J. Field Ornithol., 56(4):346–355

SPRING MIGRATION PATTERN OF SHARP-SHINNED HAWKS PASSING WHITEFISH POINT, MICHIGAN

By James Devereux, Thomas Carpenter, and Katherine Durham

Autumn migration of Sharp-shinned Hawks (*Accipiter striatus*) is well documented for eastern North America (Allen and Peterson 1936, Clark (in press), Evans and Rosenfield 1985, Haugh 1972, Hofslund 1966, Mueller and Berger 1967, Murray 1964, Rosenfield and Evans 1980). Except for the work by Haugh and Cade (1966) and Haugh (1972), spring migration has received little attention largely due to the lack of major raptor concentration areas. Data from other areas have been collected (Duncan 1982a, Hoffman 1982, Isaacs and Hennigar 1980, Morton 1982, 1983) but are largely complementary at most. Whitefish Point, Michigan, is known as a major concentration area (Magee 1922), but not until the establishment of the Whitefish Point Bird Observatory in 1979, were banding efforts significantly increased and an observation program begun. This paper reflects results of a continuing study of spring migration of Sharp-shinned Hawks past Whitefish Point. We also discuss Sharp-shinned Hawk migratory routes, supporting discussions by Evans and Rosenfield (1985), Haugh (1972), and Mueller and Berger (1967).

METHODS

Whitefish Point is on the southeastern shore of Lake Superior in Michigan's Upper Peninsula (see Figs. 3 and 4). Most hawks observed at the point arrive from the west; the shore of Lake Superior between Marquette, Michigan, and Whitefish Point is at an angle of about 83°, forming a leading line for birds encountering the lake during northbound migration.

Daily observations were made April through May during 1979–1983. The observation period was generally 0800–1600 EST except when heavy fog, rain, snow, or blowing sand impeded visibility. The observation site was atop an exposed sand dune, about 20 m above Lake Superior, where there was a relatively clear view of the surrounding area. Observations were usually made by one person with the aid of binoculars and spotting scope. Hourly totals were recorded on standard forms of the Hawk Migration Association of North America.

A study was conducted 3–24 May, 1983, to investigate hawk migratory behavior as it related to crossing a large body of water. An observer, stationed at the tip of Whitefish Point (about 500 m east of the sand dune observation site), counted individual hawks as they left or returned to the point. The net number of individuals leaving (i.e., those that presumably flew across the 26 km of water to Canada) was compared to the total number observed at the sand dune site for the same time period.

During the years 1956–1983, 8052 sharp-shins were banded at Whitefish Point. Birds were captured primarily with mist nets set up throughout a jack pine (*Pinus banksiana*) stand near the tip of the point. Luring and automatic bow nets were also used, but to a much lesser extent. Date banded, age, and sex of 3977 sharp-shins, trapped during 1978–1983, were obtained from the Whitefish Point Bird Observatory. To smooth irregularities due to inconsistent banding effort (i.e., net hours, number of nets and traps, length of nets, etc.), data for these 6 years were pooled and broken down into 6 periods encompassing the migration season. Chi-square tests were used to determine if the distribution among age and sex classes differed over time; results were considered significant if $P \leq 0.05$. Biased age and sex ratios probably exist in the banding data, however little supplemental data have been collected (e.g., trap type differences, sex and age ratios of trapped birds at other locations along the spring migration route, etc.) to allow speculation on the causes. Though actual numbers of each age and sex class may vary significantly, we assumed the percentage of each class trapped over time represented their actual distribution. Information on sharp-shin encounters was obtained from the U.S. Fish and Wildlife Service Bird Banding Laboratory and Whitefish Point Bird Observatory.

RESULTS AND DISCUSSION

An average of 10,346 Sharp-shinned Hawks was counted annually (Table 1). Numbers recorded for 1979–1982 may be higher than actual numbers as potential double counting of lingering birds was not considered. First arrivals ranged 1–13 April, averaging 7–8 April. Peak in numbers was during the first 10 days of May, later than that reported at Derby Hill (Haugh 1972, Haugh and Cade 1966) and Hawk Mountain (Morton 1982, 1983). These sites, however, are about 240 and 540 km farther south in latitude than Whitefish Point, respectively.

