

Nest Population Size and Potential Production of Geese and Spectacled Eiders on the Yukon-Kuskokwim Delta, Alaska, 1985-2011

Julian B. Fischer¹, Robert A. Stehn¹, and George Walters²

¹ U.S. Fish and Wildlife Service, Migratory Bird Management, Waterfowl Management Branch, 1011 E. Tudor Rd., Anchorage, AK 99503

² U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, P.O. Box 346, Bethel, AK 99559

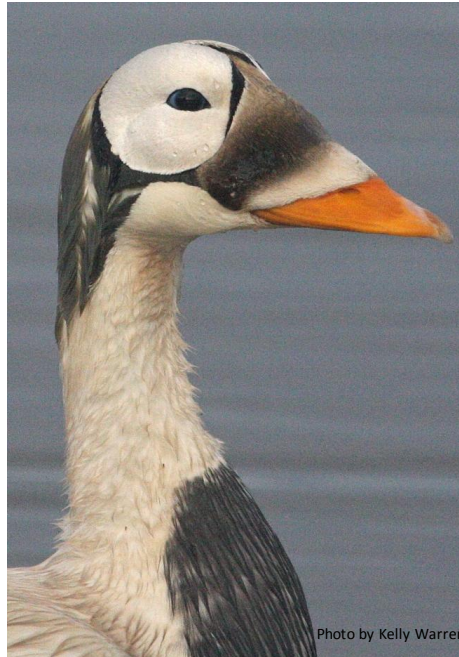


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SUMMARY: We used a ground-based survey to estimate the number of nests and eggs of geese and eiders on the Yukon-Kuskokwim Delta (YKD), Alaska, 1985-2011. Here we report annual estimates of nest and egg populations in 1985-2011, and describe 2011 estimates compared to the long-term means (1985-2011) with qualitative descriptors that correspond to quartiles (4th quartile = high, 3rd quartile = moderate, 2nd quartile = low, 1st quartile = very low). We also report annual estimates of a nest success index and clutch sizes in 1985-2011, and describe the 2011 estimates relative to long-term means in quartiles (4th quartile = excellent, 3rd quartile = good, 2nd quartile = fair, 1st quartile = poor). In 2011, numbers of nests and eggs were high for cackling Canada geese (*Branta hutchinsii minima*), emperor geese (*Chen canagica*), and greater white-fronted geese (*Anser albifrons frontalis*). Nest success for these goose species was high, but clutch sizes were low to very low relative to long term means. In contrast, spectacled eiders (*Somateria fischeri*), and common eiders (*Somateria mollissima*), produced low numbers of nests relative to long-term means (1985-2011). Eider nest success was fair to good and clutch sizes were low to moderate. Numbers of nests have increased significantly for cackling geese, emperor geese, and white-fronted geese over the 27-year time span of this survey (1985-2011) and during the most recent decade (2002-2011). Unlike the geese, the apparent increase in numbers of spectacled and common eider nests and eggs was not statistically significant. We observed no significant declines in any species in the short-term (10-year) or long-term periods (27-year). Nest initiation and hatch dates of geese and eiders in 2011 were up to 3 days earlier than the previous long-term means (1982-2011) and a long-term trend in earlier nesting was significant over the last 30 years. Based on data since 1982, we estimate that average hatch for cackling geese, for which the most data are available, occurred 0.295 days earlier each year, equating to an advance of nine days since data collection began in 1982.

INTRODUCTION

Annual assessments of nest population size and egg production of geese and eiders on the Yukon-Kuskokwim Delta (YKD), Alaska, provide information for the Spectacled Eider Recovery Team, the Pacific Flyway Technical Committee, participants in cooperative goose management plans, and biologists interested in waterfowl status and trends. We used a ground-based sampling procedure to estimate the number of nests and eggs for spectacled eiders (*Somateria fischeri*), cackling geese (*Branta hutchinsii minima*), emperor geese (*Chen canagica*), greater white-fronted geese (*Anser albifrons frontalis*), and other nesting waterbirds on the YKD, from 1985 to 2011. The ground-based nest survey estimates the population sizes of nests and eggs, and provides indices to the adult breeding population and production of young. The ground survey is conducted in a standard, high density nesting area concurrently with an aerial breeding pair survey (Bollinger 2011, Platte and Stehn 2010) and provides an index to population sizes of birds observed on the entire coastal area of the YKD. Together, these surveys contribute long-term data to monitor goose and eider population status and reproductive success.

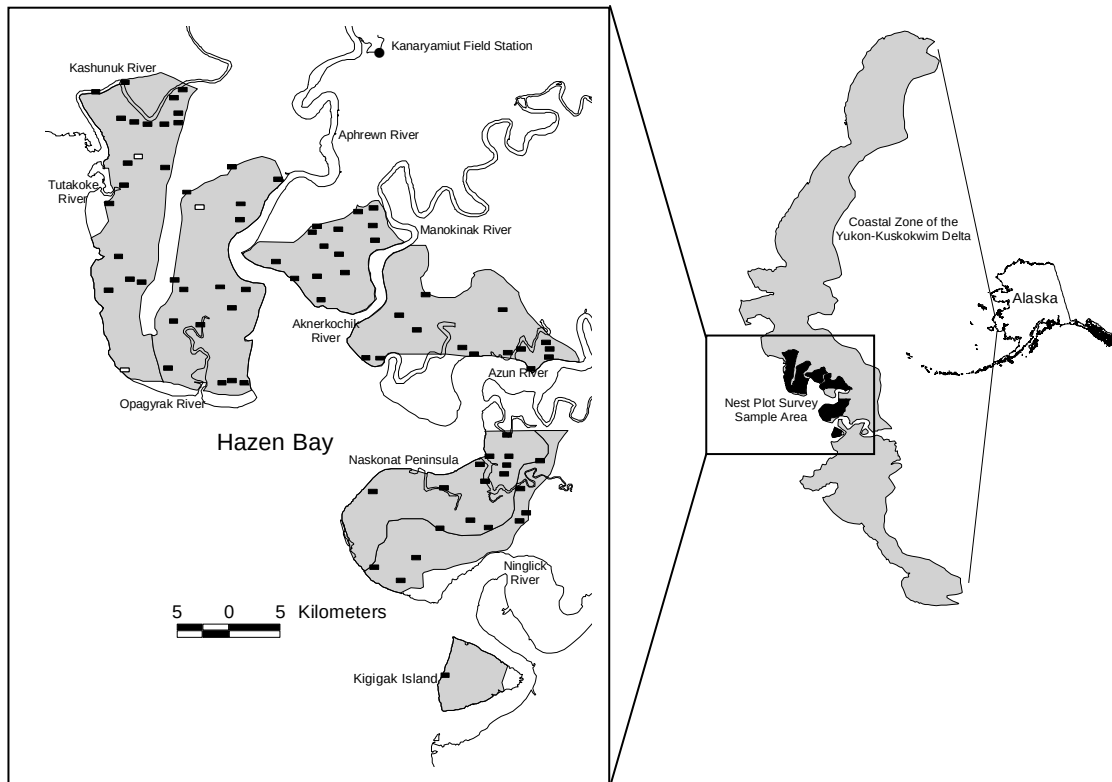


Figure 1. Location of 85 randomly selected plots within a core nesting area (716 km²) located within the Yukon-Kuskokwim Delta coastal zone (12,832 km²), Alaska, 2011. Sampled plots are represented by 82 solid rectangles. Three additional plots were selected but not sampled, shown as open rectangles.

METHODS

We used a ground-based sampling procedure to monitor goose and eider nest populations and potential production on the YKD coastal zone from 1985 to 2011. Boundaries of the survey area include lands on the Yukon Delta National Wildlife Refuge (YDNWR) surrounding Hazen Bay (Fig. 1). The total area sampled varied among years (716–4,063 km²) in response to distribution information acquired and changing study objectives. Since 2000, the

ground sampled survey area (hereafter “core nesting area”) has remained consistent at 716 km² and is comprised of medium (>1 observed spectacled eiders/ km²) and high (>2 observed spectacled eiders/ km²) density eider nesting habitat as determined by systematic aerial transect observations in 1988-1994 (USFWS unpubl. data). While the core nesting area represents just 5.6% of the total coastal zone area, aerial survey crews observed 57% of all spectacled eider pairs there from 2000 to 2010. The core nesting area specifically excludes several patches of privately owned eider nesting habitat because annual access could not be assured. In 1998-1999 and prior to 1994, plots were selected within a slightly larger portion of the coastal zone. In this report our estimates of nest population size and egg production for 1985-2011 are based only on plots within the core nesting area.

We used 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 resulted in overlap with any other plot within the current year or five years prior. Plot size was 402 m by 805 m (0.32 km²) in 1988-1994 and 1997-2011. Plot sizes were variable in 1985-1987 (0.16-1.66 km²), and were 0.45 km² in 1995, and 0.36 km² in 1996. We drew plot boundaries on aerial photographs (1985-2007) and IKONOS satellite imagery (2008-2011) at a 1:13,000 scale for use as field maps (Fig. 2). We included plots regardless of juxtaposition to lakes and rivers.

Each plot was searched by 2-4 biologists who were transported via float-equipped aircraft or motorboat. In 2011, three boat crews operating 16'-18' aluminum skiffs completed plots accessible from the Aphrewn, Opagarak, and Kashunuk rivers. Two additional boat crews operating 14' inflatable skiffs were transported via aircraft to the Naskonat Peninsula, and to the mouth of the Kashunuk River where they completed nearby plots. In addition, one crew was transported by aircraft directly from Bethel to a spike camp located on the Azun River where they completed a cluster of five plots. Data were collected at six plots by collaborating biologists in adjoining scientific camps including Kigigak Island (YDNWR), Manokinak River (US Geological Survey [USGS]) and Tutakoke River (University of Nevada, Reno [UNR]).

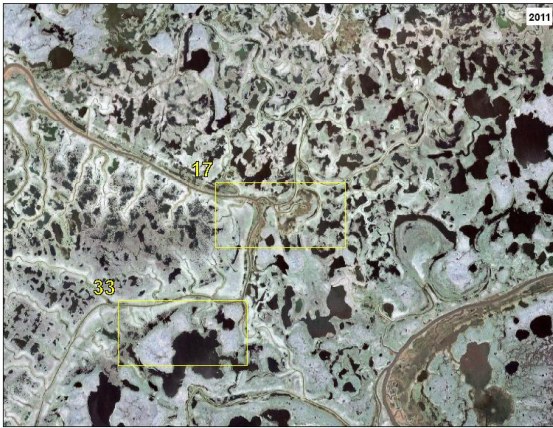


Figure 2. Example of 2011 field map used by crews for navigating within plot boundaries. Plot size was 402 m x 804 m.

All sites dry enough for a nest were examined for active and destroyed waterfowl, crane, loon, and gull nests. Nesting records of other species were recorded as encountered (data available upon request), but most shorebird and passerine nests were likely missed. At each nest we recorded species, nest status (active, destroyed, abandoned), nest site habitat (shoreline, island, peninsula, grass meadow, palsa upland, ridge upland), stage of incubation, clutch size, and 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). We estimated stage of incubation from 1-3 eggs per nest by using float angle codes (1-9 ordinal scale) that correspond to age of the egg (Westerskov 1950). From estimated hatch date, we determined nest initiation date based on published incubation duration and average clutch size. We report hatch date and clutch size

estimates in 1982-1984 using data collected by Butler (1983) based on the same techniques described above.

We estimated densities and numbers of nests and eggs within the core nesting area (716 km²) based on the size and number of plots for each year. We applied a detection rate



correction to nest population estimates using a model that considers species, nest activity status (active, destroyed), observer experience, and nest site habitat (Bowman and Stehn *manuscript in prep.*). After calculating the number of nests and eggs within the core nesting area, we expanded the estimate to the entire coastal zone of the YKD (12,832 km²) based on birds observed on aerial survey transects flown outside vs. within the core nesting area (Butler et al. 1988, Platte and Stehn 2010, Bollinger 2011). To do this, we annually calculated the ratio of aerial breeding

population indices 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 core nesting area to determine the total estimate for the coastal zone of the YKD. For most species (geese, ducks, cranes), the aerial 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. Flocks were not included in aerial indices for geese, ducks 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 visible to aerial observers.

To smooth the annual variation in the OUT:IN ratio caused by sampling error, we pooled the nearest seven years of data (current year, prior three years, and following three years, as available). For example, the 7-year OUT:IN ratio for 2006 was calculated by the sum of the aerial index population "OUT" of the core nesting area divided by the sum of the aerial index population "IN" the core nesting area for the years 2003-2009. In years that we did not have at least three "prior" or three "following" years of data, we based the 7-year OUT:IN ratio on the most proximate seven years of data. For example, the 7-year OUT:IN ratio for 2011 was calculated by the sum of the aerial index "OUT" of the core nesting area divided by the sum of the aerial index "IN" the core nesting area for the years 2005-2011. Similarly, the 7-year OUT:IN ratio for 1985 was calculated using the years 1985-1991. Standard errors of the ratios were based on the variation among the 7 years of data by standard index ratio procedures (Cochran 1963, p. 158 eq. 6.4). Variance estimates of nest populations expanded to the entire coastal zone included the 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 difficult. Loons rarely remain near their nest sites when ground crews are present on plots, and their nests and eggs are essentially indistinguishable (Bowman 2008). Thus, to determine the relative numbers of Pacific loon nests we first calculated the 7-year average ratio of Pacific loons to total loons based on aerial observations on transects within the core nesting area (Platte and Stehn 2010). 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 using the 7-year average ratio of red-throated loon nests to total loon nests.

In 2011, aerial data were not collected for ducks, loons or gulls. Therefore, for these species the 7-year OUT:IN ratios and loon species ratios were based on aerial data from 2004-2010.

To estimate nest population size, hatch date, nest initiation date, and clutch size, we tabulated, edited, sorted, and analyzed nest data using Microsoft Excel. The estimated total number of nests measures the minimum number of breeding pairs in the population. Some potential breeders may not establish a nest in a given year, and some nests are destroyed or abandoned at an early stage before they can be reliably detected by ground searching. The estimated total number of eggs is a measure of the potential young that could augment the fall population if they survive through hatch and fledging. The proportion of nests that are active when the plots are searched (active nests/total nests) is an index to nest success, though the actual proportion of successful nests is lower because some nests are abandoned prior to hatch. Definitions of these terms are summarized in the caption of Figure 3.



RESULTS:

We searched 82 plots from 5-17 June, 2011 (Fig. 1). Aircrews based at the Kanaryamiut Field Station searched 18 plots, a spike camp crew on the Azun River searched 5 plots, five boat-based crews searched 53 plots, a Yukon Delta NWR crew at Kigigak Island searched one plot, a USGS crew at the Manokinak River searched two plots, and a University of Nevada Reno crew at Tutakoke River searched three plots. Three of the 85 randomly selected plots were not sampled due to difficult access or weather delays that prevented completion of field work prior to onset of hatch. Together, crews located 3,990 nests within plot boundaries including 1,694 cackling goose, 388 emperor goose, 1,044 greater white-fronted goose, 224 black brant, 77 spectacled eider, 18 common eider, and 545 nests of other species. Calculations of clutch size and hatch date also included an additional 73 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. 3). We also describe 2011 estimates compared to the long-term mean (1985-2011) with qualitative descriptors that correspond to quartiles (4th quartile = high, 3rd quartile = moderate, 2nd quartile = low, 1st quartile = very low). We report annual estimates of a nest success index and clutch sizes in 1985-2011, and describe the 2011 estimates relative to long-term means with qualitative descriptors that correspond to quartiles (4th quartile = excellent, 3rd quartile = good, 2nd quartile = fair, 1st quartile = poor). Estimated hatch dates for all species are presented in Table 3.

Cackling Geese (*Branta hutchinsii minima*)

Numbers of cackling goose nests and eggs in 2011 were down from the previous year but were high relative to long-term means (1985-2011; Fig 3). Numbers of nests and eggs were

41% and 56% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Short-term (2002-2011) and long-term (1985-2011) growth rates show a significant positive trend (Fig. 3, Tables 1-2). Nest success (active nests/total nests) in 2011 was excellent; however, clutch size (eggs/active nests) was low relative to long-term (1985-2011) means (Fig. 3). Average hatch date for cacklers in 2011 was two days later than 2010 and one day earlier than the previous long term mean (1982-2010; Table 3).

Emperor Geese (*Chen canagica*)

Numbers of emperor goose nests and eggs in 2011 were high relative to long-term means (1985-2011; Fig 3). Numbers of nests and eggs were 13% and 8% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Over the course of this study, emperor nest and egg population sizes have been variable and depict no trend; however, within the recent decade, both indices depict positive growth (Fig. 3, Tables 1-2). Nest success in 2011 (active nests/total nests) was excellent but clutch size (eggs/active nest) was very low relative to long-term means (Fig. 3). Average hatch date in 2011 was the same as in 2010, but two days earlier than the previous long term mean (1982-2010; Table 3).



Greater White-fronted Geese (*Anser albifrons frontalis*)

Numbers of greater white-fronted goose nests and eggs in 2011 were high relative to short-term (2002-2011) and long-term means (1985-2011; Fig 3). The estimates of both nests and eggs were the highest in the 27 year span of this survey and were 146% and 140% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Since the mid 1980s, positive growth of nests and eggs has been apparent (Fig. 3, Tables 2). While nest success in 2011 (active nests/total nests) was excellent, clutch size (eggs/active nests) was very low relative to long-term means (Fig. 3). Despite low clutch size, the estimated number of total eggs exceeded all previous estimates from this survey (Fig. 3). Average hatch date in 2011 was two days later than 2010 and one day earlier than the previous long term mean (1982-2010; Table 3).

Black Brant (*Branta bernicla nigricans*)

Numbers of black brant nests and eggs in 2011 were very low relative to long-term means (1985-2011; Fig 3). Numbers of nests and eggs were 48% and 43% below the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Nest and egg population sizes have shown no patterns during short- (2002-2011) and long-term time spans (1985-2011, Fig. 3, Tables 1-2). Unlike other goose species in 2011, Nest success (active nests/total nests)



was fair and clutch size (eggs/active nests) was high, relative to long-term means (Fig. 3, Tables 1-2). Average hatch date in 2011 was the same as 2010 and one day earlier than the previous long term mean (1982-2010; Table 3).

Tundra Swans (*Cygnus columbianus*)

Numbers of tundra swan nests and eggs in 2011 were moderate relative to long-term means (1985-2011; Fig 3). Numbers of nests and eggs were 11% and 6% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). The trend in numbers of nests and eggs is positive in the long-term, but growth within the recent decade has yielded a stable population of nests and slightly declining population of eggs (Fig. 3, Tables 1-2). Nest success in 2011 (active nests/total nests) was good but clutch size (eggs/active nest) was low relative to long-term means (Fig. 3). Average hatch date in 2011 was one day later than 2010, and one day later than the previous long term mean (1982-2010; Table 3).

Sandhill Cranes (*Grus canadensis*)

Numbers of sandhill crane nests and eggs in 2011 were moderate relative to long-term means (1985-2011; Fig 3). The estimated numbers of sandhill nests and eggs were 13% and 11% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). No trends are apparent in the numbers of sandhill crane nests during the short- (2002-2011) or long-term (1985-2011) (Fig. 3, Tables 1-2). Nest success in 2011 (active nests/total nests) was fair but clutch size (eggs/active nests) was low relative to long-term means (Fig. 3). Average hatch date in 2011 was two days later than 2010, and similar to the previous long term mean (1982-2010; Table 3).



Spectacled Eiders (*Somateria fischeri*)

Numbers of spectacled eider nests and eggs in 2011 were low relative to long-term means (1985-2011; Fig 3). In 2011, numbers of spectacled eider nests were the lowest since 2003 and numbers of eggs were the lowest since 2004 (1985-2011; Fig 3). Nests and eggs were 20%, and eggs 14% below the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). From 2001-2010, the number of spectacled eider nests on the YKD yielded a positive growth rate; however, the low nest estimate in 2011 resulted in the non-significant trend in short- (2002-2011) and long-term (1985-2011) periods. Numbers of eggs remains slightly positive in the most recent 10-year period (Fig. 3, Tables 1-2). Of nests that were recorded in 2011, nest success was good although clutch size (eggs/active nests) was low relative to long-term means (Fig. 3). Average hatch date for spectacled eiders in 2011 was four days later than 2010 and one day earlier than the previous long term mean (1982-2010; Table 3).



Common Eiders (*Somateria mollissima*)

Numbers of common eider nests and eggs in 2011 were low relative to long-term means (1985-2011; Fig 3). The estimated number of common eider nests in 2011 was the lowest since 1995, and estimated total number of eggs was the lowest since 2003 (Fig. 3). Common eider nests and eggs were 32% and 31% below the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Estimated numbers of nests and eggs have increased over the long-term survey period (1985-2011), but both measures have been stable in the most recent 10-years (2002-2011). In 2011, estimated common eider nest success (active nests/total nests) was fair and clutch size (eggs/active nests) was moderate relative to long-term means (Fig. 3). Average hatch date for common eiders in 2011 was one day earlier than 2010 and one day earlier than the previous long term mean (1982-2010; Table 3).

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 a measure of potential production for these species.

Estimated numbers of glaucous gull nests and eggs in 2011 were very low relative to long-term means (1985-2011; Fig 3). Estimates in 2011 were the lowest since 1999 and were 35% and 27% below the previous long-term means for nests and eggs respectively (Fig. 3, Tables 1-2). Glaucous gull nests and eggs showed no trend in the short-term (2002-2011) or long-term (1985-2011). Glaucous gull nest success (active nests/total nests) was good in 2011 and clutch size (eggs/active nest) was moderate compared to long-term means (Fig. 3). Average hatch date for glaucous gulls in 2011 was one day later than 2010 and equal to the previous long-term mean (1982-2010; Table 3).

The estimated numbers of mew gull nests and eggs in 2011 were also very low relative to long-term means (1985-2011; Fig 3). Estimates in 2011 for nests and eggs were 35% and 27% below the previous long-term means, respectively (Fig. 3, Tables 1-2). Trends for mew gull nests and eggs were not significant in the short-term (2002-2011) or long-term (1985-2011). Mew gull nest success (active nests/total nests) was fair in 2011 and clutch size (eggs/active nests) was very low compared to long-term means (Fig. 3). Average hatch date for mew gulls in 2011 was four days later than 2010 and one day later than the previous long-term mean (1982-2010; Table 3).

