USGS
science for a changing world

Prepared in cooperation with the U.S. Fish and Wildlife Service

Status of Spectacled Eiders (*Somateria fischeri*) on the Yukon-Kuskokwim Delta, Alaska, 2022—Testing and Updating Predictive Models

Open-File Report 2023–1052

U.S. Department of the Interior
U.S. Geological Survey

Cover. Female spectacled eider (*Somateria fischeri*) on a nest, Yukon Delta National Wildlife Refuge, Alaska. Photograph by Don Becker, U.S. Geological Survey.

Status of Spectacled Eiders (*Somateria fischeri*) on the Yukon-Kuskokwim Delta, Alaska, 2022—Testing and Updating Predictive Models

By Paul L. Flint

Prepared in cooperation with the U.S. Fish and Wildlife Service

Open-File Report 2023–1052

U.S. Department of the Interior
U.S. Geological Survey

U.S. Geological Survey, Reston, Virginia: 2023

Suggested citation:
Flint, P.L., 2023, Status of spectacled eiders (*Somateria fischeri*) on the Yukon-Kuskokwim Delta, Alaska, 2022—Testing and updating predictive models: U.S. Geological Survey Open-File Report 2023–1052, 5 p., https://doi.org/10.3133/ofr20231052.

ISSN 2331-1258 (online)

Acknowledgments

I wish to acknowledge the many people who helped with this field work: including U.S. Geological Survey (USGS) employees Lauren Benedict, Aaron Rae, and Jacob Mahner. Anthony Boyscout, Earl Atchak and Greg Slats helped with logistics in the village of Chevak. Vijay Patil (USGS) helped with figures and analyses. Kate Martin (U.S. Fish and Wildlife Service [USFWS]) was essential to project design, proposal writing, and funding. Additional funding was provided by the USGS-USFWS Science Support Program through the USGS Ecosystems Mission Area. John Pearce (USGS) played a major role in developing the final report. Julian Fischer (USFWS) and Kate Martin (USFWS) provided comments and reviews of earlier versions of this report.

Contents

Figures

Conversion Factors

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
meter (m)	1.094	yard (yd)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)

Supplemental Information

Blood lead concentrations are given in parts per million (ppm).

Abbreviations

ESA	Endangered Species Act
SSA	Species Status Assessments
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Status of Spectacled Eiders (*Somateria fischeri*) on the Yukon-Kuskokwim Delta, Alaska, 2022—Testing and Updating Predictive Models

By Paul L. Flint

Abstract

The nesting biology and demography of spectacled eiders (*Somateria fischeri*) along the lower Kashunuk River on the Yukon-Kuskokwim Delta, Alaska, were studied from 1993 to 2002. This previous work demonstrated that the breeding population on the study area was declining, and demographic modeling predicted that the population would continue to decline from 2002 forward. The predicted decline was primarily because of lead shot in tundra wetlands in the area, exposure of nesting females to lead, resulting in low adult female survival. The model predicted that lead pellets already in wetlands would slowly settle beyond the foraging depth of eiders, and that, lead exposure rates would decline. The goal of this project was to test this prediction by revisiting the lower Kashunuk River study area in 2022 to (1) update previous datasets regarding demographic parameters and (2) validate (or refute) existing models relative to lead exposure rates and the effects of lead on population dynamics. In the summer of 2022, a total of 37 nests were found in a sub-area of the historical study area. Comparing to past efforts in this same sub-area, more nests were found than predicted but the proportion of nesting female spectacled eiders exposed to lead in 2022 (24.3 percent) was still similar to levels of exposure observed between 1994 and 2002 (28.5 percent). Thus, data from the 2022 survey suggests that the earlier decline in numbers of nesting spectacled eiders has reversed, but there has been little decrease in lead exposure over time.

Introduction

Spectacled eiders (*Somateria fischeri*) were listed as threatened under the Endangered Species Act (ESA) in 1993 (58 FR 27474). Associated with that listing the U.S. Fish and Wildlife Service (USFWS) is required to conduct periodic status reviews. The USFWS has developed an analytical approach for informing Endangered Species Act decisions, including 5-year reviews, called Species Status Assessments (SSA). A SSA describes (1) the current condition of the species' habitat and demographics, (2) the probable explanations for past and ongoing changes in abundance and distribution within the species' range, and (3) a species' ability to sustain populations in the wild over time. A SSA is a biological risk assessment to aid decision makers who must use the best available scientific information to make policy decisions under the ESA.

