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Maria O'Brien
Connecticut College

Robert A. Askins
Connecticut College, raask@conncoll.edu

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THE EFFECTS OF MUTE SWANS ON NATIVE WATERFOWL

MARIA O'BRIEN AND
ROBERT A. ASKINS

Mute Swans (*Cygnus olor*) were introduced into the United States from Europe at least as early as 1900 (Long 1981), but they did not become established in southern New England until the 1950's, when captive birds apparently escaped from estates in Newport (Palmer 1976). Since then swan populations have increased rapidly in Rhode Island and Connecticut. In 1965 no Mute Swans were recorded on the Connecticut mid-winter waterfowl survey conducted by the Connecticut Department of Environmental Protection (Anon. 1983). By 1970 over 200 swans were counted in the state and 1400 swans were recorded in 1984. Because Mute Swans are aggressive, reproduce rapidly, have a low mortality rate, and ingest large amounts of aquatic vegetation, their effect on resident and wintering waterfowl has been a cause of concern (Reese 1975, 1980).

Like many resident and wintering ducks in Connecticut, Mute Swans are primarily vegetarians (Berglund et al. 1963). Mute Swans not only feed on the same type of food needed by ducks, but they feed on vegetation throughout the year because they do not migrate. On the basis of a comparison of the diets of Mute Swans and various species of ducks, however, Willey and Halla (1972) concluded that feeding behavior of swans probably does not affect ducks adversely (although aggressive behavior by swans during the breeding season might).

Previous comparisons of the diets of Mute Swans and ducks were based on analyses of stomach contents. In contrast we have focused on feeding behavior because two species can use the same type of food and not compete if they consistently feed in different parts of the environment. Our observations of feeding techniques and habitat utilization by 4 species of waterfowl suggest swans and ducks depend on different food sources.

METHODS

Mute Swans were studied at three coves along the Thames River in Quaker Hill, Connecticut (Smith Cove and small coves north and south of Mamacoke Island) from September to November, 1982, and from February to May, 1983. The coves are part of an estuary with tidal differences of approximately 0.5 m. Four species of ducks were studied for comparison with swans: Mallard (*Anas platyrhynchos*), American Black Duck (*Anas rubripes*), American Wigeon (*Anas americana*), and Canvasback (*Aythya valisineria*). Other species such as Hooded Merganser (*Lophodytes cucullatus*) and Greater Scaup (*Aythya marila*) were not included in the study because they do not rely heavily on plant food (Bellrose 1976) and thus are not likely to compete with swans for food.

A vegetation analysis using five east to west transect lines was conducted in Northern Mamacoke Cove in the fall prior to observations. Vegetation samples were taken every 5 m with a benthic grab sampler and depth was recorded. Another transect line was run on the southern portion of Smith Cove.

Individual waterfowl were observed for 2-5 minutes to determine the primary feeding technique and the feeding distance from shore. Feeding techniques were classified into four categories: (1) Dabbling; Food ob-

tained from the water surface or off rocks without submergence of the body. (2) Neck-Plunging; Food obtained below the surface by submergence of the head and neck. (3) Tipping; Food obtained from deeper water by upending with submergence of head, neck and forebody. (4) Diving; Food obtained by diving below the surface.

Feeding areas were divided into 4 categories based upon distance from water's edge: 0-1 m, 1-5 m, 5-10 m, and >10 m. All distances were measured from the water's edge (rather than the shore) to compensate for tidal fluctuations.

Any threat displays or aggressive behavior shown by Mute Swans toward ducks or other swans were noted.

Results

Approximately 8 Black Ducks and 24 American Wigeon were present during both seasons, while Mallards increased from 8 in the fall to 15 in the spring. A flock of more than 500 Canvasbacks arrived in February, decreased to 0 the first few days of March, after which 24 returned and remained through the first part of April.

The 20-30 Mute Swans present in September increased to 130 by November, but were back down to 30 by February. In March, 12-14 individuals, including 2 pairs, remained. It was evident from their aggressive behavior toward other swans that the two pairs had established breeding territories.

The vegetation analysis showed the entire bottom of Northern Mamacoke Cove supported a dense carpet of sea lettuce (*Ulva lactuca*). The Smith Cove transect recorded sea lettuce out to 15 m from shore after which there was no bottom vegetation. The depth of the water increased steadily from the shore along all of the transects; 15 m from shore it reached 1.5-2 m at high tide.

