morning. This practice may assure: (a) continuation of optimal foraging group size day after day; (b) that individuals known to each other will feed together daily, which may in turn result in feeding efficiency by reducing aggressive levels (Morse, Ecol. Monogr. 40:119–168, 1970); or (c) that rafts function as information centers to decrease search time to feeding sites (Siegfried, Trans. Roy. Soc. Afr. 39:419–443, 1971; Krebs, Behaviour 51:99–131, 1974). These are only speculations on our part, but are questions for future studies.

Loons raft offshore during all times of the year (McIntyre, Ph.D. thesis, Univ. Minn., Minneapolis, Minnesota, 1975; 1978; this study). The possibility that remaining offshore and in deep water promotes safety from potential predators and minimizes tidal effects has been offered as an adaptive value for winter rafting (McIntyre 1978). In the fall, lakes begin freezing along the shoreline and remain open longest over deep water. Loons may raft offshore in late fall to minimize chances of becoming trapped in ice should a lake begin to freeze during the night. It is very likely there are different primary selective pressures operating at different times of the year, and a single factor should not be invoked for all seasons.

(2) Social relationships. Selective pressures favoring social feeding include predator avoidance and increased foraging efficiency (Hamilton, J. Theoret. Biol. 31:295–311, 1971; Cody, Theoret. Pop. Biol. 2:142–158, 1971), assuming that they ultimately contribute to increased fitness. As we know of no loon predators at Mille Lacs Lake, we reason that the proximate selective factor in social feeding is related to maximizing foraging efficiency.

Feeding associations include 10–20 members in most instances. Larger groups arose through occasional convergence of smaller units (sudden concentrations of food?). The fact that loons stayed in small groups overnight lends credence to the idea that there are "basic" small groups (neighbors from the breeding grounds?); however, stability of these smaller units awaits testing using marked individuals.

This is the only time during the year when Common Loons are known to consistently feed in flocks. Animals do switch strategies in response to ecological conditions (e.g., Krebs 1974; Gill and Wolf, Ecology 56:333–345, 1975; Stacey and Bock 1978). We suggest that behavioral flexibility may be the usual mode for migrants whose resource base changes as a factor of location as well as for non-migrants subjected to seasonal resource variability. Long term studies of the annual biology of many species should be encouraged in order to answer more general questions of strategy-switching behavior.

Acknowledgments.—This study was conducted with the cooperation and logistic support of the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Canadian Wildlife Service. J. Winship, J. Engelbrecht, and W. Johnson flew us on our aerial surveys; C. Burrows, R. Lorenz, J. Maloney, and J. Savada supplied information on Mille Lacs fishing populations; and M. Moore, J. Fellagy, H. Welty, P. Lang, and T. Savaloja provided information on former observations of loons on Mille Lacs. We thank them for their help. In particular we acknowledge the assistance of J. Bryant. We thank L. Wolf and R. Storer for comments on the manuscript, and T. Starmer and M. Petersen for help with the statistical analysis. K. Starczewski did the figures. Financial support came from the Oikos Research Foundation and NSF grant #8106567.—JUDITH W. MCINTYRE, *Dept. Biology, Utica Coll. Syracuse Univ., Utica, New York 13502* AND JACK F. BARR, *91 Forest St., Guelph, Ontario N1G 1J3 Canada.* *Accepted 5 July 1982.*

Wilson Bull., 95(1), 1983, pp. 125–132

Loon migrations off the coast of the northeastern United States.—In eastern North America the Common Loon (*Gavia immer*) breeds throughout boreal and arctic life zones, whereas the range of the Red-throated Loon (*G. stellata*) is farther north (82°N) but not as far south, reaching its southern limit in Newfoundland and the Gaspé Peninsula (Todd, Birds

