Discussion.—Roosts chosen by Boreal, Saw-whet, and Screech owls were similar in that virtually all owls perched in trees rather than using cavities, and tree density immediately around the roosts was greater than in the adjacent forest. Roosts of these species differed in the amount of cover which the roost trees provided and the positions of the perches on the branches. The pattern of roost selection suggests that roosts are chosen to provide both thermal and hiding cover. The small Saw-whet Owl, which would be most vulnerable to predation by accipiters, chose the most concealed roosts by perching in the foliage toward the end of the branch. Such a location may be energetically more costly than near the tree bole because of increased convective heat loss (Walsberg and King, Wilson Bull, 92:33–39, 1980). The larger Boreal and Screech owls, whose silhouettes would be more conspicuous far out on the branch, roosted next to the tree trunks where their cryptic plumage matched the tree bark. None of the owls perched on the unprotected area between the bole and the foliage where they would be highly visible.

Balda et al. (Auk 94:494–504, 1977) suggest that species commonly roost in situations similar to their nest-site, species which nest in cavities or domed nests selecting similar roost situations. Why didn't the Boreal, Saw-whet, and Screech owls roost in cavities when snags were plentiful in the unharvested forest? Perhaps owls consistently roost in cavities only when sufficient protective cover for concealment is not available. VanCamp and Henny (U.S. Dept. Interior Am. Fauna Ser. No. 71, 1975) reported that Screech Owls in deciduous forests began roosting in nest boxes during October when leaf fall would make a roosting owl most conspicuous. Perhaps a cavity roosting owl is protected from aerial predators but vulnerable to marten (*Martes americana*) or other arboreal mammals. Roosting under a conifer, however, may provide adequate concealment from hawks and other owls and the opportunity to escape approaching mammalian predators.

Acknowledgments.—This study was supported by the College of Forestry, Wildlife, and Range Sciences, and the Wilderness Research Center, University of Idaho. Big Creek Ranger District of the Payette National Forest provided living quarters. We thank Patricia and Phil Hayward and K. Roeder for assistance in the field. GREGORY D. HAYWARD AND EDWARD O. GARTON, *Fish and Wildlife Dept., Univ. Idaho, Moscow, Idaho 83843.* *Accepted 30 May 1984.*

Wilson Bull., 96(4), 1984, pp. 692–701

Distribution of wintering Golden Eagles in the eastern United States.—The Golden Eagle (*Aquila chrysaetos*) is the most widely distributed and, perhaps, the most numerous of the world's "large" eagles (Brown and Amadon, Eagles, Hawks and Falcons of the World, Vol. 2, McGraw-Hill, New York, New York, 1968). The North American subspecies (*A. c. canadensis*) is most abundant west of the Great Plains from northern Alaska into central Mexico (Boeker, Wildl. Soc. Bull. 2:46–49, 1974). A remnant breeding population has persisted at least until recently in the Adirondack Mountains and Maine (Spofford, Am. Birds 25:3–7, 1971), and the species apparently continues to breed, albeit sparsely, in remote parts of eastern Canada (Snyder, Can. Field-Nat. 63:39–41, 1949; Spofford 1971; Peck and James, Breeding Birds of Ontario. Nidiology and Distribution, Vol. 1: Nonpasserines, Royal Ont. Mus. Publ. Life Sci., Toronto, Ontario, 1983). A few Golden Eagles are observed each winter in subarctic and temperate sections of eastern North America (e.g., Edwards, Chat 26:19, 1962; Daley, Passenger Pigeon 25:5, 1963; Kelly, Jack-Pine Warbler 50:53–61, 1972; Adkisson et al., Raven 49:32–33, 1978).

The winter distribution of Golden Eagles in eastern North America remains poorly understood. The National Wildlife Federation's (NWF) Raptor Information Center has sponsored

TABLE 1

GOLDEN EAGLE OBSERVATIONS FROM NATIONAL WILDLIFE FEDERATION MIDWINTER EAGLE SURVEY BY STATE, 1979–1982[a]

