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PATTERNS OF MORTALITY AMONG COMMON LOONS WINTERING IN THE NORTHEASTERN GULF OF MEXICO

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Abstract.—The mortality of Common Loons (*Gavia immer*) wintering along the northeastern Gulf of Mexico from 1983 to 1988 exhibited several major patterns. First, there was a strong relationship between the timing of mortality and molt. Second, adults experienced higher mortality than sub-adults, but there was no difference in levels of mortality between sexes. Third, the homogeneity of mortality distributions suggests that the same factors influenced mortality from year to year and from site to site. Finally, these factors selectively affected loons, but not other ecologically similar fish-eating species of birds.

Little is known about population regulation in Common Loons (*Gavia immer*), although the reproductive biology of the species has been extensively studied (Vermeer 1973a, 1973b, McIntyre 1975, Ream 1976, Fox et al. 1980, McIntyre 1983). A few studies report mortality of loons resulting from commercial fishing (Vermeer 1973b, Frank et al. 1983), or from pathogens such as botulism (Brand et al. 1983), but there is little understanding of factors leading to post-breeding mortality of young and adult birds. In fact, other than studies of factors affecting brood-reduction at the chick-rearing stage (e.g., McIntyre 1983), little is known about survivorship, recruitment, age-structure, finite rate of increase, or other reproductive parameters of any of the species of loons.

Systematic studies in the form of long-term beached bird surveys (e.g., Simons 1985; Speich and Wahl 1986; Powlesland 1987) can greatly increase our understanding of the processes affecting seabird mortality and ultimately regulating seabird populations. The results of five years of systematic beached bird surveys on the northern Gulf coast of Florida presented here document high levels of winter mortality of the Common Loon, and also suggest a pattern of mortality for the species. In this paper I describe a major Common Loon mortality event in the winter of 1982-1983, document levels of mortality in wintering Common Loons over a subsequent five-year interval, present evidence of a temporal pattern in Common Loon mortality, and address the question of how winter mortality may relate to population regulation in loons.

[1]The author is deceased; the manuscript was submitted and revised by Tom Webber, Florida Museum of Natural History.

Study Area and Methods

The study area includes approximately 150 km of shoreline and coastal habitat in the northeastern Gulf of Mexico (Fig. 1). The area is bounded on the south by Waccasassa Bay, and on the west by the Apalachicola River and its estuary. Major study sites within the area were Dog Island (20 km of beach) on the western edge, Hagens Cove (4 km of beach) in the center, and Seahorse Key (2 km of beach) on the southern edge.

Common Loons generally begin to arrive in the coastal waters of the northern Gulf of Mexico by the third week of October. Numbers gradually increase over the following two-week interval, and migration is essentially complete by the second week of November (Alexander, unpubl. data). I divided the winter season into 17 biweekly intervals extending from the second half of October through the month of June. I censused beaches at Dog Island from 1983 to 1988, at Hagens Cove from 1986 to 1987, and at Seahorse Key from 1986 to 1988. The census routine involved biweekly surveys of the major study sites. Dead and moribund loons were censused or collected systematically from beaches in the study area from 1983 through 1988. Birds that were not collected were removed so that they would not be re-counted.

I placed specimens in a freezer upon collection, and subsequently weighed, measured, and necropsied them. I determined the sex of each specimen and assigned it to an age class (adult vs. juvenile) on the basis of plumage. Juveniles lack the pale spotting on the feathers of the upperparts typical of adult basic plumage (Palmer 1962). Although opinion varies as to the nature and number of sub-adult plumages of the Common Loon (Palmer 1962; Godfrey 1966; J. W. McIntyre, pers. comm.; J. F. Barr, pers. comm.), I decided that the degree of variation in plumages of specimens collected was sufficiently uniform that a bimodal classification was parsimonious (see also Storer 1988).