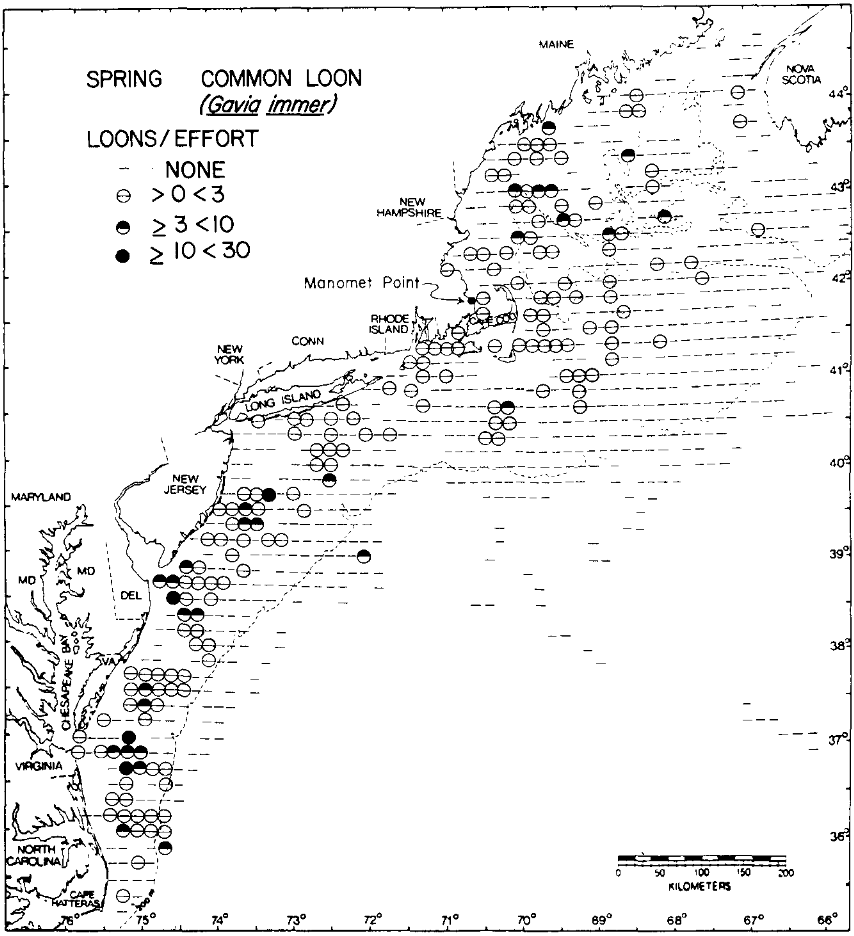

FIG. 1. Relative distribution and abundance of Common Loons in spring (April–June) off the northeastern United States. The number of loons divided by the number of standard bird counts (effort) per 10-min block of latitude and longitude is indicated.

of the Labrador Peninsula and Adjacent Areas, Univ. Toronto Press, Toronto, Canada, 1963; Godfrey, The Birds of Canada, Natl. Mus. Can. Bull. No. 203, 1966). Migrations of both species along the Atlantic coast appear similar and have been described by Forbush (Birds of Massachusetts and Other New England States, Vol. 1, Mass. Dept. Agric., Boston, Massachusetts, 1925), Stewart and Robbins (Birds of Maryland and the District of Columbia, N. Am. Fauna No. 62, Washington, D.C., 1958), Arbib (Kingbird 13:132–140, 1963), Todd (1963), and Hill (The Birds of Cape Cod, Massachusetts, Wm. Morrow and Co., New York, New York, 1965). Although several of these authors allude to loon movements seaward off coastal waters, particularly those of Common Loons, Rowlett (Observations of Marine Birds and