In both seasons the feeding areas and feeding techniques of swans were significantly different from those used by any of the duck species (chi-square test; $p<0.001$ in all cases). Swans usually fed 5-10 m from shore using a neck-plunging technique (Fig. 1 & 2). In both seasons all the dabbling ducks fed within 5 m of shore primarily by dabbling and neck-plunging, although American Wigeon were observed feeding on floating vegetation approximately 20 m from shore (Fig. 2). Canvasbacks only used diving as a feeding technique and fed 5-10 m from shore when the cove was ice free. When most of the study area was covered with ice, Canvasbacks fed along the edge of the ice, at one time 70-100 m from shore. In contrast, swans and dabbling ducks fed between the ice and shore (1-5 m from the water's edge) where a small amount of open water remained.

Discussion

The feeding techniques and feeding areas used by swans are distinctly different from those used by any of the ducks. Thus, despite the large winter concentrations of Mute Swans in the coves adjacent to Mamacoke Island, there was little competition for food between swans and ducks. Both swans and ducks fed primarily on sea lettuce, but the swans usually foraged further from shore and fed by neck-plunging. This permitted them to reach to a depth of 1.2 m (Berglund et al. 1963) and obtain food unavailable to dabbling ducks.

Canvasbacks tended to feed further from shore than swans, but when they fed in shallow water they may have used the same food supply. Even then food competition was probably limited. Canvasbacks are

more likely to dig plants out of the mud when they dive (Perry, 1982), while swans often only nip off the shoots, leaving the roots intact (Berglund et al. 1963). Furthermore, invertebrates (especially molluscs) are a major component of the diet of Canvasbacks in some regions (Perry, 1982).

Berglund et al. (1963) concluded tha Mute Swans have little effect on aquatic vegetation in southeastern Sweden because plant productivity is high and the food supply is large. Willey and Halla (1972) argued that the situation is similar in Rhode Island, even on small ponds with large concentrations of wintering swans. They concluded that competition between swans and ducks was insignificant because there was no shortage of food. Although sea lettuce was abundant in our study area, we can not conclude from the single vegetation survey that food is always so abundant that waterfowl never compete for food. However, even if food is in short supply, swans may not compete with ducks because they usually feed in deeper water than dabbling ducks and shallower water than Canvasbacks. Some competition could occur when ice forces swans to feed in shallow water or when the same vegetation zone is used by swans and ducks during different periods of the tide.

Willey and Halla (1972) suggested the aggressiveness of swans during the breeding season may interfere with nesting attempts by geese and ducks. Stone and Marsters (1970) reported that territorial Mute Swans

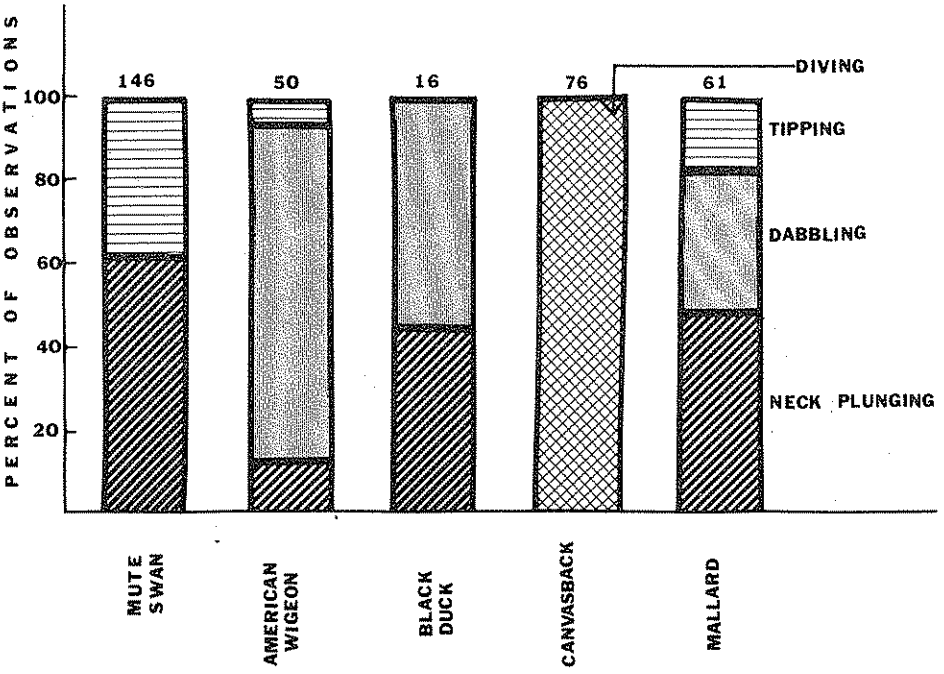

Figure 1. Primary foraging techniques of five species of waterfowl. Sample sizes are shown above the bars.

