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RED-BREASTED MERGANSERS IN AN URBAN WINTER HABITAT

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Abstract.—During the winters of 1991–95, I determined population densities, proportions of adult males, activity budgets, and foraging by Red-breasted Mergansers (*Mergus serrator*) during mid-day on the urbanized inner harbor at Boston Massachusetts. Red-breasted Mergansers arrived at Boston in mid-to-late December, reached peak densities of 1–3/ha in late January or early February, and left by the first week of April. The mid-winter proportion of adult males was 60–80% in the three winters of 1991–92 through 1993–94, but only approximately 30% during the warmer than average winter of 1994–95. Foraging, preening, and alert/swimming each accounted for about 20–30% of observations. Red-breasted Mergansers surfaced with and ingested fish after 6.4% of dives, and, when gulls attempted to pirate fish, the mergansers escaped under piers.

INDIVIDUOS DE *MERGUS SERRATOR* EN UN HÁBITAT INVERNAL URBANO

Sinopsis.—Durante el invierno de 1991–95, determiné la densidad poblacional, la proporción de machos adultos, presupuesto de actividades y patrones de forrajeo de individuos de *Mergus serrator.* El estudio se llevó a cabo a mitad del día, en la parte urbana e interior del puerto de Boston, Massachusetts. Las aves llegan a Boston de mediados a finales de diciembre, y alcanzan un pico en su densidad (1–3 ind./ha) tarde en enero o a principios de febrero. Estos dejan el área en la primera semana de abril. La proporción de machos adultos a medio-invierno resultó de 60–80% en el 1991–92 y hasta 1993–94, pero tan sólo 30% durante el invierno más templado de 1994–95. El acicalamiento, forrajeo y nado de alerta formaron entre el 20–30% de las observaciones. Las aves emergen con un pez y lo ingieren en el 6.4% de las sumergidas, y se refugian bajo los muelles, cuando las gaviotas tratan de robarle los peces.

Red-breasted Mergansers that make use of harbors are increasingly subject to human activity and urbanization. The inner harbor at Boston, Massachusetts, for example, is completely urbanized; nonetheless, Red-breasted Mergansers are common at this site during winter. The objective of this study was to quantify the population ecology and behavior of this species in this urban environment. Specifically, during the four winters of 1991–1995, I used non-interventional observations to determine population sizes, proportions of adult males, activity budgets, and foraging of Red-breasted Mergansers on the Boston inner harbor.

STUDY AREA

The study site was the Charlestown Navy Yard at Boston, Massachusetts (42°20′N, 71°5′W). This estuary on the north side of the Boston inner harbor has direct southern connection to the ocean and fresh water inflows from the Charles River to the west and the Mystic River to the north. The natural shoreline has been replaced entirely with a granite seawall and has been developed in the form of piers, marinas, parks, and condominiums.

METHODS

From 1 December through the first week of April of the four winters of 1991–1995, I recorded data on Red-breasted Mergansers that I saw during 1-h observation sessions that took place between 1000h and 1330h. For each session, I walked an established 1.8-km route and used 10 × 25 binoculars to examine a water area of about 25 ha which began at the shoreline and extended out approximately 500 m (half the width of the harbor). I carried out 2–5 sessions each week, including 65 in 1991–92, 49 in 1992–93, 48 in 1993–94, and 56 in 1994–95. All observations were made at ≥25 m to prevent disturbing birds.

During each session, I recorded the total number of Red-breasted Mergansers within the study area, as well as how many had adult male plumage. I limited sex identification to adult males, because I was unable to reliably distinguish females from juvenile males. I recorded air temperature, tide stage from an on-site depth gauge (the tidal range was 3.6 m), and notes about other species. I noted whether birds foraged by diving or by swimming with only heads underwater (Munro and Clemens 1939, Richner 1988, Sjoberg 1988), and whether birds foraged as individuals or in a coordinated manner in which several birds repeatedly dive and surface nearly simultaneously while moving in the same direction as if herding prey (Des Lauriers and Brattstrom 1965, Fargo 1931).

During the 1993–94 and 1994–95 seasons, I used scan sampling (Altmann 1974) to estimate activity budgets. At the time each merganser was identified, I assigned its activity to one of five categories: alert (head up, with or without swimming), preening, resting/sleeping (head on back), diving/foraging, and flying (cf. Inglis 1977, Reynolds 1987). Also, during each session of the third and fourth winters, I observed every merganser that surfaced from a dive and determined whether or not the bird surfaced with and ingested prey. I examined data for statistical significance with Fisher's exact test for 2 × 2 contingency tables or Chi-square with Yates correction for larger tables using the InStat (vl.12) computer program (GraphPad Software Co., San Diego CA).

