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Habitat Relationships of Waterfowl Wintering in Narragansett Bay

BY RICHARD MCKINNEY

Narragansett Bay in winter can be a hostile place—cold winds, winter storms, and ice keep most animals and people away from its shores. But many species of waterfowl are right at home in its frigid waters. Twenty-three waterfowl species are regular or occasional winter visitors to the Bay, including 11 of 15 species of sea ducks, a guild of waterfowl that breed in the remote boreal forests of Canada and winter as far south as Chesapeake Bay. Sea ducks spend most of their time during the winter on the water, favoring estuarine and near-coastal areas where they can feed on benthic invertebrates such as snails, mussels, and crabs. Narragansett Bay also hosts substantial numbers of Scaup, Mallard, American Black Duck, and American Wigeon, which take refuge in sheltered harbors and coves.

In the winter of 2001 the U.S. Environmental Protection Agency (EPA) initiated a study to investigate relationships between wintering waterfowl and the variety of habitats present in the Bay, from shallow, salt marsh-dominated coves to mid-Bay open water to rocky headlands that characterize its southern shores. As part of a new initiative to be proactive on human-induced threats to natural ecosystems, EPA is interested in the effects of habitat loss and alteration in coastal areas on resident wildlife species (USEPA 2002). As a preliminary step in this process, I have begun to assess the abundance and species diversity of wintering waterfowl in Narragansett Bay. The immediate goals of the project are to determine what waterfowl species use the Bay, what habitat types are used by different species, and what habitat characteristics are important in sustaining populations of wintering waterfowl.

What waterfowl species use Narragansett Bay habitats?

To determine waterfowl species diversity and abundance, I have conducted a mid-winter Bay-wide survey for the past three years, with the help of a number of field assistants and volunteer birders. We used direct counts (BCMELP 1999, Stott and Olson 1972) to record all waterfowl at 66 survey points that were chosen to provide as complete coverage of the Bay as possible. We found an average of 14,650 total waterfowl per survey, including 17 species of waterfowl that are regular winter inhabitants of the Bay (Table 1). Scaup (there are two species, but they are very difficult to differentiate) are the most numerous wintering waterfowl in the Bay, but their numbers today are lower than those of the mid-1900s, when over 20,000 birds were reported (Ferren, unpublished). The number of Common Eider is lower than that reported during the mid-1990s, which numbered as high as 10,000, and were concentrated near the mouth of the Bay (C. Allin, personal communication). The abundances of both Common Goldeneye and Bufflehead were consistent from year to year within our survey period, and are similar to those reported in the early to mid-1900s (Ferren, unpublished).

Bufflehead, photo: R. McKinney

What habitats do wintering waterfowl use in Narragansett Bay?

Waterfowl can be found throughout the Bay, but several general habitat types are favored by specific assemblages of species. These general patterns of habitat utilization may be driven by the life-history strategies of the species or by other factors such as competition, predation, or site fidelity (Morrison et al. 1998, Robertson and Cooke 1999, Werner and Hall 1979, Werner et al. 1983). During our surveys we found that waterfowl utilize four general habitat types in Narragansett Bay (Table 2). Dabbling ducks such as American Black Duck and Mallard use salt marshes both at high tide for protection and feeding and at low tide as roost sites. Gadwall, Canada Geese, and Bufflehead use shallow coves that offer easy access to benthic prey and also tend to be better protected from prevailing winter winds. Large flocks of Scaup, as well as Red-breasted Merganser and Common Goldeneye, frequent open water in the middle to lower part of the Bay. Harlequin Ducks and Common Eider are found primarily near rocky headlands at the mouth of the Bay.

Table 1. Mean (± standard deviation) abundance of waterfowl species per mid-winter survey in Narragansett Bay from 2001 to 2004, in order of abundance.