The number of sharp-shins banded yearly since 1979 has averaged 8.7% of the annual count (Table 1). This is considerably less than the 23% reported at both Duluth, Minnesota (Evans and Rosenfield 1985) and Little Suamico, Wisconsin (T. Erdman, pers. comm.) during fall migration. We believe this is due to the more intense banding efforts at these locations.

Banding data suggest After Second Year (ASY) birds of both sexes and Second Year (SY) females all begin migrating past Whitefish Point about the same time (Figs. 1 and 2). All exhibit a sharp increase in numbers about 27–29 April and peak 3–5 May. Approximately one-third of all ASY birds were captured during the latter 3-day period. There is, however, a slight difference in the distribution between ASY males and females over time (Chi-square = 16.4, df = 5, $0.001 < P < 0.01$), probably a result of the broader migrational peak exhibited by males. There is also a significant difference between SY females and both ASY males (Chi-square = 56.6, df = 5, $P < 0.001$) and females (Chi-square = 140.6, df = 5, $P < 0.001$). Though the peak of SY females

TABLE 1. Numbers of Sharp-shinned Hawks observed and banded 1979–1983 at Whitefish Point, Michigan.

Year	Number observed (April–May)	Number banded
1979	11,453	1168
1980	8538	832
1981	12,268	887
1982	13,230	1024
1983	6242	614
Total	51,731	4525

appears as acute as ASY birds, the decline in numbers is more gradual, especially after 12–14 May when very few ASY birds are captured.

The distribution of SY males over time differed from SY females (Chi-square = 350.0, df = 5, $P < 0.001$), first occurring about 12 days later and peaking one week later. Beginning 12 May, SY males were the most frequently trapped birds.

The greater proportion of ASY birds at the beginning of spring migration, and of SY birds toward the end, has been noted for several hawk species (Durham et al. 1983, Haugh 1972). The pattern is opposite of what occurs in autumn when immatures (hatch year birds) precede adults (after hatch year birds) (see Duncan 1982b, Mueller and Berger 1967, Rosenfield and Evans 1980). It has been speculated that because immatures are relatively inexperienced hunters in the fall (Mueller and Berger 1970), they are probably affected by the decreasing avian prey base before adults, and thus are first to migrate (Rosenfield and Evans 1980). Assuming surviving immature birds have become fairly adept hunters during winter, the initiation of spring migration is probably more hormonal related than diet or hunting experience. ASY birds may respond to changes in environmental conditions that stimulate gonadal development (see Immelmann 1973) sooner than SY birds, thus having a stronger urge to establish nesting territories as soon as possible (Newton 1979). Bent (1937) indicated that SY sharp-shins may breed, but there are few published accounts to support this (see Fischer 1984).

We know of 39 (0.52%) sharp-shins banded at Whitefish Point through 1982 that were encountered elsewhere; a similar encounter rate has been reported at Duluth (Evans and Rosenfield 1985). Almost 90% were females, most of which (71.4%) were banded as SY individuals. Over half (56.4%) the encounters were dead individuals. The time interval between banding and encounter ranged from less than one month to 6.3 years. The oldest bird encountered was a female at least eight years old, which was subsequently released.

Fifteen sharp-shins were encountered during spring and summer (1 March–31 August), 17 during autumn (1 September–30 November) and 7 during winter (1 December–29 February) (Fig. 3). Eight of the spring–