A key piece of a SSA is that it forecasts the species' response to probable future scenarios of environmental conditions and conservation efforts. Two stressors of highest concern for spectacled eiders are lead exposure from spent lead shot and winter sea ice conditions, because these parameters affect female survival (and subsequently, population growth rate) of spectacled eider populations (Flint and others, 2016; Christie and others, 2018). Flint and others (2016) studied spectacled eiders nesting along the lower Kashunuk River on the Yukon-Kuskokwim Delta, Alaska from 1993 to 2002 and predicted that this nesting population would continue to decline, primarily because of lead exposure. Under the assumption that no new lead shot was deposited into wetlands of the Kashunuk River nesting area, the model predicted that lead exposure would decline by about 50 percent in 10 years (Flint and Schamber, 2010), at which point annual adult female survival would increase and the overall population would also begin to increase (Flint and others, 2016).

The goal of this project was to serve as a key piece of information for developing and updating an SSA for spectacled eiders. Objectives of this study were to (1) repeat nest searching protocols on the lower Kashunuk River study area to assess changes in nesting population size of spectacled eiders relative to existing model projections in Flint and others (2016), (2) measure lead exposure rate to compare with historical estimates and model projections of exposure rate in Flint and Schamber (2010), (3) assess nesting productivity, and (4) validate or refute previous models that projected lead exposure rate out from 2004 (given the assumptions of the model, predictions are that lead exposure rates should be less than 50 percent of what was measured at least 15 years ago).

Methods and Study Area

The 2022 study area (hereafter "sub-area") consisted of a 6.1 square kilometers (km^2) subset of the previously used spectacled eider study area (total of 17.8 km^2, hereafter "historical study area") along the lower Kashunuk River. The historical study area was extensively searched for nesting waterfowl from 1993 to 2002 as part of detailed studies of spectacled eiders at this location to estimate clutch size, nesting success, duckling survival, annual survival, lead exposure rates, and the effect of lead exposure on adult female survival (Flint and others, 1997, 2000, 2006, 2016; Flint and Grand, 1997, 1999; Grand and Flint 1997; Flint, 1998; Franson and others, 1998; Grand and others, 1998).

In June of 2022, we searched the sub-area using the same method used in earlier studies (Grand and Flint, 1997). This involved searching for eider nests systematically using 4–6 people walking 20–40 meters apart and flagging the edges of searched areas to ensure complete coverage of search effort. We assumed nest detection rate did not vary among field crews in 1994–2002 and 2022. We monitored nesting success using the same protocol as in previous years by revisiting known nests on a regular schedule to monitor success under a Mayfield study design (Grand and Flint, 1997). We trapped female eiders on nests shortly before hatch and a blood sample was taken to assess lead exposure rate (Flint and others, 1997).

The sub-area searched in 2022 was not randomly selected but was an area with previously high nesting density. Using the historical nesting data, the proportion of the total number of nests found that occurred within the sub-area for each year from 1994 to 2002 was determined. The average of this annual proportion was used to extrapolate from the number of nests found in 2022 in the sub-area to the historical study area in 2022. This approach does not assume equal nesting density across the historical study area, but it does assume the relative distribution of nests across the area has remained constant.

Results

Spectacled Eiders

We searched for and monitored nests between June 3 and 18, 2022 in 34 percent of the historical study area. We found 57 spectacled eider nests, 75 percent of which survived to hatch. We found an average of 39 nests per year between 1994 and 2002 within the sub-area we searched in 2022 (range 19–65). Thus, number of nests increased by 46 percent over the last 20 years within the sub-area. Based on data from 1994 to 2002, when we searched the historical study area, on average 56 percent of nests (standard deviation = 0.05) were found within the sub-area we searched in 2022. By expanding the number of nests found in 2022 using this ratio, we estimate 104 nests (95 percent confidence interval 89–124) may have been present on the entire historical study area. This model prediction suggests that the overall nesting population along the lower Kashunuk River has not declined since the previous studies (fig. 1).

Lead Exposure Rates

We obtained blood samples from 37 females captured on nests at hatch in the sub-area in 2022. We did not capture or observe females banded in historical work in the sub-area. Using the established threshold of 0.2 ppm for exposure (Flint and others 2016), nine (24.3 percent) samples showed elevated lead exposure (fig. 2).

