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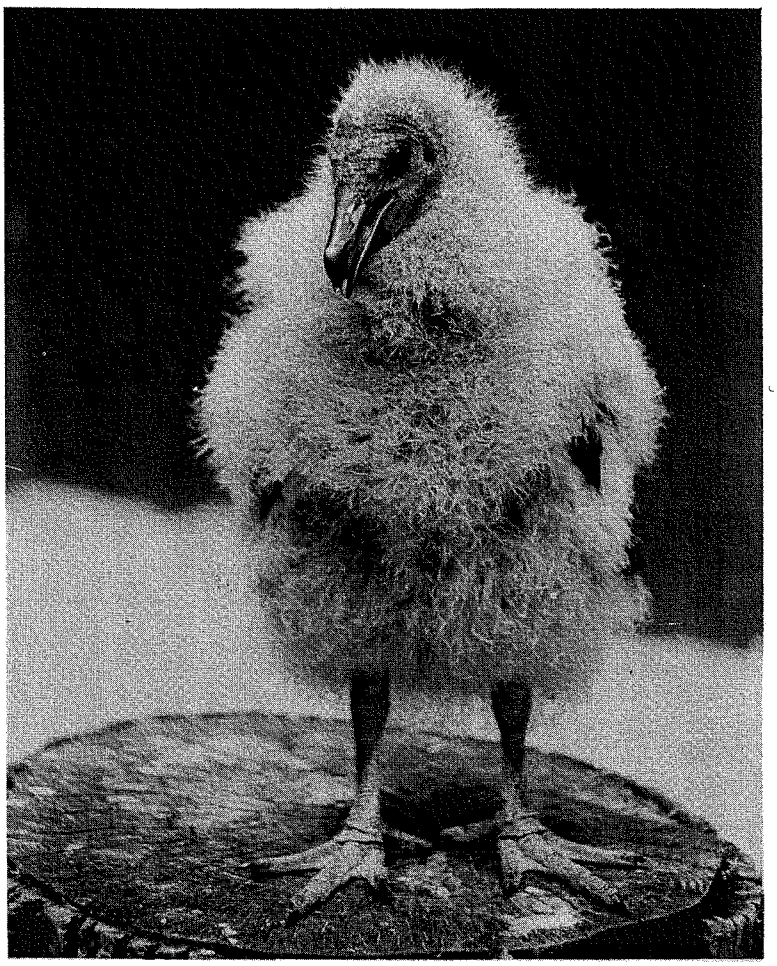

Black Vulture chick at 2 months, from nest in Upper Freehold Twp., Monmouth County. Photo by Barbara Brennan — The Raptor Trust (New Jersey's third confirmed nest).

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WINTERING RAPTORS AND WATERFOWL ON THE MAURICE RIVER

by Clay C. Sutton

Introduction

The Maurice River in Cumberland County, New Jersey rivals the Great Egg Harbor River and the Mullica River for being one of New Jersey's largest river sytems (excluding the Hudson and Delaware Rivers). Flowing southward for over 35 miles from near Williamstown, past Vineland, through Millville and emptying into Delaware Bay near Port Norris, the Maurice is by far the largest river on the Delaware Bay. The river is freshwater to below Millville, brackish until near Dorchester, and salt water through the remainder of its length. The low salinity section from near Millville to Bricksboro is characterized by extensive acreage of wild rice, in fact one of the largest stands in New Jersey (O'Connor, 1987). The lower river below Mauricetown is extensive salt marsh. Hence a variety of habitats are available to wildlife along the Maurice River.

The ornithological significance of the Maurice River has long been known. Alexander Wilson studied in the region and mentioned the vast concentrations of Ruddy Turnstones he saw in Maurice River Cove in 1812 (Centwell, 1961). Witmer Stone repeatedly mentions the Maurice River region in his 1937 work, *Bird Studies at Old Cape May*. Leck (1984) makes numerous references to regional areas such as Heislerville. One of the most significant contributions to our knowledge of the Maurice River and the region comes from Donald E. Kunkle, who in 1976 published "Bird Observations on, over and around Delware Bay", the first time the regional significance of the Maurice River was systematically presented.

While much data exists on shorebird use of the Maurice River region (Dunne, 1982), little systematic waterfowl use data has been reported in the literature. In 1987, Petrongolo noted up to 13,000 waterfowl using the river in winter. Other records have indicated up to 10,000 Snow Geese present (Kane, 1979) as well as thousands of N. Pintail and Green-Winged Teal (Sutton, unpublished, 1981). Up to 3,150 Black Ducks and 1,525 Mallards were noted on the Manumuskin River (a tributary to the Maurice River) and the adjacent Maurice in January of 1987 (Sutton and Dowdell, 1987). Existing data indicated a substantial and highly significant waterfowl concentration on the Maurice River.

Migrant raptors have been well-studied in New Jersey (Dunne and Sutton, 1986) and elsewhere. While migratory hawks lend themselves to systematic tally, relatively little is known concerning winter numbers of raptors in New Jersey. Hawks along the Delaware River were studied in the 1930's and 1940's (Potter, 1949). But the terminus of the study was in Salem County, and such data, although a valuable baseline, must

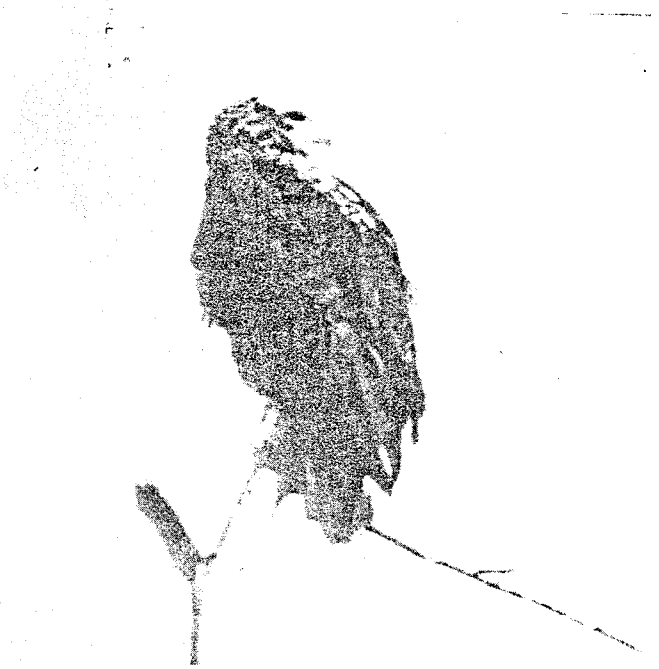
now be regarded as historical.