RESULTS

Each year, Red-breasted Mergansers arrived, reached peak numbers, and departed Boston Harbor on similar schedules (Fig. 1). In the four winters, I first sighted Red-breasted Mergansers on 17 Dec. 1991, 21 Dec. 1992, 17 Dec. 1993, and 29 Dec. 1994. The daily census was usually <10/d in December, but increased during January and reached a peak of 50–75/d (2–3/ha) near the end of January or in early February (Fig. 1). Smaller numbers remained through March, but I saw none after the first week of April.

In the first three winters, adult males made up a majority of the Red-breasted Mergansers during January and early February when daily censuses were highest (Fig. 2). During a 5–7 wk period in mid-winter, 70–80% of the mergansers were adult males in the first two winters, and 55–

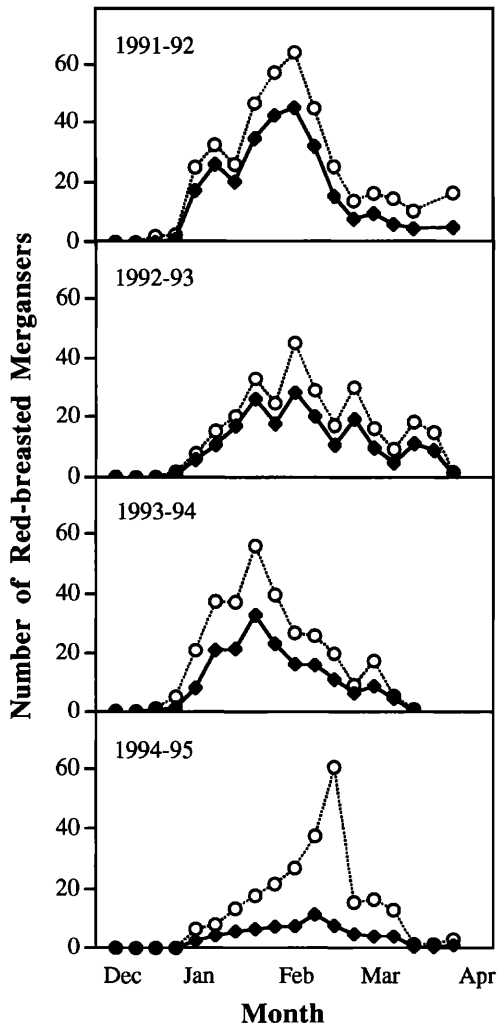

FIGURE 1. Total numbers (open circles) and adult male numbers (closed diamonds) of Red-breasted Mergansers during four winters on the inner harbor at Boston, Massachusetts. Each point is the average of all observations from a single week.

60% were adult males in the third winter (Fig. 2). In December and March of the first three winters, the proportion of adult males was ≤50%. The average flock size in 1994 was 5.0 ± 4.4 (n = 140, range 2–36) with single birds excluded, and 2.9 ± 3.5 (n = 287) with single birds included.

In the fourth winter, adult males were a minority (Fig. 2). From mid-January to the end of February 1995, only about 30% of the Red-breasted Mergansers were adult males. The first half of the winter of 1994–95 was

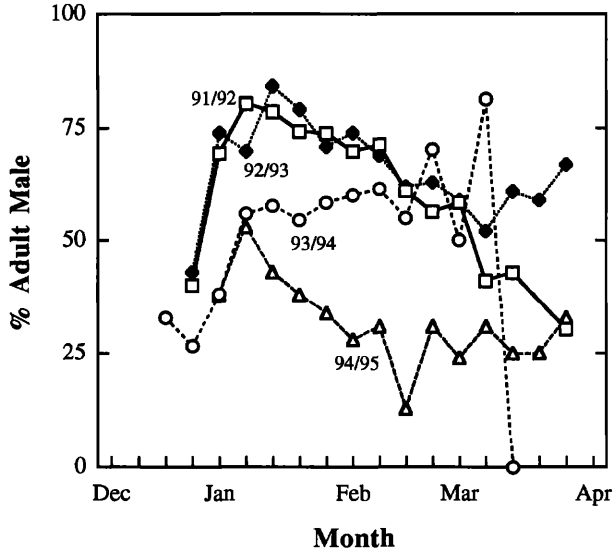

FIGURE 2. Percentages of Red-breasted Mergansers that were adult males during four winters on the inner harbor at Boston, Massachusetts. Each point is the average of all observations from a single week.

unusually warm, with average temperatures 3.3 C above average for December through the first week of February.

During 1993–94 and 1994–95, mergansers spent 20–30% of their mid-day time in each of three behaviors: foraging, preening, and alert head-up behavior, including swimming (Table 1). Sleeping and flying were less common. Activity budgets did not vary significantly with time of year ($P > 0.1$). Also, most aspects of activity budgets, except foraging in 1993–94, did not vary with tide stage ($P > 0.1$). In 1993–94, 39.0% (152 out of 390) of the Red-breasted Mergansers foraged at tides below mean com-

TABLE 1. Mid-day activities of Red-breasted Mergansers wintering on Boston harbor.

