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WINTER BEHAVIOR OF THE COMMON LOON

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Abstract.—A 2-yr study was conducted on the winter behavior of the Common Loon (*Gavia immer*) at Weekapaug, Rhode Island. Behavior of loons was assessed by recording the type of activity every 60 s for a 5-min period. Activity budgets showed an increase in the amount of time spent feeding from 23% in 1987 to 38% in 1992, possibly due to a decline in prey abundance. In addition, Common Loons spent more time in shallower waters in 1991 and 1992 versus 1987, which may reflect increases in time needed to find prey. Common Loon behavior was not correlated with water depth or time of day. No territorial behavior was observed.

COMPORTAMIENTO INVERNAL DE *GAVIA IMMER*

Sinopsis.—Se condujo un estudio de dos anos sobre el comportamiento invernal de *Gavia immer* en Weekapaug, Rhode Island. El comportamiento del ave se evaluó anotando el tipo de actividad en intérvalos de 60 seg. en 5 minutos. El tiempo invertido en la alimentación aumentó de un 23% en el presupuesto de 1987 a un 38% en 1992, posiblemente debido a una reducción en la abundancia de presas. Asímismo, las aves invirtieron mas tiempo en aguas llanas en 1991 y 1992 en contraste con 1987, lo que puede reflejar un aumento en el tiempo necesario para hallar presas. El comportamiento de la especie no se correlacionó con la profundidad del agua o con la hora del día. No se observó comportamiento territorialista.

Many of the pressures placed on Common Loons (*Gavia immer*) during the summer have been identified due to the large number of studies done on loon breeding ecology and behavior. An understanding of the winter behavior of this species may help in identifying pressures placed on loon populations during the winter. Here, we attempt to determine whether there have been changes in Common Loon winter behavior between 1987 and 1992 and to determine the reasons for any possible changes.

In a study of the activity patterns of Common Loons during the winter in Virginia, McIntyre (1978) found that feeding activity increased when the tidal rise was slow, and that maintenance behavior increased and feeding decreased when tidal rise was fast. McIntyre suggested that loons take advantage of concentration of prey items behind the receding tide. Daub (1989), however, found no correlation between tidal cycle and behavior in Rhode Island. Daub (1989) noted that the tidal changes in Rhode Island are small, so prey are not highly concentrated during ebb tide.

Daub (1989) found that drifting was the most frequently observed loon behavior during the winter, followed by feeding and maintenance. Daub reported that feeding activities occurred more frequently in depths of

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TABLE 1. Numbers of Common Loons observed at different tide levels, times of day and water depths in 1991 and 1992.

	Tide			Time of day			Water depth		
Year	Low	Mid	High	0630–0930	0930–1200	1200–1800	0–3.6 m	3.6–5.5 m	>5.5 m
1991	48	64	27	17	44	78	96	26	19
1992	44	69	28	35	22	84	49	69	23

1.5–5 m, whereas maintenance behavior and drifting occurred in deeper waters. As loons are visual predators, diving for bottom-dwelling prey may restrict feeding activity to shallow waters. Daub (1989) found no correlation between activity and time of day. McIntyre (1978) noted that Common Loons raft in deep water at night during the winter in Virginia. Daub (1989), however, saw no evidence of this behavior in Rhode Island. Winter feeding territories have been reported by Morley (1943) in Britain and McIntyre (1978) in Virginia. Daub (1989), however, observed no territorial activity by Common Loons during the winter in Rhode Island.

A long-term comparison of Common Loons during the winter is needed to monitor their winter behavior and abundance. Studies conducted by McIntyre (1978) and Daub (1989) on the winter behavior of Common Loons each have been based on only 1 yr of data. In 1991 and 1992 we continued Daub's study in Rhode Island.