Unlike the larger bodied gulls, numbers of Sabine's gull nests and eggs in 2011 were high relative to long-term means (1985-2011; Fig 3). Estimates of nests and eggs in 2011 were 62% and 54% above the previous long-term means, respectively (Fig. 3, Tables 1-2). Sabine's gull nests and eggs have increased over the long-term survey period (1985-2011); however, both measures have been stable in the most recent 10-years (2002-2011). While numbers of nests were high,

Sabine's gull nest success (active nests/total nests) was poor in 2011 and clutch size (eggs/active nests) was low, compared to long-term means (Fig. 3). Average hatch date for Sabine's gulls in



2011 was two days later than 2010 and two days earlier than the previous long-term mean (1982-2010; Table 3).



Photo by Daniela Tritscher

Estimates of Arctic tern nests and eggs in 2011 were also high relative to long-term means (1985-2011; Fig 3). Estimates of nests and eggs in 2011 were 46% and 40% above the previous long-term means, respectively (Fig. 3, Tables 1-2). Arctic tern nests and eggs have increased over the long-term survey period (1985-2011), but both measures have been stable in the most recent 10-years (2002-2011). While numbers of nests were high, Arctic tern nest success (active nests/total nests) was poor in 2011 and clutch size (eggs/active nests) was low, compared to long-term means (Fig. 3). Average hatch date for Arctic terns in 2011 was two days later than 2010 and two days earlier than the previous long-term mean (1982-2010; Table 3).

Loons

Numbers of loon nests and eggs in 2011 were moderate relative to long-term means (1985-2011; Fig 3). In 2011, numbers of red-throated loon nests and eggs were 14% and 8% above the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Numbers of Pacific loon nests and eggs were 4% above and 1% below the previous long-term means (1985-2010), respectively (Fig. 3, Tables 1-2). Significant positive growth in the number of red-throated loon nests and eggs is apparent over the short-term (2002-2011) and long-term (1985-2011). Numbers of red-throated loon eggs are stable over the long-term, but a slight positive trend over the last 10 years is evident (Tables 1-2). Significant positive growth in the number of Pacific loon nests is apparent over the short-term (2002-2011) and long-term (1985-2011), but no significant trend is evident in the numbers of eggs in the short or long-term. Relative to long-term means, loon nest success (active nests/total nests) was poor and clutch sizes (eggs/active nests) were moderate relative to long-term means (Fig. 3). Average hatch dates for Pacific loons in 2011 were similar to 2010 and the previous long term mean (1982-2010; Table 3).



Photo by Kelly Warren

DISCUSSION

The nest plot survey was specifically designed to provide annual estimates of nest and egg population size and trend, and to measure nest success and hatching dates for five focal species: cackling geese, emperor geese, greater white-fronted geese, spectacled eiders, and

common eiders. Data on black brant, tundra swans, sandhill cranes, loons, gulls, and terns were also collected and reported.

In 2011, production of nests and eggs, rates of nest success, and estimates of clutch size varied widely among focal species. Numbers of nests and eggs, and nest success were moderate to high for cackling geese, emperor geese, and white-fronted geese relative to long-term means (1985-2011), but clutch size for these species was low to very low. In contrast to the geese, spectacled and common eiders produced low numbers of nests and eggs relative to long-term means (1985-2011). Nest success was fair to good for eiders and clutch sizes were low to moderate. Numbers of nests increased significantly for cackling geese, emperor geese, and white-fronted geese over the 27-year time span of this survey (1985-2011) and during the most recent decade (2002-2011). Unlike the geese, no significant positive trend in numbers of spectacled eider nests was apparent over the long-term or short-term time periods. Variability in common eider nest numbers has precluded a clear trend in the most recent decade, though numbers of nests for this species have increased significantly since 1985.

Avian and mammalian predators are known to destroy nests on the YKD during incubation (Anthony et al. 1991, Bowman and Stehn 2003). Incidence of nest desertion and depredation in 2011 was variable among plots and not isolated to one region within the ground sampled area. Arctic fox (*Alopex lagopus*), account for much of the nest depredation in some years, particularly in brant colonies (Anthony et al. 1991). Presence of recent fox activity as indicated by fur, tracks, active dens or direct observations was noted in 55% of sampled plots in 2011 (Table 4), slightly higher than

the long-term mean of 47% (1988-2011). Fox were likely contributors to egg loss in some study plots in 2011, but sign of fox presence on a plot did not necessarily result in higher levels of depredation. For example, mean nest success was 94% in plots with fox sign, and 94% in plots without fox sign. Fox likely occur on some plots without leaving detectable sign; thus, incidental observations of fox sign provide an index to abundance of fox within the study area rather than providing a useful tool to predict plot-specific variation in nest success.

The relationship between voles (*Microtus oeconomus*), foxes and nesting success is unclear. High occurrence of tundra voles on plots in 2009 and 2010 (Table 4) may have provided alternative food for foxes and other nest predators. High egg depredation from foxes in 2001 followed a year of unprecedented numbers of voles (Table 4). Presumably, high vole populations provided abundant food supplies for fox allowing high overwinter survival. 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 (Table 4), yet there was no evidence suggesting this change resulted in a higher than average nest failure rate. One interpretation is that vole populations may have declined in



fall or winter resulting in low fox survival, thereby reducing predation effects on birds in 2011. Alternatively, voles may not play a predictable role in population dynamics of foxes.

Timing of waterfowl nest initiation is typically correlated with timing of spring breakup (Raveling 1978, Dau and Mickelson 1979). The chronology of spring warming in 2011 was similar to the recent decade and the long-term mean. Breakup of the Kuskokwim River at Bethel occurred on May 11, one day earlier than the average of the most recent 40-years (NOAA 2011). On 16 May, the average standardized deviate of thaw-degree days (TDDs) was 0.38 based on 1982-2010 data from five METAR weather stations in Bethel, St. Marys, Mekoryuk, Hooper Bay, and Emmonak. This indicated slightly later than average spring warming compared to 1982-2010. Based on these weather data, we predicted mean cackling goose nest initiation in 2011 would occur on 26 May. The realized average nest initiation was 25 May.

Initiation and hatch dates of waterfowl in 2011 were up to 3 days earlier than the previous long-term means (1982-2010). Based on data since 1982, we estimate that on average, hatch for cackling geese, for which the most data are available, occurred 0.295 days earlier each year (Fig. 4). The long-term trend towards earlier nesting is significant over the last 30 years. The annual change equates to an advance of nine days since data collection began in 1982.

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 not understood, but may prove to be a significant factor in long-term sustainability of waterfowl populations. For example, preliminary analyses indicate that the shoreline boundary of the Yukon Delta National Wildlife Refuge has lost an average of 30 ha/yr to coastal erosion over a recent fifty year period (B. Jones, USGS unpubl. data). Alteration of habitats through sea level rise (erosion, inundation, salinization), melting permafrost, and increased river discharge (accelerated sedimentation rates) could influence current nesting areas. Point location data taken at each nest sampled in this study (2009-2011) will be incorporated into ongoing cooperative habitat change studies involving USFWS, USGS, and University of Alaska. Further, standardized pond salinity monitoring (H. Wilson, MBM, unpubl. data) since 2006, and habitat selection and change modeling (C. Ely, USGS, unpubl. data) will provide baseline and trend information needed to assess changes to the waterfowl nesting habitats of the YKD.

In general, nest population trends from this study parallel trends in nesting pairs derived from aerial breeding pair surveys (Bollinger 2011). 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 (Bollinger 2011) show that by the late-1980s, the cackling goose population of nests and pairs increased rapidly, and peaked in the late-1990s. Since 1999, the trend for cackling geese has been generally stable, though numbers are variable among years

(this study, Bollinger 2011). The dramatic increase in population of greater white-fronted geese from the mid-1980s to present is documented by both aerial (growth rate 1.098; Bollinger 2011) and ground surveys (growth rate 1.094 this study). Unlike populations of the other goose species, emperor geese did not increase markedly after adoption of the Yukon Delta Goose

Management Plan, although the long-term trend indicates a slow annual increase in both the ground and air surveys (this study, Bollinger 2011).

The number of spectacled eider nests has varied widely since the beginning of the survey in the mid-1980s. The average long-term growth rate (1985-2011) is not significantly different from 1.00. Following a long-term decline of spectacled eiders on the YKD from the 1950s through the early 1990s (Stehn et al. 1993), the population stabilized and began to increase. From 2008-2010 the 10-trends in spectacled eider nests was significantly greater than 1.00, tracking closely with growth rates reported by aerial crews (Platte and Stehn 2010). The marked reduction in nests in 2011, however, reduced the growth rate of spectacled eider nests from increasing to stable.

The cause of reduced spectacled eider nests in 2011 is unclear. Relative to recent years, winter temperatures and wind created high ice concentrations south of St. Lawrence Island where spectacled eiders overwinter (Matthew Sexson, USGS, pers. comm.). Winter habitat conditions in the Bering Sea may have played a role in reducing body condition of female eiders in 2011 that in turn, may have reduced the nesting effort in June. Lacking annual indices of winter body condition it is difficult to assess this hypothesis. Presumably reduced body condition on the wintering grounds would affect all breeding populations yet investigators monitoring spectacled eider nesting success elsewhere reported average breeding success in Russia (Diana Solovieva, Wrangel Island State Nature Reserve, pers. comm.) and at several locations on the Alaskan Arctic Coastal Plain (David Safine, USFWS pers. comm., Rick Johnson, ABR Inc., pers. comm.).

Spectacled eider nest success (number of active nests divided by total nests times 100%, corrected for detection rate) has been variable among years. Plots are visited one time, so our measure of nest success is an overestimation of true 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 seldom detected and thus underestimated. Nonetheless, nest success estimates from this survey provide a valid index and generally match apparent nest success estimates from Kigigak Island (successful hatched nests/total nests) where nests are visited every seven days until hatch (Gabrielson et al. 2010; M. Gabrielson, USFWS, pers. comm.). The largest difference between estimates from these surveys was noted in 2001 and 2003, years of very poor production, where perhaps many nest failures occurred late in nesting. Alternatively, a localized factor, such as high predator populations, may have caused low success on Kigigak Island during those years. Variation due to localized factors is reduced when sampling occurs over a large portion of the nesting range as in the nest plot survey described here.

Photographic methods were initiated in the 1990s to monitor the nest population of black brant in major colonies with greater precision than ground surveys or standard straight line aerial waterfowl surveys (Wilson 2011). Photographic colony survey data indicate a decline in brant nest populations since 1992 within five primary colonies (Wilson 2011), whereas nest numbers in the ground sampled area, excluding the five primary colonies (this study; Fig. 6), and the fall and winter counts of the entire population indicate relative stability (Stehn et al. 2010). There are several explanations for 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. They found that growth rates outside of the primary colonies are positive in some locations but are not sufficient to offset region-wide decline (Stehn et al. 2011). A second explanation for the difference in growth rates measured on colony surveys vs. other surveys is that brant may have shifted their breeding distribution from the YKD to other areas

such as the Alaskan Arctic Coastal Plain and Canada. Such a shift in distribution could occur either through direct emigration or by increased population size in northern breeding areas.

The population sizes of goose and eider nests in this study should not be interpreted as direct estimates of population size. For example, 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 2010). In 2011 numbers of nests were significantly reduced from recent years but total population size was likely similar to the mean, although this is difficult to confirm because aerial surveys in 2011 were limited to geese, swans and cranes. However, ground-based crews throughout the core nesting area noted presence of spectacled eiders on 81% of plots sampled, equal to the mean presence observed in 2008-2010 when spectacled eider population indices were the highest on record (Platte and Stehn 2010). Thus, we believe the relatively low numbers of spectacled eider nests reflect either a reduced breeding effort in 2011 or a substantial nesting failure during early incubation prior to the initiation of field work.



A primary advantage of the random nest plot sampling procedure over intensive local studies is that it assures applicability of estimates for the entire core nesting areas, 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.

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 several 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. 3) enables better interpretation of data than analysis of year-to-year changes in population size.

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LITERATURE CITED

- Anthony, R. M., P. L. Flint, and J. S. Sedinger. 1991. Arctic fox removal improves nest success of black brant. *Wildl. Soc. Bull.* 19: 176-184.
- Bollinger, K. S. 2011. 2011 Yukon-Kuskokwim Delta coastal zone survey of geese, swans, and sandhill cranes. Memorandum. USFWS, Fairbanks, AK.
- Bowman, T. D. 2008. Field guide to bird nests and eggs of Alaska's coastal tundra, 2nd Edition. Alaska Sea Grant College Program, University of Alaska, Fairbanks.
- Bowman, T. D. and R. A. Stehn. 2003. Impact of investigator disturbance on spectacled eiders and cackling Canada geese nesting on the Yukon-Kuskokwim Delta. Unpubl. Rep., U.S. Fish and Wildlife Service, Anchorage, AK.
- Bowman, T. D. and R. A. Stehn. *Manuscript in prep.* Nest detection rate on plots searched to monitor Yukon-Kuskokwim Delta waterbird populations.
- Butler, W. I. Jr. 1983. U.S. Fish and Wildlife Service Memorandum, July 19, 1983. Cackling Canada goose nesting population. Yukon Delta NWR.
- Butler, W. I., Jr., R. A. Stehn, and W. D. Eldridge. 1988. Development of an aerial breeding pair survey for geese nesting in the coastal zone of the Yukon Delta. Annual progress report, U.S. Fish and Wildlife Service, Anchorage.
- Cochran, W. G. 1963. Sampling Techniques. Second edition. John Wiley and Sons, NY, 413 pp.
- Dau, C. P. and P. G. Mickelson. 1979. Relation of weather to spring migration and nesting of Cackling Geese on the Yukon-Kuskokwim Delta, pgs. 94-104, *In* R. L. Jarvis and J. C. Bartonek [eds], Management and biology of Pacific Flyway geese. Oregon State University Book Stores. Corvallis, Oregon.
- Fischer, J. B., R. A. Stehn, and G. Walters. 2010. Nest population size and potential production of geese and spectacled eiders on the Yukon-Kuskokwim Delta, Alaska, 2010. Unpubl. Rep., U.S. Fish and Wildlife Service, Anchorage, AK.
- Gabrielson, M., M. Wege, and N. Graff. 2010. Monitoring and avian influenza sampling of waterfowl on Kigigak Island, 2010. Unpubl. Rep. Yukon Delta NWR, Bethel, AK.
- IPCC. 2007. Climate Change 2007: the physical science basis, summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the IPCC. IPCC Secretariat. Geneva Switzerland.
- NOAA. 2011. National Weather Service, Alaska-Pacific, River Forecast Center Home Page. <http://aprfc.arh.noaa.gov/data/maps/brkup_map.php>.
- Pamplin, W. L. Jr. 1986. Cooperative efforts to halt population declines of geese nesting on Alaska's Yukon-Kuskokwim Delta. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 51:487-506.
- Platte, R. M. and R. A. Stehn. 2010. Abundance and trend of waterbirds on Alaska's Yukon-Kuskokwim Delta coast based on 1988 to 2010 aerial surveys. Unpubl. Rep., U.S. Fish and Wildlife Service, Anchorage, AK.
- Raveling, D. G. 1978. Timing of egg laying by northern geese. *Auk* 95: 294-303.
- Root, T. L., J. T. Price, K. R. Hall, S. H. Schneider, C. Rosenzweig, and J. A. Pounds. 2003. Fingerprints of global warming on wild animals and plants. *Nature* 42: 57-60.
- Stehn, R. A., C. P. Dau, B. Conant, and W. I. Butler. 1993. Decline of spectacled eiders nesting in western Alaska. *Arctic* 46: 264-277.
- Stehn, R. A., E. J. Mallek, and E. J. Taylor. 2010. Monitoring Pacific brant: a comparison of fall and mid-winter population surveys. Unpubl. Rep. U.S. Fish and Wildlife Service, Anchorage, AK.
- Stehn, R. A., R. M. Platte, H. M. Wilson, and J. B. Fischer. 2011. Monitoring the nesting population of Pacific black brant. Unpubl. Rep. U.S. Fish and Wildlife Service, Anchorage, AK.
- Westerkov, K. 1950. Methods for determining the age of game bird eggs. *J. Wildl. Manage.* 14:56-67.
- Wilson, H. M. 2011. Aerial photographic surveys of brant colonies on the Yukon-Kuskokwim Delta, Alaska, 2011. Unpubl. Rep., U.S. Fish and Wildlife Service, Anchorage, AK.

Figure 3 (Subsequent pages). Population size with $\pm$ 90% confidence intervals and trends of waterbird nests and egg production on the Yukon-Kuskokwim Delta Alaska, 1985-2011, with accompanying tabulated data. Column heading definitions follow:

Year = survey year;

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

Sampled km² = total area searched (N plots*plot size);

Nest index IN = number of nests within the core 716 km² 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 based on the nearest 7-years of aerial index data available

Corrected nests OUT = number of nests extrapolated beyond the ground sampled area based on the Aerial Out:In 7 year 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;

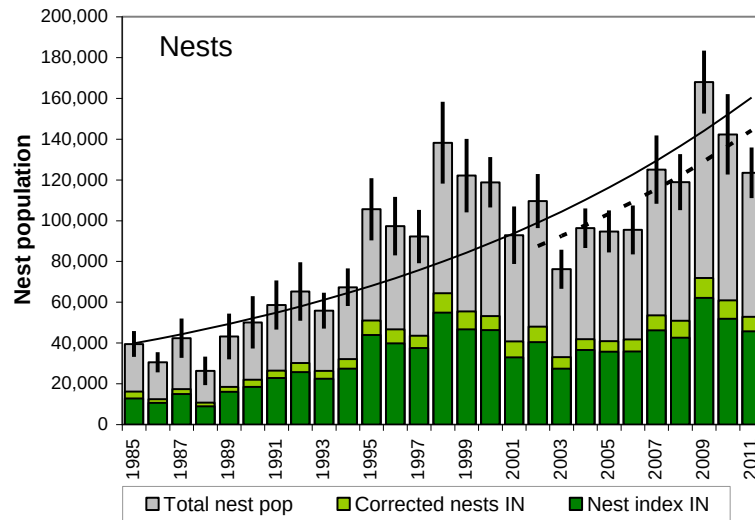
Total eggs/active nests = total viable eggs In+Out divided by the nests with eggs In+Out, corrected for detection rate;

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

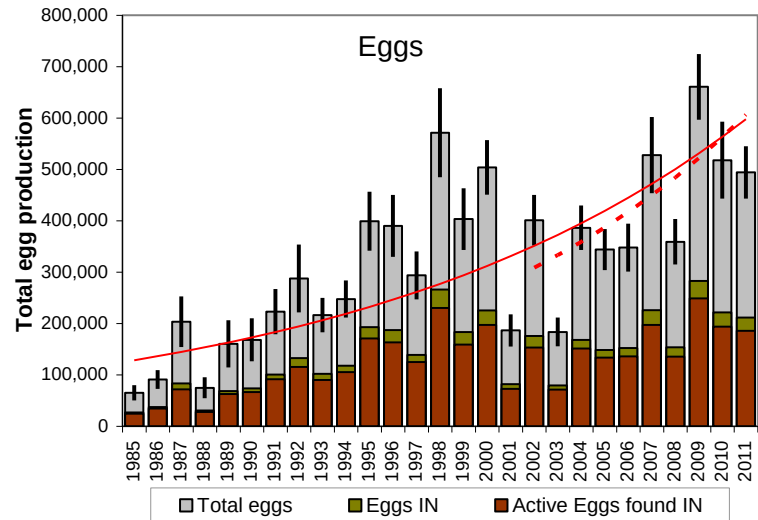
Corrected % nest success = number of active nests divided by total nests times 100%, corrected for detection rate

CCGO

Cackling Goose



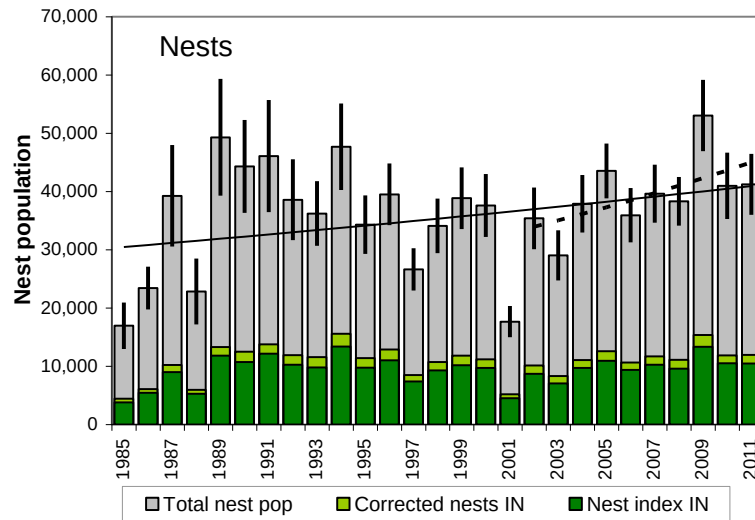
1985-2011 avg annual growth rate= 1.055 (90%c.i.= 1.044-1.066)
 2002-2011 last 10 years growth rate= 1.057 (90%c.i.= 1.026-1.089)