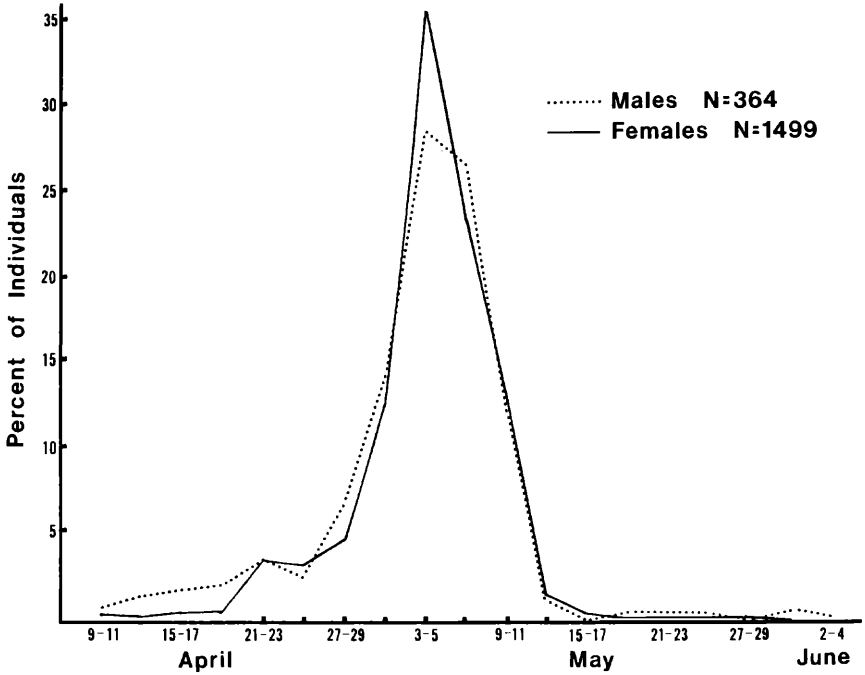

FIGURE 1. Seasonal distribution of ASY Sharp-shinned Hawks during spring migration past Whitefish Point, Michigan (based on banding data).

summer encounters were banded and encountered the same year. Of the remaining 7, the 6 encountered in the United States suggest a spring migration route around both sides of Lake Michigan. This is further evidenced by the fact that relatively large numbers of sharp-shins have been observed in Michigan's Keweenaw Peninsula during spring (Isaacs and Hennigar 1980), suggesting they arrive at Lake Superior via Wisconsin. There is also evidence indicating that some birds follow the same migratory route in subsequent years; through 1982, 15 birds (0.2%) have been retrapped at Whitefish Point 1–4 years following their initial banding.

The autumn encounters indicate sharp-shins migrate south around the west side of Lake Superior and east of Lake Huron, concentrating along the north shore of Lake Erie. Relatively few hawks are observed at Whitefish Point during autumn; this seems logical as no geographical feature occurs on the Canadian side of Lake Superior that funnels birds to Whitefish Point. Sheldon (1965), however, indicates there is a southward movement of hawks across the Straits of Mackinac, and Mueller and Berger (1967) and Erdman (pers. comm.) suggest the majority of sharp-shins observed during autumn at Cedar Grove and Little Suamico, respectively, are from the Sault Ste. Marie area.