METHODS

Our study was conducted at Weekapaug, Rhode Island (40°20′N, 71°45′W). The site is a 2.8-km stretch of beach on Block Island Sound between Watch Hill Point and Point Judith, 8 km southeast of Westerly, Rhode Island. Loons were observed 31 Jan.–14 Apr. 1991 and 15 Jan.–30 Mar. 1992. Observations were made randomly at least three times a week and lasted for at least 1 h at various times of the day. Activity was observed at all times of the day and during all periods of the tidal cycle (Table 1). The tidal level and the total number of loons sighted at the beach were recorded during each observation period.

We observed Common Loons with a 22 × Bushnell spotting scope at the mean high tide level on the beach. The location and water depth of the individual loons was determined using a 1:40,000 scale nautical chart of Block Island Sound, Pt. Judith to Montauk Pt. (National Oceanic and Atmospheric Administration). Distances of 100 m or less were measured with a Ranging 620 rangefinder. The distance of individuals more than 100 m from shore was determined using the notches on the focus knob of the spotting scope, which had been calibrated for distance (McIntyre 1978, Daub 1989). A compass was used to determine the direction of the loon from the observation point.

The behavior of individual loons was recorded at 60-s intervals for a period of 5 min (Daub 1989). Loon behavior was categorized following

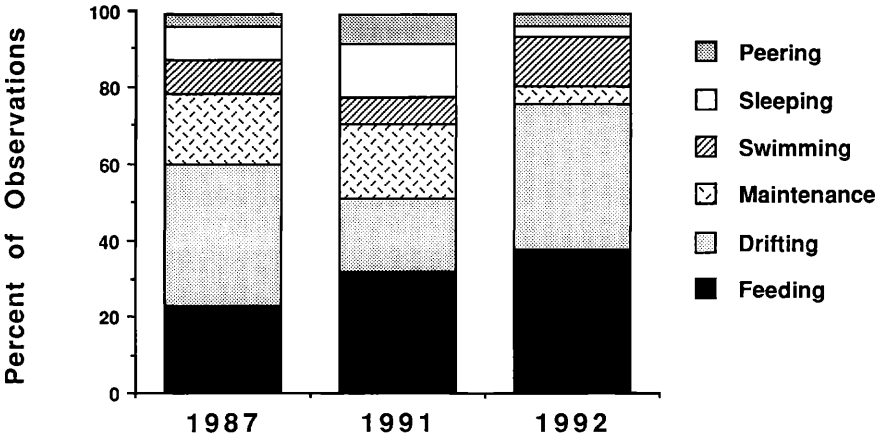

FIGURE 1. Common Loon winter activity budget for 1987 (Daub 1989), 1991 and 1992 at Weekapaug, Rhode Island. Proportions are based on all six recorded activities for each loon. Feeding includes underwater activity, diving and direct observation of feeding.

Daub (1989) as peering (head submerged in search of food), sleeping (indicated by the head laid on the back), swimming, maintenance (includes preening, head rubbing and bathing), feeding (indicated by direct observation), diving, underwater (below the surface during a dive) or drifting (sitting on the surface and not engaged in any of the previous behaviors). In the Common Loon activity budget, feeding included observations of diving, underwater activity and direct feeding. When loons fed at the surface, we also recorded prey items eaten. In addition, any interspecific or intraspecific interactions were noted.

RESULTS

We observed 139 Common Loons in 1991 and 141 in 1992 at Weekapaug. The highest mean daily number of Common Loons at Weekapaug occurred in January and February of 1992, with 23.8 per day and 24.4 per day, respectively. The overall mean number of Common Loons was 8.5 per day in 1991 and 19 per day in 1992. Common Loon abundance for February and March 1992 at Weekapaug was not significantly higher from that in 1987 ($t = -0.45$, df = 35, $P > 0.10$), but was significantly higher than in 1991 ($t = -3.45$, df = 35, $P < 0.0001$).

Although drifting was the most frequent behavior at Weekapaug in 1987 (Daub 1989), feeding behavior, which includes diving, underwater activity and direct feeding, was the most frequently observed Common Loon behavior in 1991 and 1992 (Fig. 1). Drifting was the second most frequently recorded behavior in 1991 and 1992. There was a significant difference in the behavior of Common Loons in the winters of 1987, 1991 and 1992 ($\chi^2 = 219.8$, $P < 0.001$). A higher frequency of feeding was observed in 1992 (38%) than in 1991 (32%) or in 1987 (23%) (Fig. 1).