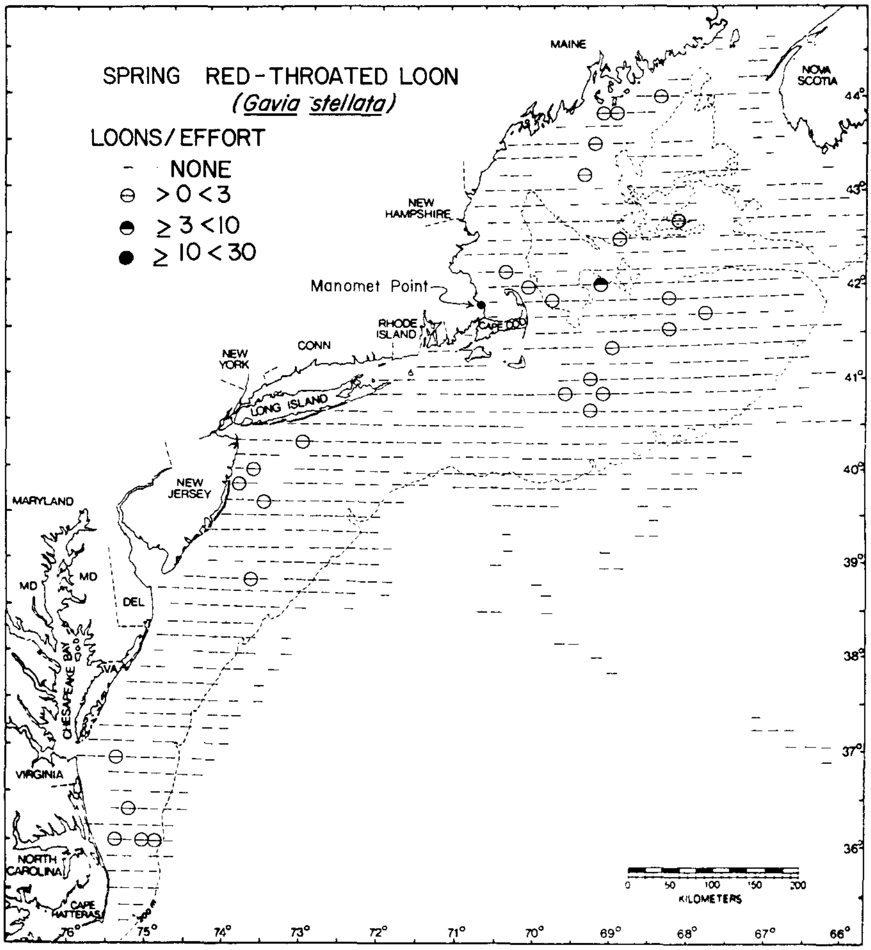

FIG. 2. Relative distribution and abundance of Red-throated Loons in spring (April–June) off the northeastern United States. The number of loons divided by the number of standard bird counts (effort) per 10-min block of latitude and longitude is indicated.

Mammals in the Northern Chesapeake Bight, U.S. Fish and Wildl. Serv., Biol. Serv. Program, FWS/OBS-80/04, 1980) is the first author to provide evidence of an offshore component. In this paper we examine differences in the temporal and spatial aspects of migrations of Common and Red-throated loons in coastal and offshore waters along the northeastern United States.

Methods.—Sightings of loons at sea were recorded by observers stationed on National Marine Fisheries Service (NMFS) and U.S. Coast Guard (USCG) vessels from 1977–1980 in a survey of the pelagic distribution of marine birds from Cape Hatteras (ca. 35°N) north to the Bay of Fundy (ca. 44°N) and from the coast seaward to 65°W. Observers made at least

