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Key site monitoring on Grindøya in 2008

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Grindøya (69°38’N 18°49’E) near Tromsø is not a full SEAPOP key-site, but is included in the programme because the most extensive time series for common eiders breeding on mainland Norway have been collected here since 1985. These time series include laying date, clutch size and the longest data series on adult survival (of females) of any marine bird species in Norwegian areas. Many other aspects of the Grindøya eider population have also been extensively studied, with special focus on parental care and parental investment. Two PhD students and nine master students have collected data for their theses at this colony. Today, the Grindøya population is also a part of a large international project on bird health led by Sveinn Are Hanssen and funded by the Norwegian Research Council as an International Polar Year (IPY) project. In 2008, a new project was started to analyse the relationship between the variation in climate and various life history traits in common eiders in two populations (the Grindøya population and one population from arctic Canada). A post doc, Sebastian Descamps at the National Wildlife Research Centre at Carleton University is working full time on these analyses in cooperation with the Grindøya team from NINA and Nigel Yoccoz at the University of Tromsø

In 2000, the outer parts of Balsfjorden near Grindøya were included as part of one of the National monitoring areas for common eider with annual counts of adult males made early in the breeding season each year. Numbers declined by ca 30% between 2005 (713 males) and 2007 (528 males), and by a further 14.3% from 2007 to 2008 (491 males). This large decline in the wintering population is worrying and is also consistent with a strong decline in the estimated survival of breeding females at Grindøya, which in 2008 was at the lowest level since the first estimate made in 1986.

The mean clutch size in 2008 was 4.4 eggs (Table 1), which is within the range of that observed between 1986 and 2007 (3.1 to 4.5 eggs). The survival of breeding females, however, has steadily declined since 2001 and is now at a very low level of 53% (Table 1). The survival in 1986-2002 (above 80%) was much higher than that observed in 2003-2006 (less than 70%) and the decrease around 2002 coincides with an increase in predation by feral mink on incubating females. Since 2002, we have observed a skew towards males in the sex ratio of birds wintering in the area with more than 60% males, corroborating the observed increased mortality of breeding females. Such a skew in sex ratio of common eiders towards males on the wintering ground has also been shown in Finland during recent years (see also the SEAPOP report for 2007).

Table 1 *Key population parameters (SE, n) of common eider on Grindøya in 2008. Population change is the change in number of adult males registered in breeding areas between 2007 and 2008 on the basis of total counts (t) of males. The listed survival estimate was derived from the basic model(s) that fitted the data set best (i.e. those with ΔQAICc < 2 when adjusting for median c-hat).*

Species	**Population change**	**Annual adult survival**		**Reproductive performance**	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Eider	– 14.3% t	2006-07 (1)	53.0 (0.10, 1278)	Clutch size	4.37 (0.69, 25)

Table 2 *Summary of demographic parameters (range) used for modelling the effect of increased mortality (predation by mink) of incubating female common eiders at Grindøya in Troms. N and Sb are from Grindøya, the others are taken from the literature. Fertility (recruitment) was calculated as Fa = Pb x Cs x F_0 x Sp x 0.5.*

Parameter	Value	Parameter	Value
N – Population size (breeding pairs, 1995)	600	Sex ratio at birth	0.50
Sp – Pre-breeding survival (0-3 years)	0.90	***Pb*** – Proportion of 1-yr old breeding	0.00
Sb – Adult survival (3-9 years)	0.85 (0.53-1.00)	***Pb*** – Proportion of 2-yr old breeding	0.00
Sc – Senescent survival (10+)	0.82	***Pb*** – Proportion of 3-yr old breeding	0.00
F_0 – Survival to fledging	0.15 (0.10-0.15)	***Pb*** – Proportion of 4-10-yr old breeding	0.80
Cs – Clutch size	4.5 (4.2-4.7)	***Pb*** – Proportion of 11+ yr old breeding	0.70
S_0 – Survival from fledging to first year	0.70 (0.6-0.8)		

To quantify the consequences of mink predation on the population trend and population sex ratio we have used simple deterministic Leslie matrix models. Input population parameters to the model are from the Grindøya population or derived from the literature (Table 2). Our objective was to simulate the population dynamics with and without mink predation. We first developed a stage-classified model using population parameters and their variances (Table 2). We then modelled the life-cycle of the population using 11 stage (age) classes: 1-, 2- and 3-year old immatures, 4- to 10-year old breeding adults and 11 years and older senescent breeders (Figure 1). The initial population age structure was set to a stable age distribution, based on values derived from running the baseline model until population growth and age structure stabilised (represented by the size of each node). The baseline model describes a stable population with population growth rate (λ) of 1 obtained as the largest eigenvalue of the matrices. We then used this model to estimate the reduction in population growth rate by simulating the effect of mink predation on the survival of breeding females (age classes 4 to 11). We simulated the effect by entering a reduction of 1 to 5% in

