

## THE DELAWARE BAYSHORE OF NEW JERSEY: A RAPTOR MIGRATION AND WINTERING SITE OF HEMISPHERIC SIGNIFICANCE

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**ABSTRACT.**—The Delaware Bayshore of New Jersey, including the lower Maurice and Cohansey Rivers and the coastal zone of Cumberland County, is a major migration and wintering area for raptors. Over 89 days of autumn migration for three years, almost 12 000 raptors of 17 species were counted at East Point at the mouth of the Maurice River ( $\bar{x}$  = 30.7 raptors/hr). In addition, the lower drainage areas of the Maurice and Cohansey Rivers and the Cumberland County coastal zone were found to support high densities of Black (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*), Bald Eagles (*Haliaeetus leucocephalus*), Red-tailed Hawks (*Buteo jamaicensis*), Northern Harriers (*Circus cyaneus*), Cooper's Hawks (*Accipiter cooperii*), Sharp-shinned Hawks (*A. striatus*), Rough-legged Hawks (*Buteo lagopus*) and American Kestrels (*Falco sparverius*) in winter. Such high numbers and diversity of migrating and wintering raptors make the area exceptional and, perhaps, unique in eastern North America. The importance of this area for raptors emphasizes the need for its conservation, especially in light of rapid development of nearby farmlands and forests for homes and industry.

**KEY WORDS:** *migration; winter population; Delaware Bayshore; conservation.*

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El Delaware Bayshore de New Jersey: Una migración de rapaces y invernada con importancia hemisférica.

**RESUMEN.**—El Delaware Bayshore de New Jersey, incluyendo los ríos abajo de Maurice y Cohansey y la zona costera de el condado Cumberland, es el mayor lugar de migración invernada para rapaces. Arriba de 89 días de migración en el otoño por tres años, casi 12000 rapaces de 17 especie fueron contados en el Punto Este en la boca del Río Maurice ( $\bar{x}$  = 30.7 rapaces/hr). En suma, en la boca baja del desagüe del Maurice y Cohansey Ríos y la zona costera del condado Cumberland se encontró apoyo de densidad alto de *Coragyps atratus* y *Cathartes aura*, *Haliaeetus leucocephalus*, *Buteo jamaicensis*, *Circus cyaneus*, *Accipiter cooperii*, *A. striatus*, *Buteo lagopus*, y *Falco sparverius* en invierno. Tanta cantidad y diversidad de rapaces de migración y sitios de invierno hace la área excepcional y, quizás, único en el este de Norte América. La importancia de este área para rapaces énfasisa la necesidad para su conservación, especialmente con el rápido desarrollo de tierras agrícolas y bosques para casas e industria.

[Traducción de Raúl De La Garza, Jr.]

The Delaware Bayshore of New Jersey, especially Cape May, has long been known as a critical area for a diversity of migrating birds (Allen and Peterson 1936, Stone 1937, Dunne and Sutton 1986, Wiedner et al. 1992). Although much of the region has been threatened or altered by human development, areas north of Cape May along the Delaware Bayshore including Cumberland County, have been largely spared. Recent proposals for

barge port development, industrial sand mines and other projects along the Maurice and Cohansey rivers in Cumberland County threaten to alter aquatic habitats, wetlands and uplands, rendering them less suitable for wildlife.

Because of these threats, we conducted an 8-yr study of raptor use during autumn migration and winter along the Delaware Bayshore of Cumberland County, New Jersey including the Maurice and Cohansey river drainages. In this report we document a large and previously unknown aggregation of migrating and wintering raptors in this area that is of hemispheric significance and worthy of major conservation effort.