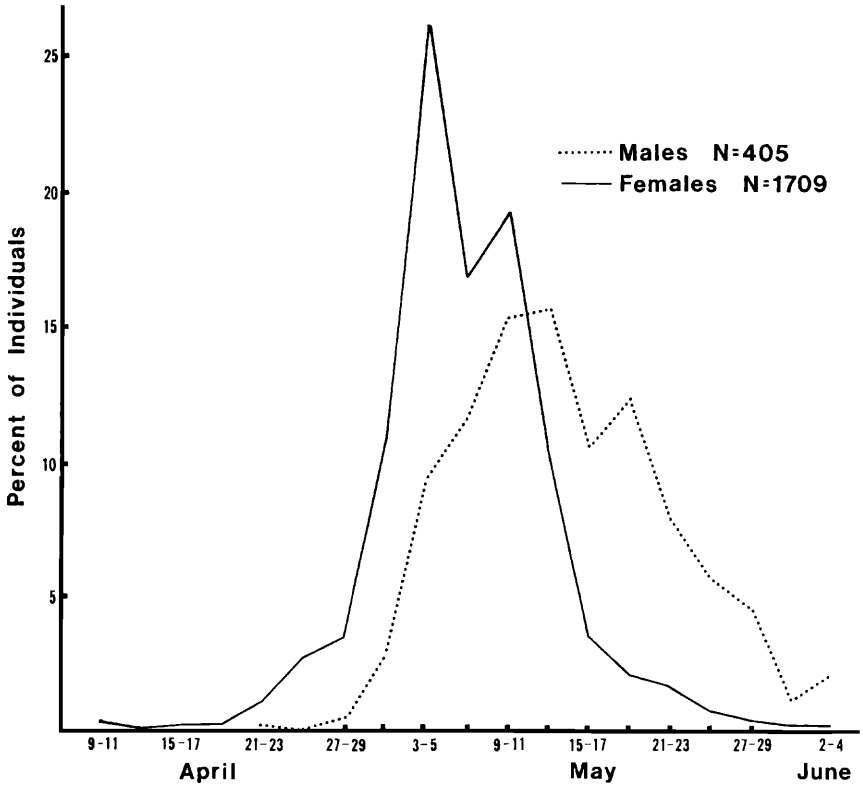

FIGURE 2. Seasonal distribution of SY Sharp-shinned Hawks during spring migration past Whitefish Point, Michigan (based on banding data).

The 3 autumn and 6 winter encounters in south-central United States, Mexico and Central America, indicate a general southward movement away from the Great Lakes and then a southwestward movement in the Gulf states toward Mexico. This pattern has also been noted by Mueller and Berger (1967) and Evans and Rosenfield (1985). Because no males were encountered during winter, speculation on differential distances travelled among the sexes (see Clark 1985), Evans and Rosenfield 1985) cannot be made.

There is circumstantial evidence that some females are from the same geographic area and/or have similar physiological rhythms, both of which may help explain their similar migration times in subsequent seasons. Two birds banded one day apart at Whitefish Point were captured the same day at Duluth the following autumn. Two other birds banded one day apart were captured 2 days apart at Cedar Grove, also the following autumn. Two birds banded one day apart in autumn 1977 at Little