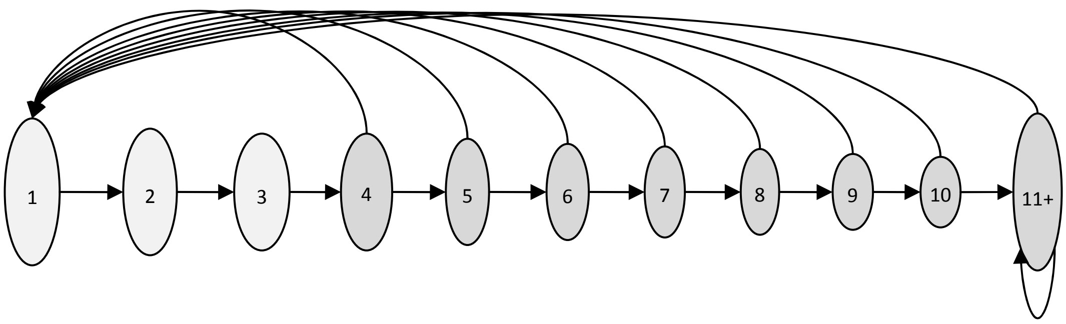

Figure 1
A life cycle diagram for the Grindøya population of common eiders. Stages 1, 2 and 3 are pre-breeders, while stages 4 to 10 are adult breeders and stage 11+ is senescent breeders. Transition probabilities are given by arrows. Left to right arrows indicate transition of pre-breeders and adult breeders to older age classes and arrows from right to left show the recruitment of young birds to the population. The size of each node is relative to the stable age distribution for the Grindøya population.

female survival and projected the population size and the skew in sex ratio 20 years into the future (Figures 2 and 3). We assume no predation on the male cohort and for simplicity we assume no compensatory mechanisms when the population declines.

The simulations show that even low rates (1-5%) of mink predation on incubating females may strongly skew the sex ratio of the population. A yearly predation rate of 4% may lead to a proportion of 60% males after 15 years, whereas the same ratio is achieved in 20 years with a predation rate of 3% (Figure 2). The mink predation may also cause the population to decline strongly. For instance, a 4-5% predation of breeding females may halve the population within 20 years (Figure 3). This is close to what we have observed since 1985, when the work at Grindøya started. It is thus clear that the predation by mink on incubating females may have contributed to the strong decrease of the Grindøya population and strongly reduced the population’s viability.

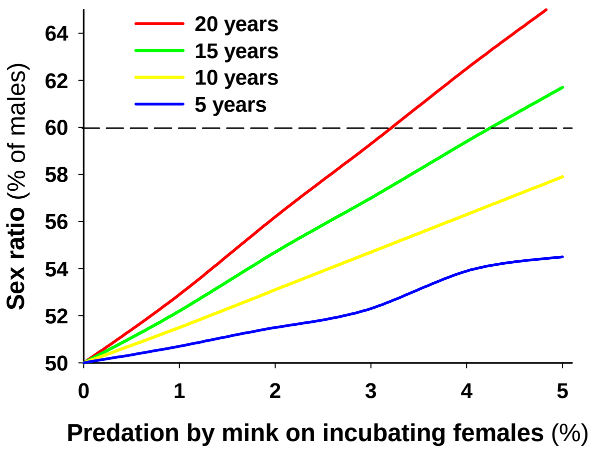

Figure 2
The estimated skew in sex ratio in a common eider population in relation to the rate of predation by mink on incubating females. The lines show the sex ratios 5 to 20 years into the future in relation to a variation i predation rate by 0-5%. The stippled line indicates the observed sex ratio in the eider population wintering near Grindøya.

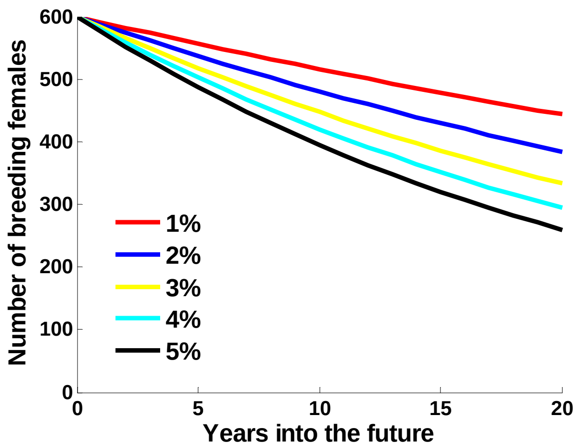

Figure 3
The estimated population trend of common eider suffering female predation from mink during the incubation period, at rates varying from 1 to 5% as represented by the different lines.

Cover photo: Female common eider. (© T. Anker-Nilssen)

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SEAPOP (SEAbird POPulations) is a long-term monitoring and mapping programme for Norwegian seabirds that was established in 2005 and implemented on the full national scale in Norway, Svalbard and adjacent sea areas in 2008. The programme is financed by the Ministry of the Environment, the Ministry of Petroleum and Energy and the Norwegian Oil Industry Association, and aims to provide and maintain the most important base-line knowledge of seabird distribution, demography and ecology needed for an improved management of these marine environments. More info about SEAPOP is found on the programme's web site www.seapop.no, including an up-to-date list of associated publications from which all reports can be freely downloaded as pdf documents.

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