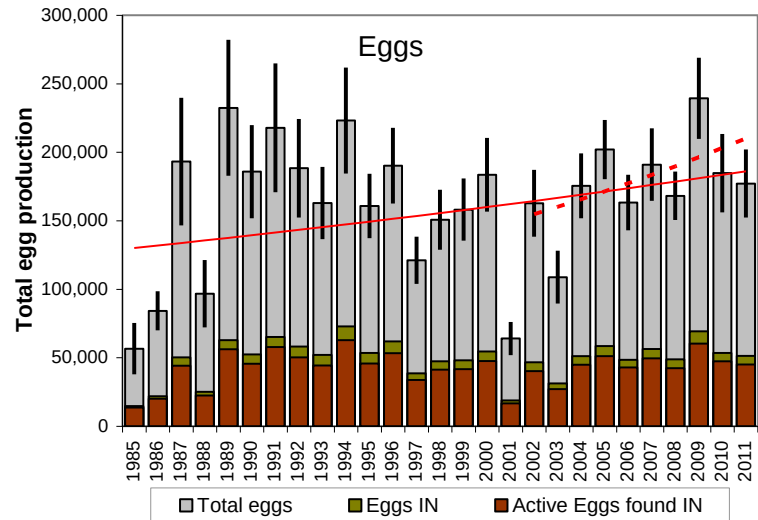
1985-2011 avg annual growth rate= 1.061 (90%c.i.= 1.044-1.078)
 2002-2011 last 10 years growth rate= 1.078 (90%c.i.= 1.023-1.133)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	12,788	1,625	79.2%	16,149	1.44	23,318	39,467	3,853	65,095	9,040	3.91	1.65	42%
1986	46	22.16	10,594	1,406	85.0%	12,467	1.44	18,002	30,469	3,006	91,057	11,048	4.89	2.99	61%
1987	37	12.67	14,909	2,693	86.1%	17,319	1.44	25,008	42,327	5,892	203,373	29,951	5.12	4.80	94%
1988	32	10.48	8,947	1,912	83.2%	10,749	1.44	15,521	26,271	4,220	74,812	12,339	4.52	2.85	63%
1989	23	7.45	16,053	3,536	87.3%	18,390	1.35	24,735	43,125	6,822	160,156	27,887	4.85	3.71	77%
1990	33	10.70	18,465	3,890	83.9%	21,997	1.28	28,063	50,060	7,796	168,006	25,451	4.55	3.36	74%
1991	36	11.66	22,840	3,763	86.5%	26,414	1.22	32,170	58,584	7,312	222,898	26,681	4.64	3.80	82%
1992	42	13.39	25,662	4,554	85.3%	30,098	1.17	35,137	65,234	8,708	287,582	40,045	4.82	4.41	91%
1993	47	15.23	22,469	2,877	85.4%	26,323	1.12	29,489	55,812	5,343	216,168	20,408	4.51	3.87	86%
1994	41	13.27	27,391	3,099	85.5%	32,051	1.10	35,272	67,323	5,630	247,517	21,884	4.58	3.68	80%
1995	50	22.56	43,839	5,413	85.9%	51,015	1.07	54,538	105,554	9,260	398,941	34,892	4.46	3.78	85%
1996	54	19.44	39,761	4,827	85.3%	46,617	1.09	50,674	97,290	8,694	390,078	36,644	4.49	4.01	89%
1997	72	23.31	37,516	4,527	86.1%	43,550	1.12	48,617	92,168	7,964	293,586	28,329	4.03	3.19	79%
1998	64	20.71	54,802	6,330	85.1%	64,403	1.15	73,777	138,179	12,196	571,203	52,636	4.47	4.13	92%
1999	53	16.97	46,698	5,561	84.1%	55,508	1.20	66,571	122,079	10,955	403,234	36,491	3.89	3.30	85%
2000	80	25.86	46,279	3,884	87.0%	53,165	1.23	65,606	118,771	7,500	503,698	32,277	4.50	4.24	94%
2001	81	26.23	32,937	3,999	80.7%	40,799	1.27	52,009	92,809	8,553	186,488	19,040	3.64	2.01	55%
2002	84	27.15	40,438	3,989	84.3%	47,948	1.29	61,678	109,626	8,059	401,168	29,950	4.42	3.66	83%
2003	83	26.87	27,323	2,905	82.6%	33,071	1.30	43,060	76,131	5,799	183,358	17,049	3.96	2.41	61%
2004	81	26.22	36,574	3,024	87.5%	41,818	1.30	54,470	96,288	5,898	386,249	26,373	4.72	4.01	85%
2005	83	26.87	35,666	3,192	87.2%	40,898	1.31	53,764	94,663	6,254	343,812	24,223	4.27	3.63	85%
2006	75	24.28	35,842	3,708	85.9%	41,706	1.29	53,735	95,441	7,281	347,649	28,466	4.43	3.64	82%
2007	79	25.58	46,112	4,684	86.2%	53,492	1.34	71,533	125,026	10,193	527,889	45,097	4.60	4.22	92%
2008	82	26.55	42,566	3,963	83.7%	50,846	1.34	68,045	118,891	8,339	358,958	26,879	4.06	3.02	74%
2009	81	26.24	62,090	4,476	86.5%	71,807	1.34	96,096	167,902	9,389	660,745	38,830	4.34	3.94	91%
2010	66	21.37	51,850	5,637	85.2%	60,861	1.34	81,447	142,307	12,000	517,907	45,468	4.21	3.64	86%
2011	82	26.55	45,690	3,602	86.5%	52,806	1.34	70,667	123,473	7,534	494,048	31,061	4.35	4.00	92%

EMGO Emperor Goose



1985-2011 avg annual growth rate= 1.011 (90%c.i.= 1.000-1.023)
2002-2011 last 10 years growth rate= 1.032 (90%c.i.= 1.008-1.056)

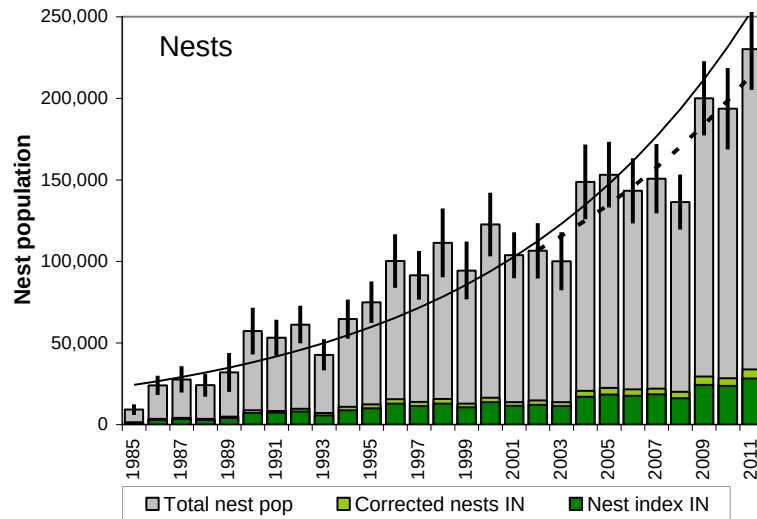


1985-2011 avg annual growth rate= 1.014 (90%c.i.= 0.999-1.029)
2002-2011 last 10 years growth rate= 1.035 (90%c.i.= 1.000-1.069)

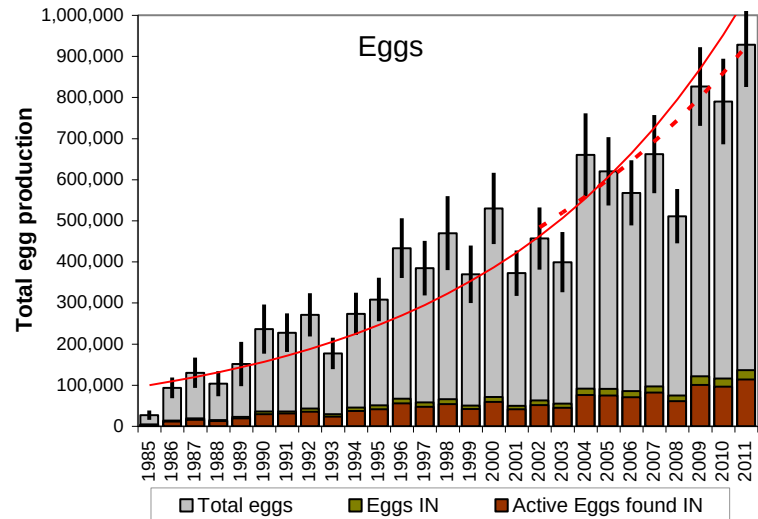
Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	3,816	685	86.5%	4,411	2.84	12,531	16,941	2,433	56,598	11,356	5.67	3.34	59%
1986	46	22.16	5,426	620	89.0%	6,096	2.84	17,316	23,412	2,238	84,215	8,644	4.93	3.60	73%
1987	37	12.67	8,979	1,477	87.9%	10,218	2.84	29,027	39,245	5,296	193,178	28,328	5.12	4.92	96%
1988	32	10.48	5,259	981	88.5%	5,942	2.84	16,881	22,824	3,448	96,671	14,965	4.70	4.24	90%
1989	23	7.45	11,824	1,769	88.9%	13,306	2.70	35,985	49,291	6,090	232,434	30,124	5.12	4.72	92%
1990	33	10.70	10,704	1,299	85.7%	12,490	2.55	31,819	44,308	4,851	185,823	20,684	4.91	4.19	85%
1991	36	11.66	12,157	1,812	88.4%	13,758	2.35	32,302	46,060	5,848	217,848	28,569	4.89	4.73	97%
1992	42	13.39	10,265	1,372	86.2%	11,906	2.24	26,670	38,575	4,223	188,333	21,893	5.07	4.88	96%
1993	47	15.23	9,777	1,116	84.5%	11,571	2.13	24,637	36,208	3,370	162,894	16,017	4.78	4.50	94%
1994	41	13.27	13,372	1,647	85.9%	15,561	2.06	32,131	47,692	4,518	223,169	23,486	4.99	4.68	94%
1995	50	22.56	9,738	1,127	85.5%	11,389	2.01	22,904	34,293	3,055	160,823	14,308	4.86	4.69	96%
1996	54	19.44	11,008	1,105	85.6%	12,866	2.07	26,633	39,499	3,219	190,186	16,832	5.14	4.81	94%
1997	72	23.31	7,368	736	87.1%	8,461	2.15	18,149	26,610	2,202	121,168	10,473	4.78	4.55	95%
1998	64	20.71	9,295	964	86.7%	10,719	2.18	23,386	34,105	2,842	150,710	13,328	4.64	4.42	95%
1999	53	16.97	10,166	875	86.2%	11,794	2.29	27,048	38,842	3,209	158,127	13,815	4.44	4.07	92%
2000	80	25.86	9,715	929	86.9%	11,185	2.36	26,402	37,587	3,287	183,533	16,384	4.98	4.88	98%
2001	81	26.23	4,503	478	86.4%	5,209	2.39	12,440	17,649	1,631	64,018	7,354	4.81	3.63	75%
2002	84	27.15	8,699	942	85.8%	10,142	2.49	25,251	35,393	3,222	162,728	14,854	4.98	4.60	92%
2003	83	26.87	7,057	768	84.9%	8,311	2.49	20,724	29,035	2,616	108,821	11,738	4.79	3.75	78%
2004	81	26.22	9,690	909	87.7%	11,051	2.43	26,853	37,904	3,000	175,520	14,396	4.88	4.63	95%
2005	83	26.87	10,948	812	87.0%	12,588	2.46	30,940	43,528	2,865	201,985	13,144	4.97	4.64	93%
2006	75	24.28	9,373	957	88.0%	10,648	2.37	25,267	35,916	2,837	163,305	12,360	4.78	4.55	95%
2007	79	25.58	10,241	976	87.6%	11,688	2.39	27,933	39,621	3,028	190,978	16,094	4.98	4.82	97%
2008	82	26.55	9,570	782	86.2%	11,103	2.45	27,217	38,320	2,545	168,142	10,750	4.81	4.39	91%
2009	81	26.24	13,340	1,137	86.8%	15,369	2.45	37,674	53,043	3,714	239,300	17,987	4.71	4.51	96%
2010	66	21.37	10,517	1,118	88.6%	11,873	2.45	29,104	40,977	3,468	184,727	17,415	4.62	4.51	98%
2011	82	26.55	10,459	994	87.6%	11,945	2.45	29,279	41,224	3,183	177,151	15,102	4.41	4.30	97%

WFGO

White-fronted Goose



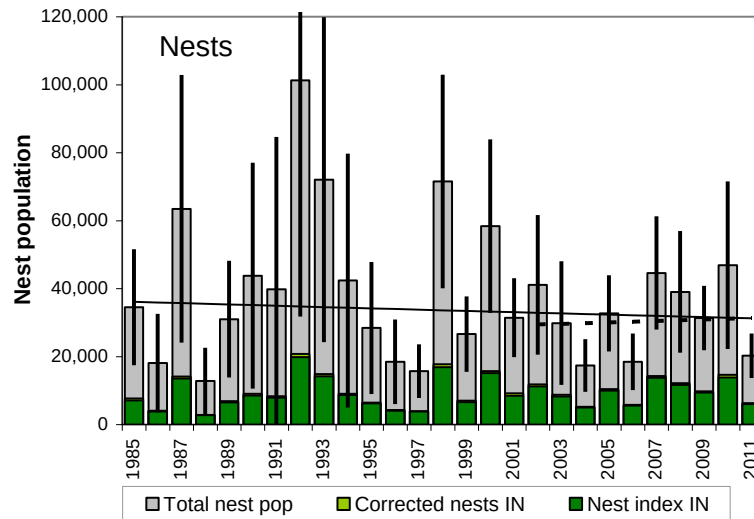
1985-2011 avg annual growth rate= 1.094 (90%c.i.= 1.081-1.108)
2002-2011 last 10 years growth rate= 1.080 (90%c.i.= 1.055-1.105)



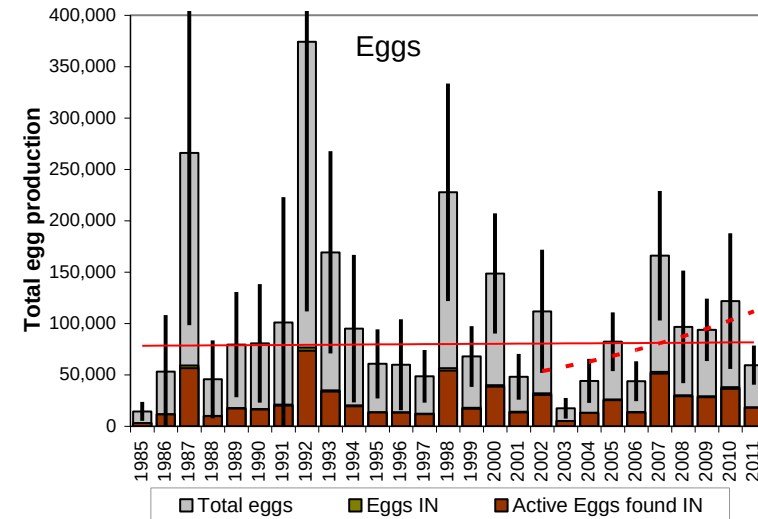
1985-2011 avg annual growth rate= 1.094 (90%c.i.= 1.078-1.110)
2002-2011 last 10 years growth rate= 1.075 (90%c.i.= 1.042-1.107)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	1,078	257	81.0%	1,331	5.86	7,805	9,136	1,970	26,992	6,982	4.20	2.95	70%
1986	46	22.16	2,907	463	83.2%	3,493	5.86	20,480	23,973	3,580	93,312	15,161	4.37	3.89	89%
1987	37	12.67	3,275	629	81.4%	4,026	5.86	23,607	27,632	4,885	130,071	22,517	4.90	4.71	96%
1988	32	10.48	2,937	576	83.7%	3,509	5.86	20,576	24,085	4,268	103,256	18,494	4.40	4.29	98%
1989	23	7.45	4,037	1,004	84.9%	4,753	5.72	27,169	31,922	7,265	151,478	32,646	5.01	4.75	95%
1990	33	10.70	7,025	1,108	81.0%	8,674	5.60	48,540	57,214	8,692	236,158	36,424	4.45	4.13	93%
1991	36	11.66	7,184	1,009	86.1%	8,345	5.37	44,836	53,181	6,723	227,570	28,601	4.53	4.28	94%
1992	42	13.39	8,019	1,001	82.6%	9,710	5.31	51,521	61,231	6,996	270,949	32,153	4.52	4.42	98%
1993	47	15.23	5,641	853	80.4%	7,015	5.08	35,641	42,656	5,819	177,001	23,365	4.27	4.15	97%
1994	41	13.27	8,789	1,097	81.3%	10,813	4.97	53,776	64,589	7,280	273,132	31,213	4.34	4.23	97%
1995	50	22.56	9,992	1,093	81.0%	12,340	5.08	62,627	74,966	7,700	308,231	32,271	4.26	4.11	97%
1996	54	19.44	12,849	1,303	82.6%	15,558	5.44	84,652	100,211	9,993	433,279	44,089	4.49	4.32	96%
1997	72	23.31	11,298	1,145	81.7%	13,823	5.62	77,659	91,481	9,034	384,409	40,358	4.28	4.20	98%
1998	64	20.71	12,785	1,320	81.7%	15,657	6.11	95,706	111,363	12,809	469,735	54,725	4.33	4.22	97%
1999	53	16.97	10,588	1,157	82.4%	12,853	6.34	81,532	94,385	10,766	369,897	42,541	4.17	3.92	94%
2000	80	25.86	13,646	1,258	82.9%	16,461	6.45	106,165	122,625	11,860	529,899	52,669	4.45	4.32	97%
2001	81	26.23	11,407	935	82.8%	13,775	6.53	89,991	103,766	8,597	372,319	33,771	3.86	3.59	93%
2002	84	27.15	11,994	1,001	81.6%	14,694	6.25	91,800	106,494	10,288	456,732	46,070	4.39	4.29	98%
2003	83	26.87	11,265	1,151	81.8%	13,773	6.27	86,293	100,065	10,788	399,190	44,557	4.25	3.99	94%
2004	81	26.22	17,059	1,465	82.7%	20,638	6.20	128,043	148,681	13,916	660,293	61,345	4.59	4.44	97%
2005	83	26.87	18,432	1,472	82.2%	22,421	5.83	130,742	153,163	12,196	620,151	50,606	4.24	4.05	96%
2006	75	24.28	17,685	1,571	82.1%	21,537	5.65	121,742	143,279	12,125	567,734	48,263	4.15	3.96	96%
2007	79	25.58	18,579	1,518	84.4%	22,017	5.84	128,632	150,649	12,908	661,896	57,754	4.47	4.39	98%
2008	82	26.55	16,175	1,124	80.8%	20,010	5.82	116,432	136,442	10,263	511,035	40,223	4.05	3.75	92%
2009	81	26.24	24,252	1,481	82.7%	29,327	5.82	170,645	199,972	13,829	826,675	58,281	4.30	4.13	96%
2010	66	21.37	23,614	1,738	83.2%	28,397	5.82	165,231	193,627	15,163	790,098	63,329	4.19	4.08	97%
2011	82	26.55	28,169	1,575	83.5%	33,736	5.82	196,298	230,035	15,193	928,258	62,649	4.10	4.04	98%

BRAN Black Brant

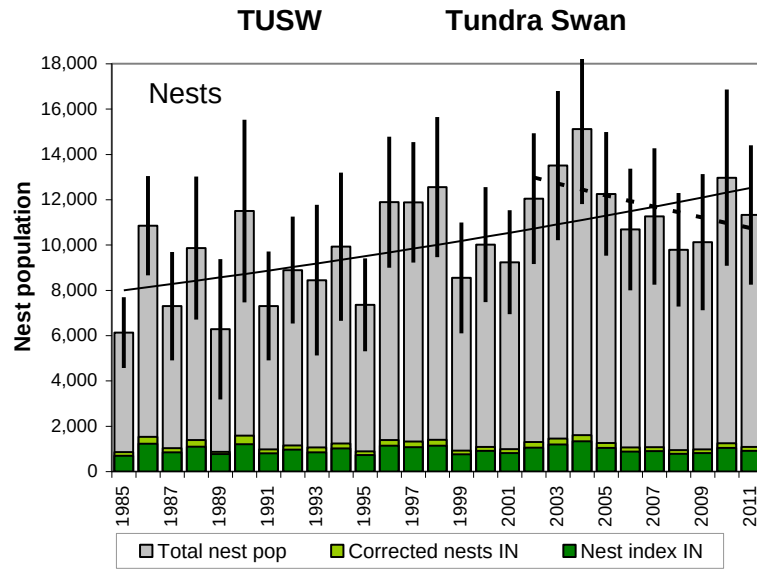


1985-2011 avg annual growth rate= 0.994 (90%c.i.= 0.973-1.016)
 2002-2011 last 10 years growth rate= 1.007 (90%c.i.= 0.936-1.078)