State[b]	No. Golden Eagle sightings			
	1979	1980	1981	1982
Alabama	1	2	2	2
Delaware	1	1	0	0
Georgia	4	0	0	0
Illinois	2	2	1	0
Kentucky	4	9	7	4
Maryland	2	6	3	2
Massachusetts	0	1	0	2
Michigan	2	1	1	1
Mississippi	1	0	2	1
New Jersey	2	0	1	2
New York	0	0	0	1
North Carolina	3	0	0	0
Pennsylvania	0	4	0	1
South Carolina	1	0	3	0
Tennessee	12	6	2	15
Vermont	0	1	0	0
Virginia	0	0	0	3
West Virginia	1	0	0	0
Wisconsin	0	0	0	1
Total	36	33	22	35

[a] Surveys were conducted each year in all eastern states except Florida.
[b] No Golden Eagles were reported on midwinter surveys in Connecticut, Indiana, Maine, New Hampshire, Ohio, and Rhode Island.

a midwinter eagle survey throughout the contiguous United States since 1979. This survey has provided the most complete information to date on the winter distribution of Golden Eagles throughout the survey region. The purpose of this note is to summarize midwinter eagle survey data and other published information on wintering Golden Eagles in the eastern United States, and to describe distributional trends and identify regular wintering areas.

Methods.—The NWF midwinter eagle survey represents a coordinated effort, involving state and federal biologists and volunteers, to count Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles throughout the coterminous United States during a 2–3-week period in January. The primary purpose of the survey is to count as many Bald Eagles as possible, but participants also actively count Golden Eagles in all states but Florida. Surveys in most cases are not systematic or standardized. Data used in this paper are from surveys from 1979–1982. Surveys were conducted from 13–27 January in 1979, from 2–20 January in 1980, and from 2–16 January in 1981 and 1982. Survey participants characteristically searched for eagles on foot, by vehicle, by boat, from fixed-wing aircraft, and/or by helicopter in as many areas as possible and reported sightings and areas searched to a regional coordinator using standardized survey forms. These reports were edited by regional coordinators to eliminate duplicate sightings and forwarded to the NWF for compilation. Although the

midwinter survey is relatively complete compared with previous efforts, in all years counts were conducted in fewer than 50% of the counties in the eastern United States and survey coverage was heavily weighted toward habitats likely to support Bald Eagles. As a result many Golden Eagle wintering areas were probably overlooked.

To supplement midwinter survey data, most local, regional, and national ornithological journals, as well as Bird-Lore (1919–1940), Audubon Magazine (1941–1946), Audubon Field Notes (1947–1970), and American Birds (1973–1981) were searched for occurrence records. Records used spanned the period 1853–1981. About 16% of the records used in this analysis were from the NWF midwinter eagle survey; the remaining 84% were from published literature.

For the purposes of this review we defined the eastern United States as the area east of the Mississippi River; we did not include sightings directly on the river, or sightings from eastern Louisiana and eastern Minnesota. These areas were excluded because Golden Eagles observed on the Mississippi River during midwinter eagle surveys were not always reported, and only a few counts were conducted away from the river in eastern parts of these states. Data were summarized by physiographic region after Brown and Kerr (Bureau of Land Manage. Physiographic Regions, Am. Geogr. Soc., Spec. Publ. No. 36, 1979). We defined the winter period as 1 December–15 March.

Owing to the volume of published material used (216 references), specific dates, locality information, and literature citations are not given for each record of occurrence. This information, as well as additional unpublished material on the midwinter eagle survey, is available upon request from the senior author.

Results and discussion.—Our review of the literature and midwinter eagle survey data resulted in a total of 613 winter Golden Eagle records of occurrence in the eastern United States during the 129-year period (1853–1982). Several other records lacking sufficient locality data for inclusion were also found.

NWF midwinter eagle surveys have resulted in an average of 31.5 (SE = 3.2) sightings annually (Table 1), although the actual number of Golden Eagles present was probably greater in each year because survey coverage was always incomplete. Counts of autumn migrants also suggested that higher numbers of Golden Eagles may be present in the eastern United States in winter, assuming that these migrants remain in the east. For example, for the period 1946–1970 an average of 42 Golden Eagles was counted each autumn at Hawk Mountain, Pennsylvania, and up to 80 have been counted there in a single year (Spofford 1971). Spofford (1971) also pointed out, however, that the Hawk Mountain counts have declined gradually throughout this period: between 1965–1970 Golden Eagle counts averaged only 29 per year.