Winter	Activity	Number (percentage) of observations
1993–94	Foraging	277 (31.0)
	Preening	261 (29.2)
	Alert/swimming	194 (21.7)
	Sleeping	102 (11.4)
	Flying	60 (6.7)
1994–95	Foraging	186 (23.7)
	Preening	160 (20.4)
	Alert/swimming	216 (27.5)
	Sleeping	124 (15.8)
	Flying	99 (12.6)

pared to only 23.8% (125 out of 504) at tides above mean ($P < 0.001$). In 1994–95, however, 21.3% (61 out of 287) foraged at tides below mean compared to 25.1% (125 out of 498) above mean ($P > 0.1$).

Red-breasted Mergansers surfaced with and ingested fish after 61 (6.4%) of 946 dives. The mergansers almost always foraged by diving and as individuals, though there were three occasions when I observed individuals forage by swimming with only heads underwater and two occasions when I observed flocks in coordinated foraging. Prey were most often round-bodied fish or, rarely, flounder-like flatfish that were almost always about twice the length of the birds' bills (about 10–15 cm). Mergansers sometimes captured, but did not ingest, larger (≥20 cm) fish, eels, or crabs (carapace widths of 10–15 cm). On seven occasions, I saw Herring (*Larus argentatus*) or Great Black-backed (*L. marinus*) Gulls attempt to pirate fish from Red-breasted Mergansers. In each case, the merganser dove with its prey and then resurfaced beneath the nearest pier, at which time the gulls broke off pursuit.

DISCUSSION

The inner harbor at Boston supported a comparatively high mid-winter density of 1–3 Red-breasted Mergansers/ha. Mid-winter densities were <0.5 Red-breasted Mergansers/ha at sites in Texas and Poland (Bowles 1980, Górski 1981), and <0.2/ha at three New Hampshire estuaries 50–100 km north of Boston (Stott and Olson 1973). In mid-winter, the number of Red-breasted Mergansers at the Boston site was relatively constant, though a study of marked birds is needed to determine if individuals remain from day-to-day.

At Boston, most Red-breasted Mergansers in January and February of the first three study winters were adult males, and this pattern also occurred at the widely separated wintering sites in Texas and Poland (Bowles 1980, Górski 1981). Adult males were in the minority at Boston in the mid-winter of the fourth winter, which was warmer than average. Perhaps Red-breasted Mergansers exhibit differential age and sex migration as do Common Mergansers (*Mergus Merganser*) (Chandler 1984, Nilsson 1970a). In December and March, adult males did not predominate at Boston, Texas, or Poland (Bowles 1980, Górski 1981), suggesting that adult males may arrive later and depart earlier than females and juveniles.

Wintering Red-breasted Mergansers devoted less time to foraging on the Boston inner harbor than at other sites. The proportion of time spent foraging was 23–31% at Boston, but 50% on the Texas coast (Bowles 1980); 80% on the Ythan estuary in northeast Scotland (Richner 1988), and 32–77% on the south Swedish coast (Nilsson 1970b). At the Scotland site, as at Boston, the foraging percentage did not vary with tide stage (Richner 1988).

The daily food intake of Red-breasted Mergansers is 200–250 g (Atkinson and Hewitt 1978, Kolbe 1989) and consists almost entirely of fish, though crustaceans are sometimes taken (Boyle 1980, Cronan and Halla 1968, Lingle and Schupbach 1977, Munro and Clemens 1939, Stott and

Olson 1973). I did not capture birds and thus did not identify prey fish at Boston. In New Hampshire and Rhode Island, Red-breasted Merganser diets were composed largely of blueback herring (*Alosa aestevalis*), killifish (*Fundulus* sp.), and silversides (*Menidia menidia*) (Cronan and Halla 1968, Stott and Olson 1973).

At Boston, the prey fish of Red-breasted Mergansers were approximately 10–15 cm long, consistent with their preference for prey of this length and a weight of 10–20 g/fish (Kolbe 1989, Lingle and Schupbach 1977). A 200–250 g diet would require about 15–20 fish of this size, which, at a 6–7% success rate, could be obtained with 250–300 dives, which would require about 4–5 h (Sjoberg 1988). Red-breasted Mergansers do not dive at night (Nilsson 1965), so 4–5 h would amount to 30–50% of all daylight and twilight time spent diving, which is similar to what I found at Boston for mid-day foraging.

Despite potential problems due to frequent human intrusions and water quality, wintering Red-breasted Mergansers on this urban estuary reached comparatively high population densities and spent similar or less amounts of time foraging than at other sites. In addition, the Boston mergansers used piers to escape gulls, a behavior that is available only in an urban site.

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