While road counts have been popularized in northern New Jersey (Barber, 1988), little counting has been done in southern New Jersey because of the lack of observers and the fact that the vast salt marshes do not lend themselves to road-oriented counting techniques. The Cumberland Christmas Bird Count (Kunkle, 1986) has for 37 years revealed spectacular numbers of raptors along the Delaware Bayshore. As in the case of waterfowl, existing data has hinted at major use of the Maurice River by wintering raptors. Up to 35 Red-tailed Hawks had been reported from a five mile stretch of the Maurice (Cutler, 1981), as well as up to 20 Northern Harrier (Sutton, unpublished, 1984) present along the river. Recently, the National Wildlife Federation mid-winter eagle survey (coordinated by the Nongame Project of the New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife) have shown up to five Bald Eagles present along the river in a single day in January (Niles, 1984). Systematic coverage of all major southern New Jersey river systems (Sutton and Sutton, 1982, 1986) has revealed up to 14 individual eagles present in a given winter in the Dividing Creek/Maurice River region. Finally, studies of the Manumuskin River tributary of the Maurice in 1987 indicated substantial Bald Eagle use of the Maurice and intimated that eagle use occurs daily (Sutton and Dowdell, 1987). In summary, published records, though comparatively few, indicated the possibility that raptor use of the Maurice River drainage basin might be occurring to a degree previously unknown and unexpected for New Jersey. The need for consistent census data coupled with the known spectacular concentrations of waterfowl and raptors led to this study. A study was proposed and carried out during the winter of 1987-1988 in an attempt to gain a more complete picture of the ornithological significance of the Maurice River.

Methods

Wintering raptors and waterfowl were studied along the lower Maurice River during the winter of 1987-1988. The study area was the 14 mile stretch of the river extending from Millville to the Delaware Bay and encompassed virtually all of the marsh on the main stem of the river. This study zone is that area of the river system which is surrounded by existing highways. Soaring birds were counted if in view on either side of the road delineating the study area. Seven survey points were established along the 14 miles of the river. These points were established to allow for standardization of count data; no other points were used. In this way, most overlap of birds counted from each site was eliminated, although some judgment was required on flying birds at times. A count was conducted from each station for 50 minutes. Including travel, the survey route took approximately 7 hours to run. All raptors and waterfowl seen during the 50 minute sampling period were recorded. Surveys were conducted between approximately 9:00 a.m. and 4:00 p.m., the peak times for raptor activity. Observations were made with Zeiss 10 x 40 binoculars, as well as spotting scopes.

The count was conducted on 21 dates between October 6, 1987 and April 1, 1988. The river was visited approximately every 9 days during the late fall, winter and early spring. In an attempt to determine the seasonality and temporal distribution of birds, the study was begun in October. An attempt was made to determine the degree of migratory use of the area, and how wintering numbers developed over the fall. The study was continued through March in order to properly enumerate peak



Immature Bald Eagle on the Maurice River, in color by Jane Galetto.

waterfowl numbers using the river during their late winter (early spring) migratory movements northward. Perhaps the largest variable in count technique was the number of observers. Ten counts were conducted by one observer, 11 were conducted by two observers. The fifty minute count periods may have negated this variable, i.e., enough time was allotted so that the "first" observer probably would have picked up what the second observer had first seen. Nonetheless, two counters invariably allowed for more exacting waterfowl estimates. Waterfowl were often estimated (in blocks of 10, 50, 100) owing to large numbers not allowing for exact counts (particularly when in flight). Raptors were counted with an extreme effort to eliminate double counting from site to site.

Weather conditions were noted as well as tide stage. Notes were taken on raptor plumages, behavior, and movements. Site specific data was retained in the files, (but not presented here); in this way areas of concentrations are known should the data be required. Data were kept on other bird species noted; yet no true census attempt was carried out. Some early morning and late afternoon owling was carried out as an adjunct to the study, but this effort was also not systematic.

Results

The Maurice River wintering diurnal raptor survey results are shown in Table 1. These results encompass 21 site visits from October 6 through April 1. Wind direction, tide stage and number of observers were also recorded. All 16 species of diurnal raptors regularly found in New Jersey were recorded. Systematic surveys revealed higher numbers than any historical data showed, as well as considerable seasonal variation and movement.

Waterfowl census results are shown in Table 2. Twenty-five species of waterfowl were recorded. Numbers of Black Ducks, Mallards and N. Pintails were higher than previous data has indicated. Pintails and Mallards predominated in the freshwater sections of the river and Black Ducks were concentrated along the lower river.

Raptor and waterfowl numbers recorded were highly significant in New Jersey. The concentrations of these birds along the Maurice show a density unreported for any region of the state. The Maurice River wetlands habitat is one of the most significant in all of New Jersey; waterfowl populations are in fact significant in the eastern flyway.

Species Commentary

Raptors: Wintering raptor populations are a hallmark of the Maurice River. Observed raptor numbers are some of the highest reported in New Jersey. When the size of the study area is considered, the river receives some of the most concentrated raptor use in New Jersey. The region studied is 14 miles in length, but only averages about one mile wide above the Mauricetown causeway and about 2 miles wide below the bridge. Therefore, the total study area comprises only approximately 21 square miles. A total of 2,347 raptor sightings were compiled during the 21 surveys; or approximately 115 raptors per daily visit. This results in raptor use of approximately 5.5 birds per square mile per day.