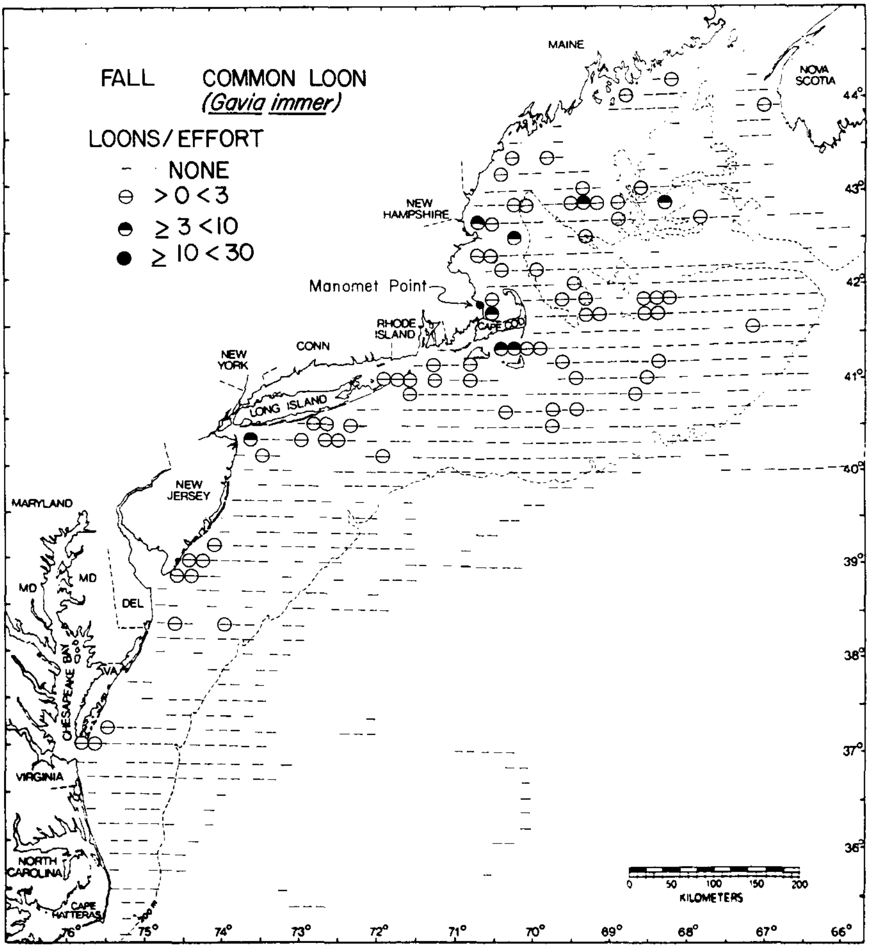

FIG. 3. Relative distribution and abundance of Common Loons in autumn (September–November) off the northeastern United States. The number of loons divided by the number of standard bird counts (effort) per 10-min block of latitude and longitude is indicated.

one standard 10-min count (Brown et al., Atlas of Eastern Canadian Seabirds, Canadian Wildl. Serv., Ottawa, Canada, 1975) of all seabirds every 30 min while the ship was underway, noting the location, date, and local time at the start of each count. Number, behavior, and flight direction were recorded for all species seen during the counts. Similar data were collected for sightings of loons between standard counts. The number of standard counts was proportional to observation time between counts, and counts were made throughout daylight hours. Therefore, effort (number of standard counts) was used as an index of observation time. There were no sightings of loons from July–August and few from Decem-