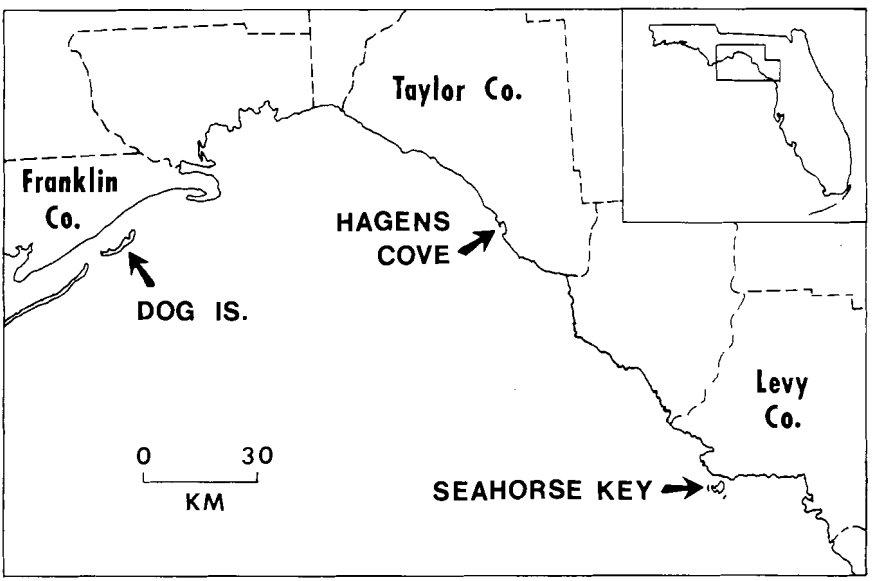

Figure 1. Location of major Common Loon study sites in northern Florida.

RESULTS

I collected a total of 735 dead loons during this study (Table 1). All data sets for major study sites are normally distributed (Kolmogorov-Smirnov test, $P < 0.05$). The distribution of data, both between years and between sites within years, was homogeneous; furthermore, the distributions were not significantly different (Kolmogorov-Smirnov, all pairwise comparisons at $P = 0.05$). A pooled frequency distribution of mortality at the major study sites for all years shows that nearly all loons were collected from the second half of December through the first half of April, with a peak in the second half of February (Fig. 2).

Onset of mortality was generally in the first or second half of January (Fig. 2) and was strongly correlated with the onset of molt ($R = 0.99$). A components-of-variance analysis (two-way ANOVA) of the pooled loon mortality data shows that mortality did not vary significantly between sexes ($P = 0.764$, Table 2), but varied significantly between age classes ($P < 0.001$). Common Loons were the most abundant dead or moribund species at all study sites for all years, and exhibited a rate of mortality greater than all other species combined ($t = 3.384$, $P = 0.0012$).

DISCUSSION

Because the mortality distributions documented here are homogeneous between years as well as between sites within years, it appears that similar factors operate from year to year to affect mortality in the wintering Common Loons of the northeastern Gulf of Mexico. These results suggest a consistent, predictable pattern of mortality. A possible explanation is that the pattern is related to the high cost of plumage replace-

Table 1. Mortality totals for Common Loons and all other species during the study.

Site/year	No. of loons	No. of individuals of other species
Dog Island 1983	497	11
Dog Island 1984	36	14
Dog Island 1985	46	15
Dog Island 1986	23	13
Seahorse Key 1986	15	3
Hagens Cove 1986	12	5
Dog Island 1987	25	11
Seahorse Key 1987	45	14
Hagens Cove 1987	17	5
Seahorse Key 1988	8	3
Dog Island 1988	11	2
Total	735	96

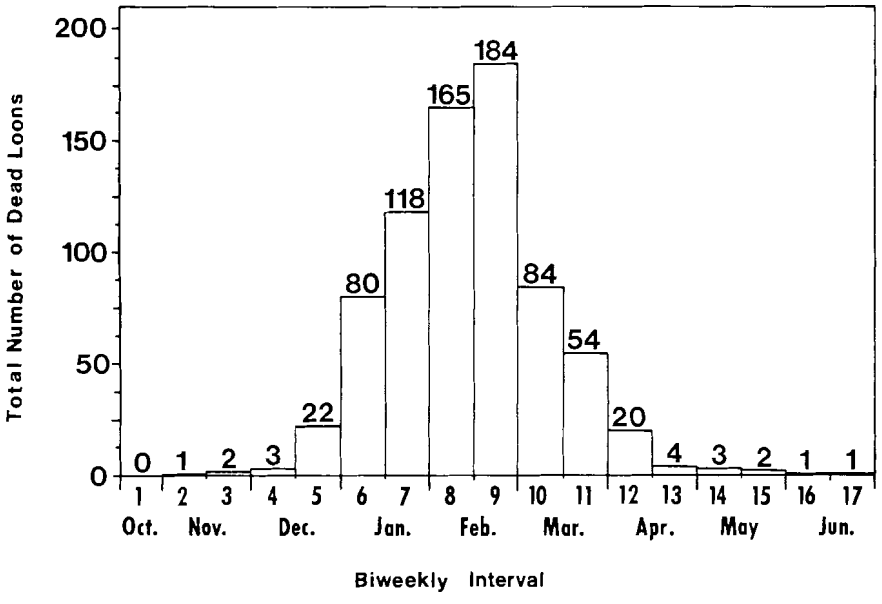

Figure 2. Total number of dead Common Loons per biweekly interval for all years of the study.

ment. Winter mortality as a consequence of the energetic cost of feather replacement may be a basic mode of population regulation in Common Loons.

Other workers have also reported high rates of mortality for the Common Loon (H. W. Kale, II *in litt.*; Simons 1985). Winter mortality is expected for migratory, temperate-zone species (Greenberg 1980, Morse 1980), but generally the effect of mortality is greater on younger age-classes, especially hatching-year birds (von Haartman 1971).

