*Journal of Wildlife Diseases*, 46(4), 2010, pp. 1290–1294


# Health Evaluation of Western Arctic King Eiders (*Somateria spectabilis*)

**Cheryl A. Scott,[1,4] Jonna A. K. Mazet,[2] and Abby N. Powell[3]** [1] School of Veterinary Medicine, University of California, One Shields Ave., Davis, California 95616, USA; [2] Wildlife Health Center, School of Veterinary Medicine, University of California, Davis, California 95616, USA; [3] US Geological Survey, Alaska Cooperative Fisheries and Wildlife Research Unit and Institute of Arctic Biology, University of Alaska, Fairbanks, Alaska 99775, USA; [4] Corresponding author (email: cascott@ucdavis.edu)

ABSTRACT: The western arctic population of King Eiders (*Somateria spectabilis*) has declined by >50% in recent years. A health assessment was conducted for adult King Eiders breeding on the north slope of Alaska, USA, to evaluate body condition ($n=90$, 2002–2006) and baseline biochemical and hematologic values ($n=20$–30, 2005–2006). Body condition for males and females was excellent. Total protein, calcium, alkaline phosphatase, amylase, and globulin were significantly higher in females than in males, likely because of differences in reproductive physiology. These baseline health data can be used to promote conservation of King Eiders and other closely related species of concern.

*Key words:* Body condition, health evaluation, hematology, King Eider, migratory waterfowl health indices, serum chemistry, *Somateria spectabilis*.

Eiders are sea ducks distributed across arctic and subarctic regions of the northern hemisphere. All four species of Eiders—King (*Somateria spectabilis*), Common (*Somateria mollissima*), Spectacled (*Somateria fischeri*), and Steller's (*Polysticta stelleri*)—have declined from historic population estimates and the Spectacled Eider and Steller's Eider are currently listed as threatened under the US Endangered Species Act. King Eiders have declined 56% since the late 1970s (Suydam et al., 2000); some of the proposed causes include anthropogenic pressures, food source declines, disease, and exposure to contaminants and toxins, including oil spills (Dickson and Gilchrist, 2002).

Baseline values for serum chemistry, hematology, and physical condition can be useful in assessing nutritional status and disease (Hollmen et al., 2001), habitat quality (Harder and Kirkpatrick, 1996), and effects of environmental stressors on wild animals (Crooks et al., 2000). For example, exposure to oil spills can alter electrolyte balance, $CO_2$, glucose, corticosterone levels, and liver enzymes in sea birds (Golet et al., 2002), and infectious disease can affect the immune system, alter serum chemistry and hematologic values, and lead to reduced body condition and mass mortality events (Hollmen et al., 2001; Skerratt et al., 2005). The objectives of this study were to establish healthy body condition scores and baseline biochemical and hematologic values for healthy adult King Eiders during the breeding season in their natural environment.

Adult King Eiders were trapped during June 2002–2006 at two locations on the North Slope of Alaska, USA: near Teshekpuk Lake (70°25′N, 153°07′W) and at Kuparuk (70°20′N, 149°45′W). At the onset of nesting, in early to mid-June, King Eiders were lured with duck decoys into mist nets placed over small bodies of water on coastal tundra. Open nets were monitored continuously, and captured birds were removed immediately, placed in a secure and dark pet kennel, and transported to a temporary indoor facility, where satellite transmitters were surgically implanted. Captured birds were not provided food and were held only long enough to complete surgical procedures and ensure adequate recovery. All ducks were returned to their original capture location within 6 hr.

Physical examinations were performed for all adult eiders captured (35 females, 55 males) by the same veterinarian for all years (C.A.S.). Gender determination was