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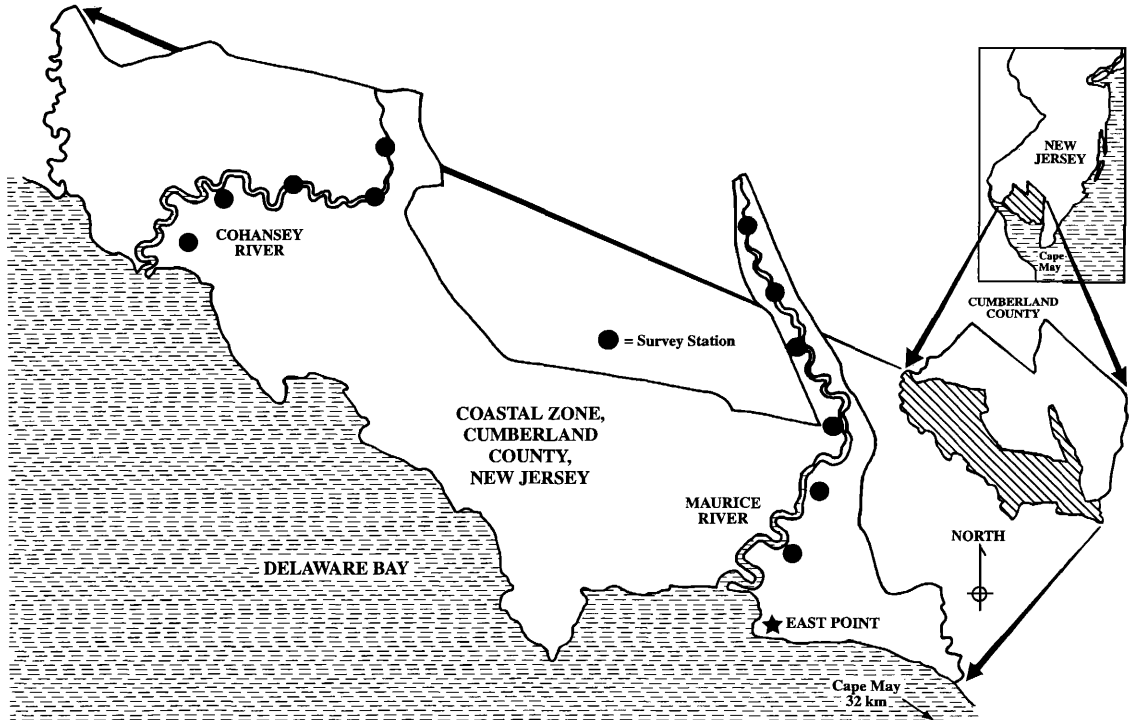


Figure 1. Maps of New Jersey and Cumberland County Coastal Zone study area including the lower Maurice and Cohanse Rivers, and the Delaware Bayshore. Closed circles indicate observation sites along the rivers. East Point hawk watch is denoted by a star at the mouth of the Maurice River.

#### METHODS

Migrating raptors were counted at East Point, Cumberland County, New Jersey (Fig. 1) from 9 September–30 November 1989–91, by a single observer during predetermined peak flight hours (mid-morning through mid-afternoon) for an average of 4.4 hr per day (range = 1–9 hr) from the wooded edge of a salt marsh near the mouth of the Maurice River at Delaware Bay. On about one-third of all days, the observation site was moved 3 km inland from the Bay at about midday, as the flight became higher and moved farther inland. East Point is a peninsula that juts out into Delaware Bay. To assess the relative importance of this site, counts from East Point were compared with same day hawk migration counts from Cape May Point, New Jersey, 32 km to the south. Counters at both sites used standard Hawk Migration Association of North America methods and recording forms (Bednarz and Kerlinger 1990, Kerlinger 1989).

We sampled wintering raptors along tidal portions of the Maurice River during eight winters, 1987–88 through 1994–95; the Cohanse River during five winters, 1990–91 and 1994–95; and in the Cumberland County Coastal Zone (CCCZ) in five winters 1989–94. Transport among sites was by automobile. Surveys were done between 22 November–21 March, mostly between 0800–1600 EST. A total of 69 surveys were done on the Maurice River and 16 on the Cohanse River. On the Maurice River, a survey

consisted of seven observation stations from a point 22.4 km upstream from the river mouth (Fig. 1) to East Point and at five stations on the Cohanse River from Bridgeton downstream to within 2 km of the mouth of the river, a distance of 17.6 km. At each observation site, all flying and perched raptors within view were counted for 50 min. Care was taken to avoid recounting individuals by noting plumage characteristics and flight direction. If a raptor was observed flying into the adjacent sampling area it was not counted if resighted in that area. Raptors seen perched between sampling sites were included in the nearest sampling site if an individual of that species was not sighted from the adjacent stations. Ten power binoculars and a 20 power spotting scope were used. On about 96% of the surveys, two observers were present and on the remaining surveys only one observer. The same observer was present for 65 of the 69 Maurice River surveys and all of the others.

Counts were conducted mostly in sunny weather with northwest winds. Ninety percent of the counts were done with these conditions, since they promoted soaring and hunting of raptors. Habitat along the Maurice and Cohanse rivers and the Cumberland County coastal zone includes tidal marsh and swamp forest, as well as adjoining upland forests and farms. Wetlands in these areas range from marshes typical of tidally inundated areas to tidally influenced freshwater marshes farther upstream.

Saltmarsh cordgrass (*Spartina alterniflora*) dominates the marshes at the mouth of the rivers, with saltmarsh hay (*S. patens*) present. Farther upstream, although tidally influenced, the marshes are comprised of freshwater and brackish wetland plants such as wild rice (*Zizania aquatica*), common reed (*Phragmites communis*), pickerel weed (*Pontederia cordata*), arrow arum (*Peltandra virginica*), spatterdock (*Nuphar advena*), waterlily (*Nymphaea odorata*) and cattail (*Typha latifolia*). Common reed is more prevalent on the Cohanse River. The banks along portions of the Maurice River are quite steep and often heavily wooded, although cropland is near both rivers. Developed areas are limited to single family homes and a few recreational boat yards. Both rivers average less than one-half mile wide and both are about one mile wide near the mouth.

