Mean	25-May	1.5	23-Jun	1.6	

**Black Brant**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	0.0	--	0.0	1
1983	24-May	9.1	19-Jun	6.7	448
1984	30-May	7.4	25-Jun	6.6	440
1985	1-Jun	4.8	27-Jun	6.0	29
1986	30-May	5.6	26-Jun	4.7	131
1987	1-Jun	5.2	25-Jun	3.5	172
1988	25-May	9.0	20-Jun	7.2	51
1989	1-Jun	6.4	27-Jun	5.6	40
1990	25-May	5.8	22-Jun	6.2	130
1991	24-May	6.6	19-Jun	6.0	183
1992	1-Jun	6.5	27-Jun	5.9	152
1993	26-May	6.0	21-Jun	5.5	107
1994	22-May	6.8	17-Jun	5.9	93
1995	23-May	7.7	18-Jun	6.7	41
1996	23-May	6.4	18-Jun	4.9	44
1997	20-May	7.6	14-Jun	7.0	100
1998	28-May	6.5	23-Jun	5.5	260
1999	31-May	7.2	26-Jun	6.6	108
2000	29-May	6.3	24-Jun	5.7	216
2001	1-Jun	6.2	26-Jun	5.5	77
2002	24-May	7.5	19-Jun	6.6	163
2003	22-May	8.2	16-Jun	7.5	56
2004	18-May	8.5	12-Jun	7.9	101
2005	23-May	6.9	17-Jun	6.6	148
2006	29-May	6.5	24-Jun	5.7	123
2007	22-May	7.1	17-Jun	6.1	147
2008	27-May	5.9	21-Jun	5.3	103
2009	29-May	7.7	24-Jun	6.7	202
2010	25-May	7.9	20-Jun	7.0	134
2011	25-May	6.2	20-Jun	5.6	50
2012	3-Jun	5.7	30-Jun	5.3	37
2013	1-Jun	5.9	28-Jun	5.2	99
Mean	27-May	1.3	22-Jun	1.3	

**White-fronted Geese**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	6-Jun	7.0	4-Jul	6.4	14
1983	22-May	7.5	20-Jun	7.1	172
1984	24-May	10.3	22-Jun	8.7	84
1985	31-May	6.6	30-Jun	4.7	42
1986	28-May	7.4	26-Jun	6.6	102
1987	28-May	6.5	26-Jun	5.2	61
1988	26-May	9.0	23-Jun	7.3	32
1989	30-May	8.1	28-Jun	6.2	21
1990	24-May	7.2	22-Jun	6.4	52
1991	23-May	7.9	21-Jun	6.7	138
1992	1-Jun	6.8	30-Jun	5.6	115
1993	26-May	6.3	24-Jun	5.7	84
1994	21-May	8.0	19-Jun	5.9	129
1995	23-May	8.0	21-Jun	6.8	178
1996	21-May	8.6	19-Jun	7.5	144
1997	20-May	8.0	18-Jun	6.6	184
1998	28-May	6.7	25-Jun	5.5	261
1999	30-May	7.6	27-Jun	6.7	208
2000	28-May	8.2	26-Jun	6.6	334
2001	31-May	6.9	28-Jun	5.8	311
2002	24-May	6.3	22-Jun	5.0	306
2003	21-May	8.7	19-Jun	7.4	272
2004	17-May	8.0	16-Jun	6.5	364
2005	23-May	8.0	20-Jun	6.9	438
2006	28-May	7.2	26-Jun	5.9	370
2007	21-May	7.6	19-Jun	6.2	446
2008	25-May	6.8	23-Jun	5.6	327
2009	27-May	6.7	25-Jun	5.6	477
2010	23-May	7.3	21-Jun	6.0	353
2011	25-May	7.3	23-Jun	5.8	549
2012	1-Jun	7.3	30-Jun	5.6	155
2013	2-Jun	6.1	1-Jul	5.2	257
Mean	26-May	1.3	24-Jun	1.3	