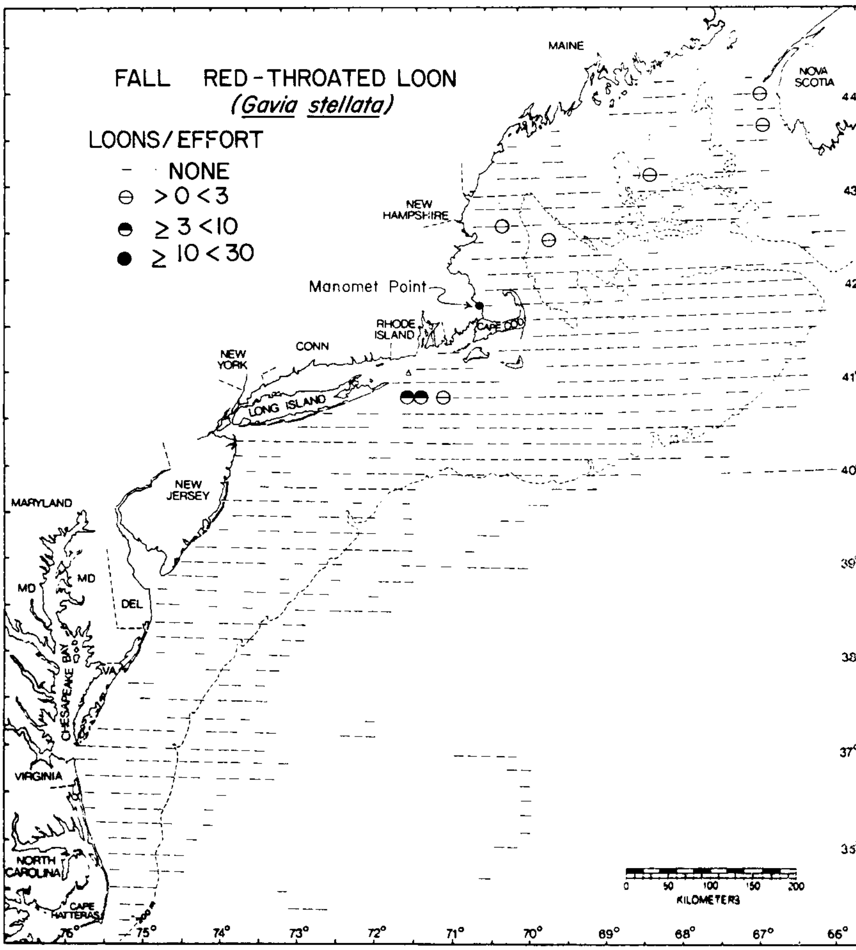

FIG. 4. Relative distribution and abundance of Red-throated Loons in fall (September–November) off the northeastern United States. The number of loons divided by the number of standard bird counts (effort) per 10-min block of latitude and longitude is indicated.

ber–March. Thus, we considered any loon seen from April–June and September–November as a migrant.

Numbers of loons were recorded migrating south past a coastal promontory (10 m ASL), Manomet Point, Plymouth, Plymouth Co., Massachusetts (41°56′N, 70°33′W, Fig. 1) in autumn from 1972–1976 and in 1978. Two observers with binoculars and a 20× telescope counted migrants of all species over the sea, while principally censusing scoters (*Melanitta* spp.). We calculated a weekly rate of passage (loons/h) for 10 periods from 17 September–25 November by dividing the number of loons seen by hours of observation for each period.

TABLE 1
BREAKDOWN OF OBSERVATIONS OF OFFSHORE (NO. 10-MIN COUNTS) AND NEAR-SHORE SIGHTINGS OF LOONS (H OF OBSERVATION)

	Offshore effort (1977–1980)		Coastal effort (1972–1976 and 1978)	
	No. 10-min counts			
Month	71–76°W	65–71°W	Week	h
Mar.	278	425	17–23 Sept.	15.0
April	435	657	24–30 Sept.	65.3
May	139	740	01–07 Oct.	132.5
June	308	564	08–14 Oct.	169.2
Sept.	186	405	15–21 Oct.	180.1
Oct.	489	1193	22–28 Oct.	120.5
Nov.	141	568	29 Oct.–04 Nov.	69.9
Dec.	80	469	05–11 Nov.	37.8
			12–18 Nov.	20.7
			19–25 Nov.	2.0

Results.—Figs. 1–4 show the offshore abundance of Common and Red-throated loons during spring and fall migration by 10-min blocks of latitude and longitude. The abundance of birds was calculated by dividing the numbers of loons observed in each 10-min block by the number of standard counts in that block.

In spring, 819 Common Loons were recorded from 460 sightings (1.8 loons per sighting). (A sighting is defined as an observation of an individual or distinct group of loons.) Another 160 loons in 81 sightings were unidentified. Common Loons were observed in offshore waters from 27 March–21 June, although 98% of the sightings were from April and May. Migration peaked in April southwest of Long Island and in May off the New England coast. Spring migrants occurred throughout waters of the continental shelf (Fig. 1). The majority of sightings were concentrated within 60 km of the coast south of Long Island, with one sighting noted 170 km east of New Jersey. East of Long Island distribution was more dispersed as Common Loons were seen up to 160 km to the south, east, and northeast of Cape Cod. A total of 49 Red-throated Loons was recorded from 31 sightings (1.6 loons per sighting), which represented 5% of the total number of spring loon sightings. Red-throated Loons were observed from 17 April–27 May. The distribution of Red-throated Loons in spring (Fig. 2) was similar to that of Common Loons (Fig. 1) as birds were observed throughout shelf waters.