The river serves as a hunting area for birds wintering in a much wider region of Cumberland County. This was particularly evident with Red-tailed Hawks, which were seen coming into the river from both the east and west almost every morning of the survey. The values of riparian ecosystems have long been recognized as both breeding and feeding areas (Franzreb, 1987). Generally, birds do not partition space proportionately within the boundaries of their home ranges. Areas receiving concentrated use by resident animals are identified as core areas (Samuel, 1985). The Maurice River study area was estimated to be a core area for all of the raptor species present except for Red-shouldered Hawk, a forest species for which most of the study area represents peripheral habitat.

The river system is undoubtedly a core area for Bald Eagle use. In fact, the area receives the heaviest eagle use on the coastal plain of New Jersey. Only the Delaware River between the Delaware Water Gap and Dingman's Ferry has more eagles present in winter (Niles, 1985), but this area is more than twice as large (30 miles in length) as the Maurice River study area. The Maurice should be regarded as critical habitat for the Bald Eagle as defined by the Northern States Bald Eagle Recovery Plan (Northern States Bald Eagel Recovery Plan, 1983).

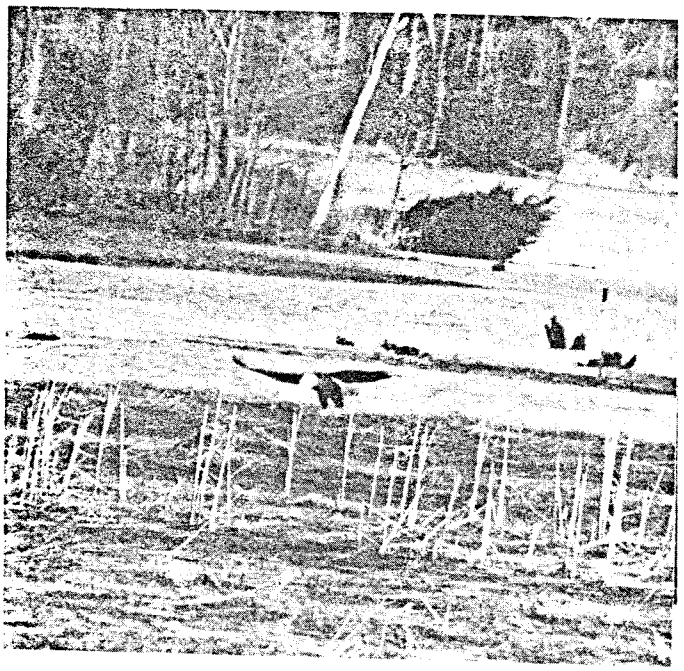
Turkey Vulture: Turkey Vultures are by far the most numerous raptor on the river. A large winter roost has been present near Laurel Lake for many years, with alternate roost sites nearby. Only two corroborative counts were actually done at the Laurel Lake roost; 70 birds were present on November 16, and 82 were there on December 14. All other counts were of birds either feeding or in flight from regular census sites. Roost attendance can vary with vultures as birds use alternate roosts closer to prey (Rabenold, 1987), and this accounts for much of the fluctuation. Oddly, vulture numbers were well down in the 1987-1988 winter season along the Maurice; the known historical peak for the river occurred on January 7, 1984 when 600 Turkey Vultures were estimated at the Laurel Lake roost (Sutton, unpublished, 1984). Four hundred were present on December 8, 1984, and 300 on December 15, 1984 (*Ibid.*). Vultures spread out from these Maurice River roosts to hunt much of Cumberland and Cape May Counties.

Black Vulture: These southern vultures are always more numerus in spring in southern New Jersey than any other season, and this survey was no exception. Black Vultures were first noted on the river on March 3, when six birds were present. Two were seen on March 15, as well as on the non-survey dates of March 7 (one bird) and March 13 (two birds). These two birds on March 13 were seen in courtship flight, indicating probable nesting in the region. The Black Vulture population in South Jersey is well known to be rapidly expanding (Sutton and Sutton, 1984).

Osprey: Migrants were seen throughout October, and one late migrant was seen fishing in the upper river on November 4. The first returning birds were noted on March 21. At least four active osprey nests are located along the river, and migratory use is daily in autumn. The upper section of the river provides optimal fishing conditions for fish hawks due to the clarity of the water and abundance of fish (O'Herron, 1987).

Bald Eagle: Eagle use of the Maurice River occurs daily. Eagles were sighted on 20 of the 21 survey dates, or 95% of the time. In the winter of 1986-1987, local resident Donald Fauerbach sighted bald eagles from his home on 19 continuous days (Sutton and Dowdell, 1987). During the winter of 1987-1988, this same resident saw two adult Bald Eagles every day from December 23 to January 3 near his home (Fauerbach, pers. comm., 1988). Historical records have also shown Bald Eagle use to be daily in winter. Five birds were seen on January 7, 1984, and three each on January 10, 1981, January 8, January 21, February 5, 1984 and February 2, 1987 (Sutton, unpublished, 1981-1987). During this survey, the peak date was February 16 when six birds were seen (3 adults and 3 immatures). Five Bald Eagles (2 adults, 1 sub-adult, 2 immatures) were seen on the migratory date of October 27 (with all birds feeding on the river), and five were noted on the non-survey date of January 23 (3 adults, 2 immatures). A minimum of 18 individual eagles were noted using the river during the survey period, including four adults and three subadults. This number is based on multiple sightings, concurrent sightings, careful plumage descriptions, as well as photographic records. A few of the birds were present most of the winter; others were seen only once—particularly those seen in February and March, indicating use of the area by wandering spring migrants.

