J. Field Ornithol., 64(2):219–222

LESSER SCAUP FORAGE ON ZEBRA MUSSELS AT COOK NUCLEAR PLANT, MICHIGAN

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Abstract.—Nineteen of 21 Lesser Scaup (*Aythya affinis*) entrained while foraging at the water intake structures of Cook Nuclear Plant, Bridgman, Michigan had consumed zebra mussels (*Dreissena polymorpha*). The average number of zebra mussels in the upper gastrointestinal tract was 260; maximum number was 987. Migrating Lesser Scaup found this new food source during the first winter following settlement of zebra mussels on the water intake structures of the power plant.

INDIVIDUOS DE *AYTHYA AFFINIS* SE ALIMENTAN DE MEJILLONES EN AGUAS DE LA PLANTA NUCLEAR COOK EN MICHIGAN

Sinopsis.—Diecinueve de 21 individuos de *Aythya affinis*, que fueron succionados por la tubería de entrada de agua de la planta nuclear Cook de Bridgman, Michigan, contenían mejillones (*Dreissena polymorpha*) en su trayecto digestivo. El número promedio de mejillones, en la parte superior del trayecto digestivo, resultó ser de 260; máximo de 987. Estos patos migratorios encontraron este nuevo recurso alimentario, un invierno después de que los mejillones se establecieron en las estructuras de entrada de agua de la planta nuclear.

Zebra mussels (*Dreissena polymorpha*) were first introduced into U.S. waters in 1985 or 1986 by discharge of freshwater ballast from a transoceanic ship into Lake St. Clair, Michigan (Snyder 1990). Since then zebra mussels have spread into all of the Great Lakes and into many rivers, including the Illinois and Mississippi (Moore 1991). Their arrival in North America has raised many ecological concerns because their high reproductive potential (Mackie 1991) can result in high densities and their nonselective feeding methods (Hebert et al. 1991, Reeders et al. 1989) may alter the trophic structure and disrupt food webs. Zebra mussels attach to hard surfaces such as rocks, shells of other molluscs, and vegetation (Hebert et al. 1991). They generally are not found on sand or soft bottom habitats unless there are substrates for attachment. Zebra mussels are eaten by diving ducks in Europe (Stanczykowska et al. 1990) and potentially offer a new source of food for ducks in North America. There are no published accounts of diving ducks eating zebra mussels in North America.

STUDY SITE AND METHODS

Cook Nuclear Plant, Bridgman, Michigan, (41°57'N, 86°33'W) operational since 1973, is located along the southeastern shore of Lake Michigan in an area with a sandy bottom. The plant's three cooling water intake structures are located 600 m offshore in 4 m of water. The ends of these structures are surrounded by a subsurface berm of rock. The water intake structures and rock berm are the only hard substrates in the immediate area.

Approximately 400 scaup, mainly (>90%) Lesser Scaup (*Aythya affinis*), were entrained into the water intake of the plant between 5 and 17 Dec. 1991. Dead birds were removed from debris-collecting screens inside the plant and frozen. On 18 and 19 Dec. 1991, 21 Lesser Scaup were haphazardly selected from the bag of 50 frozen ducks that we received from Cook Nuclear Plant. Ducks were thawed and the contents of the esophagus and proventriculus (upper gastrointestinal [GI] tract) removed separately and preserved in 95% ethanol. Scaup were sexed by the presence or absence of an enlarged tympanum (syrinx, osseus bulla) and aged by the presence or absence of the bursa of Fabricius in combination with feather characteristics (Carney 1964, Welty 1982).

Zebra mussels in each esophagus and proventriculus were counted and shell length measured to the nearest 0.1 mm. When more than 20 zebra mussels were present, a random sample of approximately 15%, but never fewer than 15, was measured. As a result of the small variation in size of zebra mussels, the mean size stabilized with 10 measurements (CAM, unpubl. data). Two-way analysis of variance (ANOVA) in a split-plot was used to test for differences in mean number and mean size of zebra mussels between ages (adult and hatching-year), sexes and tissues (esophagus and proventriculus). All statistical tests used a 0.05 level of significance.

RESULTS

Sixteen of 21 Lesser Scaup were hatching-year ducks (13 males, three females); the rest were adults (four males, one female). Nineteen scaup had zebra mussels present in either or both the esophagus and proventriculus; no food was present in the upper GI tracts of the two other scaup (both hatching-year males). No other food items, besides zebra mussels, were present in the upper GI tracts, except for one scaup whose upper GI tract also contained three small snails.

Number of zebra mussels in the entire upper GI tract averaged 260 ± 53 (SE); maximum number was 987. Zebra mussels were ingested whole with the shells pulverized after they reached the gizzard. Numbers of zebra mussels in the esophagus and proventriculus did not differ between males and females ($F = 1.16$; df = 1,17; $P = 0.30$), adults and hatching-year ducks ($F = 0.01$; df = 1,17; $P = 0.91$), or between the esophagus and proventriculus ($F = 1.13$; df = 1,17; $P = 0.30$). Average size of zebra mussels (4.1 ± 0.2 mm) did not differ significantly between

males and females ($F = 0.41$; df = 1,15; $P = 0.53$), adults and hatching-year ducks ($F = 0.29$; df = 1,15; $P = 0.60$), or between the esophagus and proventriculus ($F = 1.58$; df = 1,10; $P = 0.24$). Interaction terms were not significant in the analyses.

DISCUSSION

This is the first published account of ducks eating zebra mussels in North America. Invertebrate food items (e.g., amphipods, snails, clams and insects) usually predominate in the diet of fall migrant Lesser Scaup, although in previous studies molluscs were less than 30% aggregate dry weight in the diet of adult Lesser Scaup and only 6% in the diet of hatching-year Lesser Scaup (Afton et al. 1991). In this collection, molluscs comprised nearly 100% of the diet. Food habits in our sample of 21 Lesser Scaup were representative of the ducks retrieved from Cook Nuclear Plant. Nineteen of 24 Lesser Scaup from Cook Nuclear Power Plant, prepared for contaminant analysis, also contained 100% zebra mussels in their upper GI tract (T. Custer, U.S. Fish and Wildlife Service, pers. comm.).

Migrating scaup found this new food source almost immediately. Zebra mussels settled on the water intake structures for the first time during summer 1991 (J. Carlson, pers. obs.), and diving ducks were observed offshore from the power plant for the first time during December 1991 (J. Carlson, pers. obs.). The small size of most of the zebra mussels (<10 mm long) supports the observation that zebra mussels first settled out at the power plant during summer 1991 (Hebert et al. 1989). Thus, Lesser Scaup and probably other diving ducks seem to search out new feeding locations and will opportunistically consume zebra mussels when available during migration and winter. The importance of this new food source to migrating and wintering waterfowl remains to be determined as does the degree to which diving ducks may be able to control zebra mussels in the Great Lakes of North America.

ACKNOWLEDGMENTS

We thank Andrew F. Boysen, Christopher O. Kochanny and Carl E. Korschgen for help with the dissections; Wesley Newton for statistical support; Jane E. Austin, Thomas W. Custer, George A. Swanson and two anonymous reviewers for comments on early drafts of the manuscript; and the National Fisheries Research Lab–Great Lakes for temporarily storing frozen ducks.

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Received 6 Apr. 1992; accepted 12 Aug. 1992.