**Tundra Swan**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	2-Jun	10.1	5-Jul	9.6	11
1983	19-May	6.3	24-Jun	6.5	11
1984	23-May	10.2	26-Jun	9.7	9
1985	31-May	8.0	4-Jul	7.0	14
1986	25-May	8.7	28-Jun	8.6	24
1987	27-May	7.1	30-Jun	6.5	12
1988	23-May	11.9	26-Jun	10.6	5
1989	27-May	3.2	2-Jul	2.7	4
1990	22-May	4.1	24-Jun	3.6	4
1991	21-May	9.8	25-Jun	9.5	12
1992	29-May	9.0	1-Jul	8.8	9
1993	22-May	7.4	26-Jun	7.7	6
1994	18-May	8.7	22-Jun	7.5	9
1995	23-May	4.6	26-Jun	4.7	9
1996	17-May	8.4	20-Jun	9.3	9
1997	18-May	7.6	21-Jun	5.8	13
1998	28-May	8.4	1-Jul	7.7	20
1999	29-May	7.1	1-Jul	7.1	14
2000	24-May	8.4	27-Jun	7.6	22
2001	28-May	9.2	1-Jul	9.0	16
2002	22-May	5.2	26-Jun	4.9	10
2003	13-May	7.2	18-Jun	6.5	21
2004	14-May	8.1	20-Jun	7.7	16
2005	21-May	7.9	23-Jun	6.8	18
2006	29-May	6.0	1-Jul	6.9	14
2007	21-May	7.2	24-Jun	6.7	19
2008	26-May	6.2	29-Jun	5.3	19
2009	29-May	7.7	2-Jul	6.6	19
2010	23-May	8.3	27-Jun	8.5	14
2011	24-May	7.6	28-Jun	6.9	20
2012	3-Jun	5.3	7-Jul	4.9	6
2013	29-May	4.5	5-Jul	4.7	9
Mean	24-May	1.5	27-Jun	1.4	

**Sandhill Crane**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	24-May	2.0	24-Jun	2.0	4
1983	23-May	11.9	22-Jun	11.5	21
1984	19-May	4.5	20-Jun	8.5	9
1985	30-May	7.0	30-Jun	6.6	13
1986	27-May	8.8	26-Jun	9.3	26
1987	25-May	8.6	24-Jun	8.4	16
1988	20-May	4.4	20-Jun	4.4	6
1989	19-May	3.3	19-Jun	3.3	2
1990	19-May	4.4	18-Jun	4.5	9
1991	16-May	7.1	16-Jun	7.0	25
1992	30-May	5.2	30-Jun	5.2	11
1993	19-May	4.6	19-Jun	4.8	14
1994	14-May	2.1	14-Jun	2.6	5
1995	18-May	9.0	17-Jun	8.7	10
1996	15-May	5.9	15-Jun	5.8	14
1997	15-May	7.3	14-Jun	7.2	8
1998	21-May	4.5	20-Jun	4.5	19
1999	23-May	4.9	23-Jun	4.5	12
2000	20-May	7.1	20-Jun	7.0	22
2001	21-May	2.5	20-Jun	1.9	7
2002	19-May	10.5	19-Jun	10.5	12
2003	13-May	9.6	13-Jun	9.6	13
2004	16-May	6.8	16-Jun	6.5	10
2005	15-May	6.4	15-Jun	6.4	23
2006	23-May	8.9	23-Jun	8.5	19
2007	12-May	7.8	12-Jun	7.8	16
2008	21-May	4.3	21-Jun	4.2	12
2009	23-May	8.8	23-Jun	8.9	20
2010	18-May	5.3	18-Jun	5.5	17
2011	20-May	9.8	20-Jun	9.4	14
2012	26-May	10.7	27-Jun	10.3	7
2013	25-May	7.7	27-Jun	8.1	7
Mean	20-May	1.3	20-Jun	1.3	