Winter Golden Eagle records were not uniformly distributed throughout the eastern United States. Most sightings were concentrated within or along the southwest border of the Appalachian Plateau physiographic region (30.1% of all records) and within the Coastal Plain physiographic region (33.3% of all records) (Fig. 1). Midwinter eagle survey data show a similar distributional pattern. Relative abundance of Golden Eagles (calculated for each year of the survey as the number of individuals observed per 1°-block divided by the number of localities searched in the 1°-block) was highest in the Tennessee River valley in western Tennessee, near the confluence of the Ohio and Mississippi rivers, in the Chesapeake Bay area, and along the Mississippi River plain in northern Mississippi (Fig. 2).

Of 126 Golden Eagles reported on midwinter surveys from 1979–1982, age (adult or immature) was determined for 93: 40 were immature and 53 adult. Although the ratio of immatures to adults in the full sample did not deviate significantly from 1:1 (χ^2 goodness of fit test: $\chi^2 = 1.05$, df = 1, NS) there was a significant departure from uniformity across

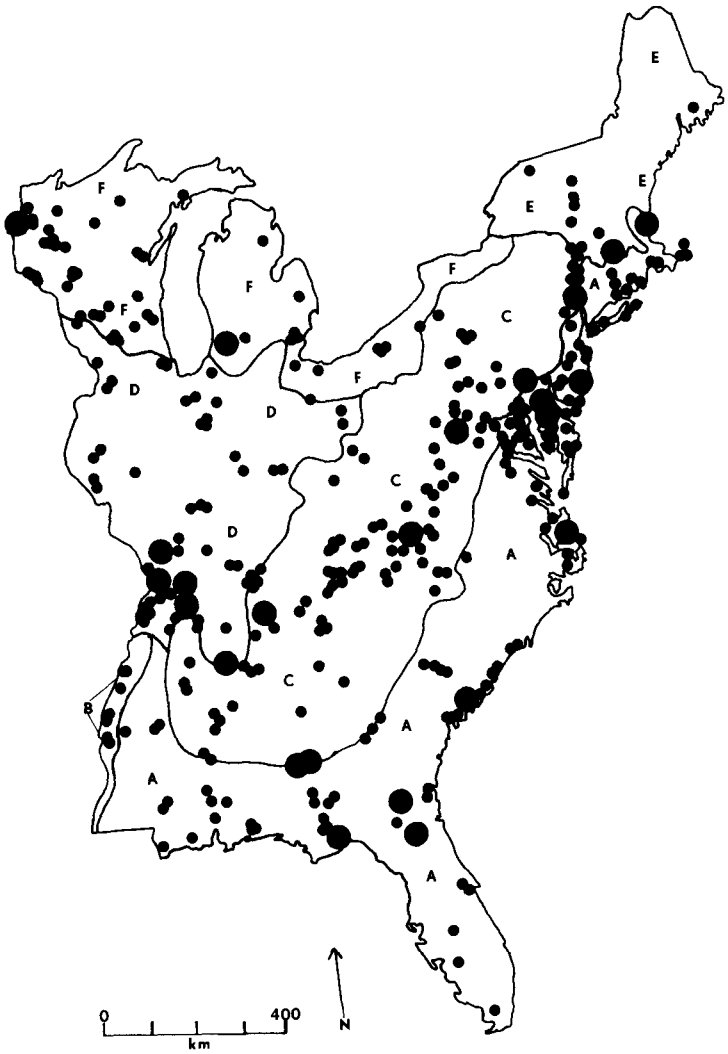

FIG. 1. Winter Golden Eagle occurrence records from 1853–1982 in the eastern United States by physiographic region (after Brown and Kerr 1979). Each small dot represents <5 records; larger circles represent regularly used winter areas (see Table 3) and indicate ≥5 records. Letters denote physiographic regions, where A = Coastal Plain, B = Mississippi Delta and Plains, C = Appalachian Plateau, D = Central Lowland, E = New England Plateau, and F = Lake Plains.