Cumberland County's resident pair of eagles use the river daily—they were often seen heading to and from the nesting area. The male of this pair was seen gathering nesting material on the marsh on February 16. Courtship flights, territoriality and eagle "play" (tail chasing, etc.) were noted. Historically, this pair was observed copulating on the river's marshes on February 5, 1984 (Sutton, unpublished, 1984). With four historic nesting locations along the river, the area hold promise for New Jersey's eagle reintroduction program. Eagles were noted feeding on muskrat, fish, and waterfowl. On numerous occasions, eagles were seen herding waterfowl, looking for targets of opportunity. Regrettably, eagle activity seemed to decrease as spring advanced and more boats (fishermen) were using the river. Bald Eagles were seen to be flushed by boats on October 6, October 27 and November 4. While eagles are noted on the river in summer, it is theorized that boating activity deters most eagle use during this water-oriented recreational season. Nonetheless, the Maurice River is a stronghold for Bald Eagles in New Jersey. Winter use is daily, and involves many birds. Clearly Bald Eagles find ideal perching and feeding habitat along the river.



Adult Bald Eagle gathering nesting material on the Maurice River Feb. 16, 1988, in color by Clay Sutton.

Golden Eagle: Historical records of Golden Eagles on the Maurice are few. An adult was recorded January 4, 1975, an immature on January 11, 1981 and two immatures on January 28, 1984 (Sutton, unpublished, 1975-1984). During this survey, Golden Eagles were observed on November 9 and December 7. Birds were also seen on the non-survey dates of November 10 and January 11 by Robert Barber (Barber, 1988). All four individual birds were immatures, and all were noted hunting waterfowl.

Northern Harrier: Marsh hawk numbers were highly significant; an average of 22 were seen per survey date. A peak number of 32 were seen on January 10. Most were females and immatures; only three adult males were known to be wintering. As only one male was seen on January 10, we do know that *more* than 32 birds were using the river during the mid-winter period. Many fall and spring birds were migrants. A noted drop in population occurred in mid-February, probably a result of early spring migration out of the area. Harriers are known to be very early migrants in the region (Sutton, 1987). Four migrant harriers were noted high overhead on March 13, 1988. Otherwise, all birds used the river for feeding, predominantly concentrating in the salt marsh below the Mauricetown causeway. Harriers were observed feeding on rodents, and one was seen with a rat (or possibly a young muskrat). Predation on birds was also attempted, and one was noted feeding on a dead black duck, which it no doubt found as carrion. Harrier numbers, more than that of any other species, seemed weather-related. Highest numbers were generally seen during days of calm winds. High winds (the best for buteos and eagles) produced fewer harriers as they simply sat it out on the marsh.

Sharp-shinned Hawk: Numbers of this small accipiter also varied with wind velocity—few were seen on days of high winds. A peak of 12 (migrants) were seen on October 6, but an astounding 12 were also seen on December 7—hinting at the true number of these forest-dwelling hawks wintering along the river. Numbers of this species (as well as Cooper's Hawk) also dropped noticeably in February, possibly representing ongoing winter dispersal, early migration out of the area, winter mortality, or probably a combination of all the above factors. Autumn use of the Maurice River by sharp-shins is extensive, as the birds often follow the Delaware Bayshore north and west after concentrating at Cape May (Allen and Peterson, 1937). On October 14, 1979, 192 sharp-shins were recorded at East Point (along with 419 American kestrels) by David Ward during 20-25 mph northwest winds (Dunne, 1979). This survey proves that a significant number stay to winter in the Maurice River region.

Cooper's Hawk: A peak of seven Cooper's Hawks was recorded on October 6. Numerous birds remained to winter in the area. At least seven individuals were present in January, a number based on sex and plumages noted. Cooper's Hawks are no doubt attracted to the numerous passerines found near the river, and make extensive use of the river valley marshes and woodlands for hunting. Few areas in New Jersey can report such consistent sightings of Cooper's Hawks in winter. Cooper's Hawks also showed a decline in numbers in late winter similar to that of Sharp-shinned Hawks.

Northern Goshawk: Only three sightings of this large northern predator were made. An immature female was seen on October 27, an immature male on November 16 and an adult female goshawk was seen on the non-survey date of January 16 by Robert Barber. This is the rarest age and plumage of goshawk to be seen in New Jersey; an adult female is a significant sighting in New Jersey in a non-invasion winter (Kerlinger, 1988).

Red-shouldered Hawk: Red-shouldered Hawks are forest--dwelling buteos (Bent, 1961). Therefore, few would be expected in the marshes of the study area, and in fact very few were seen. Besides those noted in Table 1, one immature was noted on January 16 and an adult on June 20, both near Heislerville. Four or five birds were present for the winter in the wooded swamps at Heislerville, Garron's Neck and the east bank of the river south of Millville. Red-shoulders became more evident during the harsh weather of early January as they were seen perched on sheltered edges. Red-shoulders breed just outside the study area near Port Norris, and on Buckshutem Creek near Laurel Lake, two of only six known breeding pairs in the southern New Jersey coastal plain (Sutton and Sutton, 1986).

Broad-winged Hawk: This small buteo winters in South America, and naturally none wintered within the study area. One migrant was seen on October 6. Broad-winged Hawks breed in good numbers in the forests surrounding the Maurice River; they have often been noted soaring over the upper Maurice and its tributaries in late spring and summer. Broad-wings return to the region in mid-April.

Rough-legged Hawk: Based on migratory counts, this was not a major rough-leg flight winter (Kerlinger, 1988). Few were seen compared to other winters. Beside those birds noted on the survey, sightings were made on October 25 and December 10. Six dark-morph, 8 light-morph, and two undetermined plumage sightings were recorded. At least 8 individual birds were believed present. Historically, five were seen on February 4, 1979; 6 on January 9, 1981; and four on January 21, 1984 (Sutton, unpublished, 1979-1984). A spectacular 20 rough-legs were recorded by Sutton on February 8, 1975 in the area from Stip-

son's Island to Berrytown, a 10 mile stretch encompassing the mouth of the Maurice River. Most Rough-legged Hawk use was on the salt marsh south of Mauricetown, particularly the salt hay (*Spartina patens*) areas near Port Norris and East Point.