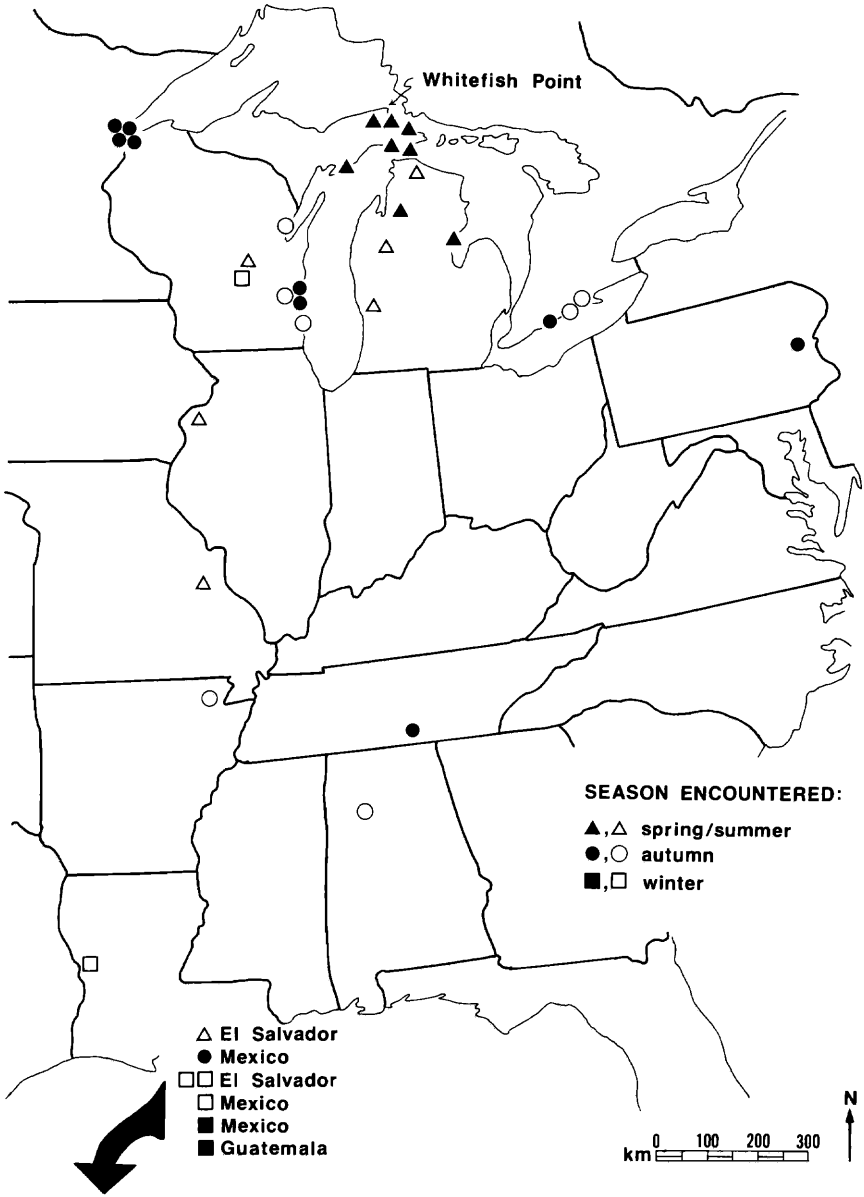

FIGURE 3. Encounter locations of Sharp-shinned Hawks originally banded at Whitefish Point. Closed symbols represent birds encountered prior to their next spring migration; open symbols represent birds encountered during or after their next spring migration.

Suamico, were retrapped on the same day at Whitefish Point 4.5 years later.

Forty-six sharp-shins, trapped at Whitefish Point, were originally banded elsewhere (Fig. 4). All were banded during autumn migration; more than half (56.5%) were retrapped the following spring. The fact that more birds banded elsewhere are captured at Whitefish Point than vice-versa, may simply indicate the relative importance this leading line has in concentrating birds during spring; during autumn, the numerous leading lines along the northern shore of the Great Lakes disperse the birds to several major locations. Though Figures 3 and 4 reveal the general migration pattern of Sharp-shinned Hawks around the four western Great Lakes, little is known of origins or destinations. Birds seen and banded around Duluth are believed to originate north and northwest of that area (Evans and Rosenfield 1985) and so may possibly migrate that direction during spring. This may explain the relatively few Whitefish Point banded birds encountered at Duluth and vice-versa, in spite of the large number captured there (see Rosenfield and Evans 1980).

Encounter data indicate that some birds reverse direction and turn south upon reaching Whitefish Point. Eight sharp-shins were encountered within two months of banding and 17–306 km from Whitefish Point (Fig. 3). All were SY females. Reverse migration is not an uncommon phenomenon among birds, weather usually being cited as the cause (see Richardson 1978). However, some birds may overshoot their breeding areas (Lack 1963, Mueller and Berger 1969) or in the midwestern United States, migrate up the west side of Lake Michigan despite breeding areas being to the east. Mueller and Berger (1969) noted a Cooper's Hawk (*Accipiter cooperii*) and Northern Harrier (*Circus cyaneus*) banded at Cedar Grove during spring migration which were encountered later the same spring in Michigan's Lower Peninsula.

Our observation data suggest many birds may reverse direction and fly south. Unfavorable atmospheric conditions as well as the psychological barriers due to the large expanse of water (Haugh 1974) are believed responsible. Of 1801 sharp-shins tallied during 62 h of observation, 3–24 May, 1983, only 20.8% were seen in flight across the water to Canada. This is considerably less than the 47% reported by Kerlinger (1984), but may be due in part to weather differences. However, his percentage may have been inflated as a result of underestimating the total number of birds arriving at Whitefish Point; he observed birds from the tip of the point and included only those which flew within 200 m of the water's edge. We counted all birds arriving at the point area (from the sand dune site) and since we had an observer at both the point's tip and sand dune site simultaneously, we found many birds were not flying to the water's edge before reversing direction. Data presently being collected on hawk movement from Whitefish Point, suggest birds not crossing the water there, follow the shoreline south, then east, and cross into Canada where the expanse of water is not so great (see Fig. 4).