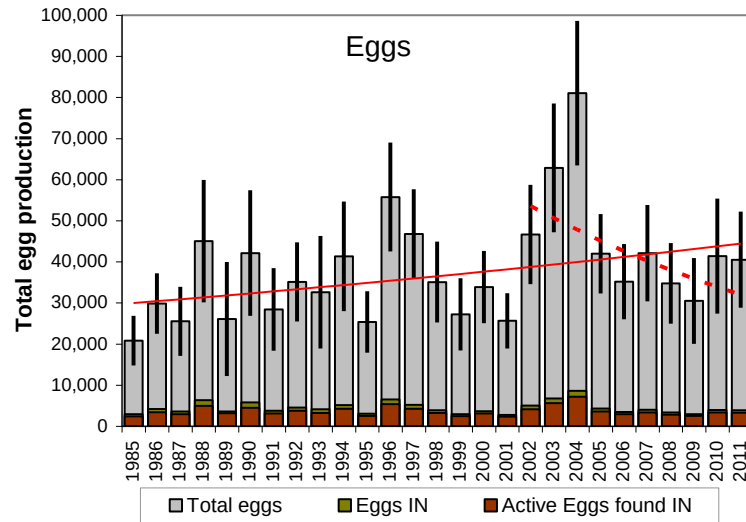


1985-2011 avg annual growth rate= 1.002 (90%c.i.= 0.971-1.032)
 2002-2011 last 10 years growth rate= 1.085 (90%c.i.= 0.959-1.212)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	7,107	2,569	92.6%	7,675	3.50	26,827	34,502	10,375	14,418	5,589	3.09	0.42	14%
1986	46	22.16	3,844	2,304	95.7%	4,017	3.50	14,043	18,060	8,818	53,117	33,465	3.99	2.94	74%
1987	37	12.67	13,497	6,158	95.6%	14,117	3.50	49,347	63,464	23,949	265,950	101,958	4.26	4.19	98%
1988	32	10.48	2,732	1,554	95.9%	2,848	3.50	9,954	12,801	5,956	45,577	23,104	3.98	3.56	89%
1989	23	7.45	6,537	2,701	94.8%	6,893	3.50	24,094	30,987	10,458	79,451	31,075	3.49	2.56	73%
1990	33	10.70	8,563	4,710	94.7%	9,047	3.84	34,743	43,790	20,216	80,631	35,110	3.15	1.84	58%
1991	36	11.66	7,859	6,513	94.3%	8,335	3.78	31,466	39,801	27,269	101,070	74,091	3.66	2.54	69%
1992	42	13.39	19,835	9,859	95.6%	20,742	3.88	80,558	101,300	42,292	374,108	159,547	3.87	3.69	95%
1993	47	15.23	14,196	6,832	95.7%	14,838	3.85	57,189	72,028	29,069	169,244	59,803	3.23	2.35	73%
1994	41	13.27	8,681	5,693	96.0%	9,047	3.68	33,320	42,367	22,709	94,990	43,578	2.42	2.24	93%
1995	50	22.56	6,186	3,119	96.5%	6,410	3.43	21,999	28,409	11,799	60,710	20,441	2.98	2.14	72%
1996	54	19.44	4,050	2,022	95.6%	4,235	3.36	14,229	18,464	7,569	59,832	26,916	3.75	3.24	87%
1997	72	23.31	3,807	1,423	96.7%	3,938	2.99	11,771	15,709	4,794	48,613	15,573	3.32	3.09	93%
1998	64	20.71	16,862	5,452	95.3%	17,702	3.04	53,804	71,506	19,116	227,666	64,391	3.67	3.18	87%
1999	53	16.97	6,581	2,064	94.1%	6,991	2.80	19,606	26,597	6,762	67,827	17,931	3.16	2.55	81%
2000	80	25.86	15,140	5,069	96.6%	15,679	2.72	42,675	58,354	15,516	148,678	35,596	2.87	2.55	89%
2001	81	26.23	8,487	2,391	92.7%	9,156	2.43	22,266	31,421	7,046	48,052	13,573	2.95	1.53	52%
2002	84	27.15	11,177	4,344	94.8%	11,792	2.48	29,301	41,092	12,496	111,783	36,423	3.12	2.72	87%
2003	83	26.87	8,229	4,048	94.1%	8,741	2.41	21,092	29,834	11,073	17,426	6,091	1.25	0.58	47%
2004	81	26.22	4,968	1,710	95.7%	5,192	2.34	12,172	17,364	4,688	44,116	12,966	3.28	2.54	77%
2005	83	26.87	10,015	2,732	96.4%	10,385	2.15	22,290	32,674	6,817	82,199	17,361	3.02	2.52	83%
2006	75	24.28	5,541	1,993	95.4%	5,810	2.17	12,634	18,444	5,039	43,696	11,763	3.44	2.37	69%
2007	79	25.58	13,711	4,083	96.5%	14,214	2.14	30,365	44,579	10,142	165,961	38,344	3.94	3.72	95%
2008	82	26.55	11,619	4,337	95.5%	12,169	2.21	26,847	39,016	10,882	96,612	33,316	3.20	2.48	77%
2009	81	26.24	9,384	2,276	96.1%	9,769	2.21	21,553	31,321	5,770	93,739	18,463	3.56	2.99	84%
2010	66	21.37	13,833	5,850	94.6%	14,618	2.21	32,250	46,868	15,004	121,823	40,103	3.29	2.60	79%
2011	82	26.55	6,038	1,550	95.7%	6,307	2.21	13,915	20,222	3,996	59,341	11,565	3.72	2.93	79%



1985-2011 avg annual growth rate= 1.017 (90%c.i.= 1.010-1.025)
 2002-2011 last 10 years growth rate= 0.979 (90%c.i.= 0.957-1.001)

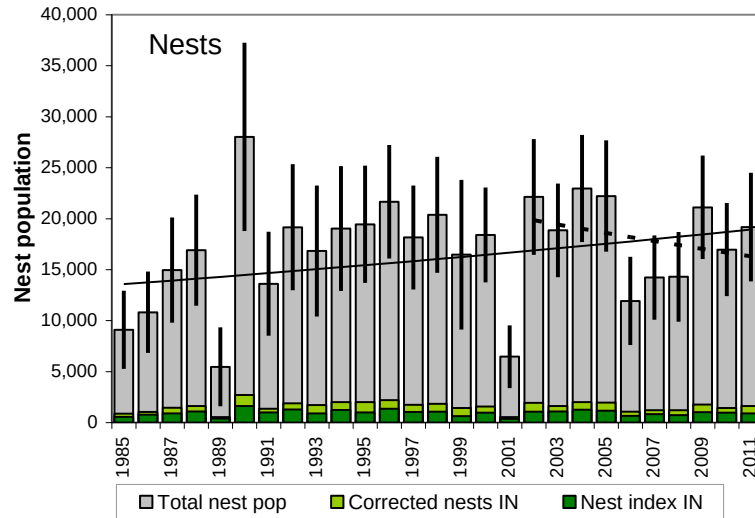


1985-2011 avg annual growth rate= 1.015 (90%c.i.= 1.003-1.027)
 2002-2011 last 10 years growth rate= 0.944 (90%c.i.= 0.902-0.986)

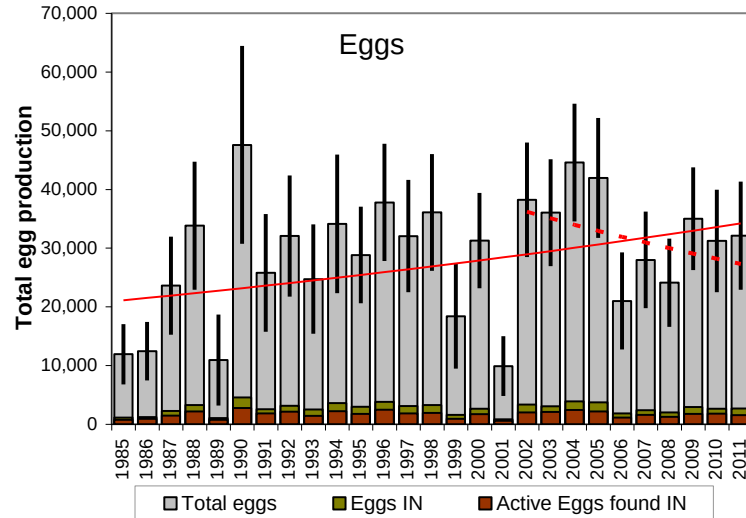
Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	699	119	81.0%	863	6.11	5,266	6,129	951	20,795	3,670	3.93	3.39	86%
1986	46	22.16	1,227	166	80.4%	1,527	6.11	9,322	10,848	1,334	29,851	4,479	3.21	2.75	86%
1987	37	12.67	847	189	82.5%	1,027	6.11	6,270	7,297	1,452	25,519	5,111	3.50	3.50	100%
1988	32	10.48	1,093	237	78.7%	1,388	6.11	8,472	9,859	1,919	45,031	9,039	4.57	4.57	100%
1989	23	7.45	769	263	88.5%	869	6.22	5,408	6,277	1,885	26,077	8,427	4.15	4.15	100%
1990	33	10.70	1,204	288	76.3%	1,579	6.28	9,916	11,495	2,450	42,133	9,274	3.92	3.67	93%
1991	36	11.66	798	178	81.8%	976	6.48	6,330	7,306	1,460	28,406	6,093	4.25	3.89	92%
1992	42	13.39	962	174	83.5%	1,152	6.71	7,736	8,888	1,434	35,112	5,860	3.95	3.95	100%
1993	47	15.23	846	226	79.6%	1,063	6.95	7,381	8,444	2,021	32,579	8,324	4.07	3.86	95%
1994	41	13.27	1,024	231	82.8%	1,237	7.02	8,689	9,926	1,988	41,333	8,118	4.16	4.16	100%
1995	50	22.56	730	135	82.1%	889	7.28	6,467	7,356	1,249	25,334	4,544	3.79	3.44	91%
1996	54	19.44	1,141	177	82.2%	1,389	7.56	10,499	11,887	1,759	55,768	8,038	4.89	4.69	96%
1997	72	23.31	1,074	155	81.0%	1,326	7.96	10,555	11,881	1,613	46,745	6,641	4.20	3.93	94%
1998	64	20.71	1,140	182	81.7%	1,396	7.99	11,155	12,551	1,878	35,063	5,978	3.10	2.79	90%
1999	53	16.97	759	145	82.2%	924	8.25	7,622	8,546	1,488	27,206	5,349	3.63	3.18	88%
2000	80	25.86	913	153	84.2%	1,085	8.23	8,932	10,017	1,543	33,856	5,342	3.62	3.38	93%
2001	81	26.23	819	134	83.1%	986	8.37	8,252	9,237	1,397	25,650	4,089	3.38	2.78	82%
2002	84	27.15	1,054	166	80.9%	1,303	8.24	10,739	12,043	1,752	46,663	7,354	4.35	3.87	89%
2003	83	26.87	1,198	187	82.7%	1,449	8.32	12,056	13,505	2,000	62,876	9,529	4.79	4.66	97%
2004	81	26.22	1,337	189	83.2%	1,608	8.40	13,512	15,119	2,017	81,019	10,685	5.48	5.36	98%
2005	83	26.87	1,039	150	82.5%	1,259	8.73	10,994	12,253	1,659	41,960	5,865	3.63	3.42	94%
2006	75	24.28	884	143	83.3%	1,062	9.06	9,621	10,683	1,630	35,162	5,568	3.54	3.29	93%
2007	79	25.58	895	154	83.6%	1,071	9.51	10,186	11,258	1,830	42,101	7,115	3.87	3.74	97%
2008	82	26.55	782	127	83.3%	939	9.43	8,849	9,788	1,524	34,736	5,957	3.85	3.55	92%
2009	81	26.24	818	155	84.3%	971	9.43	9,154	10,125	1,826	30,473	6,348	3.40	3.01	88%
2010	66	21.37	1,038	201	83.5%	1,244	9.43	11,724	12,968	2,366	41,390	8,498	3.87	3.19	83%
2011	82	26.55	917	159	84.4%	1,086	9.43	10,237	11,324	1,870	40,510	7,100	3.81	3.58	94%

SACR

Sandhill Crane



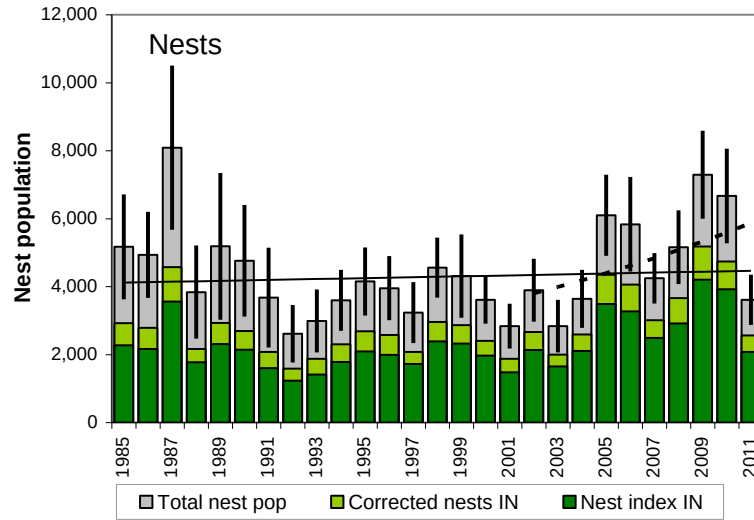
1985-2011 avg annual growth rate= 1.013 (90%c.i.= 0.998-1.028)
2002-2011 last 10 years growth rate= 0.978 (90%c.i.= 0.938-1.019)



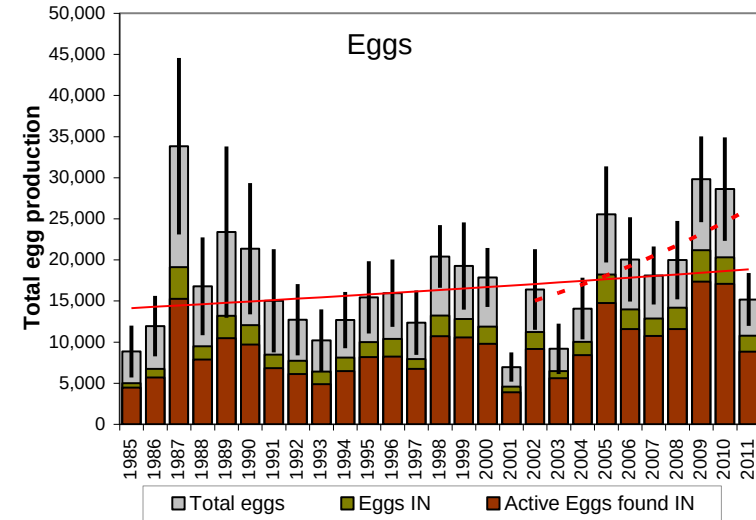
1985-2011 avg annual growth rate= 1.019 (90%c.i.= 1.002-1.036)
2002-2011 last 10 years growth rate= 0.969 (90%c.i.= 0.928-1.010)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	553	145	63.3%	875	9.39	8,214	9,089	2,327	11,915	3,116	1.63	1.31	80%
1986	46	22.16	775	188	74.5%	1,040	9.39	9,767	10,807	2,429	12,431	3,026	1.48	1.15	78%
1987	37	12.67	904	192	62.8%	1,439	9.39	13,509	14,948	3,137	23,592	5,078	1.58	1.58	100%
1988	32	10.48	1,093	220	67.2%	1,627	9.39	15,278	16,905	3,311	33,810	6,622	2.14	2.00	94%
1989	23	7.45	385	178	73.2%	526	9.39	4,935	5,460	2,352	10,921	4,705	2.00	2.00	100%
1990	33	10.70	1,606	305	59.5%	2,696	9.39	25,318	28,014	5,609	47,579	10,237	1.79	1.70	95%
1991	36	11.66	982	222	72.8%	1,350	9.08	12,255	13,605	3,097	25,771	6,106	1.89	1.89	100%
1992	42	13.39	1,283	267	68.2%	1,881	9.18	17,274	19,155	3,763	32,053	6,283	1.75	1.67	96%
1993	47	15.23	893	227	51.8%	1,723	8.76	15,102	16,826	3,905	24,713	5,665	1.67	1.47	88%
1994	41	13.27	1,240	254	62.0%	2,001	8.51	17,023	19,024	3,728	34,130	7,170	1.79	1.79	100%
1995	50	22.56	983	154	49.1%	2,003	8.71	17,439	19,442	3,496	28,814	5,001	1.92	1.48	77%
1996	54	19.44	1,362	213	62.2%	2,191	8.88	19,464	21,655	3,387	37,777	6,078	1.88	1.74	93%
1997	72	23.31	1,044	187	59.8%	1,746	9.39	16,399	18,145	3,102	32,036	5,811	1.77	1.77	100%
1998	64	20.71	1,071	175	58.2%	1,839	10.08	18,533	20,372	3,459	36,074	6,053	1.77	1.77	100%
1999	53	16.97	633	162	44.7%	1,416	10.63	15,049	16,465	4,464	18,369	5,418	1.69	1.12	66%
2000	80	25.86	969	139	62.0%	1,563	10.77	16,839	18,402	2,827	31,281	4,942	1.84	1.70	92%
2001	81	26.23	355	111	65.4%	542	10.91	5,913	6,455	1,865	9,886	3,094	1.70	1.53	90%
2002	84	27.15	1,054	149	54.6%	1,933	10.45	20,192	22,125	3,450	38,214	5,927	2.00	1.73	86%
2003	83	26.87	1,092	155	67.9%	1,608	10.72	17,237	18,845	2,798	36,030	5,529	1.96	1.91	97%
2004	81	26.22	1,256	161	62.7%	2,003	10.46	20,950	22,953	3,198	44,574	6,103	1.94	1.94	100%
2005	83	26.87	1,145	164	58.4%	1,962	10.32	20,255	22,217	3,317	41,966	6,212	1.89	1.89	100%
2006	75	24.28	648	141	61.6%	1,052	10.33	10,868	11,919	2,636	20,989	5,026	1.76	1.76	100%
2007	79	25.58	811	147	66.8%	1,215	10.70	13,001	14,216	2,513	27,981	4,993	1.97	1.97	100%
2008	82	26.55	728	136	60.7%	1,199	10.92	13,093	14,292	2,678	24,103	4,563	1.76	1.69	96%
2009	81	26.24	1,009	143	57.0%	1,771	10.92	19,334	21,105	3,081	34,996	5,323	1.85	1.66	89%
2010	66	21.37	971	157	68.3%	1,423	10.92	15,537	16,960	2,776	31,224	5,309	1.93	1.84	95%
2011	82	26.55	890	145	55.3%	1,609	10.92	17,566	19,175	3,237	32,117	5,601	1.80	1.68	93%

SPEI Spectacled Eider



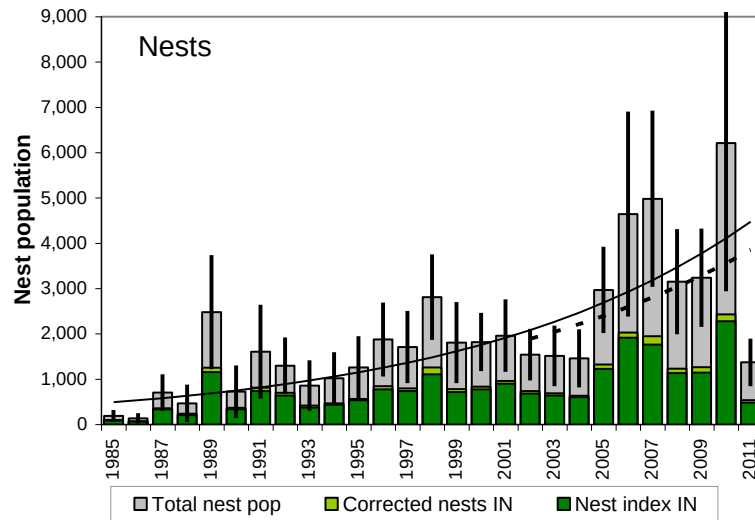
1985-2011 avg annual growth rate= 1.003 (90%c.i.= 0.991-1.015)
 2002-2011 last 10 years growth rate= 1.049 (90%c.i.= 0.994-1.105)



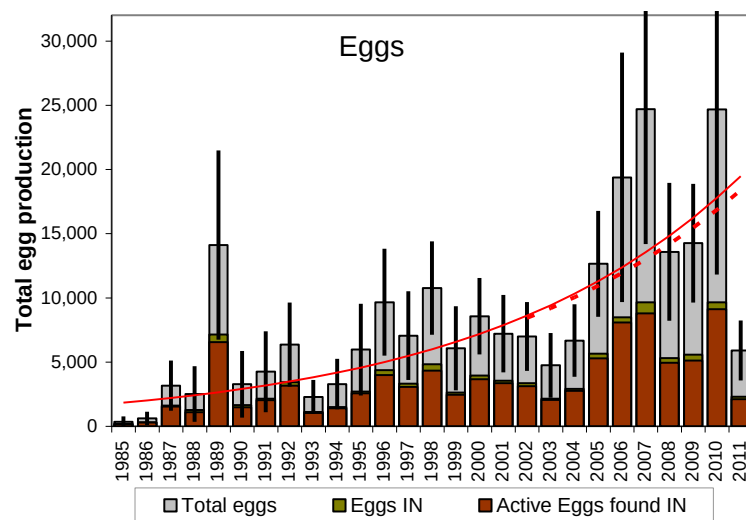
1985-2011 avg annual growth rate= 1.011 (90%c.i.= 0.996-1.027)
 2002-2011 last 10 years growth rate= 1.064 (90%c.i.= 1.001-1.126)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	2,272	489	77.8%	2,919	0.77	2,250	5,169	940	8,845	1,920	3.84	1.71	45%
1986	46	22.16	2,164	366	77.7%	2,786	0.77	2,147	4,933	770	11,936	2,241	4.40	2.42	55%
1987	37	12.67	3,558	758	77.9%	4,568	0.77	3,521	8,089	1,468	33,821	6,526	5.06	4.18	83%
1988	32	10.48	1,776	484	82.0%	2,166	0.77	1,669	3,835	834	16,772	3,614	4.81	4.37	91%
1989	23	7.45	2,307	751	78.8%	2,927	0.77	2,256	5,183	1,314	23,376	6,334	4.99	4.51	90%
1990	33	10.70	2,141	552	79.6%	2,689	0.77	2,072	4,761	997	21,351	4,853	5.03	4.48	89%
1991	36	11.66	1,596	491	76.9%	2,075	0.77	1,600	3,675	894	15,012	3,815	5.27	4.09	77%
1992	42	13.39	1,230	308	77.5%	1,587	0.65	1,024	2,611	515	12,709	2,635	5.43	4.87	90%
1993	47	15.23	1,410	348	75.3%	1,874	0.59	1,114	2,988	562	10,208	2,284	4.27	3.42	80%
1994	41	13.27	1,779	344	77.4%	2,300	0.56	1,295	3,595	547	12,669	2,087	4.65	3.52	76%
1995	50	22.56	2,094	417	78.0%	2,684	0.55	1,464	4,148	611	15,438	2,672	4.88	3.72	76%
1996	54	19.44	1,988	377	77.3%	2,573	0.54	1,380	3,952	573	15,940	2,483	5.06	4.03	80%
1997	72	23.31	1,719	404	82.7%	2,079	0.56	1,155	3,235	547	12,342	2,379	4.38	3.82	87%
1998	64	20.71	2,384	374	80.6%	2,956	0.54	1,602	4,559	537	20,402	2,317	4.87	4.48	92%
1999	53	16.97	2,320	532	81.0%	2,864	0.50	1,443	4,308	747	19,244	3,226	4.96	4.47	90%
2000	80	25.86	1,965	295	82.0%	2,398	0.50	1,209	3,607	423	17,851	2,187	5.34	4.95	93%
2001	81	26.23	1,474	275	78.7%	1,873	0.51	961	2,834	400	6,944	1,082	4.18	2.45	59%
2002	84	27.15	2,135	407	80.1%	2,664	0.46	1,226	3,890	562	16,379	2,984	5.26	4.21	80%
2003	83	26.87	1,651	350	82.7%	1,998	0.42	836	2,833	471	9,168	1,857	4.41	3.24	73%
2004	81	26.22	2,102	387	81.1%	2,590	0.41	1,051	3,641	518	14,063	2,279	4.97	3.86	78%
2005	83	26.87	3,489	538	80.3%	4,346	0.40	1,750	6,096	726	25,533	3,551	4.69	4.19	89%
2006	75	24.28	3,272	641	80.6%	4,061	0.44	1,771	5,832	846	20,045	3,122	4.50	3.44	76%
2007	79	25.58	2,490	340	82.7%	3,013	0.41	1,230	4,243	452	18,094	2,152	5.06	4.26	84%
2008	82	26.55	2,911	482	79.5%	3,662	0.41	1,495	5,157	660	19,965	2,895	5.04	3.87	77%
2009	81	26.24	4,201	576	81.2%	5,176	0.41	2,114	7,290	787	29,801	3,173	4.50	4.09	91%
2010	66	21.37	3,919	646	82.8%	4,735	0.41	1,933	6,668	846	28,604	3,821	4.98	4.29	86%
2011	82	26.55	2,076	329	81.0%	2,562	0.41	1,046	3,608	448	15,175	1,947	4.77	4.21	88%