In autumn, 212 Common Loons were recorded from 117 sightings at sea (1.8 loons per sighting). Another 51 loons in 27 sightings were unidentified. Common Loons were observed in offshore waters from 12 September–5 December and from 15 September–25 November (latest date of observer effort) at Manomet Point. Offshore migration was heaviest during November throughout the study area. The offshore distribution of Common Loons in autumn was similar to that of spring (Fig. 3), except that fewer birds were observed south of Long Island. The paucity of sightings off the mid-Atlantic states may be related to patchy effort west of 71°W during November (Table 1). We observed a movement of Common Loons across the southern Gulf of Maine and northern Georges Bank in mid- to late November (Fig. 3), which was similar to that observed from late April to early May (Fig. 1). In contrast, autumn migration of Common Loons at Manomet Point peaked at 7.5 loons/h from 22–28 October,

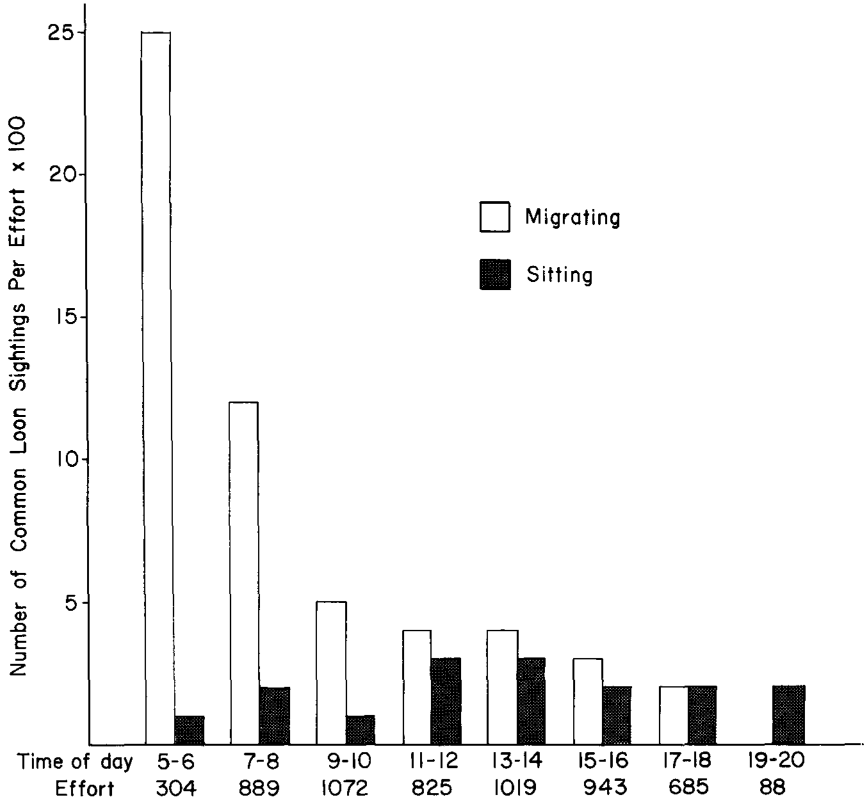

FIG. 5. Frequency histogram of Common Loon sightings by time of day (2-h periods) and behavior (migrating or sitting). Index of effort (number of standard bird counts [N]) is indicated for each 2-h period.

and declined to 2.5 loons/h by 12–18 November. A total of 44 Red-throated Loons was recorded from 12 sightings (3.7 loons per sighting), which represented 8% of the total number of loon sightings in autumn. Red-throated Loons were observed in offshore waters from 22 October–1 December, and from 30 September–25 November (latest date of observer effort) at Manomet Point. The frequency of sightings peaked in November in both near-shore and offshore waters. The offshore distribution of Red-throated Loons in autumn (Fig. 4) was similar to that in spring (Fig. 2). In contrast to the offshore results, we found a substantial coastal migration of Red-throated Loons. An initial movement of 5.4 loons/h occurred from 22–28 October, but a greater and more extended peak of 7.4–7.8 loons/h passed Manomet Point from 5–18 November, which was equivalent or greater in magnitude than the Common Loon flight. By the week of 19–25 November activity dropped to 0.3 loons/h.