Red-tailed Hawk: Red-tailed numbers along the river are spectacular, and densities are the highest reported for New Jersey. An autumn peak of 42 was found on November 16, and a spring peak of 40 on March 5 and 15. Some 37 were recorded on December 22 and January 24. Red-tails clearly came from miles around to hung along the river. Total numbers involved are unknown; a distinctive individual (either leucistic or a "Krider's" red-tail) was seen only three times, on November 9, January 1, and February 5—indicating that certainly not all red-tails in the region were recorded on each survey. Assuming only 42 birds were present, they still achieved a density of two birds per square mile of river habitat. Red-tails are attracted to the abundance of rodents along the river, and were constantly seen hunting. Red-tail numbers seemed quite tide-related. Highest numbers were generally seen on the highest stages of the tide, as prey was flushed out by the water. This seemed true for both harrier and eagle sightings as well. October 16, an adult red-tail was seen to catch, kill and carry off an immature Laughing Gull that had been soaring in the same thermal with it. A red-tail was also noted feeding on a still-alive Great Blue Heron, although it probably found the heron in a weakened state owing to the harsh

TABLE 1. Maurice River Raptor Survey: Fall, Winter, Spring, 1987-1988.

Species by date	*10/6*	*10/16*	*10/27*	*11/4*	*11/9*	*11/16*	*11/24*	*12/7*	*12/14*	*12/22*
Black Vulture										
Turkey Vulture	52	43	76	5	26	70	68	63	82	36
Osprey	3		3		1					
Bald Eagle	1		5	1	1	4	2		3	3
Northern Harrier	19	11	29	29	30	29	24	12	30	24
Sharp-shinned Hawk	12	9	7	6	1	2	2	12	3	2
Cooper's Hawk	7	3	2	4	2	3	2	3	2	
Northern Goshawk			1			1				
Red-shouldered Hawk				1				1		
Broad-winged Hawk	1									
Red-tailed Hawk	21	13	36	23	33	42	35	28	29	37
Rough-legged Hawk				1			3	1	1	1
Golden Eagle					1			1		
American Kestrel	9	2	4	2	3	3	6	2	2	3
Merlin	1		1		1					
Peregrine	1		1							1

Species by date	*1/1*	*1/9*	*1/10*	*1/24*	*2/5*	*2/16*	*2/24*	*3/5*	*3/15*	*3/21*	*3/31*
Black Vulture								6	2		
Turkey Vulture	50	33	39	45	34	44	21	42	52	24	22
Osprey										2	10
Bald Eagle	3	1	3	4	4	6	3	1	3	2	2
Northern Harrier	22	27	32	23	26	21	12	15	12	14	13
Sharp-shinned Hawk	3	5	4	5	2	1		1		2	2
Cooper's Hawk	2	1	2	1	1			1	1		1
Northern Goshawk											
Red-shouldered Hawk		1	1								
Broad-winged Hawk											
Red-tailed Hawk	31	34	30	37	35	33	29	40	40	38	24
Rough-legged Hawk	1	2	1	2					1		1
Golden Eagle											
American Kestrel	3	4	1	5	2		2	2	3	2	1
Merlin											
Peregrine							1				

weather conditions in January. Red-tail courtship was constant on February 16 and 24, and thereafter. Copulation was observed on February 16 and March 21; many pairs of Red-tailed Hawks remain to nest along the Maurice River and its undeveloped tributaries.

American Kestrel: A peak of nine were seen on migration (October 6). (However, note previous comments under Sharp-shinned Hawk). At least nine individuals wintered in the study area. Most kestrel use occurred in old fields adjacent to highways. One kestrel was seen to catch and eat a song sparrow; others were noted with mice.

Merlin: Migrant Merlin no doubt use the river daily in autumn; only one bird was known to winter. On February 12, Robert Barber saw an adult male Merlin at Bivalve (Barber, 1988). Most wintering Merlins are generally believed to be immature females.

Peregrine Falcon: Peregrines were noted on December 22 (immature), the non-survey date of February 1 (age undetermined), and an adult on February 24. The adult was believed to be from the Heislerville Wildlife Management Area nesting tower. Two pairs of nesting peregrines are known to use the Maurice River—those from Heislerville and the Egg Island Point Tower. In addition, use of the river by migratory (tundra) peregrines is daily in September and October. Peregrines are attracted to the river by the large concentrations of shorebirds and waterfowl. Historically, peregrines were noted on December 31, 1982; April 29, 1984; December 29, 1984; and January 24, 1985 (Sutton, unpublished, 1982-1985). Peregrines are an uncommon raptor on the Maurice River in winter.

In conclusion, the Maurice River is of inestimable importance to wintering raptors. Birds of prey are well known to concentrate unequally in available habitat due to natural features which provide for their needs (Steenhof, 1986). In Idaho, the Snake River attracts large numbers of raptors because of cliffs available for breeding and rangelands available for feeding (Olendorff, 1977). In New Jersey, concentrations of wintering raptors such as those that are found along the Maurice River are unreported and probably unequalled elsewhere. For its small size, (14 miles in length) the Maurice clearly shows the greatest known wintering raptor densities in the state. The largest number of eagles found on New Jersey's coast use this area in winter. In this sense, we have a "Snake River" of our own right here in New Jersey.

Owls: No systematic owl census was undertaken. Nonetheless, a few early evening and early morning visits hinted at nocturnal raptor use which may rival diurnal raptor use. At lest 16 pairs of Great Horned Owls were located within earshot of the study area. Great Horned Owl pairs can nest within one mile of one another on the Delaware Bayshore (Sutton, P., unpublished), and this no doubt occurs on the Maurice River as well. With a bare minimum of 32 Great Horned Owls present, we can estimate that their use rivals that of their diurnal counterpart, the Red-tailed Hawk.