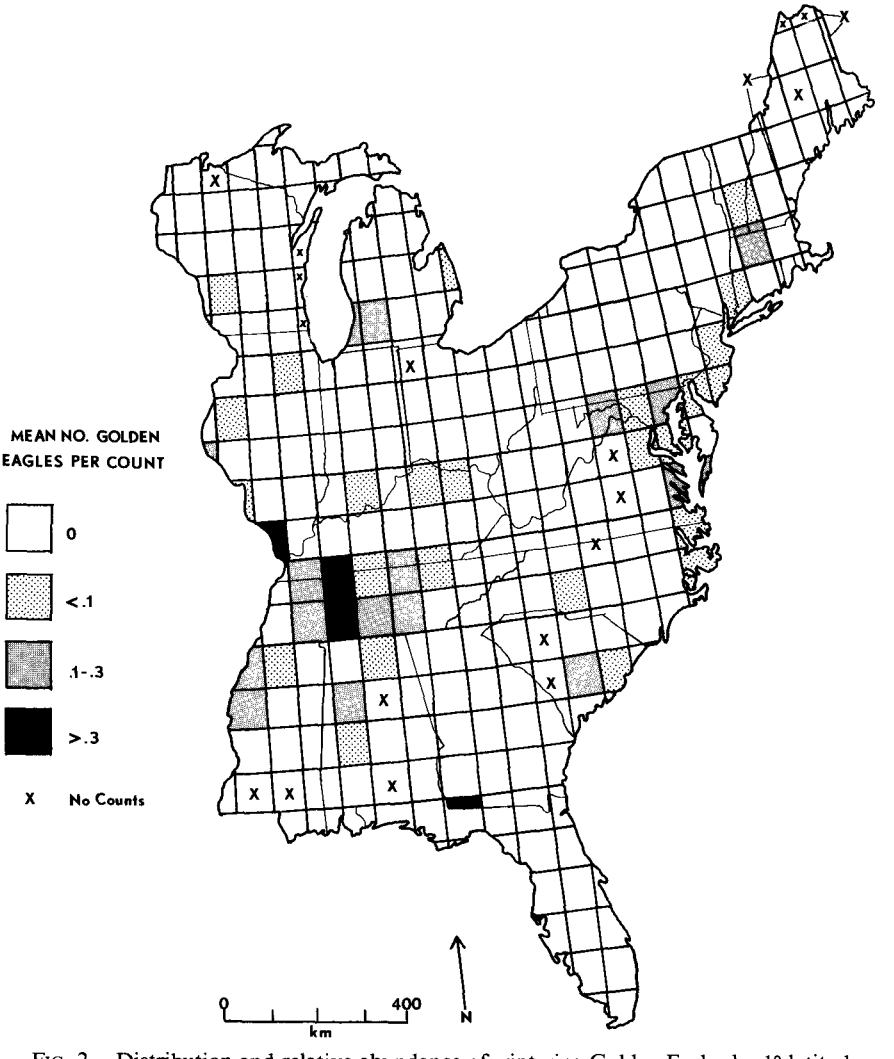

FIG. 2. Distribution and relative abundance of wintering Golden Eagles by 1°-latitude-longitude block, as determined from National Wildlife Federation midwinter eagle survey, 1979–1982. Relative abundance was calculated for each year as the number of Golden Eagles observed (excluding duplicate sightings) in each 1°-block divided by the number of counts conducted (number of localities searched) within the 1°-block. No counts were conducted in the state of Florida, or in 1°-blocks marked with an X.

TABLE 2

AGE DISTRIBUTION OF GOLDEN EAGLES SEEN IN MIDWINTER EAGLE SURVEYS, 1979–1982[a]

Year	% immatures (N) by physiographic region		
	Coastal plain	Appalachian plateau[b]	Central lowland[c]
1979	100.0 (1)	80.0 (5)	—
1980	75.0 (8)	40.0 (5)	40.0 (15)
1981	60.0 (10)	33.3 (3)	33.3 (9)
1982	53.3 (15)	25.0 (4)	11.1 (18)
Years combined[d]	61.8 (34)	47.1 (17)	26.2 (42)

[a] Age (adult or immature) was determined by plumage characteristics (Brown and Amadon 1968). Golden Eagles reported as age unknown (33) were excluded from calculations.

[b] Includes one record from the New England Plateau Physiographic Region.

[c] Includes four records from the Lake Plains Physiographic Region. No Golden Eagles were reported in this region in 1979.