The level of mortality exhibited by the loon population that I studied along the Gulf coast suggests that external factors may also be selectively intensifying processes of winter mortality in these birds. One possible external factor is mercury-induced toxicity. Other researchers have reported significant levels of mercury in loons (Haseltine et al. 1979, Fox et al. 1980, Frank et al. 1983, Barr 1986, McIntyre 1988). Loons dying on my study site exhibited symptoms (emaciation, muscular incoordination) similar to those produced by mercury poisoning (Eisler 1987). Adults would be expected to have levels of mercury higher than those of juveniles because they accumulate it over longer periods. The fact that loons on the Gulf coast died in greater numbers than other fish-eating birds suggests that they may be acquiring mercury on the breeding grounds rather than on the wintering grounds.

Table 2. Common Loon mortality by age and sex.

	Adult		Juvenile	
Site/year	Male	Female	Male	Female
Dog Island 1984	18	12	2	4
Dog Island 1985	23	19	1	3
Dog Island 1986	10	10	2	1
Dog Island 1987	10	11	2	2
Dog Island 1988	4	3	3	1
Seahorse Key 1986	5	7	1	2
Seahorse Key 1987	17	19	5	4
Seahorse Key 1988	3	3	2	0
Hagens Cove 1986	6	4	0	2
Hagens Cove 1987	8	7	1	1
Total	104	95	19	20

Loons suffered especially heavy mortality during the winter season of 1982-83, when an estimated 5,000-10,000 died in the northern Gulf of Mexico (Stroud and Lange 1983, Alexander 1985). Symptoms of affected birds included extreme emaciation, anemia, high parasite burdens, and loss of motor coordination and strength (Stroud and Lange 1983; Alexander 1985; R. E. Lange, pers. comm.; D. J. Forrester, pers. comm.; Alexander, unpubl. data). Freshly-collected specimens showed high levels of mercury (Stroud and Lange 1983, Alexander 1985). Affected birds were also flightless due to complete molt of primaries and secondaries, a condition normal for the species at that time of year (Woolfenden 1967).

These findings point to the possibility that this population of loons may be experiencing a disturbance of normal patterns of survivorship and stable age distribution. To test further these suggestions we need data on the proportions of live juvenile and adult loons to one another and to other species of fish-eating water birds along the Gulf coast, and accurate censuses to allow estimates of the absolute rate of winter mortality in Common Loons.

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Literature Cited

Alexander, L. L. 1985. Trouble with loons. The Living Bird Quarterly. Spring 1985: 10-13.

Barr, J. F. 1986. Population dynamics of the Common Loon (*Gavia immer*) associated with mercury-contaminated waters in northwestern Ontario. Canadian Wildlife Service Occasional Paper No. 56.

Brand, C. J., R. M. Duncan, S. P. Garrow, D. Olson, and L. E. Schumann. 1983. Waterbird mortality from Botulism Type E in Lake Michigan: an update. Wilson Bull. 95: 269-275.

Eisler, R. 1987. Mercury hazards to fish, wildlife, and invertebrates: A synoptic review. U.S. Fish & Wildlife Service Biol. Report 85 (1.10). Contaminant hazard review report no. 10.

Fox, G. E., K. S. Yonge, and S. G. Sealy, 1980. Breeding performance, pollutant burden, and eggshell thinning in Common Loons *Gavia immer* nesting on a boreal forest lake. Ornis Scandinavica 11: 243-248.

Frank, R., H. Lumsden, J. F. Barr, and H. E. Braun. 1983. Residues of organochlorine insecticides, industrial chemicals, and mercury in eggs and in tissues taken from healthy and emaciated Common Loons, Ontario, Canada, 1968-1981. Arch. Environ. Contam. Toxicol. 12: 641-654.

Godfrey, W. E. 1966. The birds of Canada. Ottawa, National Museum of Canada Bulletin No. 203.

Greenberg, R. 1980. Demographic aspects of long-range migration. Pp. 493-503 *in* Migrant birds in the Neotropics: Ecology, behavior, distribution, and conservation (A. Keast and E. Morton, Eds.). Washington, D.C., Smithsonian Institution Press.

Haseltine, S. D., J. S. Fair, S. A. Sutcliffe, and D. M. Swineford. 1979. Trends in organochlorine and mercury residues in Common Loon (*Gavis immer*) eggs from New Hampshire. Unpub. manuscript.

McIntyre, J. W. 1975. Biology and behavior of the Common Loon (*Gavia immer*) with reference to its adaptability in a man-altered environment. Ph.D. diss., University of Minnesota.

McIntyre, J. W. 1983. Nurseries: a consideration of habitat requirements during the chick-rearing period in Common Loons. J. Field Ornithol. 54: 247-253.