At least eight pairs of E. Screech-owls were located—no doubt the true number is many times higher. Two Com. Barn-owls and one Long-eared Owl were found along the river in 1987-1988. A Saw-whet Owl responded to an imitation of its call near Port Norris on January 28 and a road-kill was found near Heislerville on November 24. Historically, two saw-whets were recorded in October, 1985 and November, 1986. Long-eared Owls were previously recorded in December and January of 1981 (Barber, 1988). Barred Owls nest along the Maurice River tributaries of Muskee Creek, the Manumuskin River and Buckshutem Creek (Sutton, 1987), but probably the pair in Garron's Neck Swamp near Mauricetown is the only pair actually within the immediate study area.

Finally, at least three Short-eared Owls were found on the marshes near East Point. Birds were noted November 24, January 1, 9 and 28. Historically, 4 Short-eared Owls were seen together near Bivalve on February 8, 1975, and two plus were present throughout the winter of 1986-1987 at East Point (Kane, 1975-1987). The marshes of the lower river remain important habitat for this species in New Jersey. Barn owl pellets collected on the lower river in December contained Meadow Vole remains, and one pellet contained the skull of a Short-tailed Shrew. A long-eared pellet contained the skull of a Lesser Yellowlegs. Finally, Great Horned Owl pellets contained Meadow Vole, Cottontail Rabbit, and Muskrat bones. Owl use of the Maurice River marshes is substantial.

Waterfowl: The waterfowl concentrations along the Maurice River are the largest reported in New Jersey except for Forsythe (Brigantine) National Wildlife Refuge near Oceanville, New Jersey. Snow Geese, Black Ducks, Mallards and N. Pintail abound. By simply taking the highest counts for each species and adding them together, it is evident that a minimum of 22,244 waterfowl used the river during the study period; and this method does not allow for any seasonal turnover of birds. While the turnover rate is unknown at this time, it is safe to say that more birds are using the Maurice River marshes than peak numbers of this study indicate.

While raptor numbers varied with wind, weather and tide, waterfowl numbers varied even more so. All higher counts were either made on high tides, when birds were easily visible feeding "on top" of the marsh (as opposed to down in creeks at low tide), or when eagle activity flushed hidden waterfowl into the air, allowing for easier counting. Indeed, the highest black, mallard and pintail numbers were tallied on February 16 and March 15 when eagles were constantly herding waterfowl along the upper sections of the river, looking for easy prey.

In this sense, waterfowl counts are not precisely comparable, as the above factors always influenced counts. In addition, two observers regularly allowed for more exact waterfowl counts. Nonetheless, predictable seasonal variation is easily seen in the data, and numbers are consistent for ground-based counting. Often, however, *many* more waterfowl were present than were recorded, particularly Black Ducks on the vast marshes of the lower river. The numbers presented should be considered as what might be recorded by land-based observers in approximately seven party-hours of census effort. For most survey dates, the numbers of ducks recorded represent spectacular numbers and concentrations for New Jersey.

Snow Goose: Numbers varied considerably due to local movements along the Delaware Bayshore. Highs of 5,000 were estimated on February 24 and March 21. Single blue-morph Snow Geese were noted on October 16 and February 24. Historically, 10,000 Snow Geese (with six blues) were seen on February 8, 1975, and 10,000 were counted on March 9, 1979 (Sutton, unpublished, 1975-1979). The lower river is excellent habitat for snow geese.

Canada Goose: Most Canada Geese concentrated on the upper

section of the river; the peak of 899 represented late migrants on January 9. Historically, 1,050 were seen on January 24, 1987 (Sutton, unpublished, 1987) along the 3 Tundra Swans (the only other known record for this species on the river except for the 19 migrants noted on January 24 during this study).

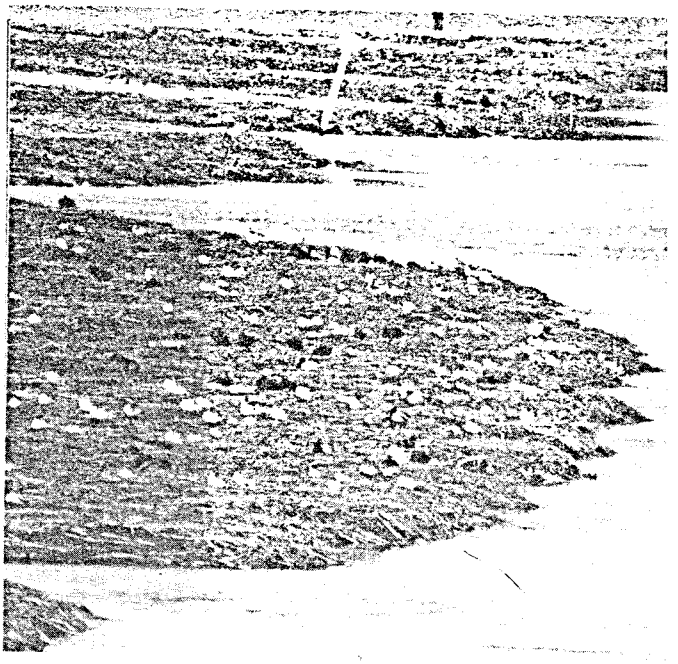
Wood Duck: The 115 recorded on October 6 is a very good count for coastal New Jersey in any season. The first returning Wood Duck was seen on February 5.

Green-winged Teal: An abundant species along the length of the river, the Green-winged Teal peaked at 1,500 on November 16. A total of 1,378 represented the spring peak on March 15. Thousands were estimated along the river on March 1, 1981 (Sutton, unpublished, 1981).