[d] χ^2 goodness of fit test of the distribution of sightings of immature Golden Eagles across regions led to rejection of the null hypothesis of uniformity ($\chi^2 = 15.87$, df = 2, $P < 0.001$).

physiographic regions (Table 2). In general, survey data show that the proportion of immature Golden Eagles in counts declined from the Coastal Plain inland. The use of different wintering areas by adults and immatures of the same species is not uncommon among large eagles; e.g., adult Bald Eagles and adult Steppe Eagles (*Aquila rapax*) winter farther north than immatures (Sprunt and Ligas, pp. 25–30 *in* Proc. 62nd Natl. Audubon Soc. Ann. Conf., 1966; Brooke et al., Occ. Pap. Natl. Mus. Rhodesia B5:61–114, 1972). Erskine (Auk 85: 681–683) suggested that, at least for the Bald Eagle, partial segregation of adults and immatures on the winter range lessens intraspecific competition for food. Assuming observed geographic differences in age ratio for the Golden Eagle are not artifacts of the small sample size, the tendency for immatures to winter in greater numbers near the coast may be equivalent to the use of low latitudes by immature Bald and immature Steppe eagles since proximity to the ocean moderates the climate of the Coastal Plain (Shelford, The Ecology of North America, Univ. Illinois Press, Urbana, Illinois, 1963).

Habitat information was available for 245 of the total 613 records, and of these, 201 (82.0%) were associated with riverine or wetland systems. Most inland records were from steep river valleys or associated reservoirs and marshes. On the coast, estuarine marshlands, barrier islands and associated sounds, and the mouths of major river systems accounted for most records. Eleven of 23 regularly used wintering sites (five or more records over three or more years) were on wildlife management areas that, according to Bellrose (Ducks, Geese and Swans of North America, Stackpole Books, Harrisburg, Pennsylvania, 1976), attract considerable numbers of waterfowl and other wetland species (Table 2). Wetland management areas are probably visited more than upland management areas or private lands by persons likely to report Golden Eagle sightings owing to the accessibility and high wildlife values of these areas; thus, these results may be misleading. Nevertheless, the occurrence records do show that activities on many managed wetlands have been conducive to winter use by Golden Eagles. Three factors may contribute to the attractiveness of managed wetlands: (1) a dominance of open vegetation; (2) large, concentrated prey populations; and (3) absence of harassment and reduced human disturbance.

Sanders (pp. 109–110 *in* Proc. Fire by Prescription Symp., Atlanta, Georgia, 1976) re-

TABLE 3

REGULAR WINTERING SITES[a] OF GOLDEN EAGLES IN THE EASTERN UNITED STATES

State County	Location	Span of records	Total no. of records
Alabama			
Barbour	Eufaula NWR[b]	1975–1978	5
Morgan/Limestone	Wheeler NWR	1974–1981	5
Florida			
Alachua	Not specified	1928–1981	5
Wakulla	Wakulla Springs	1960–1978	7
Georgia			
Quitman	Eufaula NWR	1975–1980	5
Ware	Okefenokee NWR	1958–1976	6
Illinois			
Williamson	Crab Orchard NWR	1957–1980	5
Kentucky			
Ballard	Ballard Co. WMA[c]	1979–1981	12
Trigg/Lyon	Land Between the Lakes	1967–1980	9
Maryland			
Dorchester	Blackwater NWR	1954–1981	17
Kent	Eastern Neck NWR area	1962–1981	9
Massachusetts			
Essex	Not specified	1931–1974	14
Franklin/Worcester	Quabbin Reservoir	1973–1980	9
Michigan			
Allegan	Allegan NWR area	1972–1980	5
New Jersey			
Atlantic	Brigantine NWR	1975–1979	6
New York			
Dutchess/Ulster	Not specified	1969–1981	13
North Carolina			
Dare	Pea Island NWR	1951–1953	5
Pennsylvania			
Berks	Hawk Mountain area	1960–1977	7
South Carolina			
Charleston	Not specified	1950–1968	6
Tennessee			
Benton/Humphreys	Tennessee NWR	1952–1979	19
Cannon/DeKalb	Not specified	1968–1980	17

TABLE 3
CONTINUED

State County	Location	Span of records	Total no. of records
Virginia			
Montgomery	Jefferson NF[d]	1911–1980	5
West Virginia			
Pendelton	Not specified	1976–1981	10
Wisconsin			
Burnett	Crex Meadows NWR	1963–1977	7
Total			278

[a] Regularly used wintering areas were sites with five or more records over 3 or more years.
[b] NWR = National Wildlife Refuge.
[c] WMA = Wildlife Management Area.
[d] NF = National Forest.

ported that montane grass and heath balds (naturally occurring treeless areas below the climatic treeline in otherwise forested areas) are also important to wintering Golden Eagles for foraging, based upon his observations in the Appalachian Plateau physiographic region in North Carolina. Although only a small proportion (1.8%) of the 613 records used in this study were explicitly associated with montane balds, this figure may be misleading as this ecosystem is comparatively inaccessible and less subject to casual observation than valley and coastal wetlands. Further research is needed to elucidate the relative importance of montane bald ecosystems to wintering Golden Eagles.