COEI Common Eider



1985-2011 avg annual growth rate= 1.089 (90%c.i.= 1.063-1.114)
2002-2011 last 10 years growth rate= 1.082 (90%c.i.= 0.975-1.190)

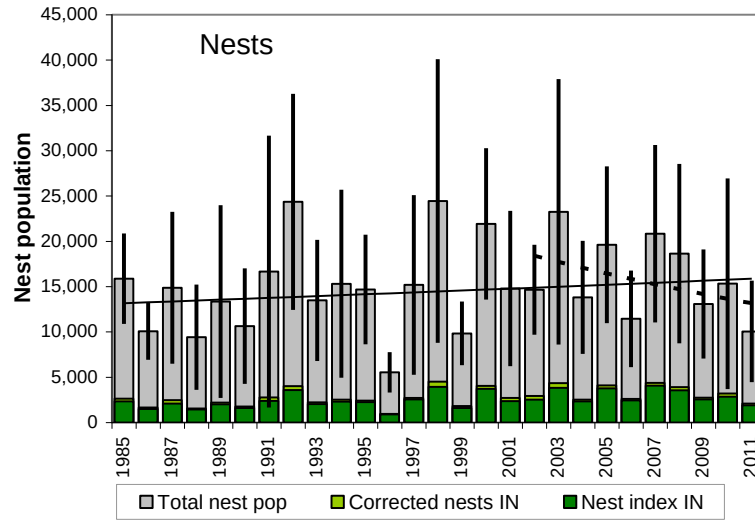


1985-2011 avg annual growth rate= 1.095 (90%c.i.= 1.064-1.125)
2002-2011 last 10 years growth rate= 1.090 (90%c.i.= 0.976-1.205)

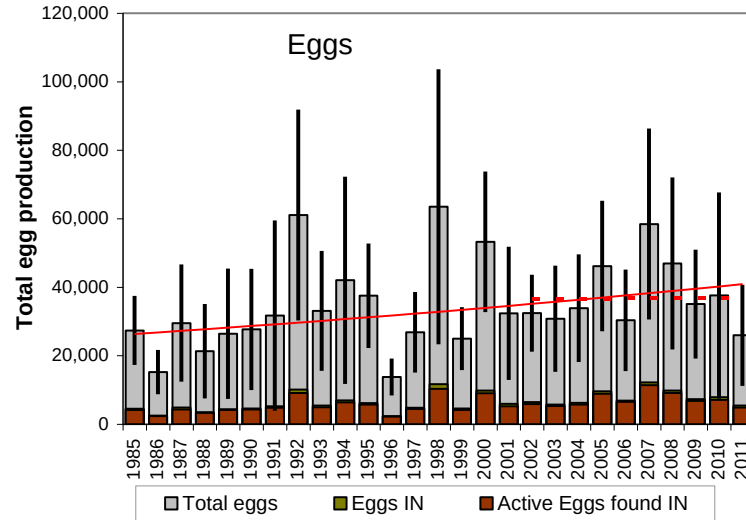
Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	87	47	90.2%	97	0.98	95	191	78	352	251	6.00	1.84	31%
1986	46	22.16	65	45	94.2%	69	0.98	67	136	70	612	318	4.52	4.52	100%
1987	37	12.67	339	152	94.7%	358	0.98	349	707	244	3,162	1,186	5.41	4.47	83%
1988	32	10.48	205	150	86.3%	237	0.98	232	469	250	2,510	1,314	5.35	5.35	100%
1989	23	7.45	1,154	456	91.9%	1,256	0.98	1,225	2,481	766	14,097	4,479	5.68	5.68	100%
1990	33	10.70	335	216	91.2%	367	0.98	358	725	350	3,265	1,577	4.50	4.50	100%
1991	36	11.66	737	381	90.6%	814	0.98	794	1,607	628	4,239	1,910	4.76	2.64	55%
1992	42	13.39	642	254	91.9%	698	0.86	598	1,296	378	6,349	1,988	5.38	4.90	91%
1993	47	15.23	376	203	89.5%	420	1.04	439	859	339	2,287	797	4.43	2.66	60%
1994	41	13.27	431	205	92.7%	465	1.19	553	1,018	350	3,282	1,197	3.73	3.22	86%
1995	50	22.56	539	247	95.1%	567	1.22	690	1,257	418	5,966	2,171	5.08	4.75	93%
1996	54	19.44	773	271	91.4%	846	1.22	1,028	1,874	496	9,655	2,536	5.44	5.15	95%
1997	72	23.31	737	285	92.1%	800	1.14	908	1,708	485	7,051	2,097	4.53	4.13	91%
1998	64	20.71	1,106	299	87.7%	1,261	1.23	1,548	2,809	574	10,757	2,205	5.01	3.83	76%
1999	53	16.97	717	296	91.7%	782	1.31	1,024	1,806	544	6,059	1,990	4.47	3.35	75%
2000	80	25.86	775	212	92.6%	837	1.17	982	1,819	390	8,557	1,810	4.90	4.70	96%
2001	81	26.23	900	292	93.6%	962	1.04	998	1,959	486	7,204	1,829	4.10	3.68	90%
2002	84	27.15	685	191	92.6%	740	1.08	800	1,541	347	6,977	1,629	4.72	4.53	96%
2003	83	26.87	639	225	92.9%	688	1.20	826	1,514	405	4,740	1,528	4.28	3.13	73%
2004	81	26.22	600	212	94.3%	637	1.29	822	1,459	389	6,663	1,717	4.80	4.57	95%
2005	83	26.87	1,225	298	92.4%	1,325	1.24	1,644	2,969	580	12,645	2,508	4.93	4.26	86%
2006	75	24.28	1,916	751	94.4%	2,030	1.29	2,613	4,643	1,374	19,371	5,905	4.81	4.17	87%
2007	79	25.58	1,763	540	90.5%	1,948	1.56	3,034	4,983	1,182	24,683	6,386	5.22	4.95	95%
2008	82	26.55	1,132	329	91.9%	1,232	1.56	1,919	3,152	704	13,579	3,265	4.82	4.31	89%
2009	81	26.24	1,146	295	90.5%	1,266	1.56	1,972	3,238	659	14,250	2,814	4.91	4.40	90%
2010	66	21.37	2,278	976	93.8%	2,428	1.56	3,781	6,209	1,986	24,662	7,815	4.86	3.97	82%
2011	82	26.55	485	146	90.5%	536	1.56	835	1,372	318	5,896	1,417	4.89	4.30	88%

GLGU

Glaucous Gull

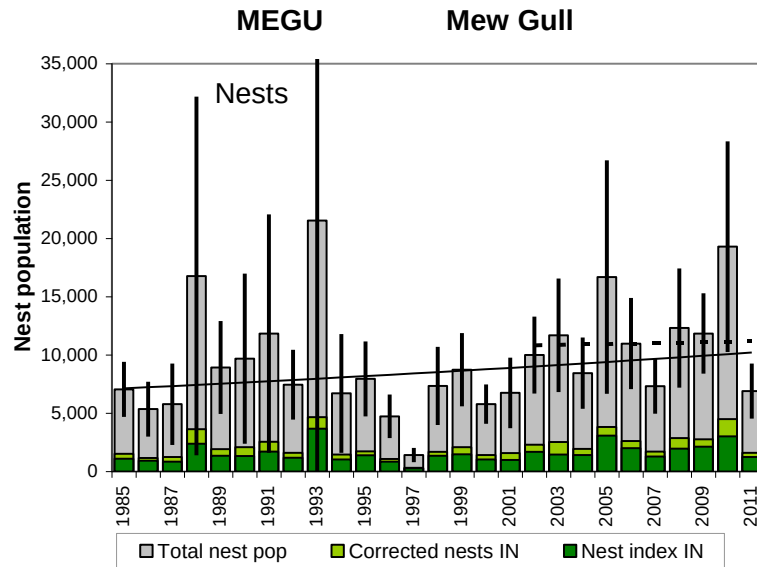


1985-2011 avg annual growth rate= 1.007 (90%c.i.= 0.993-1.021)
2002-2011 last 10 years growth rate= 0.963 (90%c.i.= 0.918-1.009)

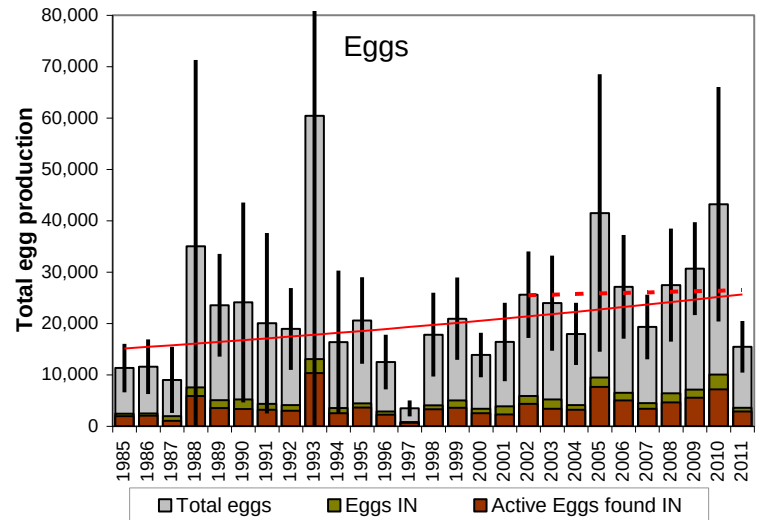


1985-2011 avg annual growth rate= 1.017 (90%c.i.= 1.003-1.032)
2002-2011 last 10 years growth rate= 1.002 (90%c.i.= 0.955-1.049)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	2,330	487	88.8%	2,625	5.05	13,247	15,872	3,038	27,355	6,129	2.08	1.72	83%
1986	46	22.16	1,486	316	89.3%	1,663	5.05	8,394	10,058	1,907	15,232	3,919	2.15	1.51	70%
1987	37	12.67	2,089	766	85.0%	2,457	5.05	12,400	14,857	5,092	29,528	10,414	2.15	1.99	93%
1988	32	10.48	1,434	622	92.2%	1,556	5.05	7,851	9,407	3,526	21,313	8,394	2.53	2.27	89%
1989	23	7.45	2,019	1,106	91.4%	2,208	5.05	11,141	13,349	6,462	26,412	11,544	2.27	1.98	87%
1990	33	10.70	1,606	689	91.3%	1,758	5.05	8,872	10,630	3,878	27,669	10,763	2.91	2.60	90%
1991	36	11.66	2,395	1,501	86.9%	2,754	5.05	13,898	16,653	9,113	31,730	16,868	2.99	1.91	64%
1992	42	13.39	3,582	1,211	88.9%	4,027	5.05	20,322	24,349	7,252	61,105	18,716	2.71	2.51	92%
1993	47	15.23	2,021	703	90.7%	2,228	5.05	11,245	13,474	4,062	33,075	10,632	2.53	2.45	97%
1994	41	13.27	2,319	1,103	91.6%	2,532	5.05	12,778	15,310	6,302	42,030	18,380	2.83	2.75	97%
1995	50	22.56	2,252	643	92.8%	2,428	5.05	12,251	14,678	3,676	37,510	9,257	2.56	2.56	100%
1996	54	19.44	884	241	94.0%	940	4.89	4,592	5,532	1,348	13,787	3,284	2.49	2.49	100%
1997	72	23.31	2,548	1,188	93.8%	2,716	4.59	12,461	15,177	6,022	26,844	7,152	1.79	1.77	99%
1998	64	20.71	3,939	1,749	87.6%	4,495	4.44	19,945	24,440	9,514	63,484	24,393	2.67	2.60	97%
1999	53	16.97	1,603	387	88.9%	1,804	4.45	8,023	9,827	2,133	24,982	5,580	2.72	2.54	94%
2000	80	25.86	3,709	974	91.5%	4,054	4.40	17,856	21,909	5,079	53,249	12,481	2.50	2.43	97%
2001	81	26.23	2,347	955	86.3%	2,718	4.44	12,068	14,786	5,206	32,359	11,831	2.36	2.19	93%
2002	84	27.15	2,531	580	86.7%	2,917	4.02	11,735	14,652	3,015	32,424	6,828	2.59	2.21	85%
2003	83	26.87	3,835	1,748	88.4%	4,338	4.36	18,911	23,249	8,910	30,795	9,412	1.64	1.32	81%
2004	81	26.22	2,320	717	91.5%	2,534	4.45	11,271	13,806	3,800	33,867	9,553	2.49	2.45	99%
2005	83	26.87	3,782	1,049	92.6%	4,084	3.80	15,528	19,612	5,268	46,173	11,584	2.41	2.35	98%
2006	75	24.28	2,446	742	94.1%	2,600	3.40	8,834	11,434	3,233	30,347	9,016	2.69	2.65	99%
2007	79	25.58	4,057	1,101	93.0%	4,360	3.78	16,470	20,831	5,953	58,429	16,954	2.83	2.80	99%
2008	82	26.55	3,558	1,156	91.2%	3,901	3.78	14,737	18,638	6,017	46,931	15,262	2.67	2.52	94%
2009	81	26.24	2,537	688	92.8%	2,735	3.78	10,332	13,067	3,663	35,079	9,664	2.72	2.68	99%
2010	66	21.37	2,847	1,429	88.8%	3,206	3.78	12,110	15,316	7,070	37,588	18,297	2.54	2.45	96%
2011	82	26.55	1,887	621	89.8%	2,102	3.78	7,940	10,042	3,407	25,970	8,967	2.63	2.59	98%



1985-2011 avg annual growth rate= 1.014 (90%c.i.= 0.992-1.036)
 2002-2011 last 10 years growth rate= 1.003 (90%c.i.= 0.940-1.067)

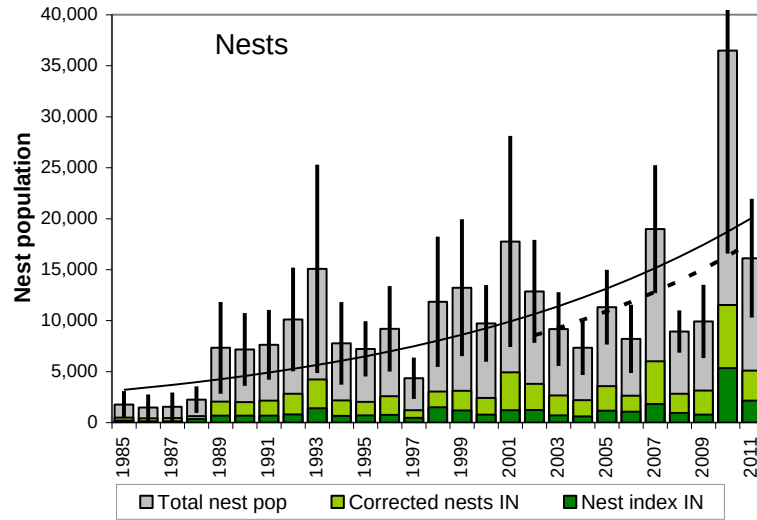


1985-2011 avg annual growth rate= 1.021 (90%c.i.= 0.998-1.043)
 2002-2011 last 10 years growth rate= 1.004 (90%c.i.= 0.940-1.069)

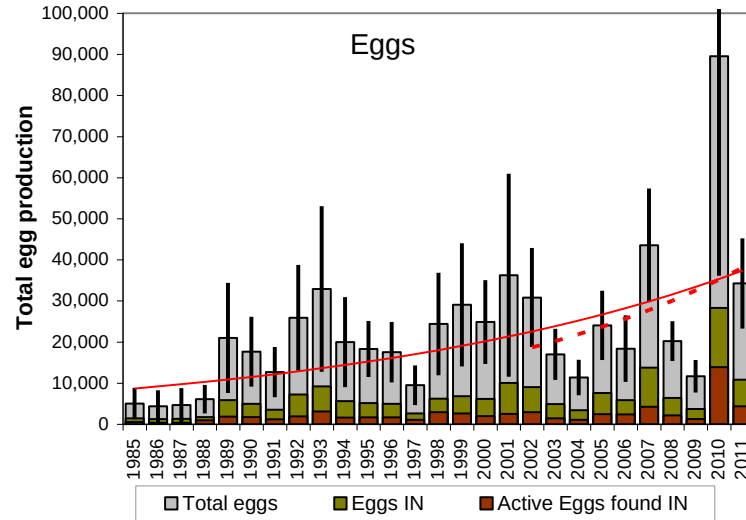
Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	1,107	270	72.6%	1,525	3.62	5,522	7,046	1,434	11,333	2,862	1.95	1.61	82%
1986	46	22.16	937	286	80.9%	1,157	3.62	4,192	5,349	1,428	11,592	3,224	2.29	2.17	95%
1987	37	12.67	847	385	67.8%	1,249	3.62	4,523	5,772	2,118	9,012	3,907	1.56	1.56	100%
1988	32	10.48	2,390	1,793	65.9%	3,629	3.62	13,144	16,773	9,356	35,020	22,058	2.47	2.09	85%
1989	23	7.45	1,346	385	69.7%	1,930	3.62	6,988	8,918	2,426	23,531	6,073	2.64	2.64	100%
1990	33	10.70	1,338	814	63.9%	2,095	3.62	7,586	9,680	4,441	24,098	11,819	2.68	2.49	93%
1991	36	11.66	1,719	1,037	67.1%	2,562	3.62	9,281	11,843	6,221	20,062	10,675	2.37	1.69	72%
1992	42	13.39	1,176	323	72.9%	1,612	3.62	5,840	7,452	1,821	18,944	4,844	2.69	2.54	95%
1993	47	15.23	3,667	2,931	78.7%	4,661	3.62	16,879	21,540	13,305	60,424	37,666	2.81	2.81	100%
1994	41	13.27	1,024	547	70.7%	1,450	3.62	5,250	6,699	3,092	16,352	8,480	2.65	2.44	92%
1995	50	22.56	1,396	403	81.2%	1,719	3.62	6,227	7,947	1,957	20,564	5,119	2.59	2.59	100%
1996	54	19.44	847	241	78.2%	1,083	3.37	3,651	4,735	1,140	12,494	3,227	2.64	2.64	100%
1997	72	23.31	276	85	85.6%	323	3.38	1,091	1,414	367	3,471	941	2.45	2.45	100%
1998	64	20.71	1,348	446	80.0%	1,685	3.36	5,654	7,340	2,038	17,806	4,958	2.43	2.43	100%
1999	53	16.97	1,476	399	70.7%	2,089	3.18	6,640	8,730	1,913	20,921	4,876	2.48	2.40	97%
2000	80	25.86	1,024	189	72.4%	1,414	3.09	4,366	5,780	1,031	13,859	2,625	2.59	2.40	93%
2001	81	26.23	982	300	61.8%	1,588	3.24	5,153	6,741	1,838	16,404	4,642	2.43	2.43	100%
2002	84	27.15	1,687	378	73.2%	2,305	3.33	7,687	9,992	2,003	25,602	5,119	2.68	2.56	96%
2003	83	26.87	1,465	387	57.8%	2,535	3.61	9,152	11,688	2,960	23,947	5,618	2.58	2.05	79%
2004	81	26.22	1,419	326	73.4%	1,934	3.37	6,508	8,442	1,863	17,957	3,678	2.45	2.13	87%
2005	83	26.87	3,090	1,366	81.0%	3,813	3.38	12,871	16,685	6,095	41,504	16,425	2.49	2.49	100%
2006	75	24.28	2,004	507	76.4%	2,623	3.19	8,356	10,980	2,382	27,139	6,142	2.47	2.47	100%
2007	79	25.58	1,287	252	75.5%	1,705	3.30	5,624	7,329	1,440	19,309	3,834	2.63	2.63	100%
2008	82	26.55	1,968	520	68.7%	2,866	3.30	9,449	12,315	3,113	27,466	6,701	2.49	2.23	90%
2009	81	26.24	2,128	370	77.2%	2,755	3.30	9,086	11,841	2,096	30,667	5,487	2.65	2.59	98%
2010	66	21.37	3,015	960	67.1%	4,489	3.30	14,804	19,294	5,497	43,217	13,881	2.56	2.24	87%
2011	82	26.55	1,240	261	77.2%	1,605	3.30	5,294	6,899	1,437	15,472	3,051	2.33	2.24	96%