Common Name	Species	Mean (SD)	Primary Habitat
Scaup	*Aythya* spp.	2829 (1056)	Estuarine open water
Canada Goose	*Branta canadensis*	2051 (20)	Shallow coves
Common Goldeneye	*Bucephala clangula*	1803 (735)	Estuarine open water
Common Eider	*Somateria mollissima*	1515 (811)	Rocky headlands
Brant	*Branta bernicla*	1053 (1214)	Shallow coves
American Black Duck	*Anas rubripes*	980 (40)	Salt marsh
Mallard	*Anas platyrhynchos*	784 (759)	Salt marsh
Red-breasted Merganser	*Mergus serrator*	780 (63)	Estuarine open water
American Wigeon	*Anas americanus*	763 (421)	Salt marsh
Bufflehead	*Bucephala albeola*	659 (83)	Shallow coves
Gadwall	*Anas strepera*	395 (152)	Shallow coves
Mute Swan	*Cygnus olor*	387 (193)	Shallow coves
White-winged Scoter	*Melannita fusca*	353 (82)	Estuarine open water
Black Scoter	*Melannita nigra*	128 (99)	Estuarine open water
Harlequin Duck	*Histrionicus histrionicus*	87 (26)	Rocky headlands
Hooded Merganser	*Mergus cucullatus*	58 (35)	Shallow coves
Surf Scoter	*Melanitta perspicillata*	23 (28)	Estuarine open water

What habitat characteristics are important in sustaining populations of wintering waterfowl?

In addition to the Bay-wide survey, we also collected bimonthly census data from November through April at twelve study sites. The data revealed differences in habitat use, even for the same species in the same habitat type. For example, Bufflehead abundance varied across six shallow, salt marsh-dominated coves, from a high of 41 in Coggeshall Cove on Prudence Island to a low of 14 in Watchemoket Cove near Providence (ANOVA, df = 5, F = 7.91, $p < 0.001$). What factors are driving our observed differences in abundance, even between similar habitat types? Overall prey abundance ($r^2 = 0.09$, $p = 0.55$) and habitat area ($r^2 = 0.42$, $p = 0.16$) did not significantly influence abundance; in fact, the number of Bufflehead actually decreased with increasing habitat area. Ongoing studies at these sites indicate that the energetic demands of wintering Bufflehead at these sites are adequately met, and that in theory these habitats could support more birds than are present (McKinney and McWilliams, manuscript in preparation). We therefore began to look for other habitat characteristics that may be influencing patterns of utilization not just by Bufflehead, but also by all waterfowl species in the Bay. To look for habitat characteristics that may be influencing utilization, I used abundance-weighted principal component analysis (AW-PCA), a statistical technique that overlays species abundances on principal component analysis plots of study sites and can give insights into habitat characteristics that may be influencing use. PCA can take a number of habitat and landscape characteristics and reduce them to several dominant characteristics that are then used to describe or group the sites.

When waterfowl abundances were added to PCA plots, species that prefer rocky headlands and estuarine open water appeared to favor larger sites with greater amounts of natural vegetation or salt marsh in a 100-m radius around the habitat, and a higher proportion of the habitat perimeter bordered by salt marsh or natural vegetation. On the other hand, salt-marsh and shallow-cove species tended to favor sites with higher amounts of adjacent forested land or structures that could potentially block prevailing winds and sites with more adjacent residential development. Our finding that species inhabiting shallow coves prefer areas with higher residential development seems at odds with the general perception that waterfowl will avoid direct human disturbance (Belanger and Bedard 1990; Evans and Day 2001, 2002; Perry and Dellar 1996). One possible explanation may lie in the amount of hunting activity in these areas. In Rhode Island, waterfowl hunting is often prohibited in coves and embayments with adjacent residential development, and this, along with the wind-attenuating effect of houses and other structures immediately adjacent to the cove, may offset the effects of human disturbance for species that use these areas.

Table 2. Locations of high waterfowl diversity or abundance in Narragansett Bay during winter. Species richness, or the number of waterfowl species recorded, dominant species, and the total number of waterfowl present are reported for the 2004 survey.