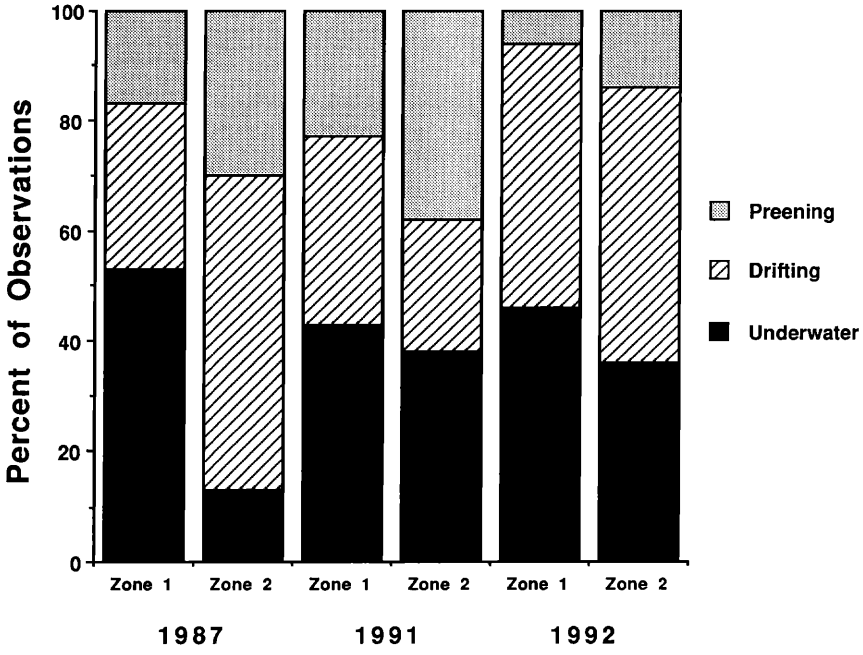

FIGURE 2. The percentage of time Common Loons spent underwater, drifting and preening in Zone 1 (<5.5 m) and Zone 2 (>5.5 m) for 1987 (Daub 1989), 1991 and 1992. Percentages are based on the last recorded behavior of each loon's 5-min sampling period.

In addition, the frequency of maintenance during 1992 (4.9%) was lower than in the preceding winter (19%) and in 1987 (18%).

In 1991, Common Loons were observed with higher frequency in the shallower depths of Zone 1A (<3.6 m; 68%) than in the deeper water of Zone 1B (3.6–5.5 m; 18%) and Zone 2 (>5.5 m; 14%). The proportion of observations for Zone 1A in 1992 (35%) was lower than in 1991, and the proportion of Common Loons observed in Zone 2 were higher in 1992 than in 1991 (49%). The frequency of drifting, feeding (indicated by loons underwater) and preening by Common Loons was not significantly different in the three zones in 1991 ($\chi^2 = 4.4$, $P > 0.05$) or 1992 ($\chi^2 = 3.2$, $P > 0.05$; Fig. 2). The occurrence of feeding in Zone 1A, however, was slightly higher than in the two deeper zones.

In 1991 and 1992, the distribution of Common Loons on the basis of water depth was significantly different from that found in 1987 ($\chi^2 = 70.6$, $P < 0.001$ and $\chi^2 = 64.3$, $P < 0.001$, respectively). Distribution on the basis of water depth was not significantly different during 1991 and 1992 ($\chi^2 = 0.17$, $P > 0.05$).