killed a large number of ducks and geese in a zoo, but all of the waterfowl were pinioned and were confined to a small enclosure. Swans apparently are not normally this aggressive under more natural circumstances. From an extensive study of Mute Swans in Great Britain, Eltringham (1963) concluded that attacks on other species are rare. Likewise, during our extended observations of both territorial and non-territorial swans, we recorded no instances of aggressive behavior toward ducks. Also, Ann Balsamo (pers. comm.) observed no aggression against other species of birds in a 14 week study of courtship and territorial behavior of 5 pairs of Mute Swans on the Thames River. Both Eltringham (1963) and Willey and Halla (1972) recorded waterfowl nesting within a few meters of Mute Swan nests without any signs of aggressive behavior.

Our study near Mamacoke Island suggests Mute Swans have relatively little effect on wintering and resident ducks. Competition for food between swans and ducks may be limited by an abundance of food as well as differences in feeding areas and feeding methods. However, the steady increase in Mute Swan populations makes it imperative to continue monitoring the effect of swans on native waterfowl.

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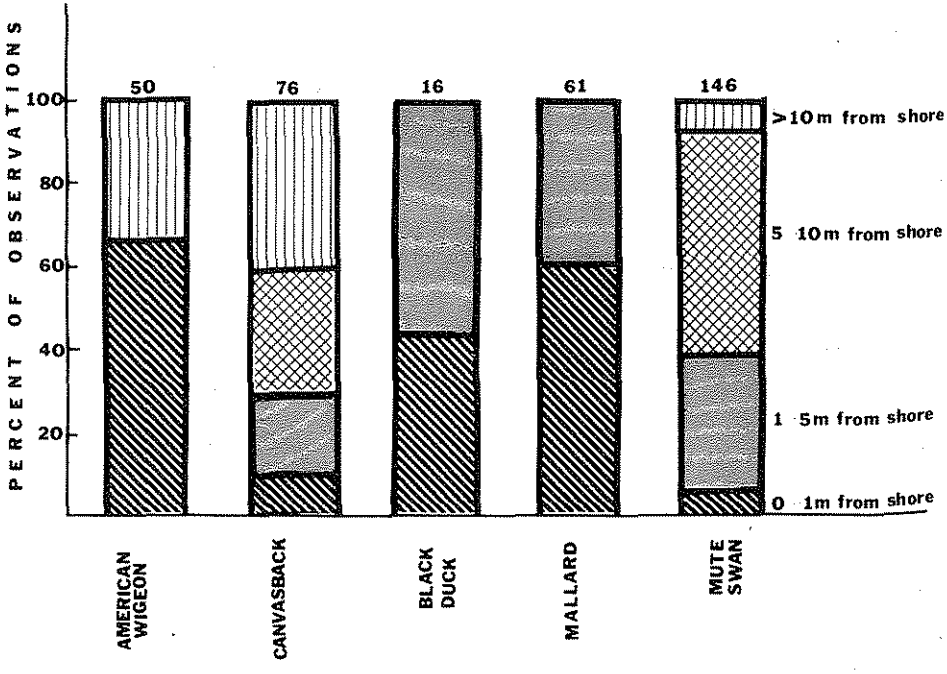

Figure 2. Primary feeding areas of five species of waterfowl. Sample sizes are shown above the bars.

ments on drafts of this paper. Much of the field work was done in the Connecticut Arboretum.

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Department of Zoology, Connecticut College, New London, CT 06320

THE NATCHAUG ORNITHOLOGICAL SOCIETY

Dolores T. Hilding

The Natchaug Ornithological Society (NOS) of Mansfield, Connecticut, began as an independent group for the study of birds on 26 June 1956. Jerauld Manter, Professor Emeritus of Entomology, and James Slater, Professor of Biology, both of the University of Connecticut, and two experienced ornithologists, Frank McCamey and the late Richard May, along with eleven other persons, selected the Society's name. They also dedicated the Society to the study, observation, sharing of sightings, and establishment of a record of the birds of Mansfield and the nearby towns of Coventry, Tolland, Willington, Ashford, Chaplin, Windham, and Columbia. Subsequently the NOS has expanded its coverage to the town of Union. Storrs, the part of Mansfield in which the University of Connecticut is located, has been an area of special interest to the NOS.

The Society's emphasis from the beginning, and throughout all twenty-eight years, has been on the accurate reporting and recording of where and when particular species have been seen, and, more recently, on nesting, feeding, and other behavioral activities. A board of three members reviews unusual sightings, and one board