**Spectacled Eider**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	13-Jun	9.4	8-Jul	5.2	18
1983	28-May	12.3	24-Jun	11.6	35
1984	6-Jun	9.1	30-Jun	8.8	9
1985	7-Jun	9.0	4-Jul	7.6	20
1986	8-Jun	10.7	3-Jul	9.0	38
1987	31-May	8.2	28-Jun	7.4	28
1988	30-May	6.8	27-Jun	7.0	19
1989	4-Jun	10.6	2-Jul	9.0	5
1990	26-May	5.4	23-Jun	4.9	15
1991	24-May	10.1	22-Jun	9.3	25
1992	4-Jun	7.5	3-Jul	6.0	18
1993	28-May	7.1	24-Jun	7.3	18
1994	27-May	13.0	23-Jun	11.2	15
1995	26-May	8.0	24-Jun	7.3	44
1996	22-May	7.1	19-Jun	6.9	33
1997	23-May	8.1	19-Jun	7.2	39
1998	31-May	8.6	28-Jun	7.4	52
1999	31-May	10.3	28-Jun	9.7	51
2000	31-May	8.2	29-Jun	8.0	52
2001	6-Jun	8.8	3-Jul	6.7	32
2002	24-May	7.4	22-Jun	6.5	59
2003	26-May	11.0	22-Jun	10.1	36
2004	19-May	10.3	16-Jun	9.3	57
2005	24-May	9.2	20-Jun	8.7	101
2006	1-Jun	9.4	29-Jun	8.5	78
2007	26-May	8.8	23-Jun	8.0	68
2008	27-May	10.2	24-Jun	9.3	73
2009	30-May	9.2	26-Jun	8.3	124
2010	24-May	7.5	21-Jun	6.8	71
2011	28-May	10.1	25-Jun	9.0	50
2012	3-Jun	7.5	2-Jul	6.9	47
2013	3-Jun	8.1	2-Jul	6.5	42
Mean	30-May	1.7	26-Jun	1.5	

**Common Eider**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	11-Jun	3.0	9-Jul	1.4	4
1983	29-May	5.6	26-Jun	6.2	3
1984	--	--	--	--	0
1985	--	--	--	--	0
1986	--	--	--	--	0
1987	1-Jun	5.3	29-Jun	5.7	10
1988	--	--	--	--	1
1989	2-Jun	7.4	2-Jul	6.1	4
1990	23-May	3.3	22-Jun	2.1	3
1991	28-May	5.9	26-Jun	5.7	27
1992	4-Jun	6.2	3-Jul	5.3	12
1993	25-May	5.4	24-Jun	5.2	5
1994	26-May	10.1	24-Jun	9.2	9
1995	25-May	11.2	23-Jun	10.7	13
1996	22-May	11.1	20-Jun	10.5	14
1997	22-May	9.4	19-Jun	8.0	15
1998	30-May	6.8	28-Jun	6.2	18
1999	2-Jun	9.5	30-Jun	9.8	12
2000	1-Jun	5.8	30-Jun	4.9	23
2001	2-Jun	7.6	30-Jun	7.0	23
2002	25-May	7.7	24-Jun	6.8	17
2003	25-May	12.1	22-Jun	10.8	16
2004	21-May	9.5	18-Jun	8.7	18
2005	21-May	8.4	19-Jun	8.2	34
2006	2-Jun	7.7	1-Jul	6.8	52
2007	22-May	7.2	21-Jun	6.9	50
2008	27-May	7.4	25-Jun	6.8	34
2009	28-May	5.7	26-Jun	5.5	33
2010	26-May	5.7	24-Jun	5.4	41
2011	25-May	7.6	23-Jun	6.4	10
2012	2-Jun	4.1	2-Jul	4.0	7
2013	1-Jun	6.4	2-Jul	6.0	21
Mean	28-May	1.6	26-Jun	1.6	