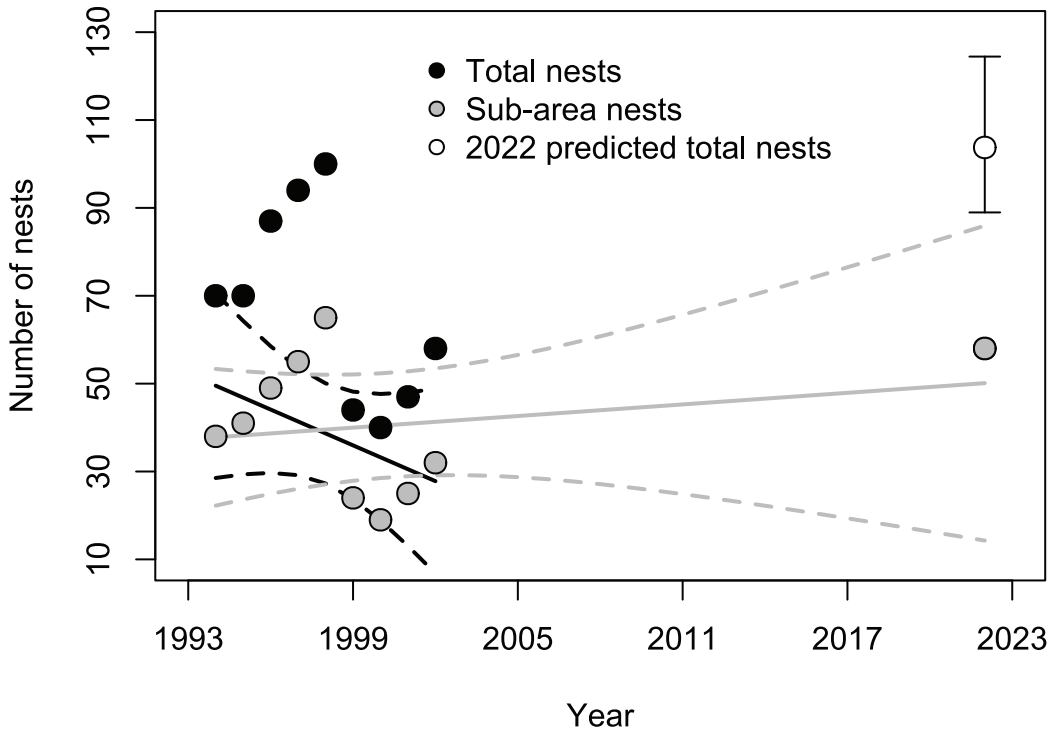

Figure 1. Number of spectacled eider (*Somateria fischeri*) nests locations along the lower Kashunuk River study area by year (1994–2002), and the current study sub-area in 2022. Black dots represent the total number of nests on the study area between 1994 and 2002. Gray dots at the left side of the figure are nests in the current study sub-area (defined in 2022) between 1994 and 2002. The single gray dot at the right side of the figure represents the number of nests on the sub-area searched in 2022. The white dot is the number of nests predicted to be present in 2022 based on the average proportion of nests on the sub-area between 1994 and 2002 (see Flint and others, 2016). The solid black line is the population trend from 1994 to 2002, and the solid gray line is trend in the number of nests from 1994 to 2022 (95 percent confidence intervals shown with dashed gray lines).