The behavior of loons in offshore waters for spring and autumn was divided into three categories: sitting, migrating (flying NW to NE in spring, SE to SW in fall), and flying (flying, but not in the appropriate direction). Behavior was noted in 508 sightings of Common Loons; 111 were sitting, 366 were migrating, and 31 were flying. The frequency of sightings of migrating loons was greatest in early morning hours (05:00–08:00) and low throughout the rest of the day (Fig. 5). In spring Williams (Wilson Bull. 85:230, 1973) rarely noted Common Loons migrating after 09:30 at a coastal location along the Gulf of Mexico. Kerlinger (Condor 84:97–100, 1982) observed Common Loons migrating from 2–9 h after sunrise in central New York state. The behavioral data for offshore sightings of Red-throated Loons were insufficient to reveal any conclusive pattern of daily timing. The near-shore data from Manomet Point were not analyzed, since observation effort was biased toward morning hours.

Discussion.—Our data show a substantial offshore migration of Common Loons in both spring and autumn, while Red-throated Loons occur with less frequency away from the coast. The proportions of Red-throated to Common loons at a coastal site in Massachusetts during autumn, when compared to their abundance offshore, indicate that substantial numbers of Red-throated Loons migrate near shore (cf. Ward, Records of New Jersey Birds 6:2–4, 1980). The offshore distribution of both species conforms to waters over the continental shelf (shoreward of the 200-m isobath); thus, sightings off the mid-Atlantic states are closer to shore and less dispersed than in waters northeast of Long Island (Figs. 1–4).

Forbush (1925) and Hill (1965) indicated that Common Loons principally migrate over Cape Cod, but another flight remains at sea outside of Cape Cod. Our offshore data confirm the latter flight since we found Common Loons passing south of the Cape Cod islands of Nantucket and Martha's Vineyard. These loons probably cross the southern Gulf of Maine to or from Nova Scotia. The timing of this movement in autumn (mid-November), which differs from peak flights at Manomet Point (late October), suggests that different populations of Common Loons are using different migration routes. The offshore component may be breeders from Nova Scotia and Newfoundland, whereas the coastal movement may originate from the mainland of eastern Canada. Such an hypothesis may explain why there is no substantial migration of Red-throated Loons away from the coast, since their breeding range does not extend as far east along the Atlantic coast as that of Common Loons.

Acknowledgments.—We are indebted to the many volunteers from the Manomet Bird Observatory (MBO) who collected much of the data and to NMFS and USCG allowing observers aboard their vessels. J. M. Riccitelli compiled the coastal data from Manomet Point and E. H. Backus drew the figures. J. A. Hagar, N. P. Hill, and J. McIntyre provided helpful comments on an earlier version of this manuscript. This study was supported with funding from the U.S. Dept. Energy (DOE Contract No. DE-AC02-78EV04706), U.S. Fish and Wildlife Service (USFWS Contract No. 14-16-0005-6057) and private grants to MBO.—KEVIN D. POWERS AND JEFFREY CHERRY, *Manomet Bird Observatory, Manomet, Massachusetts 02345.* (Present address JC: *Dept. Biological Sciences, State Univ. New York, Albany, New York 12222.*) *Accepted 25 Apr. 1982.*

Wilson Bull., 95(1), 1983, pp. 132–138

Responses of Black-headed Grosbeaks to songs of conspecifics.—Bird song may communicate several kinds of information, including the species, sex, reproductive status, aggressiveness, location, and individual identity of the singer. Birds recognize songs of their own species and usually respond exclusively to them (Marler, Behaviour 11:13–39, 1957; Lanyon, Am. Mus. Novit., No. 2126:1–16, 1963; and others). Such recognition appears to depend on song features that are relatively constant among all individuals of a given species (Falls, pp. 259–271 *in* Proc. 13th Int. Ornithol. Congr., Ithaca, New York, 1963; Emlen, Behaviour 41:130–171, 1972; Wunderle, Anim. Behav. 27:982–996, 1979).