In addition to surveys on the Maurice and Cohanse rivers, one road survey per year was made in the first two weeks of January 1990–94, during which raptors were counted in the entire Cumberland County coastal zone (Fig. 1). This latter survey consisted of 12 primary observation sites along a 48 km course. Standard raptor road survey methods were used between observation sites. The coastal zone count included regular counts (nearest calendar date) from the Maurice and Cohanse rivers, all conducted in a 3-d-period. This method was an attempt to determine roughly the total number of raptors that winter in the Cumberland coastal region.

#### RESULTS AND DISCUSSION

Over 89 d (389.25 hr), we observed 11 944 hawks (30.7/hr) of 17 species at East Point (Table 1). Sharp-shinned Hawks (*Accipiter striatus*) were most numerous, accounting for 39.7% of all hawks counted. This species, plus Turkey Vultures (*Cathartes aura*), Northern Harriers (*Circus cyaneus*), Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*) accounted for 84.5% of all raptors observed. In 1990, the year most observations were made, a total of 9042 raptors was recorded during 308.5 hr of observation on 60 d (9 September–7 December). This was 34.6% of the 26 164 raptors seen at Cape May Point during the same 60-d-period.

Species composition differed between East Point and Cape May Point which may be attributable, in part, to differences among species in their tendency to cross water. Greater numbers of vultures, Bald Eagles (*Haliaeetus leucocephalus*), Northern Harriers, Rough-legged Hawks (*Buteo lagopus*), Red-tailed Hawks and relatively fewer Ospreys, Sharp-shinned Hawks and falcons were counted at East Point (Table 1). Kerlinger (1985) documented differences in water crossing tendency among most of the species reported here in a study at Cape May Point. Upon reaching the end of the peninsula, only some species crossed without hesitation. At

Table 1. Summary of autumn migrants recorded at East Point and Cape May, New Jersey, on the same 89 days during 1989, 1990 and 1991. Total numbers of migrants counted and percentage of total hawks counted at each site are given. One Swainson's Hawk (*Buteo swainsoni*) was also seen at East Point.

SPECIES	EAST POINT		CAPE MAY	
	COUNT	PER-CENT	COUNT	PER-CENT
Black Vulture	39	<1%	24	<1%
Turkey Vulture	1219	10%	62	2%
Osprey	233	2%	2012	6%
Bald Eagle	97	1%	65	<1%
Northern Harrier	888	7%	1110	3%
Sharp-shinned Hawk	4744	40%	16 853	47%
Cooper's Hawk	754	6%	2312	6%
Northern Goshawk	7	<1%	36	<1%
Red-shouldered Hawk	91	1%	234	<1%
Broad-winged Hawk	188	2%	1168	3%
Red-tailed Hawk	1398	12%	1453	4%
Rough-legged Hawk	42	<1%	4	<1%
Golden Eagle	14	<1%	28	<1%
American Kestrel	1854	16%	7400	21%
Merlin	297	3%	1551	4%
Peregrine Falcon	72	1%	855	2%
Total Hawks	11 944		35 968	
Total Hours	389.25		798.5	
Hawks Per Hour	30.7		45.0	

East Point, the vast majority of most species moved west, whereas Osprey (*Pandion haliaetus*), Merlins (*Falco columbarius*) and Peregrine Falcons (*Falco peregrinus*) usually flew to the southeast toward Cape May. The latter species are not reluctant to cross Delaware Bay (Kerlinger 1985, 1989). It is likely that upon seeing the end of the Cape May peninsula, many soaring birds turn westward to follow the Delaware Bayshore, rather than proceeding to the tip of the Cape May peninsula where they would be counted. Others fly through Cape May and are counted near the Point before flying north and west along the Bayshore toward East Point.

During January road surveys of the coastal zone, 14 species were observed totaling between 472 and 932 birds/survey (Table 2). This year to year variation was attributable largely to variation in the number of roosting vultures and, perhaps, to weather. Species composition and numbers of most species observed along the Maurice and Cohanse rivers were similar (Table 2). The numbers of American Kestrels and Sharp-shinned Hawks along

Table 2. Summary of wintering diurnal raptors along Maurice and Cohansey Rivers and the Cumberland County Coastal zone area. Letters following species names indicate status of the species (T = federally threatened, t = New Jersey threatened, e = New Jersey endangered, u = unknown status in New Jersey; first of state letters indicates breeding season, second indicates nonbreeding season—migration and winter). Totals are the mean of yearly mean totals and min–max of yearly average totals.