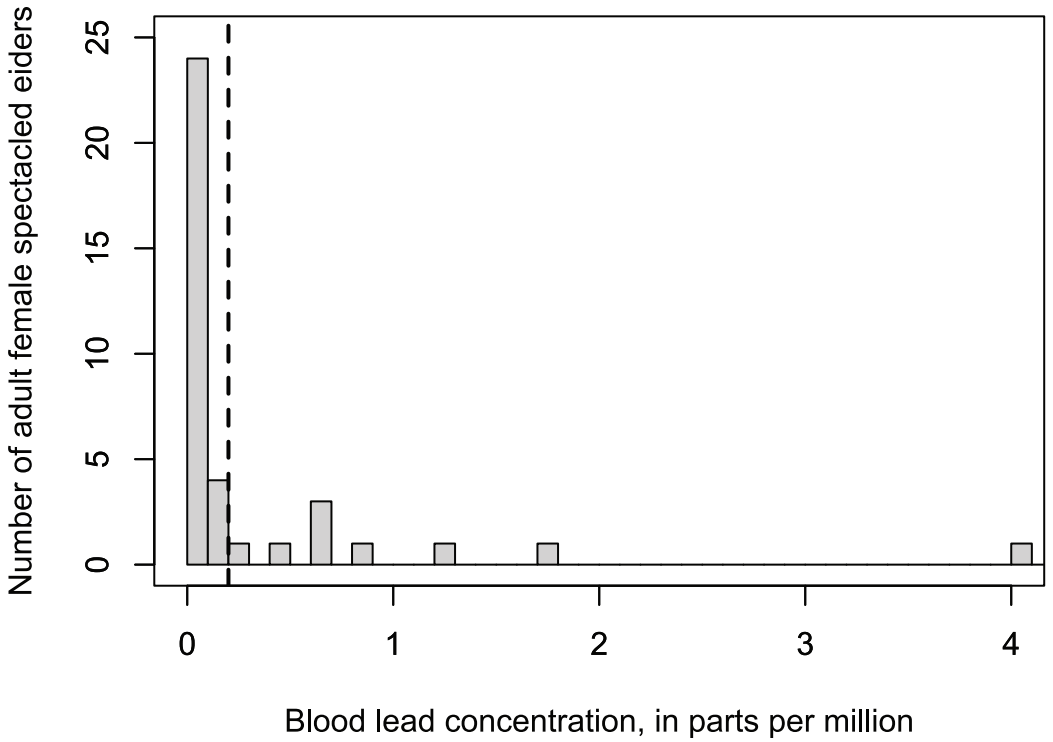

Figure 2. Blood lead concentration for 37 adult female spectacled eiders (*Somateria fischeri*) sampled at hatch along the lower Kashunuk River in June 2022. The vertical dashed line indicates the level (0.2 ppm) that is considered the upper limit to background levels. Blood lead concentrations above 0.2 ppm are considered "exposed" above normal background levels.

Discussion

Based on the number of nests observed in 2022, the number of nesting spectacled eiders on the lower Kashunuk River study area has increased since 2002 (fig. 2). Over this same time, the number of nesting spectacled eiders in the broader Yukon-Kuskokwim Delta region has increased almost threefold (from 3,532 nests in 2002 to 9,464 nests in 2016; Fischer and others, 2017). Thus, the increase in nests along the lower Kashunuk River appears to be somewhat less than for other areas on the Yukon-Kuskokwim Delta.

Flint and Schamber (2010) examined the rate that lead pellets settle within pond sediments along the lower Kashunuk River and estimated that most pellets would be unavailable to foraging eiders after 25 years. Under the assumption that deposition of new lead pellets ceased in 2002, we would have expected a substantial decline in lead exposure rate by 2022. Previous work on the lower Kashunuk River study area showed that 28.5 percent of females sampled at hatch were exposed to lead (Flint and others 1997), similar to this study (24.3 percent). This similarity suggests that there has been little decrease in lead exposure over time, implying that either the previous work overestimated the rate at which existing lead pellets would become unavailable to eiders, or new lead pellets have continued to be deposited into wetlands along the lower Kashunuk River.

Annual survival rates of female spectacled eiders nesting along the lower Kashunuk River have been shown to be closely tied to lead exposure (Grand and others, 1998; Flint and others, 2016). Given that lead exposure rate of nesting females has not changed from 20 years ago, it is unlikely that survival rates of females from this area has increased. Flint and others (2016) modeled population dynamics and suggested that the lower Kashunuk River area nesting population was likely supported by females immigrating into the study area from surrounding areas. Because the overall spectacled eider nesting population on the Yukon-Kuskokwim Delta has increased substantially since 2002, the local increase in nesting density on the lower Kashunuk River study area likely results from increased immigration rate.

Compared to previous work on this study area, the summer of 2022 was unusual in terms of much warmer temperatures, little precipitation, and an outbreak of highly pathogenic avian influenza in the Yukon-Kuskokwim Delta and across much of North America. During field work on the lower Kashunuk River, dead birds of multiple species (snowy owl [*Bubo scandicus*], glaucous gull [*Larus hyperboreus*], short-billed gull [*Larus canus*], Sabine's gull [*Xema sabini*]) were observed as well as birds that were ill and unable to fly, such as black brant (*Branta bernicla*). Several black brant were also observed in the Kashunuk River swimming in small circles. These birds did not fly away when approached to within a few feet. It is unknown if this outbreak had any effect on our results in terms of numbers of nesting eiders.