**Pacific Loon, Red-throated Loon**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	13-Jun	7.7	8-Jul	3.7	25
1983	2-Jun	11.7	29-Jun	9.9	16
1984	5-Jun	6.3	3-Jul	6.3	5
1985	12-Jun	10.9	7-Jul	6.7	15
1986	8-Jun	9.3	5-Jul	6.2	38
1987	5-Jun	6.5	3-Jul	5.9	35
1988	31-May	11.2	28-Jun	11.7	5
1989	5-Jun	12.3	2-Jul	10.4	5
1990	3-Jun	6.8	1-Jul	6.6	11
1991	30-May	7.1	26-Jun	6.9	21
1992	9-Jun	7.0	6-Jul	4.8	15
1993	28-May	6.9	25-Jun	6.6	12
1994	27-May	6.0	24-Jun	5.7	6
1995	29-May	5.7	26-Jun	5.4	10
1996	27-May	7.2	23-Jun	7.3	9
1997	25-May	6.6	22-Jun	6.5	17
1998	3-Jun	8.5	30-Jun	8.0	37
1999	5-Jun	8.6	3-Jul	8.1	48
2000	3-Jun	7.8	1-Jul	7.7	40
2001	6-Jun	8.4	4-Jul	7.2	27
2002	29-May	6.2	26-Jun	5.9	42
2003	27-May	8.9	24-Jun	9.0	14
2004	27-May	9.7	24-Jun	9.4	10
2005	30-May	10.3	27-Jun	10.0	42
2006	5-Jun	4.1	2-Jul	4.0	22
2007	27-May	7.1	24-Jun	7.3	31
2008	1-Jun	8.5	29-Jun	8.1	46
2009	4-Jun	8.4	1-Jul	7.9	35
2010	31-May	6.4	28-Jun	6.2	28
2011	1-Jun	7.6	29-Jun	7.4	29
2012	5-Jun	9.7	4-Jul	9.1	7
2013	6-Jun	5.7	6-Jul	5.1	28
Mean	2-Jun	1.4	30-Jun	1.3	

**Glaucous Gull**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	11-Jun	8.0	5-Jul	6.2	23
1983	28-May	10.4	21-Jun	9.9	19
1984	30-May	4.8	25-Jun	9.7	8
1985	8-Jun	6.1	3-Jul	6.3	23
1986	2-Jun	8.0	27-Jun	7.4	19
1987	3-Jun	8.4	28-Jun	8.1	19
1988	29-May	8.9	23-Jun	9.1	9
1989	28-May	0.0	22-Jun	0.0	3
1990	24-May	2.5	19-Jun	4.1	3
1991	24-May	7.2	18-Jun	7.3	26
1992	3-Jun	5.9	27-Jun	5.6	24
1993	26-May	9.9	20-Jun	9.4	11
1994	23-May	7.5	17-Jun	7.0	17
1995	24-May	4.2	17-Jun	4.4	17
1996	22-May	4.3	15-Jun	4.2	15
1997	23-May	8.8	17-Jun	8.2	19
1998	28-May	7.5	22-Jun	7.2	64
1999	2-Jun	9.5	26-Jun	9.1	25
2000	29-May	8.8	23-Jun	8.6	72
2001	31-May	7.9	24-Jun	7.9	50
2002	23-May	7.7	17-Jun	7.4	56
2003	20-May	7.8	13-Jun	7.4	58
2004	17-May	7.2	11-Jun	7.0	21
2005	20-May	8.0	14-Jun	7.7	69
2006	31-May	8.6	25-Jun	8.3	46
2007	22-May	7.2	15-Jun	7.1	76
2008	27-May	7.2	21-Jun	6.8	67
2009	29-May	7.7	23-Jun	7.6	59
2010	27-May	9.1	20-Jun	8.5	28
2011	27-May	9.1	21-Jun	8.5	23
2012	4-Jun	11.0	29-Jun	9.9	8
2013	4-Jun	8.2	29-Jun	7.3	37
Mean	28-May	1.7	22-Jun	1.7	