Location	Species Richness	Dominant Species[a]	Total Abundance	Habitat Type
Brush Neck Cove	7	AWIG, ABDU	1831	Salt Marsh
Apponaug Cove	9	CAGO, MALL	497	Salt Marsh
Wickford Harbor	5	BUFF	506	Shallow Cove
Potter Cove[b]	4	COGO, BUFF	307	Shallow Cove
Sabin Point	6	Scaup, COGO	2431	Open Water
Central Narragansett[c]	3	RBME	158	Open Water
Sachuest Point	8	HADU	238	Rocky Headland
Beavertail Point	6	COEI	331	Rocky Headland

a AWIG = American Wigeon, ABDU = American Black Duck, BUFF = Bufflehead, CAGO = Canada Goose, COEI = Common Eider, COGO = Common Goldeneye, HADU = Harlequin Duck, MALL = Mallard, RBME = Red-breasted Merganser
b Prudence Island
c Includes State Pier #5 and Narragansett Town Beach

Summary and conclusions

A total of 42% of the 55 native North American waterfowl species (Bellrose 1980) winters in Narragansett Bay. The average waterfowl density in the Bay is 39 birds per square kilometer, which is comparable to Boston Harbor (36 birds per square kilometer; TASL Online: http://www.gis.net/~szendeh/tasl.htm), but less than Chesapeake Bay (55 birds per square kilometer; http://www.chesapeakebay.net). We found that roughly two-thirds of the waterfowl inhabited estuarine open water and small coves, 22% frequented salt marshes, and only 11% used rocky headlands. Further investigation using abundance-weighted PCA suggested that adjacent land use may be influencing habitat utilization. Future studies will focus on developing models that can estimate waterfowl abundances in coastal vegetated habitats, in the hope of providing insights into the effects of habitat loss and alteration on resident waterfowl populations.

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Notes from Field and Study

BY RICHARD ENSER

One goal of the Rhode Island Natural History Survey is to catalog the full complement of biodiversity in the state, hopefully leading to an understanding of human impacts on biological complexity and the actions needed to preserve biodiversity into the future. Completing portions of this catalog has been accomplished for well-known, obvious, or otherwise charismatic groups such as vertebrate animals, vascular plants, and some invertebrate groups such as butterflies. But there remains a large number of organisms yet to be inventoried because there has not yet been a particular expert available to help mentor local naturalists on the nuances of capture and identification. For example, the spiders are a fascinating group of which many people can profess some familiarity and the ability to identify 10, 20, or maybe more species. However, it will take a considerable effort and an expert arachnologist to tackle this group fully given the more than 500 species estimated in this area.

Another way to work on some of the larger groups is to identify particular subgroups, or families whose members share particular characteristics in morphology, behavior, or ecology that help single them out. In this manner the tiger beetles, a rather small family within the Coleoptera, have been well-documented in Rhode Island because individual species tend to use similar habitats, are relatively easy to find and capture, and are not difficult to separate taxonomically.

Diptera (flies and relatives) is a large order of insects estimated to contain more than 2000 species statewide. As such this necessitates the selection of smaller groups for study. One dipteran group that has recently begun to receive increased scrutiny is the family Asilidae, or the robber flies.

Ginger and Charlie Brown, fresh from their successes during the state Odonate Atlas project, were determined to use their field skills in a new arena. They reconnected with Mike Thomas of the Connecticut Agricultural Experiment Station, an expert on robber flies who is preparing a southern New England assessment. In no time they were supplying Mike with Rhode Island specimens.

According to Mike, little is known about the approximate 78 asilid species recorded in Connecticut. There are no field guides or comprehensive texts on the group, although there are a few treatments—including *The Asilidae of Connecticut* by Stanley W. Bromley, published in 1946. What is known is that the robber flies are fairly distinctive predatory insects, many with long abdomens so they superficially resemble damselflies. They lay their eggs in soil and rotten wood, with some species being fairly specific in their selection of wood from only certain tree families. The larvae as well are predators, hunting bark beetles and other large insects.

Mike also explains that some species historically recorded in New England have not been found in recent years, and he suspects at least two that were common in the early 1900s during the agricultural era have probably disappeared. But fieldwork conducted by the Browns in 2004 has resulted in some good rediscoveries. During BioBlitz 2004 in June at the Alton Jones Campus, *Laphria champlanii* was identified after not being seen in New England since 1913. It's a species that perches almost exclusively on Scrub Oak (*Quercus ilicifolia*). In addition, *Echthodopa formosa* was found at the Great Swamp following a nearly 70-year absence. To date, about 48 species of robber flies have been documented in one year's effort in Rhode Island, or about 60% of the expected number. Although the remaining 40% may collectively be more challenging to find, Rhode Island is well on its way toward learning about this varied group of flies and completing another piece of the state's biodiversity puzzle.

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