



Effects of Nutrients on the Physiology, Energetics, and Behavior of Captive Seaducks Relative to Seaduck Feeding Ecology in Chesapeake Bay

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Statement of Problem: The Chesapeake Bay has undergone changes in the food sources it offers wintering waterfowl due to the degradation of water quality. There is a need for research on the availability and nutritional quality of these food sources for wintering seaducks as a possible explanation for the decline in the wintering populations. The availability of food resources is especially important in areas of the Chesapeake Bay at depths of 20-40 feet where seaducks typically feed. These areas may be the first to be impacted by anoxic conditions if poor water conditions occur during the summer months. A captive colony could be used for studies dealing with food webs and food habits. Captive seaducks on various diets could be part of a physiological study dealing with blood and other non-lethal techniques to develop an extensive database for seaducks that would be invaluable for field studies conducted throughout North America.

Objectives:

1. Determine the effects of experimental diets varying in protein and energy levels on the physiology and behavior of captive seaducks.
2. Determine if seaducks exhibit an endogenous rhythm in regard to body weight and condition during the winter.
3. Analyze the influence of depth of water, type of water (salt or fresh), density of food, and depth of substrate on the feeding performance of seaducks in two large aquariums (dive tanks).

Approach: Field Sampling: During July 2004, 30 eggs will be collected from the wild from nests of scoters (black, surf, and white-winged) and long-tailed ducks in areas where these species are successfully breeding and incubated at PWRC. Principal food organisms used by wintering seaducks in the Chesapeake Bay will be collected from major feeding areas. Proximate analyses of food sources for each species will determine experimental diets. The experimental diets will vary by energy and protein (Perry et al. 1986). Seaducks will be obtained from local hunters and quantities of food in the gullet (esophagus and proventriculus) and gizzard will be analyzed. Food material will be separated, identified to species, and then measured volumetrically (Perry and Uhler 1988). Aerial flights will be completed over the Chesapeake Bay to locate general areas where seaducks are foraging. Benthic samples will be collected in the winter to determine availability of food.

Pen Studies: Diets will be formulated based on most current food habits analyses of the gullet and gizzard of seaducks and also by proximate analyses of foods collected from benthic sampling in feeding areas. The experimental diets will vary by energy and protein. All ducks will be weighed and morphological parameters measured at the end of each month after being placed on experimental diets. Blood samples will also be drawn from equal numbers of males, females, immatures, and adults from each of the treatment diets throughout the study to determine the effects of diet on blood values. Blood samples will also be drawn from more wild birds found on the Chesapeake Bay to compare with the captive birds (Perry et al. 1986). Observers outside of pens will record the location and behavior of experimental ducks using scan sampling techniques (Altmann 1974, Perry et al. 1989). The location (land, water, air, or nest box), behavior (aggression, alert, bank feeding, courtship, diving, drinking, feeding, inactive, locomotion, maintenance, surface feeding, and vocalization), and species of each duck will be recorded each minute during a 5-minute period per pen. To determine if changes in winter body weight are related to an endogenous rhythm or to changing environmental temperatures, 6 females from each species will be kept indoors at 22°C and a light regimen simulating natural photoperiod and 6 females will be maintained on a natural winter temperature regimen in similar facilities with same light regimen (Perry et al. 1986). All females will be weighed and their temperature measured biweekly and maintained on the control diet provided ad libitum.

Dive Tank: Two large aquariums (dive tanks) were designed and constructed indoors for use on feeding trials at PWRC. Feeding performance of diving birds is influenced by environmental factors such as water depth, food density, and depth of substrate covering the food (Carbone 1995). To measure how a shift between food sources influences the foraging energetics we will evaluate each food type in terms of profitability (energy intake – cost of diving) (Richman and Lovvorn 2002). We will measure 1) the assimilation efficiency (fraction of ingested energy absorbed by the gut) of different food sources found in the Chesapeake Bay, and 2) the “functional response” (food intake rate for different prey sizes, densities, and depth in substrate). With all this information we will create a management model based on food availability in the Bay, energetics, food preference, food habits determined from hunter killed ducks, and population status for seaducks wintering in the Chesapeake Bay.

Selected Reports and Other Products:

Wells, A.M., and Perry, M.C., 2002. Nutritional, physiological, and behavioral research on captive seaducks: North American Sea Duck Conference and Workshop, Victoria, British Columbia, Canada, November 7-10 [poster]

Wells, A.M., Perry, M.C., Olsen, G.H., and Teate, E.L., 2003, Surf and white-winged scoter trends and blood chemistry, USGS [poster]

Wells, A.M., Perry, M.C., Olsen, G.H., and Teate, E.L., 2004, Surf and white-winged scoter trends and blood chemistry, USGS [poster]

Kidwell, D.M., and Perry, M.C., 2004, Techniques for determining the availability of food items to seaducks wintering on the Chesapeake Bay, Maryland, USGS [poster]

Relevance and Benefits: The long-term goal of this research is to determine factors that could be causing population declines in Atlantic Flyway seaduck populations, with emphasis on Chesapeake Bay.

Atlantic Seaduck Project web page is <http://www.pwrc.usgs.gov/resshow/perry/scoters/>