During the 2022 nesting season on the lower Kashunuk River, the number of nests for all species of geese (black brant, greater white-fronted goose [*Anser albifrons*], and cackling goose [*Branta canadensis minima*]) appeared to have increased in the historical study area. Notably, black brant and common eiders (*Somateria mollissima*) were observed nesting in areas where they had not been observed during historical work on this site. The lower Kashunuk River study area was very dry during the mid-summer of 2002 and many ponds had little to no water. Similar to past low water years, shortly after hatch, multiple dead cackling goose and white-fronted goose goslings were attributed to being trapped on ponds because of undercut banks and overhanging vegetation, as a direct result of the low water conditions. Moose [*Alces alces*] were observed in the study area almost daily, whereas historically, a single moose was seen in one year.

References Cited

Christie, K.S., Hollmen, T.E., Flint, P.L., and Douglas, D., 2018, Non-linear effect of sea ice—Spectacled eider survival declines at both extremes of the sea ice spectrum: Ecology and Evolution, v. 8, no. 23, p. 11808–11818, accessed June 27, 2023, at https://doi.org/10.1002/ece3.4637.

Fischer, J.B., Williams, A.R., and Stehn, R.A., 2017, Nest population size and potential production of geese and spectacled eiders on the Yukon-Kuskokwim Delta, Alaska, 1985–2016: Anchorage, Alaska, U.S. Fish and Wildlife Service, 47 p., accessed June 27, 2023, at https://www.sciencebase.gov/catalog/item/6452ed63d34eefd5da83a1fb.

Flint, P.L., 1998, Settlement rate of lead shot in tundra wetlands: The Journal of Wildlife Management, v. 62, no. 3, p. 1099–1102.

Flint, P.L., and Grand, J.B., 1997, Survival of spectacled eider adult females and ducklings during brood rearing: The Journal of Wildlife Management, v. 61, p. 217–221.

Flint, P.L., and Grand, J.B., 1999, Incubation behavior of spectacled eiders: The Condor, v. 101, no. 2, p. 413–416.

Flint, P.L., and Schamber, J.L., 2010, Long-term persistence of spent lead pellets in tundra wetlands: The Journal of Wildlife Management, v. 74, no. 1, p. 148–151, accessed June 27, 2023, at https://doi.org/10.2193/2008-494.

Flint, P.L., Morse, J.A., Grand, J.B., and Moran, C.L., 2006, Correlated growth and survival of juvenile spectacled eider—Evidence of habitat limitation?: The Condor, v. 108, p. 901–911, accessed June 27, 2023, at https://doi.org/10.1093/condor/108.4.901.

Flint, P.L., Grand, J.B., Morse, J.A., and Fondell, T.F., 2000, Late summer survival of adult female and juvenile spectacled eiders on the Yukon-Kuskokwim Delta, Alaska: Waterbirds, v. 23, p. 292–297.

Flint, P.L., Grand, J.B., Petersen, M.R., and Rockwell, R.F., 2016, Assessing the effects of lead exposure, environmental conditions and metapopulation processes on population dynamics of spectacled eiders: North American Fauna, v. 81, no. 1, p. 1–41, accessed June 27, 2023, at https://doi.org/10.3996/nafa.81.0001.

Flint, P.L., Petersen, M.R., and Grand, J.B., 1997, Exposure of spectacled eiders and other diving ducks to lead in western Alaska: Canadian Journal of Zoology, v. 75, no. 3, p. 439–443.

Franson, J.C., Petersen, M.R., Creekmore, L.C., Flint, P.L., and Smith, M.R., 1998, Blood lead concentrations of spectacled eiders near the Kashunuk River, Yukon Delta National Wildlife Refuge, Alaska: Ecotoxicology, v. 7, no. 1, p. 175–181. [Also available at https://doi.org/10.1023/A:1014308411665.]

Grand, J.B., and Flint, P.L., 1997, Productivity of nesting spectacled eiders on the lower Kashunuk River, Alaska: The Condor, v. 99, no. 4, p. 926–932.

Grand, J.B., Flint, P.L., Petersen, M.R., and Moran, T.L., 1998, Effect of lead poisoning on spectacled eider survival rates: The Journal of Wildlife Management, v. 62, no. 3, p. 1103–1109.

For information about the research in this report, contact
Director, Alaska Science Center
U.S. Geological Survey
4210 University Drive
Anchorage, Alaska 99508
https://www.usgs.gov/centers/asc/

Manuscript approved on July 6, 2023

Publishing support provided by the U.S. Geological Survey Science Publishing Network, Tacoma Publishing Service Center

ISSN 2331-1258 (online)
https://doi.org/10.3133/ofr20231052