based on distinct breeding dimorphism (Suydam, 2000). Birds were weighed to the nearest 10 g using a spring scale. Body condition scores were determined based on a system used in poultry that assigns scores of 0–3 points according to palpation of keel bone and pectoral muscle mass (Gregory and Robins, 1998), modified to include midpoint scores (0.5 points) from 0 to 3, for a total of seven score categories. Blood samples were collected before surgery via jugular venipuncture from 30 healthy adult King Eiders, with no more than 6 ml taken from any one animal. Aliquots of 3–4 ml were immediately transferred into serum-separator tubes (Vacutainer®, Becton-Dickinson, Franklin Lakes, New Jersey, USA), and the remaining blood was transferred into anticoagulant-treated ethylenediaminetetraacetic acid (EDTA) tubes. Blood in serum-separator tubes was allowed to clot at ambient temperature for 1 hr and centrifuged at 805×G for 10 min. Harvested serum was kept frozen until analysis. Peripheral blood smears were prepared immediately from whole blood samples for manual differential blood cell counts. Use of smears to determine white blood cell counts (WBC) can be subject to error (Zinkl, 1986); hence, our results should be interpreted with caution. Serum chemistry and manual hematology analyses were performed by IDEXX Veterinary Services (West Sacramento, California, USA).

Analysis for serum biochemistry provided results for 16 analytes—alkaline phosphatase, aspartate aminotransferase, creatinine kinase, lactate dehydrogenase, amylase, albumin, total protein, globulin, cholesterol, glucose, calcium, phosphorus, potassium, sodium, albumin/globulin ratio, and uric acid—and was conducted via Hitachi 747 analyzer (Hitachi Instruments Incorporated, Indianapolis, Indiana, USA). Manual hematologic measurements included estimated counts of WBC, heterophils, lymphocytes, monocytes, eosinophils, basophils, and thrombocytes, excluding samples that exhibited gross hemolysis. Because environmental factors that might influence King Eider health, such as ambient mean temperature and timing of sea ice melting, were similar during June 2005 and June 2006, and sample sizes were relatively small, we pooled data from both years. We used *t*-tests with a Bonferroni sequential correction to test for differences between genders ($\alpha=0.05$; Rice, 1989).

Physical examinations indicated that all King Eiders were clinically healthy at the time of capture, active and alert, with no discernable morphologic or behavioral abnormalities. Body weight did not differ among years for females ($F_{4,34}=0.62$, $P=0.653$) or males ($F_{4,54}=0.67$, $P=0.614$). Mean body weight for females (1,704 g) was higher ($t=2.63$, $P=0.01$) than that of males (1,598 g); these weights are typical for this species, with females weighing more than males at the beginning of the breeding season (Suydam, 2000). Across years, body condition scores were high in both sexes (94% of females and 75% of males scored ≥2.5 in all yr), but females had consistently higher mean scores (2.94) than did males (2.84). Excellent female condition at the onset of breeding likely reflects abundant stores of body fat (Kellett and Alisauskas, 2000). Maternal body reserves are used for energy during egg laying, nesting, and incubation (Bentzen et al., 2008), energy costs that are not incurred by males, who return to sea to feed at the onset of incubation (Suydam, 2000).

Thirty King Eiders were sampled for serum chemistry analysis (Table 1) and 20 of these for hematologic measurements (Table 2). Values for total protein, calcium, alkaline phosphatase, amylase, and globulin were significantly higher in females than males ($P<0.05$), a result consistent with sex differences in Mallards (*Anas platyrhynchos*; Fairbrother et al., 1990). Because our study was conducted during breeding and egg-laying phases, we expected to find increased values in females for alkaline phosphatase, amylase,

TABLE 1. Serum chemistry values of adult King Eiders (*Somateria spectabilis*) captured in Alaska, USA, during the breeding season, June 2005–2006.