Drifting, feeding and preening behavior did not significantly differ with time of day in 1991 ($\chi^2 = 8.02$, $P > 0.05$) and 1992 ($\chi^2 = 1.58$, $P > 0.20$)

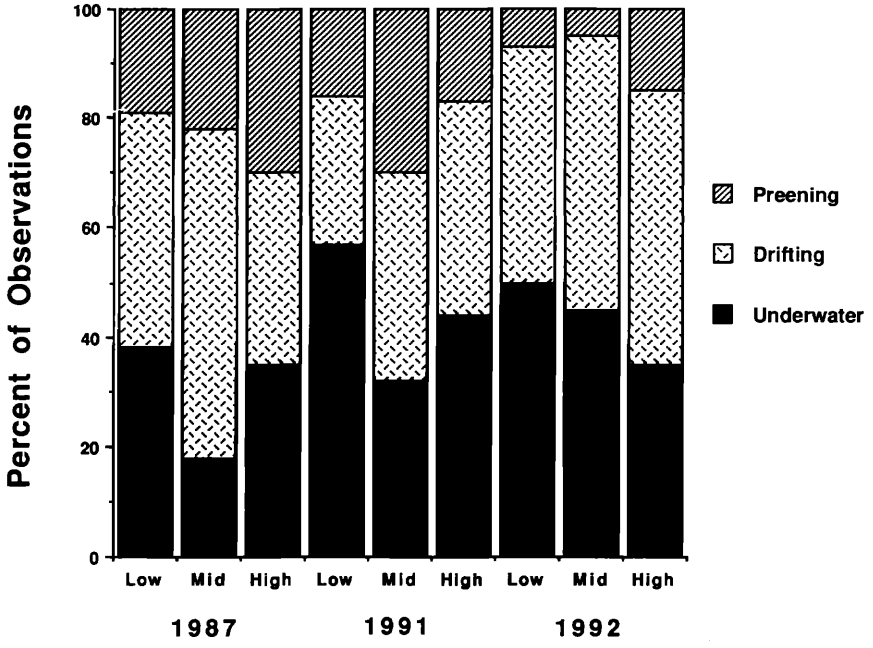

FIGURE 3. The percentage of time Common Loons spent underwater, drifting and preening at low, mid and high tides in 1987 (Daub 1989), 1991 and 1992. The percentages are based on the last recorded behavior of each loon's 5-min sampling period.

or tidal cycle in 1991 ($\chi^2 = 7.10$, $P > 0.10$) or 1992 ($\chi^2 = 2.89$, $P > 0.20$; Fig. 3). Moreover, the location of Common Loons at low, mid and high tides was not significantly different with respect to shallow and deep water in 1992 ($\chi^2 = 1.34$, $P > 0.10$).

Direct feeding by Common Loons was observed 32 times in 1991 and 25 times in 1992. Common Loons fed on crabs in 53 cases, flounder (*Pseudopleuronectes americanus*) in three cases, unidentified prey in 14 cases, and a starfish in one case. The frequency of crabs and other prey items observed in direct feeding was significantly different among the three years ($\chi^2 = 7.5$, $P < 0.05$). The proportion of crabs eaten by Common Loons during surface feeding increased from 48% in 1987 and 56% in 1991 to 84% in 1992.

We witnessed six incidences of kleptoparasitism on Common Loons by Herring Gulls (*Larus argentatus*) in 1991 and three incidences in 1992. During these encounters, Common Loons dropped their food into the water before diving underwater to avoid the approaching gull. The gull would then land next to the dropped food and eat it. There were two instances during this study in which Common Loons avoided kleptoparasitism by taking their food with them underwater instead of dropping it.

Even when not threatened by gulls, loons were often observed taking prey underwater with them after bringing it to the surface.

No territorial behavior or rafting by Common Loons was observed during the study. Common Loons were often seen in groups of 5–15 individuals. These groups, however, usually broke up after 10–20 min.

DISCUSSION

Time spent feeding by Common Loons increased from 23% of their activity budget in 1987 to 38% in 1992. This increase may have been caused by a decline in local fish populations. Common Loons rely on fish, such as cod (*Gadus morhua*), herring (*Clupea harengus*), mackerel (*Scomber scombrus*) and flounder (*Pseudopleuronectes americanus*), for a major part of their diet (Cramp 1982). A comparison of prey items taken by surface-feeding Common Loons in 1987, 1991 and 1992 showed a significant increase in the proportion of crabs and a decline in the number of large fish.