SPECIES	MAURICE RIVER (1987–1995)		COHANSEY RIVER (1990–1995)		CUMBERLAND COASTAL ZONE (1989–1994)	
	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE
Black Vulture	9.9	1–45	7.0	3–10	35.8	9–77
Turkey Vulture	73.4	49–111	54.8	41–68	272.8	165–501
Bald Eagle (T,e,e)	5.5	3–10	2.4	2–4	21.2	17–27
Northern Harrier (e,u)	20.0	15–24	19.0	16–22	122	79–171
Sharp-shinned Hawk	2.6	2–4	4.1	3–6	19.8	6–37
Cooper's Hawk (e,e)	1.3	1–2	1.9	1–3	8.2	3–14
Northern Goshawk	0.1	0–1	0.2	0–1	1.4	0–2
Red-shouldered Hawk (e,t)	0.2	0–1	0.4	0–1	3.6	2–5
Red-tailed Hawk	37.9	33–42	37.3	34–42	134.6	86–159
Rough-legged Hawk	1.0	0–2	0.4	0–1	10.2	4–17
Golden Eagle	0.2	0–1	0.1	0–1	0.8	0–3
American Kestrel	2.2	1–3	7.2	6–11	30.6	18–43
Merlin	0.1	0–1	0.2	0–1	1.4	0–4
Peregrine Falcon (T,e,e)	0.1	0–1	0.2	0–1	1.2	0–2
Totals	154.7	117–204	134.7	115–151	663.8	72–932
Years of sureys	8		5		5	
Mean number of surveys per year (range)	8.6	7–14	3.2	2–4	1	

the Cohansey River were slightly greater than along the Maurice River because there is more farmland and forest edge along the Cohansey. Conversely, more Bald Eagles and Turkey Vultures were reported from the Maurice River, a function of greater waterfowl numbers, waterfowl hunting and carrion present at a livestock farm. Determining absolute abundance for statistical comparison is extremely difficult in such a heterogeneous landscape.

Turkey Vultures were the most numerous of all species, followed by Red-tailed Hawks and Northern Harriers. Bald Eagles were an important component of the winter raptor community of the Delaware Bayshore of New Jersey; as many as 16 were seen on a survey of the Maurice River. Among the wintering raptors observed, five were on the federal or New Jersey threatened or endangered lists (Table 2). Single Merlins, typically a Neotropical migrant, wintered on the study site in most years.

Probably a combination of factors is attributable to the great diversity and abundance of raptors migrating and wintering along the Delaware Bayshore. Delaware Bay is a topographic barrier to mi-

gration. Raptors reluctant to cross water seem to either fly around the Bay or terminate their migration along the Bayshore. The importance of migration stopovers among songbirds, shorebirds and waterfowl has long been known, but few biologists have recognized its importance among raptors (Newton 1979, Kerlinger 1989). Many of these birds are compelled to make migratory stopovers in the area. The abundance of open space, high-quality habitat and abundant prey make the Bayshore very attractive to both migrating and wintering hawks.

The Bayshore has frequently been recognized as an ecosystem of hemispheric or global significance. For example, the wetlands of the Delaware Bay are a RAMSAR site, in part because they support globally important populations of shorebirds and waterfowl. In addition, the EPA National Estuary Program has recognized the area as biotically important and has funded major studies of the area (Zapalorti et al. 1993). Much of the Maurice River and three tributaries, the Manumuskin River, Menanico Creek and Muskee Creek, are now included in the U.S. National Park Service Wild and Scenic Riv-

er program. The data presented herein support these designations.

Another factor that influences the winter abundance of Bald Eagles, vultures and to a lesser extent Red-tailed Hawks, Golden Eagles and Peregrine Falcons are the vast concentrations of waterfowl and other birds that migrate and winter along the Delaware Bayshore. Winter waterfowl counts conducted simultaneous to these raptor counts show that more than 25 species of waterfowl in numbers totaling greater than 10 000 to 15 000 occur regularly on the Maurice River portion of the study site alone (Sutton 1988). Likewise, huge numbers of migrating songbirds, prey for some hawks, are known to frequent the Delaware Bayshore (Wiedner et al. 1992). These birds search for stopover habitat as they move along the Bayshore.

Our data indicate that the Delaware Bayshore, and Maurice and Cohansey river drainages, support one of the largest and most diverse concentrations of migrating and wintering raptors reported in eastern North America. We make this claim understanding that there is little comparative information on abundance and winter concentration areas for raptors in eastern North America (other than for eagles and vultures). The Delaware Bayshore is all the more important because it serves hawks during both winter and migration. We know of no other migration sites that also serve as important wintering areas for raptors. It seems that many migrants end their southbound migration on the Delaware Bayshore. The conservation value of this area is obvious.

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