| Analyte | Male ($n=18$) | | Female ($n=12$) | |
|---|---|---|---|---|
| | Mean (SD) | Range | Mean (SD) | Range |
| Alkaline phosphatase (IU/l) | 56 (16.1) | 30–88 | 173 (73.7) | 80–333 |
| Aspartate aminotransferase (IU/l) | 44 (29.9) | 3–125 | 50 (26.8) | 10–106 |
| Creatinine kinase (IU/l) | 659 (380.4) | 181–1,522 | 696 (433.0) | 240–1,518 |
| Lactate dehydrogenase (IU/l) | 424 (182.9) | 148–728 | 423 (217.4) | 134–840 |
| Amylase (IU/l) | 1,173 (277.7) | 665–1,895 | 2,660 (993.5) | 849–4,302 |
| Albumin (g/dL) | 1.6 (0.14) | 1.3–1.8 | 1.8 (0.32) | 1.3–2.2 |
| Total protein (g/dL) | 3.9 (0.37) | 3.3–4.6 | 5.2 (0.72) | 4.1–6.4 |
| Globulin (g/dL) | 2.4 (0.32) | 1.9–3.0 | 3.3 (0.73) | 2.5–4.8 |
| Cholesterol (mg/dL) | 355 (57.1) | 277–503 | 261 (166.5) | 86–562 |
| Glucose (mg/dL) | 229 (32.6) | 167–286 | 249 (49.6) | 184–343 |
| Calcium (mg/dL) | 9.9 (0.57) | 9.3–11.7 | 28.2 (10.44) | 10.0–39.9 |
| Phosphorus (mg/dL) | 3.6 (2.14) | 0.5–7.5 | 5.9 (3.14) | 1.0–11.3 |
| Potassium (mEq/dL) | 3.1 (1.31) | 1.5–7.4 | 3.3 (2.29) | 1.6–9.7 |
| Sodium (mEq/dL) | 154 (5.0) | 147–162 | 152 (3.8) | 144–157 |
| Albumin/Globulin ratio | 0.7 (0.10) | 0.5–0.9 | 0.6 (0.17) | 0.3–0.8 |
| Uric acid (mg/dl) | 4.7 (1.94) | 2.3–9.8 | 8.0 (3.41) | 2.6–14.8 |

calcium, and total protein. Alkaline phosphatase and total protein values were likely higher in our female ducks because of egg-shell deposition and the estrogen-induced hyperproteinemia accompanying egg formation (Harr, 2002). In general, birds tolerate much higher total blood calcium levels under normal physiologic functioning compared with mammals, and actively oviparous females can have dramatic increases because of the calcium-bound yolk proteins being transported to the ovaries (Harr, 2002). Amylase in birds is derived from the pancreas, liver, and small intestine, which makes the determination of origin difficult, yet the increased amylase levels we observed may have been associated with inflammatory changes in the gastrointestinal tract associated with egg laying (Fairbrother et al., 1990). Further, amylase production by the pancreas is determined by the degree of carbohydrate intake. Thus, reduced amounts of carbohydrates, along with increased metabolism of fat stores, can produce higher amylase values in females (Harrison and Harrison, 1986).

Overall, our hematology and serum chemistry values for King Eiders were similar to those reported for Common

TABLE 2. Hematologic values of adult King Eiders (*Somateria spectabilis*) captured in Alaska, USA, during the breeding season, June 2005–2006.

| Hematology | Male ($n=11$) | | Female ($n=9$) | |
|---|---|---|---|---|
| | Mean (SD) | Range | Mean (SD) | Range |
| WBC[a] ($\times 10^3/\mu l$) | 10 (4.9) | 3–17 | 10 (4.0) | 5–17 |
| Heterophils (%) | 46 (22.7) | 11–76 | 62 (15.2) | 44–88 |
| Lymphocytes (%) | 48 (23.1) | 20–80 | 35 (13.1) | 11–49 |
| Monocytes (%) | 0.2 (0.63) | 0–2.0 | 0.1 (0.38) | 0–1.0 |
| Eosinophils (%) | 1.6 (2.17) | 0–6 | 1.7 (1.70) | 0–4 |
| Basophils (%) | 4.3 (4.08) | 0–14 | 2 (1.8) | 0–5 |

[a] WBC = white blood cell count.

Eiders during the breeding season (Hollmen, 2001), as well as for ducks in the genus *Anas* (Harr, 2002). However, three enzyme activities (alkaline phosphatase, aspartate aminotransferase, and lactate dehydrogenase) were substantially higher in both male and female eiders compared with Mallards, and one metabolite (calcium) was higher in female King Eiders than female Mallards and *Anas*. (Fairbrother et al., 1990; Harr, 2002). The reasons for these interspecific differences are uncertain, but they may reflect differences in phylogeny or life histories, especially diet, or perhaps, differences in responses to stress.

Numerous explanations have been proposed for the decline in King Eider numbers, but wildlife health and disease should be a consideration in the conservation of this species (Deem et al., 2001). Our baseline information on body condition and hematologic and biochemical values in healthy individual King Eiders can serve as a reference for future interventions.