Black Duck: The abundance of Black Ducks on the Maurice River was one of the major discoveries and highlights of the study. A peak count of 8,120 was achieved on February 16. Only at Forsythe (Brigantine) NWR are such concentrations reported in New Jersey. For comparison, during the 1986-1987 Christmas Bird Count Season, the highest number of Black Ducks reported was at Oceanville (where the count circle includes Brigantine NWR) where 5,436 Black Ducks were counted (LeBarron, 1988). Waterfowl numbers always peak in February and early March in southern New Jersey (reflecting early spring migration) and the numbers are therefore not directly comparable. Suffice it to say, however, that Maurice River Black Duck numbers are among the highest in New Jersey. The Black Duck is a species of special concern of the United States Fish and Wildlife Service (Tate, 1986), and such concentrations need to be documented and protected. Black Ducks were distributed evenly in numbers along the full length of the river, feeding in both fresh and salt water marshes. However, almost 100% of the ducks below the Maurice River causeway were blacks. Numbers of Black Ducks along the river dropped significantly in December. The three December sample dates all were within the legal duck hunting season, and birds not only dispersed regionally due to intensive hunting pressure along the river, but also most waterfowl flew out intoi the Delaware Bay at dawn. Here they spent the day in rafts, away from the eyes of hunters and census-takers. The birds would then fly back at dusk to feed on the Maurice River marshes. While numbers vary, seasonal patterns are seen in the data; many Black Ducks were still present at the end of the study period.

Mallard: Mallard numbers were also highly significant. A peak of 3,250 was recorded on February 16. Mallard numbers seem to fluctuate independently of black and pintail numbers; mallards outnumbered blacks during the hunting season. Numerous black and mallard hybrids were noted during virtually every survey. Mallards preferred the freshwater marshes of the upper river, and were rarely seen below Mauricetown. The wild rice marshes of the Maurice River are clearly a mallard stronghold in New Jersey.

N. Pintail: Historical records of 1,000 pintails on the Maurice on March 4, 1979, February 16, 1980, and March 1, 1981 (Sutton, unpublished, 1981) only hinted at the abundance of this handsome puddle duck. Pintails peaked on the expected date of March 15 at 3,170 birds. A total of 499 were seen in a single flock at the Maurice River Bluffs on February 24. They are virtually absent during fall migration here, but the New Jersey



N. Pintails, Mallards and Black Ducks on the Maurice River near the bluffs, in color by Clay Sutton, Feb. 24, 1988.

Delaware Bayshore is an important spring migration staging area for pintails. The only known higher counts of pintails in New Jersey were 4,000 at Mad Horse Creek WMA (Salem County) on March 15, 1980 and 5,500 at Pedricktown Marshes (Salem County) on March 14, 1977 (Leck, 1984). The Maurice River shows certainly one of the greatest concentrations of pintails in the state. In fact, these numbers are significant for the entire eastern flyway. Only Bodie-Pea Island National Wildlife Refuge in North Carolina shows a Christmas Bird Count number of pintails (4,545) exceeding those found on the Maurice River (LeBaron, 1988). In short, the largest concentrations of pintails in the east are in New Jersey, and the Maurice River is one of the most important pintail habitats of the Delaware Bayshore.

Gadwall: Gadwall peaked at only 60 birds on March 15. Many gadwall remain, however, as breeding birds in the Maurice River marshes.

American Wigeon: Wigeon are less common than they formerly were. Only 38 were seen on March 5, all at the Heislerville impoundments. Perhaps a changing ecology at these pools has rendered them less attractive to the wigeon. Over 100 were present there during the winters from 1972 through 1975. A drake Eurasian Wigeon was seen there on March 16, 1974 and February 8, 1975 (Sutton, unpublished, 1975) as well as during the winter of 1972-1973 (Barber, 1988).

The wintering populations and early spring staging of waterfowl on the Maurice River are significant both in New Jersey and in the eastern flyway. Numbers of Black Ducks, Mallards, and N. Pintails are spectacular. Twenty-five species of waterfowl were recorded, and a *minimum* of 22,244 birds were present during the survey. Other tributaries to the Maurice, the Manumuskin and Menantico Rivers, doubtless held several thousand more ducks, as well, (Sutton and Dowdell, 1987). While survey numbers are not exactly comparable owing to variations in tide and numbers of birds flushed during each survey, a clear picture of seasonality and waterfowl abundance emerges. The Maurice River marshes are some of the most important duck habitat in

TABLE 2. Maurice River Waterfowl Survey: Fall, Winter, Spring, 1987-1988.

Species by date	*10/6*	*10/16*	*10/27*	*11/4*	*11/9*	*11/16*	*11/24*	*12/7*	*12/14*	*12/22*
Tundra Swan										
Mute Swan	8	4						2	6	8
Snow Goose		252	15	3		75	250			124
Canada Goose	70	42					200	55		
Wood Duck	115	1				1				
Green-winged Teal	1025	5	70	150	150	1500	50	7	8	
Black Duck	160	130	220	1220	1000	750	1350	511	896	243
Mallard	40	21	50	451	300	500	600	706	902	259
N. Pintail	2		3	1		5	161	182	142	26
Blue-winged Teal	3		1							
N. Shoveler										
Gadwall						10	2		1	
American Wigeon	6						1			
Canvasback										
Ring-necked Duck							2			
Greater Scaup										18
Lesser Scaup										
Oldsquaw						1		1		
Black Scoter										
Com. Goldeneye			8							20
Bufflehead			4	3	50	12		7		20
Hooded Merganser					5					
Common Merganser										
Red-br. Merganser								3		20
Ruddy Duck			10	10						
TOTALS:	1429	455	380	1839	1505	2854	2616	1474	1955	738