SAGU

Sabine's Gull

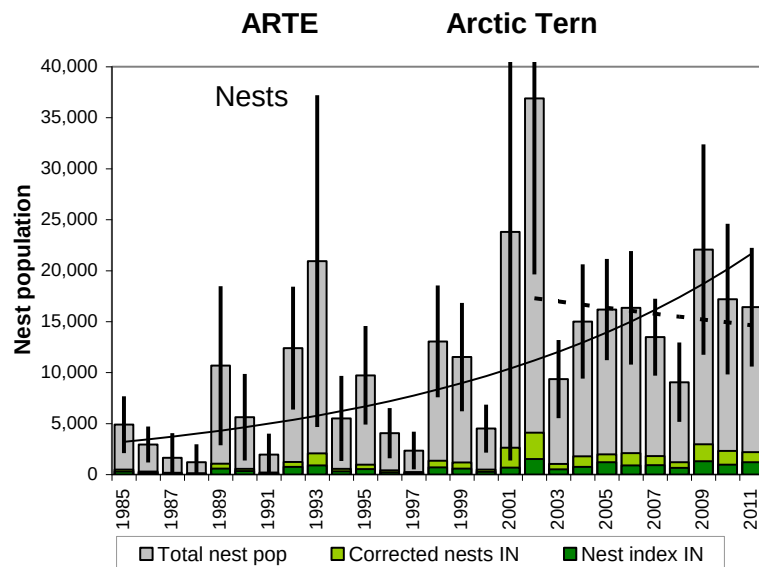


1985-2011 avg annual growth rate= 1.073 (90%c.i.= 1.050-1.097)
2002-2011 last 10 years growth rate= 1.084 (90%c.i.= 0.997-1.172)

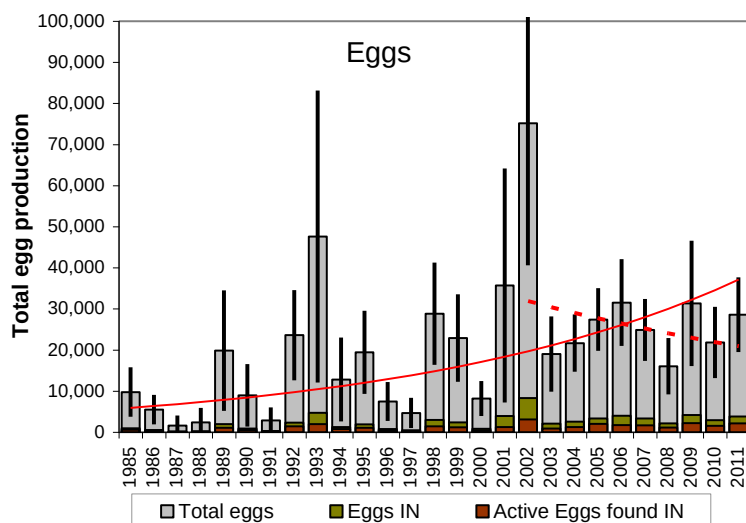


1985-2011 avg annual growth rate= 1.058 (90%c.i.= 1.033-1.082)
2002-2011 last 10 years growth rate= 1.082 (90%c.i.= 0.961-1.203)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	195	99	39.6%	491	2.57	1,261	1,753	804	5,050	2,325	2.88	2.88	100%
1986	46	22.16	129	78	31.5%	410	2.57	1,052	1,462	788	4,387	2,364	3.00	3.00	100%
1987	37	12.67	113	76	25.9%	436	2.57	1,118	1,554	836	4,662	2,509	3.00	3.00	100%
1988	32	10.48	341	142	54.3%	628	2.57	1,613	2,241	791	6,101	2,114	2.72	2.72	100%
1989	23	7.45	673	291	32.8%	2,053	2.57	5,270	7,323	2,730	20,978	8,152	2.86	2.86	100%
1990	33	10.70	669	223	33.3%	2,007	2.57	5,150	7,157	2,165	17,651	5,169	2.47	2.47	100%
1991	36	11.66	675	192	31.6%	2,134	2.57	5,478	7,612	2,083	12,671	3,713	1.66	1.66	100%
1992	42	13.39	802	291	28.3%	2,833	2.57	7,270	10,103	3,091	25,912	7,824	2.56	2.56	100%
1993	47	15.23	1,410	724	33.4%	4,225	2.57	10,842	15,067	6,219	32,884	12,253	2.41	2.18	91%
1994	41	13.27	647	220	29.7%	2,179	2.57	5,591	7,770	2,461	19,984	6,652	2.57	2.57	100%
1995	50	22.56	698	185	34.5%	2,024	2.57	5,194	7,218	1,651	18,320	4,145	2.54	2.54	100%
1996	54	19.44	736	216	28.4%	2,591	2.55	6,596	9,187	2,546	17,499	4,475	2.42	1.90	79%
1997	72	23.31	460	136	38.5%	1,196	2.63	3,145	4,342	1,226	9,487	2,938	2.18	2.18	100%
1998	64	20.71	1,486	720	49.1%	3,026	2.91	8,820	11,846	3,885	24,375	7,586	2.06	2.06	100%
1999	53	16.97	1,181	560	37.9%	3,113	3.25	10,107	13,220	4,083	29,044	9,094	2.20	2.20	100%
2000	80	25.86	775	182	32.2%	2,408	3.03	7,304	9,712	2,283	24,857	6,197	2.56	2.56	100%
2001	81	26.23	1,201	423	24.4%	4,915	2.61	12,839	17,754	6,291	36,255	15,026	2.30	2.04	89%
2002	84	27.15	1,239	404	32.8%	3,774	2.41	9,079	12,853	3,071	30,823	7,329	2.40	2.40	100%
2003	83	26.87	692	186	26.1%	2,656	2.45	6,515	9,171	2,197	16,999	3,790	2.18	1.85	85%
2004	81	26.22	600	148	27.3%	2,199	2.33	5,122	7,321	1,621	11,363	2,617	1.99	1.55	78%
2005	83	26.87	1,145	256	32.0%	3,579	2.16	7,730	11,308	2,232	24,048	5,130	2.13	2.13	100%
2006	75	24.28	1,061	372	40.6%	2,616	2.13	5,575	8,191	2,036	18,382	4,917	2.24	2.24	100%
2007	79	25.58	1,819	398	30.4%	5,992	2.17	12,975	18,967	3,820	43,519	8,401	2.29	2.29	100%
2008	82	26.55	944	151	33.5%	2,819	2.17	6,105	8,925	1,256	20,225	2,949	2.27	2.27	100%
2009	81	26.24	764	187	24.4%	3,130	2.17	6,779	9,909	2,187	11,661	2,402	1.76	1.18	67%
2010	66	21.37	5,326	3,366	46.2%	11,524	2.17	24,956	36,480	12,100	89,509	32,463	2.56	2.45	96%
2011	82	26.55	2,156	830	42.4%	5,091	2.17	11,026	16,117	3,538	34,253	6,678	2.22	2.13	96%



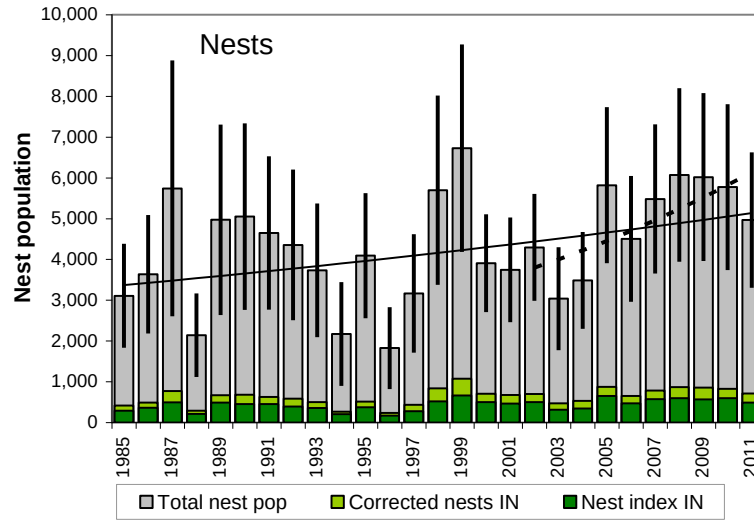
1985-2011 avg annual growth rate= 1.076 (90%c.i.= 1.046-1.107)
 2002-2011 last 10 years growth rate= 0.982 (90%c.i.= 0.907-1.057)



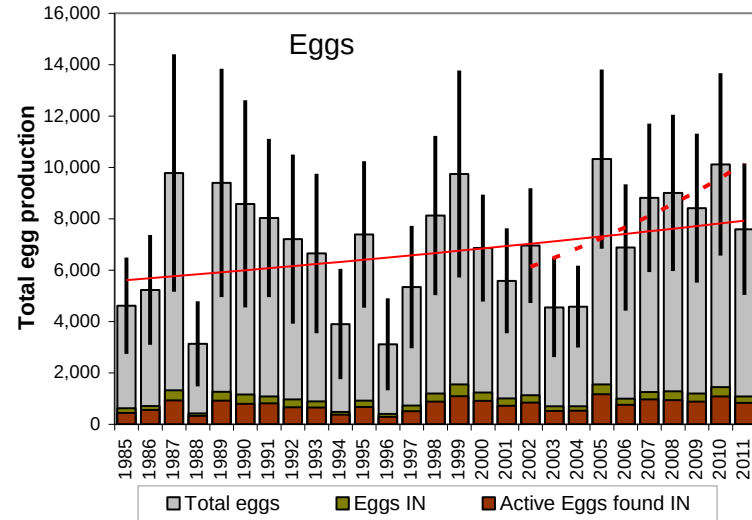
1985-2011 avg annual growth rate= 1.073 (90%c.i.= 1.040-1.106)
 2002-2011 last 10 years growth rate= 0.954 (90%c.i.= 0.882-1.027)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	291	110	60.3%	483	9.13	4,406	4,888	1,696	9,777	3,653	2.00	2.00	100%
1986	46	22.16	194	77	66.6%	291	9.13	2,658	2,949	1,069	5,506	2,179	1.87	1.87	100%
1987	37	12.67	113	112	70.1%	161	9.13	1,470	1,631	1,472	1,631	1,472	1.00	1.00	100%
1988	32	10.48	68	68	57.9%	118	9.13	1,076	1,194	1,079	2,388	2,157	2.00	2.00	100%
1989	23	7.45	577	284	54.7%	1,054	9.13	9,617	10,671	4,743	19,880	8,906	1.86	1.86	100%
1990	33	10.70	335	168	60.3%	554	9.13	5,060	5,614	2,584	8,982	4,626	1.60	1.60	100%
1991	36	11.66	123	85	63.3%	194	9.13	1,770	1,964	1,238	2,898	1,904	1.48	1.48	100%
1992	42	13.39	748	235	61.1%	1,225	9.13	11,179	12,404	3,664	23,604	6,679	1.90	1.90	100%
1993	47	15.23	893	482	43.2%	2,066	9.13	18,856	20,921	9,896	47,604	21,611	2.28	2.28	100%
1994	41	13.27	323	163	59.5%	544	9.13	4,961	5,505	2,536	12,819	6,209	2.33	2.33	100%
1995	50	22.56	539	165	56.1%	961	9.13	8,768	9,728	2,932	19,456	6,139	2.00	2.00	100%
1996	54	19.44	221	85	52.5%	421	8.62	3,623	4,044	1,497	7,501	2,870	1.86	1.86	100%
1997	72	23.31	154	78	64.6%	238	8.85	2,103	2,340	1,122	4,679	2,244	2.00	2.00	100%
1998	64	20.71	691	193	51.3%	1,348	8.69	11,704	13,051	3,331	28,828	7,571	2.21	2.21	100%
1999	53	16.97	591	170	49.6%	1,190	8.68	10,323	11,513	3,233	22,902	6,481	1.99	1.99	100%
2000	80	25.86	277	90	58.6%	473	8.52	4,027	4,499	1,425	8,196	2,580	1.82	1.82	100%
2001	81	26.23	682	269	26.0%	2,623	8.07	21,164	23,787	13,626	35,706	17,294	1.92	1.50	78%
2002	84	27.15	1,529	434	37.4%	4,091	8.01	32,790	36,882	10,487	75,168	21,025	2.04	2.04	100%
2003	83	26.87	506	136	49.2%	1,028	8.11	8,337	9,365	2,331	19,034	5,556	2.03	2.03	100%
2004	81	26.22	737	137	41.2%	1,789	7.39	13,216	15,006	3,408	21,680	4,221	1.77	1.44	82%
2005	83	26.87	1,199	258	60.4%	1,985	7.15	14,199	16,184	3,023	27,407	4,635	1.69	1.69	100%
2006	75	24.28	884	175	42.4%	2,087	6.83	14,250	16,336	3,385	31,531	6,417	1.93	1.93	100%
2007	79	25.58	923	169	51.1%	1,806	6.46	11,670	13,476	2,293	24,896	4,585	1.85	1.85	100%
2008	82	26.55	647	170	53.4%	1,213	6.46	7,837	9,050	2,369	16,053	4,158	1.77	1.77	100%
2009	81	26.24	1,309	463	44.3%	2,956	6.46	19,104	22,060	6,271	31,358	9,269	1.75	1.42	81%
2010	66	21.37	971	216	42.1%	2,305	6.46	14,893	17,198	4,493	21,837	5,277	1.74	1.27	73%
2011	82	26.55	1,213	244	55.2%	2,199	6.46	14,211	16,410	3,544	28,600	5,525	1.84	1.74	95%

RTLO Red-throated Loon



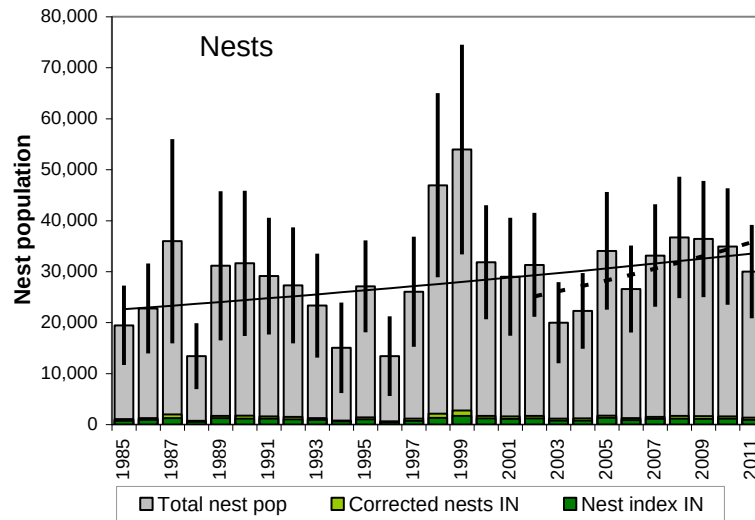
1985-2011 avg annual growth rate= 1.016 (90%c.i.= 1.003-1.030)
2002-2011 last 10 years growth rate= 1.055 (90%c.i.= 1.019-1.091)



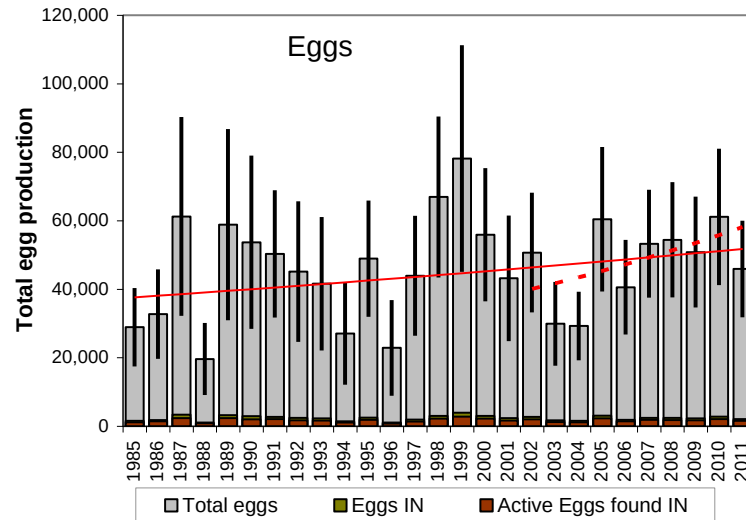
1985-2011 avg annual growth rate= 1.013 (90%c.i.= 0.999-1.027)
2002-2011 last 10 years growth rate= 1.058 (90%c.i.= 1.009-1.106)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	287	67	68.7%	418	6.43	2,687	3,106	775	4,613	1,140	1.64	1.49	90%
1986	46	22.16	364	85	74.4%	489	6.43	3,145	3,634	884	5,228	1,300	1.64	1.44	88%
1987	37	12.67	494	141	63.9%	773	6.43	4,966	5,739	1,908	9,779	2,811	1.95	1.70	88%
1988	32	10.48	212	64	73.5%	288	6.43	1,852	2,141	624	3,129	1,005	1.66	1.46	88%
1989	23	7.45	488	150	72.9%	669	6.43	4,301	4,970	1,421	9,393	2,704	1.89	1.89	100%
1990	33	10.70	453	128	66.6%	680	6.43	4,369	5,049	1,391	8,574	2,452	1.82	1.70	93%
1991	36	11.66	450	109	71.9%	626	6.43	4,022	4,648	1,143	8,029	1,876	1.86	1.73	93%
1992	42	13.39	392	101	66.8%	586	6.43	3,768	4,355	1,124	7,206	2,000	1.86	1.65	89%
1993	47	15.23	358	98	71.8%	498	6.48	3,230	3,728	997	6,647	1,886	1.92	1.78	93%
1994	41	13.27	205	77	77.2%	265	7.18	1,904	2,170	772	3,898	1,308	1.80	1.80	100%
1995	50	22.56	373	76	73.0%	511	7.01	3,581	4,092	933	7,390	1,734	1.81	1.81	100%
1996	54	19.44	170	56	71.6%	237	6.71	1,588	1,825	610	3,112	1,086	1.71	1.71	100%
1997	72	23.31	276	67	63.7%	434	6.29	2,730	3,164	883	5,337	1,449	1.91	1.69	88%
1998	64	20.71	517	97	61.5%	840	5.78	4,856	5,696	1,410	8,123	1,883	1.87	1.43	76%
1999	53	16.97	663	125	61.8%	1,072	5.27	5,653	6,725	1,547	9,743	2,449	1.81	1.45	80%
2000	80	25.86	501	85	71.2%	703	4.56	3,204	3,907	728	6,860	1,266	1.89	1.76	93%
2001	81	26.23	463	95	68.4%	677	4.53	3,065	3,742	781	5,580	1,242	1.62	1.49	92%
2002	84	27.15	501	77	71.7%	699	5.14	3,595	4,294	797	6,956	1,359	1.72	1.62	94%
2003	83	26.87	312	70	66.4%	470	5.47	2,567	3,036	767	4,546	1,173	1.73	1.50	86%
2004	81	26.22	345	61	64.9%	531	5.56	2,954	3,485	722	4,578	968	1.72	1.31	76%
2005	83	26.87	654	116	74.8%	874	5.65	4,943	5,817	1,164	10,322	2,119	1.81	1.77	98%
2006	75	24.28	469	91	72.0%	652	5.91	3,851	4,502	939	6,876	1,495	1.72	1.53	89%
2007	79	25.58	574	99	73.4%	782	6.01	4,700	5,482	1,112	8,812	1,757	1.74	1.61	92%
2008	82	26.55	600	110	69.2%	866	6.01	5,205	6,072	1,293	9,002	1,850	1.64	1.48	91%
2009	81	26.24	569	100	66.3%	859	6.01	5,160	6,018	1,251	8,410	1,763	1.73	1.40	81%
2010	66	21.37	596	118	72.3%	824	6.01	4,950	5,774	1,236	10,112	2,158	1.85	1.75	95%
2011	82	26.55	489	88	69.0%	708	6.01	4,256	4,964	1,011	7,592	1,556	1.84	1.53	83%

PALO Pacific Loon



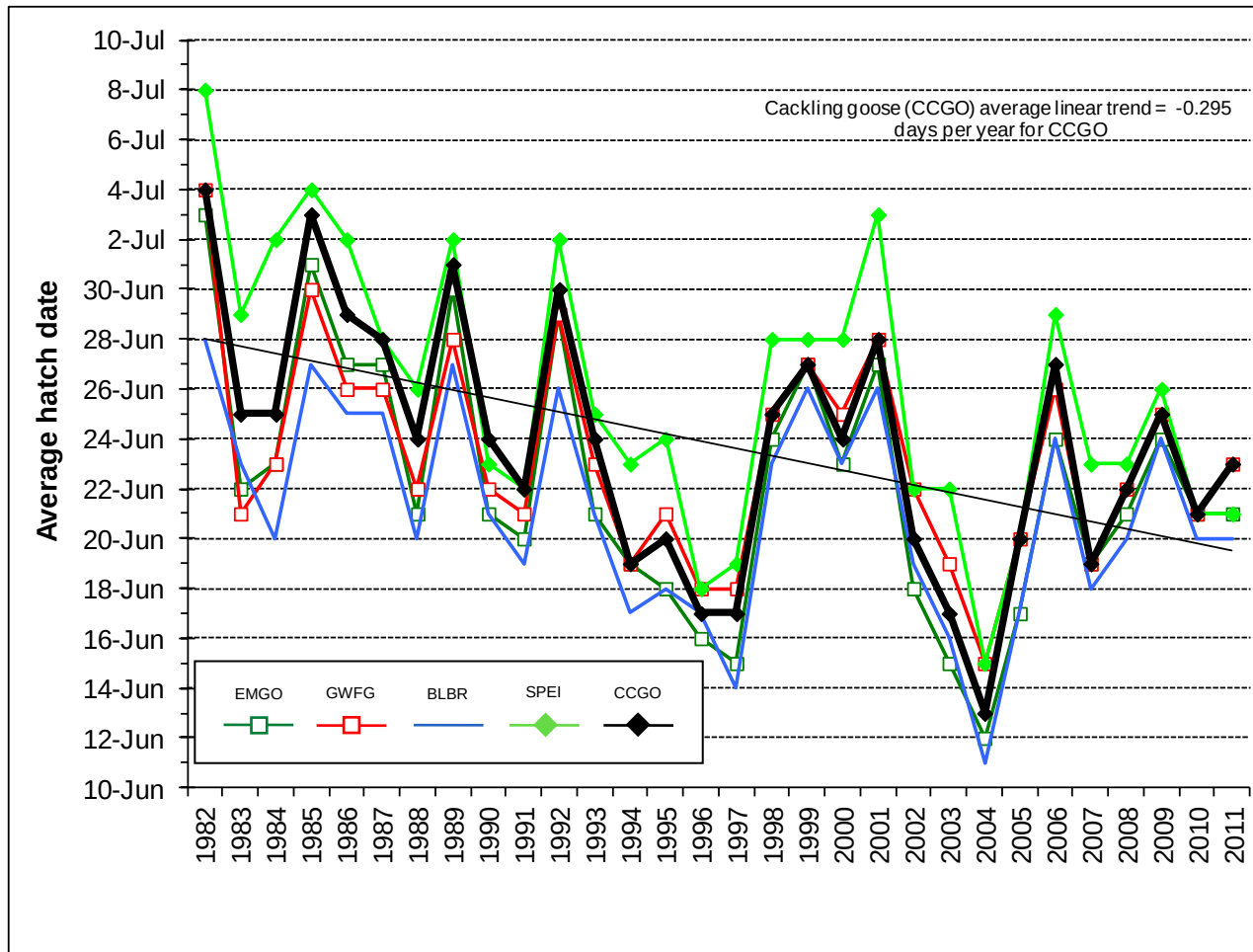
1985-2011 avg annual growth rate= 1.015 (90%c.i.= 1.002-1.028)
2002-2011 last 10 years growth rate= 1.040 (90%c.i.= 1.005-1.074)