**Mew Gull**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	17-Jun	4.6	10-Jul	1.9	11
1983	30-May	11.3	23-Jun	11.0	9
1984	--	--	--	--	2
1985	11-Jun	7.2	4-Jul	6.4	8
1986	7-Jun	13.0	2-Jul	10.6	18
1987	2-Jun	8.5	26-Jun	7.4	8
1988	25-May	7.1	19-Jun	6.5	4
1989	--	--	--	--	1
1990	28-May	7.4	22-Jun	7.4	2
1991	26-May	7.6	20-Jun	8.1	8
1992	4-Jun	5.1	28-Jun	4.9	10
1993	31-May	9.3	24-Jun	8.9	7
1994	21-May	6.4	15-Jun	6.1	8
1995	24-May	3.3	18-Jun	3.5	16
1996	21-May	6.0	15-Jun	5.5	10
1997	25-May	5.7	19-Jun	5.7	8
1998	30-May	7.0	24-Jun	6.5	19
1999	1-Jun	9.1	25-Jun	8.8	25
2000	2-Jun	8.4	26-Jun	8.0	17
2001	2-Jun	8.7	27-Jun	8.2	18
2002	22-May	8.3	16-Jun	8.0	40
2003	23-May	8.3	17-Jun	8.1	20
2004	21-May	4.4	14-Jun	3.9	19
2005	26-May	8.9	19-Jun	8.5	32
2006	2-Jun	9.3	26-Jun	9.1	45
2007	24-May	8.3	18-Jun	7.8	32
2008	27-May	7.2	20-Jun	6.9	42
2009	30-May	7.4	24-Jun	7.2	54
2010	26-May	5.4	20-Jun	5.1	44
2011	30-May	7.9	23-Jun	8.1	18
2012	4-Jun	5.8	29-Jun	4.9	13
2013	2-Jun	6.0	28-Jun	5.8	24
Mean	30-May	1.9	23-Jun	1.8	

**Sabine's Gull**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	1
1983	28-May	11.9	21-Jun	13.0	3
1984	--	--	--	--	0
1985	9-Jun	12.7	2-Jul	9.7	3
1986	31-May	11.2	24-Jun	10.1	7
1987	28-May	10.1	21-Jun	9.1	7
1988	1-Jun	9.6	25-Jun	9.1	8
1989	7-Jun	16.5	1-Jul	15.6	2
1990	--	--	--	--	0
1991	22-May	5.5	15-Jun	5.9	9
1992	--	--	--	--	0
1993	24-May	5.8	17-Jun	5.6	8
1994	18-May	6.6	11-Jun	5.4	6
1995	25-May	9.8	18-Jun	8.6	6
1996	18-May	5.4	12-Jun	4.7	3
1997	21-May	6.7	14-Jun	6.9	8
1998	28-May	10.1	21-Jun	9.4	11
1999	27-May	7.2	20-Jun	7.4	20
2000	30-May	9.8	23-Jun	9.8	7
2001	3-Jun	6.6	27-Jun	6.4	10
2002	21-May	8.4	14-Jun	8.2	28
2003	19-May	7.7	12-Jun	7.5	5
2004	17-May	13.2	10-Jun	12.0	3
2005	23-May	9.7	16-Jun	9.3	30
2006	28-May	3.9	22-Jun	3.7	23
2007	24-May	8.9	17-Jun	8.2	30
2008	25-May	7.0	18-Jun	6.7	17
2009	29-May	10.0	22-Jun	9.6	17
2010	22-May	3.0	15-Jun	2.6	20
2011	24-May	3.8	17-Jun	4.0	40
2012	1-Jun	5.2	26-Jun	4.8	14
2013	2-Jun	5.4	27-Jun	5.6	21
Mean	26-May	1.9	20-Jun	1.8	

**Arctic Tern**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	0
1983	--	--	--	--	0
1984	--	--	--	--	0
1985	6-Jun	6.1	29-Jun	5.7	8
1986	3-Jun	14.7	26-Jun	13.7	6
1987	1-Jun	4.7	24-Jun	4.7	3
1988	2-Jun	0.8	25-Jun	0.0	2
1989	--	--	--	--	1
1990	--	--	--	--	1
1991	24-May	4.8	17-Jun	4.8	4
1992	8-Jun	8.6	2-Jul	8.1	6
1993	23-May	2.8	17-Jun	3.9	3
1994	--	--	--	--	1
1995	23-May	4.7	16-Jun	5.1	3
1996	--	--	--	--	1
1997	--	--	--	--	0
1998	3-Jun	10.5	26-Jun	10.0	5
1999	2-Jun	5.2	26-Jun	5.1	8
2000	3-Jun	4.8	26-Jun	4.8	5
2001	29-May	7.7	22-Jun	8.2	5
2002	25-May	6.2	18-Jun	5.8	37
2003	21-May	7.8	13-Jun	7.2	5
2004	25-May	11.5	17-Jun	10.9	9
2005	28-May	8.1	21-Jun	7.7	15
2006	30-May	5.9	23-Jun	5.7	17
2007	23-May	7.5	16-Jun	7.3	18
2008	28-May	7.9	21-Jun	7.5	16
2009	2-Jun	7.5	26-Jun	7.4	30
2010	30-May	8.8	22-Jun	8.5	9
2011	31-May	9.6	24-Jun	9.4	19
2012	3-Jun	7.4	28-Jun	7.0	14
2013	31-May	8.7	24-Jun	7.9	20
Mean	30-May	1.6	22-Jun	1.6	