We interviewed several local fisherman who stated that fish populations at Weekapaug had declined markedly in recent years. According to the National Marine Fisheries Service (NMFS), there has been a steep decline in the abundance of flounder since the mid-1980s in southern New England (National Oceanic and Atmospheric Administration 1991). The metric tonnage of mackerel brought back by commerical fishing increased from 1980 to 1988 due to greater fishing effort, but has decreased by 16% since 1989. Commerical landings have reported an increase in the metric tonnage of cod and herring since 1987. The NMFS stated, however, that both of these species have been severely overexploited by commerical fishing during the past 5 yr. A major reduction in the population of large, commercially valuable individuals of these species has probably had an adverse effect on the populations of the smaller size classes. As a result, availability of smaller individuals of these species to loons has probably been reduced. As loons rely heavily on consumption of smaller prey underwater (King 1976), loons may have increased the amount of time devoted to feeding activities in response to the decline in small prey abundance.

A decrease in fish populations may also cause Common Loons to spend more time in shallower waters to find alternate, bottom-dwelling prey, such as crabs. We found significantly more Common Loons in Zone 1 (<5.5 m deep) and fewer in Zone 2 (>5.5 m deep) than did Daub (1989) (Fig. 3). In addition, we found that Common Loons concentrated in Zone 1 throughout the tidal cycle, whereas Daub (1989) observed more individuals in Zone 2 at mid- and high tide. This increase in time spent in shallow water may reflect the added time needed by Common Loons to find prey.

In 1991 and 1992 the behavior of Common Loons had no significant correlation to water depth, tidal cycle or time of day. Although Daub (1989) also found no relationship between Common Loon activity patterns and tidal cycle or time of day, she did observe a correlation between

winter behavior and depth, with feeding activities occurring more frequently in shallow water. The reason that we found no relationship between behavior and depth may be due to a decline in prey abundance at Weekapaug. A decline in prey abundance would force Common Loons to increase the amount of time spent feeding while in deeper waters. Contrary to both studies at Weekapaug, McIntyre (1978) reported a relationship between Common Loon behavior and tidal cycle in Virginia. The absence of any correlation between behavior and tidal cycle in both years further supports Daub's (1989) hypothesis that the small tidal change in Rhode Island does not concentrate prey during the ebb tide. Therefore, Common Loons are not compelled to concentrate feeding activity during a single tidal period.

Also in contrast to the Weekapaug studies, McInyre (1978) observed territorial behavior by Common Loons. There may be two reasons for these contrasting results. McIntyre (1988) suggested that during harsh winters loons tend to concentrate in the southern Atlantic rather than northern waters. Powers and Cherry (1983) stated that loon distribution conforms to the waters over the continental shelf; therefore, loons found off the narrow shelf of the mid-Altantic are less dispersed and closer to shore than in waters northeast of Long Island, where the continental shelf is wider. These two factors, which would increase loon density, could increase competition for food resources off the coast of Virginia. Consequently, Common Loons may establish feeding territories during the winter only when there are high concentrations of Common Loons in the area.

Daub (1989) reported the possible pressure placed on feeding Common Loons by gull kleptoparasitism. During the 3 yr of observations at Weekapaug, a consistent proportion (14%, 19% and 12%, respectively) of surface-feeding Common Loons was attacked by gulls. Therefore, gull kleptoparasitism has probably not caused increases in time spent feeding by Common Loons.

In summary, the most important result of this study is the increase in the time spent by Common Loons feeding since 1987, which is probably due to a decline in prey abundance. A further decline in fish populations in southern New England might result in a decline in the winter population of Common Loons. This, in turn, may adversely affect the breeding population of Common Loons. Clearly, further investigation of this and other pressures placed on Common Loons in winter is needed. A long-term study on local fish populations at Weekapaug, in conjunction with a continuation of the Common Loon behavior study, may help define the exact role prey abundance has on winter behavior and abundance of Common Loons.

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