1985-2011 avg annual growth rate= 1.012 (90%c.i.= 0.999-1.026)
2002-2011 last 10 years growth rate= 1.042 (90%c.i.= 0.996-1.089)

Year	N plots	Sampled km2	Nest index IN	SE nest index IN	Avg nest detection rate	Corrected nests IN	Aerial OUT:IN 7yr ratio	Corrected nests OUT	Total nests IN+OUT	SE total nests	Total eggs IN+OUT	SE total eggs	Total eggs / active nests	Total eggs / total nests	Corrected % nest success index
1985	49	24.57	732	156	68.7%	1,065	17.27	18,388	19,454	4,741	28,894	6,954	1.64	1.49	90%
1986	46	22.16	928	197	74.4%	1,246	17.27	21,518	22,764	5,375	32,751	7,943	1.64	1.44	88%
1987	37	12.67	1,257	336	63.9%	1,968	17.27	33,982	35,950	12,187	61,255	17,630	1.95	1.70	88%
1988	32	10.48	539	153	73.5%	734	17.27	12,675	13,409	3,921	19,602	6,394	1.66	1.46	88%
1989	23	7.45	1,242	361	72.9%	1,704	17.27	29,429	31,133	8,905	58,836	16,963	1.89	1.89	100%
1990	33	10.70	1,153	304	66.6%	1,732	17.27	29,897	31,629	8,663	53,710	15,363	1.82	1.70	93%
1991	36	11.66	1,146	252	71.9%	1,594	17.27	27,524	29,118	6,967	50,294	11,300	1.86	1.73	93%
1992	42	13.39	998	237	66.8%	1,493	17.27	25,784	27,277	6,918	45,137	12,473	1.86	1.65	89%
1993	47	15.23	911	235	71.8%	1,270	17.38	22,060	23,330	6,196	41,594	11,833	1.92	1.78	93%
1994	41	13.27	604	220	77.2%	783	18.23	14,266	15,048	5,396	27,037	9,075	1.80	1.80	100%
1995	50	22.56	1,023	180	73.0%	1,401	18.33	25,688	27,089	5,489	48,926	10,324	1.81	1.81	100%
1996	54	19.44	456	142	71.6%	637	20.07	12,779	13,416	4,757	22,876	8,481	1.71	1.71	100%
1997	72	23.31	737	159	63.7%	1,156	21.52	24,879	26,035	6,568	43,910	10,658	1.91	1.69	88%
1998	64	20.71	1,315	226	61.5%	2,137	20.97	44,800	46,937	10,968	66,932	14,287	1.87	1.43	76%
1999	53	16.97	1,700	299	61.8%	2,749	18.62	51,189	53,939	12,499	78,143	20,118	1.81	1.45	80%
2000	80	25.86	1,215	188	71.2%	1,706	17.66	30,140	31,846	6,800	55,913	11,822	1.89	1.76	93%
2001	81	26.23	1,092	214	68.4%	1,596	17.15	27,369	28,965	7,035	43,198	11,147	1.62	1.49	92%
2002	84	27.15	1,212	174	71.7%	1,692	17.50	29,608	31,300	6,200	50,705	10,612	1.72	1.62	94%
2003	83	26.87	754	164	66.4%	1,136	16.58	18,829	19,965	4,840	29,894	7,446	1.73	1.50	86%
2004	81	26.22	774	125	64.9%	1,192	17.69	21,087	22,279	4,518	29,263	6,088	1.72	1.31	76%
2005	83	26.87	1,291	215	74.8%	1,725	18.73	32,322	34,047	7,021	60,416	12,829	1.81	1.77	98%
2006	75	24.28	887	165	72.0%	1,231	20.58	25,340	26,571	5,193	40,577	8,383	1.72	1.53	89%
2007	79	25.58	1,104	178	73.4%	1,504	21.04	31,638	33,142	6,114	53,274	9,582	1.74	1.61	92%
2008	82	26.55	1,153	199	69.2%	1,666	21.04	35,043	36,708	7,248	54,420	10,223	1.64	1.48	91%
2009	81	26.24	1,095	179	66.3%	1,651	21.04	34,734	36,385	6,943	50,846	9,823	1.73	1.40	81%
2010	66	21.37	1,146	215	72.3%	1,584	21.04	33,323	34,907	6,945	61,135	12,105	1.85	1.75	95%
2011	82	26.55	940	159	69.0%	1,362	21.04	28,648	30,009	5,566	45,898	8,592	1.84	1.53	83%

Figure 4. 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, 1982-2011. Linear regression on cackling goose hatch date indicates an average linear advance of 0.295 days per year since 1982.



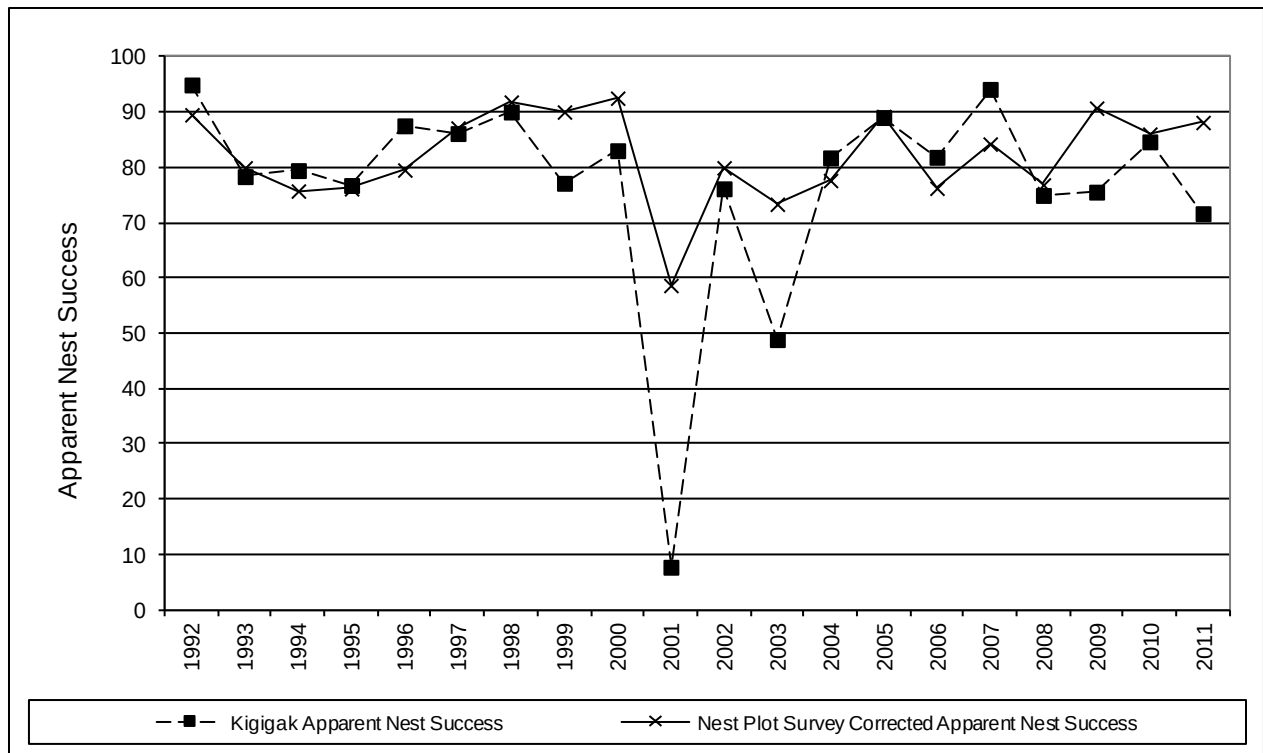


Figure 5. Comparison of spectacled eider apparent nest success measures at Kigigak Island (successful hatched nests/total nests; Gabrielson et al. 2010; M. Gabrielson, USFWS, pers. comm.) and the Yukon-Kuskokwim Delta nest plot survey (active nests at time of search/total nests, corrected for nest detection rate), 1992-2011.

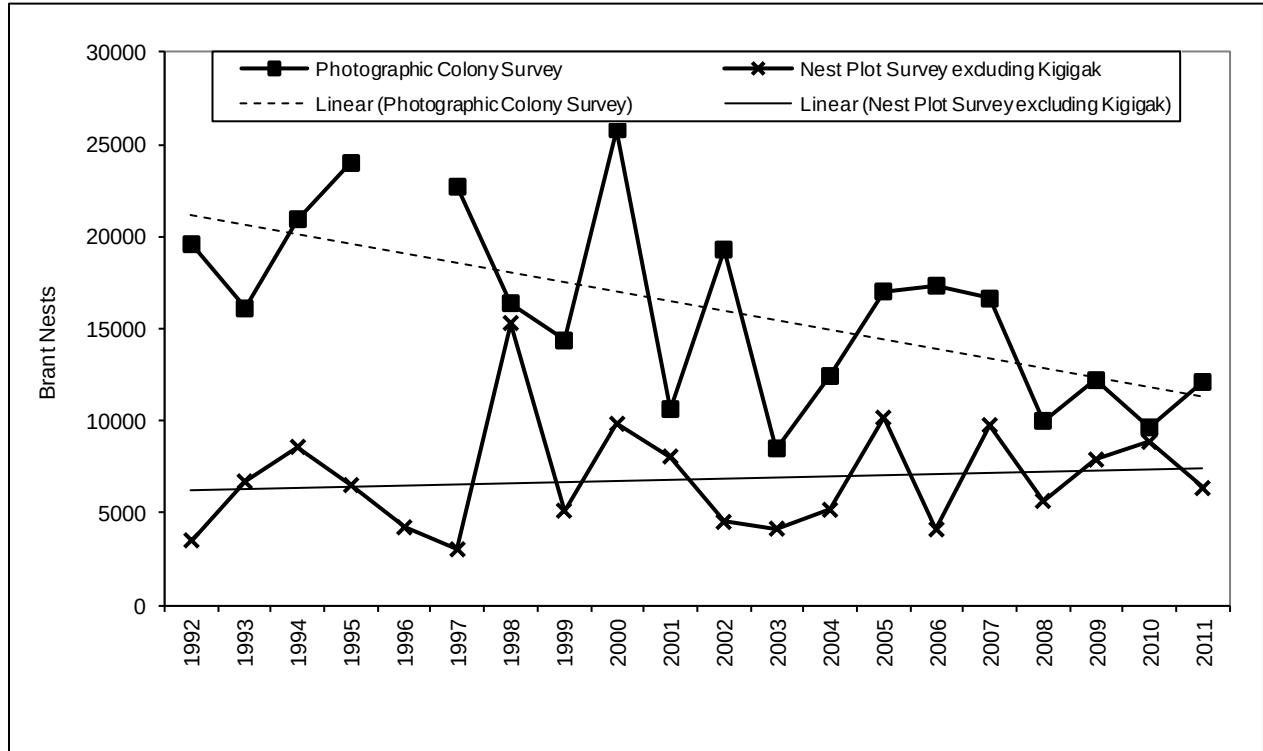


Figure 6. Numbers and trends of black brant nests as measured by an aerial photographic survey in five primary colonies (black squares, dashed line; Wilson 2011) and by the nest plot survey (black crosses, solid line). Nest estimates from the nest plot survey represent the ground sampled area only, not expanded to entire coastal zone) and exclude the brant colony at Kigigak Island.

Table 1. Estimated 10-year average (2002-2011) population sizes and growth rates (90% CI) of nests and eggs on the YKD coastal zone (12,832 km²). 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	114,975	1.057 (1.026-1.089)	422,178	1.078 (1.023-1.133)
Emperor Goose	39,496	1.032 (1.008-1.056)	177,266	1.035 (1.000-1.069)
White-fronted Goose	156,241	1.080 (1.055-1.105)	642,206	1.075 (1.042-1.107)
Black Brant	32,141	1.007 (0.936-1.078)	83,670	1.085 (0.959-1.212)
Tundra Swan	11,907	0.977 (0.957-1.001)	45,689	0.944 (0.902-0.986)
Sandhill Crane	18,381	0.978 (0.938-1.019)	33,219	0.969 (0.928-1.010)
Spectacled Eider	4,926	1.049 (0.994-1.105)	19,683	1.064 (1.001-1.126)
Common Eider	3,108	1.082 (0.975-1.190)	13,347	1.090 (0.976-1.205)
Glaucous Gull	16,065	0.963 (0.918-1.009)	37,760	1.002 (0.955-1.049)
Mew Gull	11,546	1.003 (0.940-1.067)	27,228	1.004 (0.940-1.069)
Sabine's Gull	13,924	1.084 (0.997-1.172)	30,078	1.082 (0.961-1.203)
Arctic Tern	17,197	0.982 (0.907-1.057)	29,756	0.954 (0.882-1.027)
Red-throated Loon	4,945	1.055 (1.019-1.091)	7,721	1.058 (1.009-1.106)
Pacific Loon	30,531	1.040 (1.005-1.074)	47,643	1.042 (0.996-1.089)

Table 2. Estimated 27-year average (1985-2011) population sizes and growth rates (90% CI) of nests and eggs on the YKD coastal zone (12,832 km²). Nest and egg estimates are corrected for average nest detection rate. Growth rates significantly different from zero are indicated by bold red font.

Species	Mean Nest Population	Nest Population Growth Rate (90% CI)	Mean Egg Population	Egg Population Growth Rate (90% CI)
Cackling Goose	88,714	1.055 (1.044-1.066)	322,432	1.061 (1.044-1.078)
Emperor Goose	36,596	1.011 (1.000-1.023)	164,533	1.014 (0.999-1.029)
White-fronted Goose	98,401	1.094 (1.081-1.108)	406,657	1.094 (1.078-1.110)
Black Brant	38,184	0.994 (0.973-1.016)	102,838	1.002 (0.971-1.032)
Tundra Swan	10,260	1.017 (1.010-1.025)	38,272	1.015 (1.003-1.027)
Sandhill Crane	16,984	1.003 (0.991-1.015)	29,013	1.011 (0.996-1.027)
Spectacled Eider	4,472	1.003 (0.991-1.015)	17,470	1.011 (0.996-1.027)
Common Eider	1,993	1.089 (1.063-1.114)	8,477	1.095 (1.064-1.125)
Glaucous Gull	15,221	1.007 (0.993-1.021)	35,010	1.017 (1.003-1.032)
Mew Gull	9,601	1.014 (0.992-1.036)	22,525	1.021 (0.998-1.043)
Sabine's Gull	10,169	1.073 (1.050-1.097)	22,626	1.058 (1.033-1.082)
Arctic Tern	11,432	1.076 (1.046-1.107)	20,738	1.073 (1.040-1.106)
Red-throated Loon	4,375	1.016 (1.003-1.030)	7,031	1.013 (0.999-1.027)
Pacific Loon	28,987	1.015 (1.002-1.028)	46,498	1.012 (0.999-1.026)

Table 3. Estimated nest initiation and hatch date based on egg float angles (1982-2011). Means calculated using nest as sample unit. Years with fewer than 3 nests per species not included in calculations.

Cackling Goose						Emperor Geese					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	5-Jun	9.3	4-Jul	6.8	170	1982	5-Jun	8.2	4-Jul	6.4	71
1983	25-May	9.5	24-Jun	8.2	428	1983	22-May	9.3	20-Jun	7.7	177
1984	29-May	9.4	27-Jun	8.5	328	1984	26-May	10.3	24-Jun	8.2	161
1985	4-Jun	8.0	2-Jul	6.3	278	1985	2-Jun	7.6	1-Jul	5.7	107
1986	31-May	8.1	30-Jun	6.3	347	1986	29-May	7.4	27-Jun	5.6	197
1987	29-May	8.0	28-Jun	6.3	209	1987	30-May	7.3	27-Jun	5.5	142
1988	26-May	10.7	24-Jun	9.0	88	1988	24-May	8.9	22-Jun	6.8	102
1989	1-Jun	8.1	30-Jun	6.5	55	1989	1-Jun	8.1	30-Jun	6.0	63
1990	25-May	7.8	24-Jun	6.9	195	1990	23-May	8.6	21-Jun	6.5	100
1991	24-May	7.7	22-Jun	6.5	356	1991	22-May	7.2	20-Jun	6.0	263
1992	1-Jun	7.1	1-Jul	6.0	397	1992	1-Jun	6.5	30-Jun	5.0	184
1993	26-May	7.1	24-Jun	6.0	358	1993	24-May	7.2	21-Jun	5.9	139
1994	21-May	7.8	19-Jun	6.5	409	1994	21-May	7.4	19-Jun	5.8	192
1995	22-May	7.0	20-Jun	6.2	725	1995	21-May	7.4	18-Jun	6.0	188
1996	20-May	7.7	18-Jun	6.7	755	1996	19-May	6.3	17-Jun	5.1	185
1997	19-May	7.3	17-Jun	6.7	812	1997	18-May	7.5	15-Jun	5.8	153
1998	27-May	6.1	25-Jun	5.2	889	1998	27-May	6.5	24-Jun	5.2	215
1999	29-May	7.3	27-Jun	6.4	772	1999	30-May	6.5	27-Jun	5.6	188
2000	27-May	6.8	25-Jun	6.0	1014	2000	26-May	7.2	24-Jun	5.9	280
2001	31-May	6.3	28-Jun	5.8	522	2001	29-May	7.5	27-Jun	5.4	104
2002	22-May	6.4	20-Jun	5.3	930	2002	20-May	6.6	17-Jun	5.3	249
2003	19-May	9.1	17-Jun	7.9	562	2003	18-May	8.6	15-Jun	6.8	153
2004	16-May	7.9	14-Jun	7.1	964	2004	15-May	7.7	13-Jun	6.2	253
2005	22-May	8.4	20-Jun	7.4	957	2005	19-May	9.4	17-Jun	7.2	303
2006	29-May	6.4	27-Jun	5.3	845	2006	27-May	6.3	24-Jun	5.0	253
2007	21-May	7.1	19-Jun	6.2	1027	2007	21-May	7.0	19-Jun	5.4	275
2008	25-May	6.1	23-Jun	5.2	906	2008	24-May	6.9	22-Jun	5.2	240
2009	27-May	6.4	25-Jun	5.6	1374	2009	26-May	6.5	24-Jun	5.1	349
2010	23-May	6.5	21-Jun	5.7	773	2010	23-May	6.4	20-Jun	5.2	189
2011	25-May	6.7	23-Jun	5.8	902	2011	24-May	6.6	21-Jun	5.0	206
Mean	26-May		23-Jun			Mean	25-May		22-Jun		

Table 3. Estimated nest initiation and hatch date continued.

White-fronted Geese						Black Brant					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	6-Jun	7.0	4-Jul	6.4	14	1982	--	--	--	--	--
1983	22-May	7.5	20-Jun	7.1	172	1983	24-May	9.1	19-Jun	6.7	448
1984	24-May	10.3	22-Jun	8.7	84	1984	30-May	7.4	25-Jun	6.6	440
1985	31-May	6.6	30-Jun	4.7	42	1985	1-Jun	4.8	27-Jun	6.0	29
1986	28-May	7.4	26-Jun	6.6	102	1986	30-May	5.6	26-Jun	4.7	131
1987	28-May	6.5	26-Jun	5.2	61	1987	1-Jun	5.2	25-Jun	3.5	172
1988	25-May	9.0	23-Jun	7.3	32	1988	25-May	9.0	20-Jun	7.2	51
1989	30-May	8.1	28-Jun	6.2	21	1989	1-Jun	6.4	27-Jun	5.6	40
1990	24-May	7.2	22-Jun	6.4	52	1990	25-May	5.8	22-Jun	6.2	130
1991	23-May	7.9	21-Jun	6.7	138	1991	24-May	6.6	19-Jun	6.0	183
1992	1-Jun	6.8	30-Jun	5.6	115	1992	1-Jun	6.5	27-Jun	5.9	152
1993	26-May	6.3	23-Jun	5.7	84	1993	26-May	6.0	21-Jun	5.5	107
1994	21-May	8.0	19-Jun	5.9	129	1994	21-May	6.8	17-Jun	5.9	93
1995	23-May	8.0	21-Jun	6.8	178	1995	23-May	7.7	18-Jun	6.7	41
1996	21-May	8.6	19-Jun	7.5	144	1996	23-May	6.4	18-Jun	4.9	44
1997	20-May	8.0	18-Jun	6.6	184	1997	19-May	7.6	14-Jun	7.0	100
1998	28-May	6.7	25-Jun	5.5	261	1998	28-May	6.5	23-Jun	5.5	260
1999	30-May	7.6	27-Jun	6.7	208	1999	31-May	7.2	26-Jun	6.6	108
2000	27-May	8.2	26-Jun	6.6	334	2000	29-May	6.3	24-Jun	5.7	216
2001	31-May	6.9	28-Jun	5.8	311	2001	1-Jun	6.2	26-Jun	5.5	77
2002	24-May	6.3	22-Jun	5.0	306	2002	24-May	7.5	19-Jun	6.6	163
2003	21-May	8.7	19-Jun	7.4	272	2003	21-May	8.2	16-Jun	7.5	56
2004	17-May	8.0	16-Jun	6.5	364	2004	17-May	8.5	12-Jun	7.9	101
2005	23-May	8.0	20-Jun	6.9	438	2005	22-May	6.9	17-Jun	6.6	148
2006	28-May	7.2	26-Jun	5.9	370	2006	29-May	6.5	23-Jun	5.7	123
2007	21-May	7.6	19-Jun	6.2	446	2007	22-May	7.1	17-Jun	6.1	147
2008	25-May	6.8	23-Jun	5.6	327	2008	27-May	5.9	21-Jun	5.3	103
2009	27-May	6.7	25-Jun	5.6	477	2009	29-May	7.7	24-Jun	6.7	202
2010	23-May	7.3	21-Jun	6.0	353	2010	25-May	7.9	20-Jun	7.0	134
2011	25-May	7.3	23-Jun	5.8	549	2011	25-May	6.2	20-Jun	5.6	50
Mean	25-May		23-Jun			Mean	26-May		21-Jun		

Table 3. Estimated nest initiation and hatch date continued.