Banding data further indicate that many sharp-shins will linger around

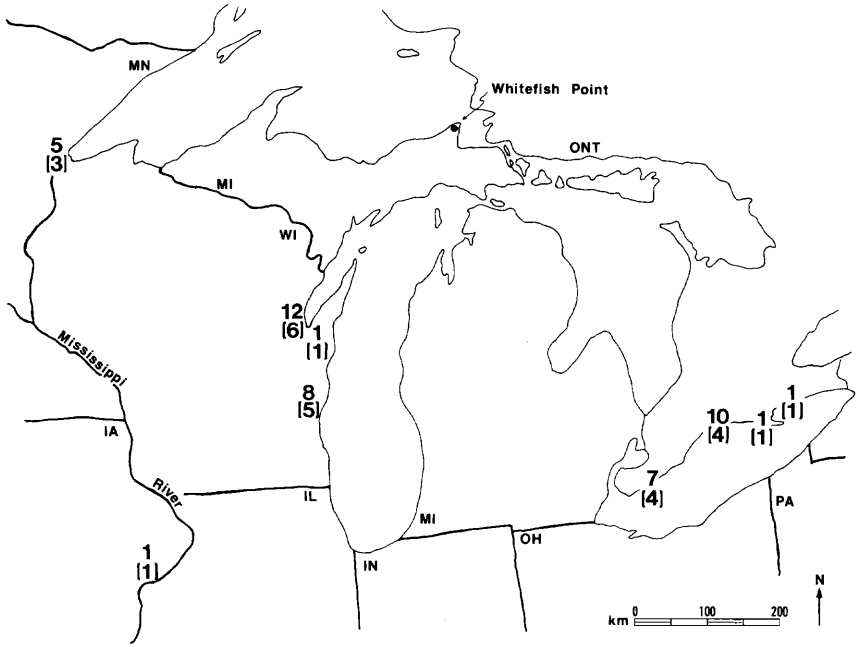

FIGURE 4. Numbers and original banding locations of Sharp-shinned Hawks encountered at Whitefish Point. All were banded during autumn migration. The number of birds encountered during the following spring is indicated in parentheses.

the point, perhaps waiting for more favorable weather conditions or simply because they are "confused" (especially SY birds, which are making the trip for the first time). Of the 614 birds captured in 1983, 72 (11.7%) were recaptured at the point; 28 were recaptured in the same day and 44 within an average of 3.5 days.

SUMMARY

An average of 10,346 Sharp-shinned Hawks are counted and 905 banded each spring during migration past Whitefish Point, Michigan. Banding data indicate ASY birds of both sexes and SY females arrive about the same time whereas arrival of SY males is about 12 days later. Encounters of banded sharp-shins suggest an autumn migratory route along the west side of Lake Superior, north side of Lake Erie, and through the Sault Ste. Marie area into Michigan and Wisconsin. Movement is then south toward Mexico and Central America. During spring, they are funneled up to Whitefish Point along both sides of Lake Michigan. The 26 km of Lake Superior between Whitefish Point and Canada appear to be an obstacle for many birds; there is evidence that birds linger around the point for up to several days, as well as engage in reverse migration to avoid an overwater flight.

ACKNOWLEDGMENTS

We thank the following banders whose efforts made this paper possible: D. Berger, A. Carpenter, B. Deaner, T. Erdman, R. Grefe, Hawk Cliff Raptor Banding Station, T. Heatley, M. Jones, J. Judge, A. Knutsen, W. Lamb, Long Point Bird Observatory, S. Marcus, D. Miller, D. Steers, C. Weatherby, and B. Winchell. We also thank the hawk counters who participated in the observatory program. We appreciate T. Erdman, D. Ewert, W. D. Klimstra, H. Mueller, and J. Roseberry for their helpful suggestions on the manuscript. This is contribution number 3 of the Whitefish Point Bird Observatory.

LITERATURE CITED

ALLEN, R. P., AND R. T. PETERSON. 1936. The hawk migration at Cape May Point, New Jersey. Auk 53:393–404.

BENT, A. C. 1937. Life histories of North American birds of prey. Part I. U.S. Natl. Mus. Bull. 167.

CLARK, W. S. The migrating Sharp-shinned Hawks at Cape May Point—banding and recovery results. Proc. of the North Am. Hawk Migration Conf. IV. Rochester, New York, 1983. Hawk Migration Assoc. North Am. (In press).

DUNCAN, B. W. 1982a. Vinemount raptor banding station, 1981 report. Ont. Bird Banding 15:16–23.

———. 1982b. Sharp-shinned Hawks banded at Hawk Cliff, Ontario: 1971–1981: analysis of the data. Ont. Bird Banding 15:24–38.