There are five eastern recoveries of Golden Eagles banded as nestlings. All were from natal areas in eastern North America, and all were recovered in autumn or winter in the eastern United States or southeastern Canada (Fig. 3). Only one was recovered after its first year (at 18 months of age). These records support arguments by Snyder (1949) and Spofford (Bird-Banding 35:123–124, 1964) that the principal source of Golden Eagles that winter in the eastern United States is the northeastern Canadian Arctic and, to a lesser degree, the far northeastern United States. Smith (Redstart, July:94–97, 1982) mentions the possibility that another source may be northwestern Canada. While data are too sparse to rule out this possibility, it is of interest to note that of 275 nestling Golden Eagles banded in western North America that have been recovered, none have been found east of the Mississippi River (U.S. Fish and Wildlife Service, Office of Migratory Bird Management, Bird Banding Laboratory, pers. comm.).

Several authors have speculated that Golden Eagle populations have decreased considerably within the last century in eastern North America (Bent, U.S. Natl. Mus. Bull. 167, 1937; Spofford 1971; Smith 1982). Although the actual extent and history of the population may never be known, comparatively recent data suggest the eastern breeding population may indeed be declining (Spofford 1971; Singer, N.Y. Fish and Game J. 21:19–31, 1974). While maintenance of habitat integrity in existing breeding areas is important if current population levels are to be sustained or increased, the availability of sufficient wintering habitat is equally important.

To date there has been little intentional management of Golden Eagle breeding or wintering

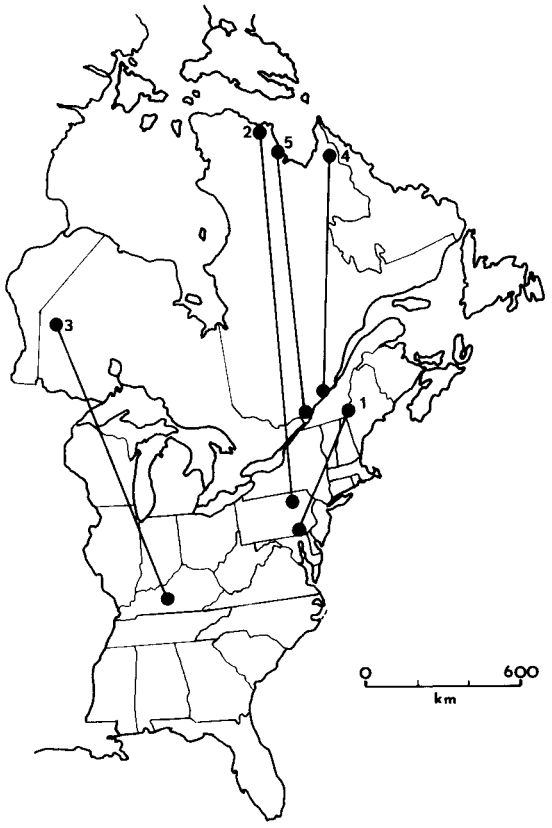

FIG. 3. Natal and recovery sites of banded nestling Golden Eagles recovered in eastern North America. Nestling no. 1 was banded on 10 July 1963 and was found dead in November 1963 (Spofford 1964). Nestling no. 2 was banded on 26 July 1967 and was recaptured and released on 23 October 1967 (Spofford 1971). Nestling no. 3 was banded on 28 June 1978 and was found dead in December 1979. Nestling no. 4 was banded on 7 July 1969 and was found shot in October 1969. Nestling no. 5 was banded on 8 August 1972 and was found in a trap on 20 January 1973.