Tundra Swan						Sandhill Crane					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	2-Jun	10.1	5-Jul	9.6	11	1982	24-May	2.0	24-Jun	2.0	4
1983	19-May	6.3	24-Jun	6.5	11	1983	23-May	11.9	22-Jun	11.5	21
1984	23-May	10.2	26-Jun	9.7	9	1984	19-May	4.5	20-Jun	8.5	9
1985	31-May	8.0	4-Jul	7.0	14	1985	30-May	7.0	30-Jun	6.6	13
1986	25-May	8.7	28-Jun	8.6	24	1986	27-May	8.8	26-Jun	9.3	26
1987	27-May	7.1	30-Jun	6.5	12	1987	25-May	8.6	24-Jun	8.4	16
1988	23-May	11.9	26-Jun	10.6	5	1988	20-May	4.4	20-Jun	4.4	6
1989	27-May	3.2	2-Jul	2.7	4	1989	19-May	3.3	19-Jun	3.3	2
1990	22-May	4.1	24-Jun	3.6	4	1990	19-May	4.4	18-Jun	4.5	9
1991	21-May	9.8	25-Jun	9.5	12	1991	16-May	7.1	16-Jun	7.0	25
1992	29-May	9.0	1-Jul	8.8	9	1992	30-May	5.2	30-Jun	5.2	11
1993	22-May	7.4	26-Jun	7.7	6	1993	19-May	4.6	19-Jun	4.8	14
1994	18-May	8.7	22-Jun	7.5	9	1994	14-May	2.1	14-Jun	2.6	5
1995	23-May	4.6	26-Jun	4.7	9	1995	18-May	9.0	17-Jun	8.7	10
1996	17-May	8.4	20-Jun	9.3	9	1996	15-May	5.9	15-Jun	5.8	14
1997	18-May	7.6	21-Jun	5.8	13	1997	15-May	7.3	14-Jun	7.2	8
1998	28-May	8.4	30-Jun	7.7	20	1998	20-May	4.5	20-Jun	4.5	19
1999	29-May	7.1	1-Jul	7.1	14	1999	23-May	4.9	23-Jun	4.5	12
2000	24-May	8.4	27-Jun	7.6	22	2000	20-May	7.1	20-Jun	7.0	22
2001	28-May	9.2	1-Jul	9.0	16	2001	21-May	2.5	20-Jun	1.9	7
2002	22-May	5.2	26-Jun	4.9	10	2002	19-May	10.5	19-Jun	10.5	12
2003	13-May	7.2	18-Jun	6.5	21	2003	13-May	9.6	13-Jun	9.6	13
2004	14-May	8.1	20-Jun	7.7	16	2004	16-May	6.8	16-Jun	6.5	10
2005	21-May	7.9	23-Jun	6.8	18	2005	15-May	6.4	15-Jun	6.4	23
2006	29-May	6.0	1-Jul	6.9	14	2006	23-May	8.9	23-Jun	8.5	19
2007	21-May	7.2	24-Jun	6.7	19	2007	12-May	7.8	12-Jun	7.8	16
2008	26-May	6.2	29-Jun	5.3	19	2008	21-May	4.3	21-Jun	4.2	12
2009	29-May	7.7	2-Jul	6.6	19	2009	23-May	8.8	22-Jun	8.9	20
2010	23-May	8.3	27-Jun	8.5	14	2010	18-May	5.3	18-Jun	5.5	17
2011	24-May	7.6	27-Jun	6.9	20	2011	20-May	9.8	20-Jun	9.4	14
Mean	24-May		27-Jun			Mean	20-May		19-Jun		

Table 3. Estimated nest initiation and hatch date continued.

Spectacled Eider						Common Eider					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	13-Jun	9.4	8-Jul	5.2	18	1982	11-Jun	3.0	9-Jul	1.4	4
1983	28-May	12.3	24-Jun	11.6	35	1983	29-May	5.6	26-Jun	6.2	3
1984	6-Jun	9.1	30-Jun	8.8	9	1984	--	--	--	--	--
1985	7-Jun	9.0	4-Jul	7.6	20	1985	--	--	--	--	--
1986	8-Jun	10.7	3-Jul	9.0	38	1986	--	--	--	--	--
1987	31-May	8.2	28-Jun	7.4	28	1987	1-Jun	5.3	29-Jun	5.7	10
1988	30-May	6.8	27-Jun	7.0	19	1988	--	--	--	--	--
1989	4-Jun	10.6	2-Jul	9.0	5	1989	2-Jun	7.4	2-Jul	6.1	4
1990	26-May	5.4	23-Jun	4.9	15	1990	23-May	3.3	22-Jun	2.1	3
1991	24-May	10.1	22-Jun	9.3	25	1991	28-May	5.9	26-Jun	5.7	27
1992	4-Jun	7.5	3-Jul	6.0	18	1992	4-Jun	6.2	3-Jul	5.3	12
1993	28-May	7.1	24-Jun	7.3	18	1993	25-May	5.4	24-Jun	5.2	5
1994	26-May	13.0	23-Jun	11.2	15	1994	26-May	10.1	24-Jun	9.2	9
1995	26-May	8.0	24-Jun	7.3	44	1995	25-May	11.2	23-Jun	10.7	13
1996	22-May	7.1	19-Jun	6.9	33	1996	22-May	11.1	20-Jun	10.5	14
1997	23-May	8.1	19-Jun	7.2	39	1997	22-May	9.4	19-Jun	8.0	15
1998	31-May	8.6	28-Jun	7.4	52	1998	30-May	6.8	28-Jun	6.2	18
1999	31-May	10.3	28-Jun	9.7	51	1999	2-Jun	9.5	30-Jun	9.8	12
2000	31-May	8.2	28-Jun	8.0	52	2000	1-Jun	5.8	30-Jun	4.9	23
2001	6-Jun	8.8	3-Jul	6.7	32	2001	2-Jun	7.6	30-Jun	7.0	23
2002	24-May	7.4	21-Jun	6.5	59	2002	25-May	7.7	24-Jun	6.8	17
2003	25-May	11.0	22-Jun	10.1	36	2003	25-May	12.1	22-Jun	10.8	16
2004	19-May	10.3	16-Jun	9.3	57	2004	21-May	9.5	18-Jun	8.7	18
2005	24-May	9.2	20-Jun	8.7	101	2005	21-May	8.4	19-Jun	8.2	34
2006	1-Jun	9.4	29-Jun	8.5	78	2006	2-Jun	7.7	1-Jul	6.8	52
2007	26-May	8.8	23-Jun	8.0	68	2007	22-May	7.2	20-Jun	6.9	50
2008	27-May	10.2	24-Jun	9.3	73	2008	27-May	7.4	25-Jun	6.8	34
2009	30-May	9.2	26-Jun	8.3	124	2009	28-May	5.7	26-Jun	5.5	33
2010	24-May	7.5	21-Jun	6.8	71	2010	26-May	5.7	24-Jun	5.4	41
2011	28-May	10.1	25-Jun	9.0	50	2011	25-May	7.6	23-Jun	6.4	10
Mean	29-May		25-Jun			Mean	28-May		25-Jun		

Table 3. Estimated nest initiation and hatch date continued.

Pacific Loon, Red-throated Loon						Glaucous Gull					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	13-Jun	7.7	8-Jul	3.7	25	1982	11-Jun	8.0	5-Jul	6.2	23
1983	2-Jun	11.7	29-Jun	9.9	16	1983	28-May	10.4	21-Jun	9.9	19
1984	5-Jun	6.3	3-Jul	6.3	5	1984	30-May	4.8	25-Jun	9.7	8
1985	12-Jun	10.9	7-Jul	6.7	15	1985	8-Jun	6.1	3-Jul	6.3	23
1986	8-Jun	9.3	5-Jul	6.2	38	1986	2-Jun	8.0	27-Jun	7.4	19
1987	5-Jun	6.5	3-Jul	5.9	35	1987	3-Jun	8.4	27-Jun	8.1	19
1988	31-May	11.2	28-Jun	11.7	5	1988	29-May	8.9	23-Jun	9.1	9
1989	5-Jun	12.3	2-Jul	10.4	5	1989	28-May	0.0	22-Jun	0.0	3
1990	3-Jun	6.8	1-Jul	6.6	11	1990	24-May	2.5	19-Jun	4.1	3
1991	29-May	7.1	26-Jun	6.9	21	1991	24-May	7.2	18-Jun	7.3	26
1992	9-Jun	7.0	6-Jul	4.8	15	1992	3-Jun	5.9	27-Jun	5.6	24
1993	28-May	6.9	25-Jun	6.6	12	1993	26-May	9.9	20-Jun	9.4	11
1994	27-May	6.0	24-Jun	5.7	6	1994	23-May	7.5	17-Jun	7.0	17
1995	29-May	5.7	26-Jun	5.4	10	1995	24-May	4.2	17-Jun	4.4	17
1996	27-May	7.2	23-Jun	7.3	9	1996	22-May	4.3	15-Jun	4.2	15
1997	25-May	6.6	22-Jun	6.5	17	1997	23-May	8.8	17-Jun	8.2	19
1998	3-Jun	8.5	30-Jun	8.0	37	1998	28-May	7.5	22-Jun	7.2	64
1999	5-Jun	8.6	3-Jul	8.1	48	1999	2-Jun	9.5	26-Jun	9.1	25
2000	3-Jun	7.8	1-Jul	7.7	40	2000	29-May	8.8	23-Jun	8.6	72
2001	6-Jun	8.4	4-Jul	7.2	27	2001	31-May	7.9	24-Jun	7.9	50
2002	29-May	6.2	26-Jun	5.9	42	2002	23-May	7.7	17-Jun	7.4	56
2003	27-May	8.9	24-Jun	9.0	14	2003	20-May	7.8	13-Jun	7.4	58
2004	27-May	9.7	24-Jun	9.4	10	2004	17-May	7.2	11-Jun	7.0	21
2005	30-May	10.3	27-Jun	10.0	42	2005	20-May	8.0	14-Jun	7.7	69
2006	4-Jun	4.1	2-Jul	4.0	22	2006	31-May	8.6	24-Jun	8.3	46
2007	27-May	7.1	24-Jun	7.3	31	2007	22-May	7.2	15-Jun	7.1	76
2008	1-Jun	8.5	29-Jun	8.1	46	2008	27-May	7.2	21-Jun	6.8	67
2009	4-Jun	8.4	1-Jul	7.9	35	2009	29-May	7.7	23-Jun	7.6	59
2010	31-May	6.4	28-Jun	6.2	28	2010	27-May	9.1	20-Jun	8.5	28
2011	1-Jun	7.6	29-Jun	7.6	29	2011	27-May	9.1	21-Jun	8.5	23
Mean	1-Jun		29-Jun			Mean	27-May		20-Jun		

Table 3. Estimated nest initiation and hatch date continued.

Mew Gull						Sabine's Gull					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	17-Jun	4.6	9-Jul	1.9	11	1982	--	--	--	--	--
1983	30-May	11.3	23-Jun	11.0	9	1983	28-May	11.9	21-Jun	13.0	3
1984	--	--	--	--	--	1984	--	--	--	--	--
1985	11-Jun	7.2	4-Jul	6.4	8	1985	9-Jun	12.7	2-Jul	9.7	3
1986	7-Jun	13.0	2-Jul	10.6	18	1986	31-May	11.2	24-Jun	10.1	7
1987	2-Jun	8.5	26-Jun	7.4	8	1987	28-May	10.1	21-Jun	9.1	7
1988	25-May	7.1	19-Jun	6.5	4	1988	1-Jun	9.6	25-Jun	9.1	8
1989	--	--	--	--	--	1989	--	--	--	--	--
1990	--	--	--	--	--	1990	--	--	--	--	--
1991	26-May	7.6	20-Jun	8.1	8	1991	22-May	5.5	15-Jun	5.9	9
1992	4-Jun	5.1	28-Jun	4.9	10	1992	--	--	--	--	--
1993	31-May	9.3	24-Jun	8.9	7	1993	24-May	5.8	17-Jun	5.6	8
1994	21-May	6.4	15-Jun	6.1	8	1994	18-May	6.6	11-Jun	5.4	6
1995	24-May	3.3	18-Jun	3.5	16	1995	25-May	9.8	18-Jun	8.6	6
1996	21-May	6.0	15-Jun	5.5	10	1996	18-May	5.4	12-Jun	4.7	3
1997	25-May	5.7	19-Jun	5.7	8	1997	21-May	6.7	14-Jun	6.9	8
1998	30-May	7.0	24-Jun	6.5	19	1998	28-May	10.1	20-Jun	9.4	11
1999	1-Jun	9.1	25-Jun	8.8	25	1999	27-May	7.2	20-Jun	7.4	20
2000	1-Jun	8.4	26-Jun	8.0	17	2000	30-May	9.8	23-Jun	9.8	7
2001	2-Jun	8.7	27-Jun	8.2	18	2001	3-Jun	6.6	27-Jun	6.4	10
2002	22-May	8.3	16-Jun	8.0	40	2002	21-May	8.4	14-Jun	8.2	28
2003	23-May	8.3	17-Jun	8.1	20	2003	19-May	7.7	12-Jun	7.5	5
2004	21-May	4.4	14-Jun	3.9	19	2004	17-May	13.2	10-Jun	12.0	3
2005	26-May	8.9	19-Jun	8.5	32	2005	23-May	9.7	16-Jun	9.3	30
2006	2-Jun	9.3	26-Jun	9.1	45	2006	28-May	3.9	22-Jun	3.7	23
2007	24-May	8.3	18-Jun	7.8	32	2007	24-May	8.9	17-Jun	8.2	30
2008	27-May	7.2	20-Jun	6.9	42	2008	25-May	7.0	18-Jun	6.7	17
2009	30-May	7.4	24-Jun	7.2	54	2009	29-May	10.0	22-Jun	9.6	17
2010	26-May	5.4	20-Jun	5.1	44	2010	22-May	3.0	15-Jun	2.6	20
2011	30-May	7.9	24-Jun	8.1	18	2011	23-May	3.8	17-Jun	4.0	40
Mean	28-May		22-Jun			Mean	25-May		19-Jun		

Table 3. Estimated nest initiation and hatch date continued.

Arctic Tern						Greater Scaup, Long-tailed Duck					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	--	1982	18-Jun	5.8	10-Jul	0.0	5
1983	--	--	--	--	--	1983	--	--	--	--	--
1984	--	--	--	--	--	1984	--	--	--	--	--
1985	6-Jun	6.1	29-Jun	5.7	8	1985	--	--	--	--	--
1986	3-Jun	14.7	26-Jun	13.7	6	1986	7-Jun	5.9	9-Jul	3.4	4
1987	1-Jun	4.7	24-Jun	4.7	3	1987	6-Jun	6.7	7-Jul	5.4	4
1988	--	--	--	--	--	1988	--	--	--	--	--
1989	--	--	--	--	--	1989	--	--	--	--	--
1990	--	--	--	--	--	1990	--	--	--	--	--
1991	24-May	4.8	17-Jun	4.8	4	1991	--	--	--	--	--
1992	8-Jun	8.6	2-Jul	8.1	6	1992	7-Jun	6.3	8-Jul	5.4	21
1993	23-May	2.8	17-Jun	3.9	3	1993	2-Jun	5.7	2-Jul	3.3	18
1994	--	--	--	--	--	1994	2-Jun	3.8	2-Jul	1.4	7
1995	23-May	4.7	16-Jun	5.1	3	1995	3-Jun	7.9	3-Jul	8.7	14
1996	--	--	--	--	--	1996	31-May	11.7	29-Jun	9.3	7
1997	--	--	--	--	--	1997	27-May	10.4	27-Jun	10.0	10
1998	3-Jun	10.5	26-Jun	10.0	5	1998	2-Jun	7.5	4-Jul	6.4	14
1999	2-Jun	5.2	26-Jun	5.1	8	1999	8-Jun	8.0	8-Jul	3.9	10
2000	3-Jun	4.8	26-Jun	4.8	5	2000	5-Jun	5.5	7-Jul	5.2	26
2001	29-May	7.7	22-Jun	8.2	5	2001	11-Jun	8.1	7-Jul	4.0	6
2002	25-May	6.2	18-Jun	5.8	37	2002	31-May	6.0	1-Jul	2.3	8
2003	21-May	7.8	13-Jun	7.2	5	2003	30-May	3.6	30-Jun	1.3	3
2004	25-May	11.5	17-Jun	10.9	9	2004	--	--	--	--	--
2005	28-May	8.1	21-Jun	7.7	15	2005	1-Jun	9.4	1-Jul	7.1	9
2006	30-May	5.9	23-Jun	5.7	17	2006	3-Jun	6.4	5-Jul	5.2	5
2007	23-May	7.5	16-Jun	7.3	18	2007	2-Jun	5.0	2-Jul	2.5	5
2008	28-May	7.9	21-Jun	7.5	16	2008	--	--	--	--	--
2009	2-Jun	7.5	26-Jun	7.4	30	2009	3-Jun	9.5	3-Jul	8.1	7
2010	30-May	8.8	22-Jun	8.5	9	2010	29-May	10.0	29-Jun	10.9	6
2011	30-May	9.6	24-Jun	9.4	19	2011	31-May	5.8	1-Jul	5.3	4
Mean	27-May		22-Jun			Mean	2-Jun		3-Jul		

Table 3. Estimated nest initiation and hatch date continued.

Pintail, Shoveler, Mallard, Teal						Small Shorebirds					
Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)	Year	Mean Initiation	90% CI (days)	Mean Hatch	90% CI (days)	n (nests)
1982	--	--	--	--	--	1982	--	--	--	--	--
1983	--	--	--	--	--	1983	--	--	--	--	--
1984	--	--	--	--	--	1984	--	--	--	--	--
1985	--	--	--	--	--	1985	13-Jun	12.9	3-Jul	11.6	4
1986	6-Jun	8.0	3-Jul	7.4	13	1986	1-Jun	13.3	27-Jun	9.6	23
1987	6-Jun	8.4	3-Jul	8.1	12	1987	28-May	5.9	21-Jun	4.7	7
1988	--	--	--	--	--	1988	--	--	--	--	--
1989	9-Jun	0.0	6-Jul	0.0	4	1989	1-Jun	12.8	24-Jun	11.7	3
1990	1-Jun	2.5	28-Jun	4.1	4	1990	--	--	--	--	--
1991	27-May	7.2	24-Jun	7.3	13	1991	28-May	12.2	22-Jun	11.9	21
1992	7-Jun	5.9	5-Jul	5.6	18	1992	3-Jun	4.0	28-Jun	4.2	11
1993	1-Jun	9.9	28-Jun	9.4	16	1993	27-May	7.1	20-Jun	6.9	15
1994	31-May	7.5	28-Jun	7.0	5	1994	--	--	--	--	--
1995	1-Jun	4.2	27-Jun	4.4	11	1995	26-May	7.6	19-Jun	7.6	6
1996	28-May	4.3	26-Jun	4.2	10	1996	27-May	13.7	20-Jun	13.9	10
1997	20-May	8.8	17-Jun	8.2	4	1997	19-May	3.6	12-Jun	3.4	3
1998	4-Jun	7.5	1-Jul	7.2	39	1998	29-May	8.3	22-Jun	7.3	8
1999	3-Jun	9.5	2-Jul	9.1	17	1999	31-May	7.0	25-Jun	6.9	17
2000	3-Jun	8.8	1-Jul	8.6	28	2000	30-May	7.2	24-Jun	6.4	13
2001	5-Jun	7.9	2-Jul	7.9	13	2001	2-Jun	8.3	27-Jun	8.1	22
2002	28-May	7.7	24-Jun	7.4	21	2002	25-May	5.7	19-Jun	5.8	21
2003	22-May	7.8	20-Jun	7.4	8	2003	21-May	2.8	15-Jun	2.8	3
2004	21-May	7.2	19-Jun	7.0	19	2004	20-May	5.9	13-Jun	6.1	10
2005	26-May	8.0	23-Jun	7.7	24	2005	26-May	7.3	20-Jun	6.7	30
2006	3-Jun	8.6	1-Jul	8.3	15	2006	2-Jun	9.0	26-Jun	8.1	29
2007	25-May	7.2	22-Jun	7.1	17	2007	24-May	7.5	19-Jul	14.5	33
2008	30-May	7.2	27-Jun	6.8	21	2008	26-May	8.3	20-Jun	7.8	53
2009	31-May	7.7	28-Jun	7.6	16	2009	1-Jun	8.2	26-Jun	8.0	23
2010	27-May	9.1	24-Jun	8.5	18	2010	27-May	9.2	21-Jun	8.9	29
2011	28-May	7.4	26-Jun	4.9	6	2011	26-May	5.9	19-Jun	5.8	26
Mean	30-May		28-Jun			Mean	29-May		21-Jun		

Table 4. Numbers and proportions of plots with fox sign (observed fox, scat, fur, tracks, and/or active dens) and vole sign (observed voles, digging, runways), 1988-2011.

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
Mean	61	30	21	0.47	0.35