McIntyre, J. W. 1988. The Common Loon: spirit of northern waters. Minneapolis, Minnesota University Press.

Morse, D. H. 1980. Population limitation: breeding or wintering grounds. Pp. 505-515 *in* Migrant birds in the Neotropics: Ecology, behavior, distribution, and conservation (A. Keast and E. Morton, Eds.). Washington, D.C., Smithsonian Institution Press.

Palmer, R. S. 1962. Handbook of North American birds. Vol. 1. New Haven, Connecticut, Yale Univ. Press.

Powlesland, R. G. 1987. Seabirds found dead on New Zealand beaches in 1985, and a review of *Pterodroma* recoveries since 1960. Notornis 34: 237-252.

Ream, C. H. 1976. Loon productivity, human disturbance, and pesticide residues in northern Minnesota. Wilson Bull. 88: 427-432.

Simons, M. M. 1985. Beached bird survey project on the Atlantic and Gulf coasts. Am. Birds 39: 358-362.

Speich, S. M. and T. R. Wahl. 1986. Rates of occurrence of dead birds in Washington's inland marine waters, 1978 and 1979. Murrelet 67: 51-59.

Storer, R. W. 1988. Variation in the Common Loon (*Gavia immer*). Pp. 54-65 *in* Papers from the 1987 conference on Common Loon management and research (Paul I.V. Strong, Ed.). Meredith, New Hampshire, North American Loon Fund.

Stroud, R. K., and R. E. Lange. 1983. Information summary: Common Loon die-off—winter and spring of 1983. Unpubl. manuscript.

VERMEER, K. 1973a. Some aspects of the nesting requirements of Common Loons in Alberta. Wilson Bull. 85: 429-435.

VERMEER, K. 1973b. Some aspects of the breeding and mortality of Common Loons in East-Central Alberta. Canadian Field-Naturalist 87: 403-408.

VON HAARTMAN, L. 1971. Population dynamics. Pp. 391-459 *in* Avian Biology, Vol. 1. (D. S. Farner, J. R. King, and K. C. Parkes, Eds.). New York, Academic Press.

WOOLFENDEN, G. E. 1967. Selection for a delayed simultaneous wing molt in loons (Gaviidae). Wilson Bull. 79: 416-420.

NOTES

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FIRST NESTING RECORD OF BLACK-BELLIED WHISTLING-DUCK IN CENTRAL FLORIDA

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The Black-bellied Whistling-Duck (*Dendrocygna autumnalis*) has been recorded in central Florida since at least 1973 (F. Montalbano and G. Williams in Edscorn 1977). In recent years there have been frequent sightings, including: an apparently injured adult observed in May 1986 near Wauchula in Hardee County (J. Maddox, pers. comm.); two adults observed 11 July 1989 at IMC Fertilizer Inc.'s Clear Springs Mine near Bartow in Polk County (Feiertag and King in Renken 1989); and a small flock seen at Agrico's Fort Green Mine in Polk County in the summer of 1990 (C. Geanangel, pers. comm.). The only other locations in Florida where this species is currently found are Sarasota County and Palm Beach County (C. W. Biggs, pers. comm.).

On 8 September 1990 at approximately 0730 EDT, Larry McCandless, Jim Sampson, and I visited a clay settling pond just west of CF Industries' Hardee complex in Section 6, Range 24E, Township 35S in northern Hardee County. Shortly after we arrived at the pond, we saw two adult Black-bellied Whistling-Ducks and 12 ducklings (Fig. 1). The young birds were feathered and about three-fourths adult size. They followed the adults during the time we saw them. As we approached the birds, they swam to cover in vegetation (predominantly *Typha* sp.) at the edge of the pond. When we reached the area where the birds were thought to have gone, one adult flew up and repeatedly circled overhead. No attempt was made to locate the nest and we left without seeing the ducklings again that day. The adult pair and the brood of young had previously been seen on 31 August by McCandless and Sampson. The ducks were seen again about a week later by Sampson, who was able to photograph them.

Although the birds appeared to be wild (i.e. they were difficult to approach, lived in an area where there is relatively little human activity, and survived without human assistance), their origin is unknown. Stevenson (1968) noted that presumably escaped birds of this species were breeding more than 20 years ago in Dade County and were seen during breeding season in Broward County. All of the sightings of this species in Florida have occurred since that time. This species has been seen as far north as Zellwood in Orange County (B. Payne in Ogden 1975, J. Hintermeister and J. Horner in Edscorn in 1978, P. Sykes in Paul 1986), sometimes in association with the Fulvous Whistling-Duck (*Dendrocygna bicolor*), which was becoming established in the state during that period. It is possible that the Black-bellied Whistling-Ducks that are being observed in central Florida today