Species by date	*1/1*	*1/9*	*1/24*	*2/5*	*2/16*	*2/24*	*3/5*	*3/15*	*3/21*	*3/31*
Tundra Swan						19				
Mute Swan	6		2	4	2	4	3	5	3	3
Snow Goose	1300		1100	503	900	5000	2000	1524	5000	966
Canada Goose	104	899	150	4	135		12	8	2	
Wood Duck				1			1			
Green-winged Teal				51	40	150	220	1378	705	1350
Black Duck	1117	1529	5425	2550	8120	5180	3500	3102	1920	1108
Mallard	1146	604	1750	730	3250	1856	3020	1060	1510	69
N. Pintail	90	37	200	580	2050	2540	2372	3170	2002	2
Blue-winged Teal								3	2	23
N. Shoveler						1		6	3	2
Gadwall	2	2	2				5	60	27	4
American Wigeon			3	4			38	25		1
Canvasback						5				
Ring-necked Duck	1						7	1	1	
Greater Scaup	10					12			4	8
Lesser Scaup						2	22	22	26	
Oldsquaw										
Black Scoter	1									
Goldeneye		3								
Bufflehead	55	2	1		3	1	1			
Hooded Merganser							1	3		
Common Merganser		7	9	1	1	3	1			
Red-br. Merganser		1	24		4	22	3	25	15	10
Ruddy Duck										
TOTALS:	3832	3084	8685	4428	14505	14766	11206	10392	11218	3546

New Jersey, and must be regarded and protected as such by responsible agencies and concerned citizens.

The abundance of waterfowl and raptors, when considered together, make the Maurice River one of New Jersey's most important natural areas. Every effort must be made to keep the Maurice River habitats from being eroded by those forms of change which have rendered so many of the state's once important wetland habitats useless to wild birds. The complete wetlands and upland buffer zones of the Maurice River and its tributaries should receive priority consideration for Federal National Wildlife Refuge status. There are few if any places in New Jersey where one can watch a single wheeling flock of 6,000 ducks flushed by three Bald Eagles hunting and soaring together over them.

Acknowledgements

This study was made possible by a contract from Citizens United to Protect the Maurice River and its Tributaries. We thank them for their support of this project and for their yeoman ongoing efforts to protect the river. I particularly wish to thank Donald Fauerbach for access to the river and for shared eagle sightings and detailed reports. I thank Jack Kontes for permission to census the Fralinger Site and Mark Hedden for his continuing contribution for eagle sightings and insight into the birds' habits. Special thanks go to Jane Galetto for her shared eagle information and chocolate donuts, and particularly, for her interest and support in this project. Bob Zappalorti receives a major thank you for allowing me to spend time well over and above contract requirements on this project.

The project would have been the poorer were it not for Bob Barber's ongoing assistance; many of the best sightings were his. I particularly thank him for his background and insight into the mysteries of the river. Thank you to Patricia Sutton and David Sibley for field assistance on the survey. Dave's itinerant regional and national perspective helped greatly in putting the Maurice River in proper focus. Finally, heartfelt thanks go to Jim Dowdell for his assistance in many a shared survey and for bringing so much to the study. Such splendid results could never have been achieved without his abilities and particularly his abiding interest.

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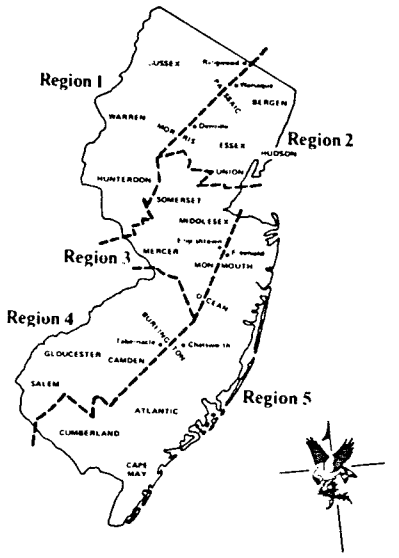
—Regional Manager Herpetological Associates, Inc., Environmental Consultants, 129 Buck Avenue, Cape May Court House, NJ 08210

Spring Field Notes

Mar. - May 1988



REGION NO. 1—*Northwestern Region, including Sussex, Warren, Hunterdon and the western portions of Morris and Passaic Counties.* **EDITOR**—*Greg Hanisek, R.D. 3, Box 263, Phillipsburg, N.J. 08865.*

The season's weather progressed unremarkably until May, which was cooler and wetter than normal. The nastiest weather, five straight days of rain beginning May 16, set the stage for a good passerine flight May 21. Warbler species-counts that day included 25 in two hours in a single Pequannock Watershed location (KK *et al.*) and 26 in Stokes State Forest (FT). Following is a compilation of first-arrival dates for regular migrants. Uninitialed observations are by Tetlow from Culvers L. and Sunrise Mt., Patten from Space Run, Bull's I. and Alexandria Twp.; Bacinski from Pequannock Watershed and Hanisek from Pahaquarry, Phillipsburg and Harmony. Earliest arrived dates follow.

Green-backed Heron—April 27, Lafayette (JZ); Osprey—April 10, Ghost Lake, Great Meadows (DB); Broad-winged Hawk—April 5, Perryville (EP); Killdeer—April 7, Harmony; Solitary Sandpiper—April 15, Harmony (JE); Spotted Sandpiper—April 30, Pahaquarry; Chimney Swift—April 22, Phillipsburg; Ruby-throated Hummingbird—April 30, Hackettstown (AS); E. Wood-Peewee—May 9, Pahaquarry; Least Flycatcher—April 30, Pahaquarry; Great Crested Flycatcher—May 5, Pequannock Watershed; E. Kingbird—April 30, Pahaquarry; Purple Martin—April 4, Phillipsburg; Tree Swallow—March 25, Culvers L.; N. Rough-winted Swallow—April 16, Culvers L.; Bank Swallow—April 29, Harmony; Barn Swallow—April 9, Harmony (JE); House Wren—April 26, Waterloo (DB); Blue-gray Gnatcatcher—April 9, Culvers L.; Veery—April 27, Stephens State Park (DB); Wood Thrush—April 30, Culvers L.; Gray Catbird—April 30.