**Greater Scaup, Long-tailed Duck**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	18-Jun	5.8	10-Jul	0.0	5
1983	--	--	--	--	1
1984	--	--	--	--	1
1985	--	--	--	--	1
1986	7-Jun	5.9	9-Jul	3.4	4
1987	6-Jun	6.7	7-Jul	5.4	4
1988	--	--	--	--	1
1989	--	--	--	--	1
1990	8-Jun	4.9	7-Jul	1.6	2
1991	26-May	6.6	28-Jun	7.4	2
1992	7-Jun	6.3	8-Jul	5.4	21
1993	2-Jun	5.7	2-Jul	3.3	18
1994	2-Jun	3.8	2-Jul	1.4	7
1995	3-Jun	7.9	3-Jul	8.7	14
1996	31-May	11.7	29-Jun	9.3	7
1997	27-May	10.4	27-Jun	10.0	10
1998	2-Jun	7.5	4-Jul	6.4	14
1999	8-Jun	8.0	8-Jul	3.9	10
2000	5-Jun	5.5	7-Jul	5.2	26
2001	11-Jun	8.1	7-Jul	4.0	6
2002	31-May	6.0	1-Jul	2.3	8
2003	30-May	3.6	30-Jun	1.3	3
2004	22-May	8.2	21-Jun	3.3	2
2005	1-Jun	9.4	1-Jul	7.1	9
2006	3-Jun	6.4	5-Jul	5.2	5
2007	2-Jun	5.0	2-Jul	2.5	5
2008	--	--	--	--	1
2009	3-Jun	9.5	3-Jul	8.1	7
2010	29-May	10.0	29-Jun	10.9	6
2011	29-May	5.8	1-Jul	5.3	4
2012	8-Jun	2.5	9-Jul	0.8	2
2013	1-Jun	8.8	6-Jul	7.4	6
Mean	3-Jun	1.8	3-Jul	1.4	

**Pintail, Mallard,  
Shoveler, Teal**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	1
1983	--	--	--	--	1
1984	10-Jun	3.3	8-Jul	5.8	2
1985	13-Jun	6.6	8-Jul	3.3	2
1986	6-Jun	11.6	4-Jul	9.0	13
1987	6-Jun	13.2	3-Jul	10.5	12
1988	3-Jun	4.9	2-Jul	4.1	2
1989	9-Jun	6.4	6-Jul	4.3	4
1990	1-Jun	7.8	28-Jun	5.6	4
1991	27-May	11.1	24-Jun	10.7	13
1992	7-Jun	10.9	5-Jul	8.0	18
1993	1-Jun	6.1	28-Jun	2.7	16
1994	31-May	5.8	28-Jun	2.4	5
1995	1-Jun	14.9	27-Jun	11.5	11
1996	28-May	13.2	26-Jun	11.4	10
1997	20-May	7.6	17-Jun	4.7	4
1998	4-Jun	8.2	1-Jul	6.9	39
1999	3-Jun	10.2	2-Jul	8.2	17
2000	3-Jun	7.9	1-Jul	6.3	28
2001	5-Jun	4.2	2-Jul	3.7	13
2002	28-May	13.8	24-Jun	9.8	21
2003	22-May	10.0	20-Jun	10.0	8
2004	21-May	12.4	19-Jun	10.8	19
2005	27-May	12.3	23-Jun	10.3	24
2006	4-Jun	9.1	1-Jul	7.9	15
2007	25-May	8.7	22-Jun	7.0	17
2008	30-May	11.1	27-Jun	8.5	21
2009	31-May	8.5	28-Jun	6.9	16
2010	27-May	8.5	24-Jun	6.6	18
2011	28-May	7.4	26-Jun	4.9	6
2012	4-Jun	6.7	3-Jul	5.6	4
2013	7-Jun	9.5	5-Jul	7.2	16
Mean	1-Jun	1.8	29-Jun	1.7	