The Minerals Management Service; Coastal Marine Institute; University of Alaska, Fairbanks; North Slope Borough; US Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit; ConocoPhillips Alaska, Inc., and the MPVM Program at the University of California, Davis provided financial support. This work was conducted under approval of the University of Alaska Institutional Animal Care and Use Committee (05-29). We thank L. Phillips, R. Bentzen, S. Oppel, and C. Latty, M. Carlson, J. Kurek, D. Van Vuren, J. Eadie, and M. Johnson for project assistance or manuscript review. Any use of trade, product, or firm names in this publication does not imply endorsement by the US government.

## LITERATURE CITED

Bentzen, R. L., A. N. Powell, T. D. Williams, and A. S. Kitaysky. 2008. Characterizing the nutritional strategy of incubating King Eiders *Somateria spectabilis* in northern Alaska. Journal of Avian Biology 39: 683–690.

Crooks, K. R., C. A. Scott, L. Bowen, and D. H. Van Vuren. 2000. Hematology and serum chemistry of the island fox on Santa Cruz Island. Journal of Wildlife Diseases 36: 397–404.

Deem, S. L., W. B. Karesh, and W. Weisman. 2001. Putting theory into practice: Wildlife health in conservation. Conservation Biology 15: 1224–1233.

Dickson, D. L., and H. G. Gilchrist. 2002. Status of marine birds of the southeastern Beaufort Sea. Arctic 55: 46–58.

Fairbrother, A., A. Morrie, K. Walker, and D. O'Loughlin. 1990. Changes in mallard (*Anas platyrhynchos*) serum chemistry due to age, sex, and reproductive condition. Journal of Wildlife Diseases 26: 67–77.

Golet, G. H., P. E. Sieser, A. D. McGuire, D. D. Roby, J. B. Fischer, K. J. Kuletz, D. B. Irons, T. A. Dean, S. C. Jewett, and S. H. Newman. 2002. Long-term direct and indirect effects of the 'Exxon Valdez' oil spill on pigeon guillemots in Prince William Sound, Alaska. Marine Ecology Progress Series 241: 287–304.

Gregory, N. G., and J. K. Robins. 1998. A body condition scoring system for layer hens. New Zealand Journal of Agricultural Research 41: 555–559.

Harder, J. D., and R. L. Kirkpatrick. 1996. Physiological methods in wildlife research. *In* Research and management techniques for wildlife and habitats, T. A. Bookhout (ed.). The Wildlife Society, Bethesda, Maryland, pp. 275–306.

Harr, K. E. 2002. Clinical chemistry of companion avian species: A review. Veterinary Clinical Pathology 31: 140–151.

Harrison, G. J., and L. R. Harrison. 1986. Clinical avian medicine and surgery. W. B. Saunders Co., Philadelphia, Pennsylvania, 736 pp.

Hollmen, T., J. C. Franson, M. Hario, S. Sankari, M. Kilpi, and K. Lindstrom. 2001. Use of serum biochemistry to evaluate nutritional status and health of incubating common eiders (*Somateria mollissima*) in Finland. Physiological and Biochemical Zoology 74: 333–342.

Kellett, D. K., and R. T. Alisauskas. 2000. Body-mass dynamics of King Eiders during incubation. Auk 117: 812–817.

Rice, W. R. 1989. Analyzing tables of statistical tests. Evolution 43: 223–225.

Skerratt, L. F., J. C. Franson, C. U. Meteyer, and T. E. Hollmen. 2005. Causes of mortality in sea ducks (Mergini) necropsied at the USGS-National Wildlife Health Center. Waterbirds 28: 193–207.

Suydam, R. S. 2000. King Eider (*Somateria spectabilis*). *In* The birds of North America No. 491, A. Poole and F. Gill (eds.). The Birds of North

America, Inc., Philadelphia, Pennsylvania, pp. 1–28.

———, D. L. DICKSON, J. B. FADELY, AND L. T. QUAKENBUSH. 2000. Population declines of king and common eiders of the Beaufort Sea. Condor 102: 222–227.

ZINKL, J. G. 1986. Avian hematology. *In* Schalm's veterinary hematology. 4th Edition, N. C. Jain (ed.). Lea and Febiger, Philadelphia, Pennsylvania.

*Submitted for publication 18 March 2009.*
*Accepted 28 May 2010.*