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Immune parameters in different age classes of captive male Steller's eiders (*Polysticta stelleri*)

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Abstract
The immune system is important for host defense against antigens, but little is known about Steller's eider (*Polysticta stelleri*) immunology. This study compared hematological parameters, serum protein levels, lymphocyte proliferation, heat shock protein levels and oxidative damage in four different age classes of captive male Steller's eiders. The hatch year cohort had significantly higher total white blood cell and lymphocyte counts. The second year cohort had significantly higher albumin, alpha globulins and lymphocyte proliferation, and significantly lower beta globulin levels. The 9 year old males had a significantly higher IgY:IgY(ΔFc) ratio. The oldest eiders in the study, 14+ year old males, had significantly higher serum IgY, pre-albumin and glutathione reductase activity, and the lowest lymphocyte proliferation. This study provided a baseline of immune parameters in captive male Steller's eiders, and the results suggested the parameters were influenced by age-related changes.

Keywords
Steller's eider, immunology, age, oxidative damage

1. Introduction

Steller's eiders (*Polysticta stelleri*) are sea ducks that inhabit Russia, northern Europe and Alaska, and the Alaska breeding population was listed as threatened under the Endangered Species Act in 1997 due to reductions in their nesting range (Federal Register 1997). The exact cause of the population decline is unknown, but contaminants and disease may have been factors. Changing environmental conditions may increase toxicant exposure and infectious disease transmission and susceptibility. Additionally, immune system efficacy may be diminished due to factors such as reduced body condition or elevated stress levels (Burek et al. 2008). Establishing baselines for eider immune parameters will be important to determine how their population may be impacted by anticipated environmental change and anthropogenic activity in the Arctic.

Most of what is known about avian immunology has been determined using the domestic chicken, *Gallus gallus domesticus,* and domestic ducks (*Anas* spp.) (Davison et al. 2008). Adaptive immune responses are antigen-specific and mediated by B and T cells (Rose 1979). Ducks produce immunoglobulins (Ig) M, A and Y in response to antigens (Lundqvist et al. 2006). IgY is the predominant antibody in serum, and ducks have three forms, a secreted full form (IgY), a secreted truncated form (IgY(ΔFc)) and a receptor form (Lundqvist et al. 2006).