DURHAM, K., J. DYKEHOUSE, AND J. DEVEREUX. 1983. Spring, 1983, raptor migration study at Whitefish Point, Michigan. Unpubl. Rep., Whitefish Point Bird Observ., Michigan Audubon Soc. 92 pp.

EVANS, D. L., AND R. ROSENFIELD. 1985. Migration and mortality of Sharp-shinned Hawks ringed at Duluth, Minnesota, U.S.A. Internatl. Council for Bird Preserv., Tech. Publ. No. 5:311–316.

FISCHER, D. L. 1984. Successful breeding of a pair of Sharp-shinned Hawks in immature plumage. Raptor Res. 18:155–156.

HAUGH, J. R. 1972. A study of hawk migration in eastern North America. Search 2(16): 1–60.

———. 1974. Large aggregations of soaring raptors: the influence of weather and topography. Pp. 235–260, *in* S. A. Gauthreaux, ed. Proc. Conf. Biol. Aspects of the Bird/Aircraft Collision Problem. Clemson Univ., South Carolina.

———, AND T. J. CADE. 1966. The spring hawk migration around the southeastern shore of Lake Ontario. Wilson Bull. 78:88–110.

HOFFMAN, R. 1982. 1982 spring hawk count in southern Sauk County. Passenger Pigeon 44:123–124.

HOFSLUND, P. B. 1966. Hawk migration over the western tip of Lake Superior. Wilson Bull. 78:79–87.

IMMELMAN, K. 1973. Role of the environment in reproduction as source of "predictive" information. Pp. 121–147, *in* D. S. Farner, ed. Breeding Biology of Birds. Natl. Acad. Sci., Washington, D.C.

ISAACS, F. B., AND L. A. HENNIGAR. 1980. Spring hawk migration at Brockway Mountain, Keweenaw County, Michigan. J. Hawk Migr. Assoc. North Am. 2:24–33.

KERLINGER, P. 1984. Flight behavior of Sharp-shinned Hawks during migration. II: Over water. Anim. Behav. 32:1029–1034.

LACK, D. 1963. Migration across the southern North Sea studied by radar. Part 5. Movements in August, winter and spring, and conclusion. Ibis 105:461–492.

MAGEE, M. J. 1922. Hawk migration route at Whitefish Point, Upper Peninsula of Michigan. Auk 39:257–258.

MORTON, R. 1982. Spring migration at Hawk Mountain. Hawk Mt. News 58:7–10.
———. 1983. Spring migration at Hawk Mountain. Hawk Mt. News 60:10–12.
MUELLER, H. C, AND D. D. BERGER. 1967. Fall migration of Sharp-shinned Hawks. Wilson Bull. 79:397–415.
———, AND ———. 1969. Navigation by hawks migrating in spring. Auk 86:35–40.
———, AND ———. 1970. Prey preferences in the Sharp-shinned Hawk: the roles of sex, experience and motivation. Auk 87:452–457.
MURRAY, B. G. 1964. A review of Sharp-shinned Hawk migration along the northeastern coast of the United States. Wilson Bull. 76:257–264.
NEWTON, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, South Dakota.
RICHARDSON, W. J. 1978. Timing and amount of bird migration in relation to weather: a review. Oikos 30:224–272.
ROSENFIELD, R., AND D. L. EVANS. 1980. Migration incidence and sequence of age and sex classes of the Sharp-shinned Hawk. Loon 52:66–69.
SHELDON, W. 1965. Hawk migration in Michigan and the Straits of Mackinac. Jack-Pine Warbler 43:79–83.

Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, Illinois 62901 (JD); *3646 South John Hix Rd., Wayne, Michigan 48184* (TC); *330 Dartmouth St., Boston, Massachusetts 02116* (KD). Received 30 Oct. 1984; accepted 20 June 1985.

NOTICE TO AUTHORS—CHANGE OF EDITORS

Effective immediately, all new or revised manuscripts submitted for possible publication in the Journal of Field Ornithology should be submitted to our editor-elect:

Dr. Edward H. Burtt, Jr.
Department of Zoology
Ohio Wesleyan University
Delaware, OH 43015