**Shorebirds**

Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	1
1983	--	--	--	--	0
1984	--	--	--	--	3
1985	13-Jun	12.9	3-Jul	11.6	4
1986	1-Jun	13.3	27-Jun	9.6	23
1987	28-May	5.9	21-Jun	4.7	7
1988	24-May	1.6	18-Jun	1.6	2
1989	1-Jun	12.8	24-Jun	11.7	3
1990	1-Jun	7.4	26-Jun	7.4	2
1991	28-May	12.2	22-Jun	11.9	21
1992	3-Jun	4.0	28-Jun	4.2	11
1993	27-May	7.1	21-Jun	6.9	15
1994	25-May	9.9	19-Jun	9.0	2
1995	26-May	7.6	19-Jun	7.6	6
1996	27-May	13.7	20-Jun	13.9	10
1997	19-May	3.6	12-Jun	3.4	3
1998	29-May	8.3	22-Jun	7.3	8
1999	31-May	7.0	25-Jun	6.9	17
2000	30-May	7.2	24-Jun	6.4	13
2001	2-Jun	8.3	27-Jun	8.1	22
2002	25-May	5.7	19-Jun	5.8	21
2003	21-May	2.8	15-Jun	2.8	3
2004	20-May	5.9	13-Jun	6.1	10
2005	26-May	7.3	20-Jun	6.7	30
2006	2-Jun	9.0	26-Jun	8.1	29
2007	24-May	7.5	18-Jun	7.2	33
2008	26-May	8.3	20-Jun	7.8	53
2009	1-Jun	8.2	26-Jun	8.0	23
2010	27-May	9.2	21-Jun	8.9	29
2011	25-May	5.9	19-Jun	5.8	26
2012	3-Jun	8.8	29-Jun	8.1	27
2013	1-Jun	4.5	26-Jun	5.0	13
Mean	28-May	1.6	22-Jun	1.4	

Table 5. Numbers and proportions of plots with fox sign (observed fox, scat, fur, tracks, and/or active dens) and vole sign (observed voles, digging, runways), 1988-2013.

Year	Number Plots Sampled	Number Plots with Fox Sign	Number Plots with Vole Sign	Proportion of Plots with Fox Sign	Proportion of Plots with Vole Sign
1988	26	15	10	0.58	0.38
1989	20	8	8	0.40	0.40
1990	30	13	16	0.43	0.53
1991	33	7	12	0.21	0.36
1992	41	15	9	0.37	0.22
1993	45	7	8	0.16	0.18
1994	38	6	4	0.16	0.11
1995	48	21	14	0.44	0.29
1996	44	20	15	0.45	0.34
1997	72	25	18	0.35	0.25
1998	62	21	21	0.34	0.34
1999	53	24	20	0.45	0.38
2000	79	24	62	0.30	0.78
2001	80	71	31	0.89	0.39
2002	84	50	19	0.60	0.23
2003	83	69	44	0.83	0.53
2004	81	53	16	0.65	0.20
2005	83	46	10	0.55	0.12
2006	74	44	11	0.59	0.15
2007	79	26	26	0.33	0.33
2008	82	58	33	0.71	0.40
2009	81	33	58	0.41	0.72
2010	66	28	38	0.42	0.58
2011	82	45	11	0.55	0.13
2012	77	33	10	0.43	0.13
2013	59	25	16	0.42	0.27
Mean	62	30	21	0.46	0.34