habitat in eastern North America. One notable exception is the work in North Carolina by the U.S. Forest Service to maintain physiognomic characteristics of montane bald ecosystems through prescribed burns (Sanders 1976). Nevertheless, data presented in this paper suggest that intensive waterfowl management programs involving the acquisition, reclamation, and management of wetlands may have indirectly benefitted Golden Eagles, although the association may not be entirely positive. Bald Eagles that winter in waterfowl concentration areas open to hunting with lead shot are susceptible to secondary lead poisoning (Griffin et al., Trans. N. Am. Wildl. Nat. Resour. Conf. 45:252–262, 1980: Hoffman et al., J. Wildl. Disease 17:423–431, 1981), and nationwide, Bald Eagle mortality from lead toxicosis may

be substantial (Pattee and Hennes, Trans. N. Am. Wildl. Nat. Resour. Conf. 48:230–237, 1983). Golden Eagles regularly feed on waterfowl and carrion (Sherrod, Raptor Resear. 12: 49–121), and individuals that winter at waterfowl concentration areas where lead shot is used probably feed on moribund and dead ducks and geese. Secondary lead poisoning may be a significant cause of mortality for this species as well.

Acknowledgments.—The NWF midwinter eagle survey was coordinated from 1979–1981 by M. E. Pramstaller, and the survey data used in this analysis resulted from his efforts on this project as well as the efforts of the regional coordinators and several thousand dedicated volunteers. R. W. Fyfe, J. W. Grier, and W. R. Spofford graciously permitted the use of information on band recoveries, and M. R. Fuller was instrumental in making this information available. We would like to thank K. W. Ballard, G. R. Bortolotti, W. S. Clark, K. W. Cline, M. W. Collopy, M. R. Fuller, R. S. Kennedy, M. N. LeFranc, Jr., S. D. Miller, and W. A. Wentz for critically reviewing the manuscript, as well as R. Hudson for typing the manuscript.—BRIAN A. MILLSAP AND SANDRA L. VANA, *Raptor Information Center, Institute for Wildlife Research, National Wildlife Federation, 1412 Sixteenth Street, N.W., Washington, D.C. 20036.* *Accepted 27 Aug. 1984.*

Wilson Bull., 96(4), 1984, pp. 701–705

Some factors affecting productivity in Abert's Towhee.—Abert's Towhee (*Pipilo aberti*) is restricted to desert riparian zones of Arizona and bordering states (Phillips et al., The Birds of Arizona, Univ. Arizona Press, Tucson, Arizona, 1964). Its breeding behavior, communication, and physiological responses have been detailed by Marshall (Condor 62:49–64, 1960; pp. 620–622 *in* Proc. XIII Int. Ornithol. Congr., Ithaca, New York, 1962; Condor 66:345–356, 1964), and Dawson (Univ. Calif. Publ. Zool. 59:81–124, 1954), but no information is available on annual productivity. Abert's Towhee is multibrooded, and therefore, the number of broods per season as well as nesting success and clutch-size contribute to productivity. My objectives were to describe the productivity of Abert's Towhee in 1980 and to quantify seasonal variation in length of nesting, a factor that affects productivity. I have documented elsewhere (Finch, Condor 85:355–359, 1983) the effects of changing rates of brood parasitism on the nesting success of Abert's Towhee.

Methods.—During the summer of 1979, I established a 20-ha grid in honey mesquite (*Prosopis glandulosa*) habitat 10 km N of Ehrenberg, Yuma Co., Arizona. From January–July 1980, 15 h each week were spent looking for nests on, or near, the study grid. Nests were inspected between 10:00 and 12:00 every 2 or 3 days. Fieldwork terminated in July when no new nests were initiated.

From May–August 1979, I mist-netted and color-banded Abert's Towhees, of which eight were adults. Five banded adult females were present in the breeding population the following year. In 1980, I color-banded 12 more females.

Annual productivity, which is the number of fledglings produced in one year, can be estimated from the expression (Ricklefs, pp. 336–435 *in* Breeding Biology of Birds, D. S. Farner, ed., Natl. Acad. Sci., Washington, D.C., 1973): (no. eggs/clutch · no. nesting attempts · % success)/2 adults/pair. The number of nesting attempts was measured directly by following marked females throughout their breeding cycle. To increase sample size, I also used nesting data for unmarked birds and estimated the number of attempts indirectly by dividing the length of the season by the time required for each nesting attempt (Ricklefs 1973). The length of a nesting attempt is approximated by the equation (Ricklefs 1973): $T = P(t + r_s) + Q(t_f + r_f)$, where T = average length of a nesting attempt, P = proportion of nestings that succeed, $Q = 1 - P$, proportion of nestings that fail, t = combined average