

**NUTRITIONAL VALUE AND MANAGEMENT OF WATERFOWL
AND SHOREBIRD FOODS IN ATLANTIC COASTAL
MOIST-SOIL IMPOUNDMENTS**

by

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ABSTRACT

The mid-Atlantic coast region, an area of continental significance to migratory and wintering waterfowl and shorebirds, contains numerous moist-soil impoundments that are managed for waterbirds. Positive relationships between nonbreeding body condition and subsequent survival and reproduction have been documented for waterfowl, yet few evaluations of habitat management consider nutritional value of foods. I assessed 2 types of impoundment manipulation, using nutritional data as a basis for evaluation.

Invertebrate and plant seed production were measured in disced and control plots in impoundments at Back Bay National Wildlife Refuge. Seed production was higher ($P = 0.0614$) in disced (1052 ± 468 kg / ha) than in control (529 ± 226 kg / ha) plots. Discing produced higher Chironomid larva abundance during spring, and higher abundance of Amphipods and non-Chironomid Diptera during fall. Waterbird predation reduced abundance of Chironomid larvae, non-Chironomid Diptera, and Amphipods. The predation effect on Total Invertebrate dry mass was 2x higher in disced than in control areas.

Invertebrate production also was measured in habitats denuded by foraging greater snow geese (*Anser caerulescens atlantica*) at Prime Hook National Wildlife Refuge. Chironomid larvae were 2–6x more abundant in vegetated habitats than in areas where geese had foraged intensively, but exclosure data showed little effect of shorebird predation on invertebrate abundance. These results suggest that high goose populations can reduce waterbird food availability, and that shorebird use of invertebrates in denuded habitats is low.

Mean true metabolizable energy (TME) of moist-soil seeds and invertebrates in blue-winged teal (*Anas discors*) ranged from $-0.18 - 3.47$ kcal / g. Correction of means for fiber concentration eliminated negative values, thereby enhancing their practical value.

Potential duck use-days predicted using TME and seed production data were about 2x higher for disced than for control areas at Back Bay. Magnitude of the discing effect on duck use-days was largely insensitive to different estimates of seed nutritional value, although substantial variation in absolute measures of potential carrying capacity occurred. Discing positively influenced invertebrate abundance, and quantity and quality of moist-soil seeds produced, and should be considered a viable habitat management approach for both shorebirds and waterfowl.

Key Words: Blue-winged teal, impoundment, invertebrate, metabolizable energy, moist-soil management, nutrition, shorebird, snow goose, waterfowl, wetland

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INTRODUCTION

Management of wetland habitats for wildlife is often accomplished through passive means, such as regulatory mandates, conservation easements or land purchase and set-aside. In contrast to these, moist-soil management is an active approach through which the hydrology of impounded wetlands is directly manipulated to encourage development of a desirable plant and animal assemblage. The mid-Atlantic Coastal region supports some of the highest concentrations of migrant and wintering waterfowl in the Atlantic Flyway. The initial development of impoundments in this region focused on providing hunting opportunities by retention of water through the hunting season. With increasing losses of coastal marshes came the recognition that appropriately managed impoundments could contribute to waterfowl survival through the nonbreeding season by providing foraging and roosting habitat. Management of moist-soil impoundments thus became focused on providing for significant life-history needs of nonbreeding waterfowl.

The mid-Atlantic Coastal region also supports some of the highest concentrations of spring migrant shorebirds in North America. Delaware Bay has been recognized as a shorebird stopover area of hemispheric significance by the Western Hemisphere Shorebird Reserve Network. High shorebird use of this area coincides with spawning of horseshoe crabs on intertidal sandy beaches. This habitat type is favored by shorebirds, and horseshoe crab eggs provide an abundant and presumably nutritious source of forage. Dramatic declines in horseshoe crab populations have led to concern for shorebird species that rely heavily on this resource. Population trends of spring migrant shorebirds largely mirror those of horseshoe crabs, suggesting that food availability and/or quality may be limiting to these birds.

Many coastal impoundments are being managed with an integrated approach that is designed to benefit both waterfowl and shorebirds. Because physiological condition is important for the survival of nonbreeding birds, this approach typically seeks to maximize availability of forage and suitable foraging habitat. Among waterfowl, the focus is often on dabbling ducks, for which shallowly flooded herbaceous vegetation is used by most species. These habitats may benefit both herbivorous (e.g., northern pintail) and carnivorous (e.g., northern shoveler) ducks by

providing abundant plant seeds and macroinvertebrates. Spring drawdowns may be timed to coincide with the arrival of spring migrant shorebirds, providing saturated substrate with sparse to absent vegetation. Drawdowns provide the dual function of affording shorebirds access to benthic macroinvertebrates, while also facilitating the regeneration of seed-producing annual plants to benefit waterfowl during the subsequent winter. The hydrological cycle is completed with fall flooding of regenerated herbaceous plants, providing foraging habitat for waterfowl.

A generally accepted precept of integrated impoundment management is that waterbird species diversity increases with increasing habitat diversity. A primary means for enhancing habitat diversity in impoundments is manipulation of vegetative cover. Openings created by such management can provide habitat conditions that favor wildlife not traditionally associated with heavily vegetated impoundments (e.g., shorebirds). Thus, creation of openings is often a management goal where migrant shorebirds are species of management concern.

Manipulation of hydrology can create openings in heavily vegetated habitat by killing herbaceous annuals. However, these habitats may become dominated by perennial plants after several years of management. The well-developed root structure of perennials may render them resistant to removal by flooding, limiting the value of water level manipulation at creating openings. Thus, other techniques (e.g., discing, mowing, burning) may be employed to create openings where perennial plants dominate. These techniques also may be favored where large, contiguous openings are a desirable management goal.

Where target species are potentially limited by food availability, food production is a key component of habitat quality assessment. Food availability is often expressed in units of density (e.g., number of food items per area of habitat) or biomass per unit area. However, this approach does not account for variation in nutritional value among food items. Waterfowl nutritional research has focused primarily on nutrient acquisition and allocation to the clutch by breeding females. The importance of nutrition to nonbreeding birds has received comparatively little attention, although it is recognized that condition of spring migrants is correlated with survival and reproductive success for some taxa. Given the significance of nutrition to maintaining

physiological condition during the nonbreeding season, management of habitats for nonbreeding birds should consider both quantity and quality of foods.

Physiological condition is also of significance to spring migrant shorebirds. The northward migration is generally a rapid event, with birds minimizing stopover time. Migration timing is critical due to the narrow window of breeding opportunity provided by the short arctic growing season. Successful breeding depends on being able to rapidly acquire sufficient reserves to fuel long-distance migration and arrive on the breeding grounds in adequate condition for reproduction.

OBJECTIVES

The primary goal of this study was to evaluate several impoundment management practices in a nutritional context. Specifically, the study seeks to

- 1) Assess nutritional value of common waterfowl and shorebird foods from Atlantic Coastal impoundments;
- 2) Evaluate the efficacy of impoundment discing as a shorebird management technique by assessing effects on aquatic invertebrate production;
- 3) Evaluate the efficacy of impoundment discing as a waterfowl management technique by assessing effects on moist-soil plant seed production;
- 4) Evaluate potential secondary impacts of snow geese on other waterbirds by assessing aquatic invertebrate responses to goose herbivory on moist-soil vegetation; and,
- 5) Integrate laboratory measures of quality and field measures of abundance as a means for assessing waterbird food production in a nutritional context.