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PART I

WINTERING RAPTORS AND WATERFOWL  
ALONG THE MAURICE RIVER  
ON THE DELAWARE BAYSHORE  
CUMBERLAND COUNTY, NEW JERSEY

Submitted March 30, 1988

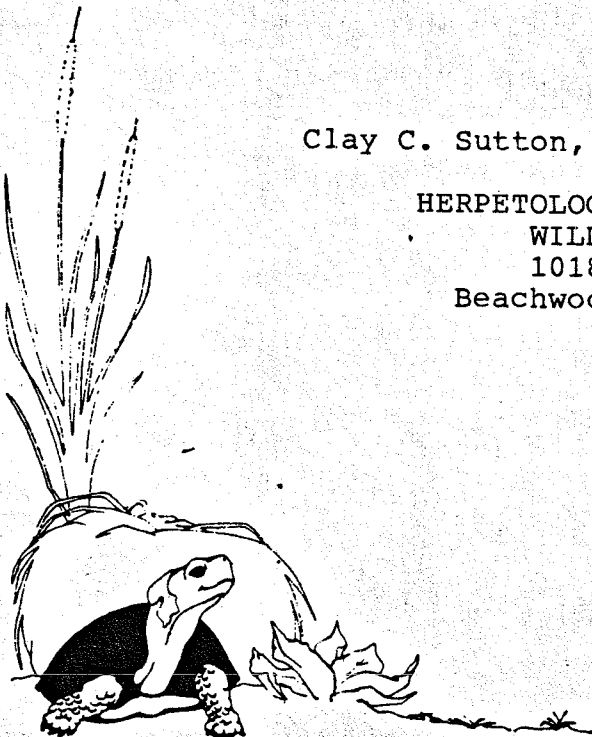
to

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by

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## **I. Introduction**



## 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 systems (save 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 regional location of the Maurice is shown in Figure 1. The Maurice River in Cumberland County is shown in Figure 2.

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, this in fact being 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". In 1984, Leck 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 Delaware 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 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.

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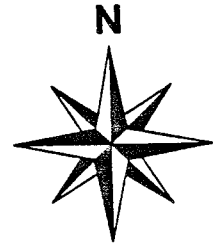
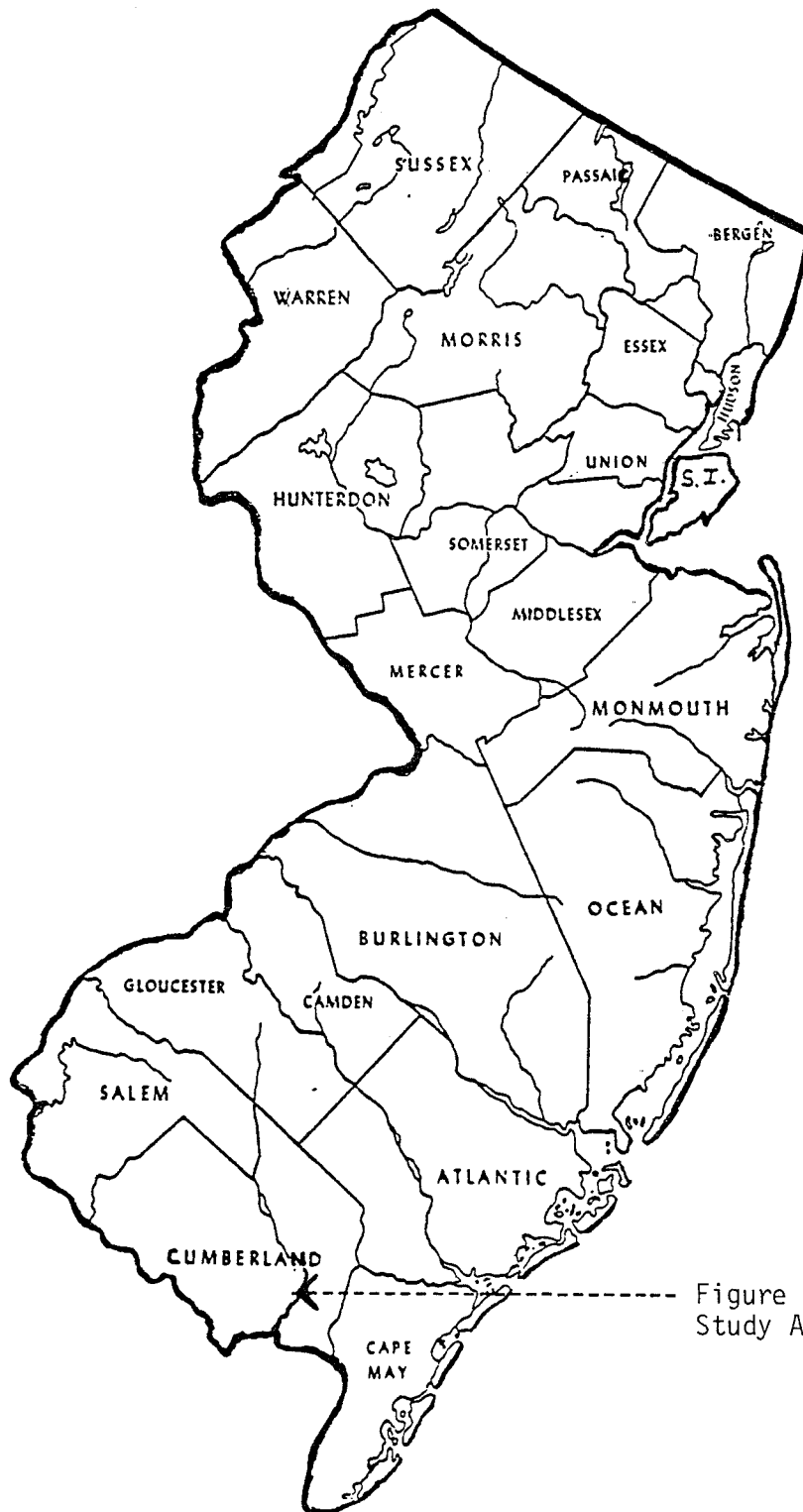
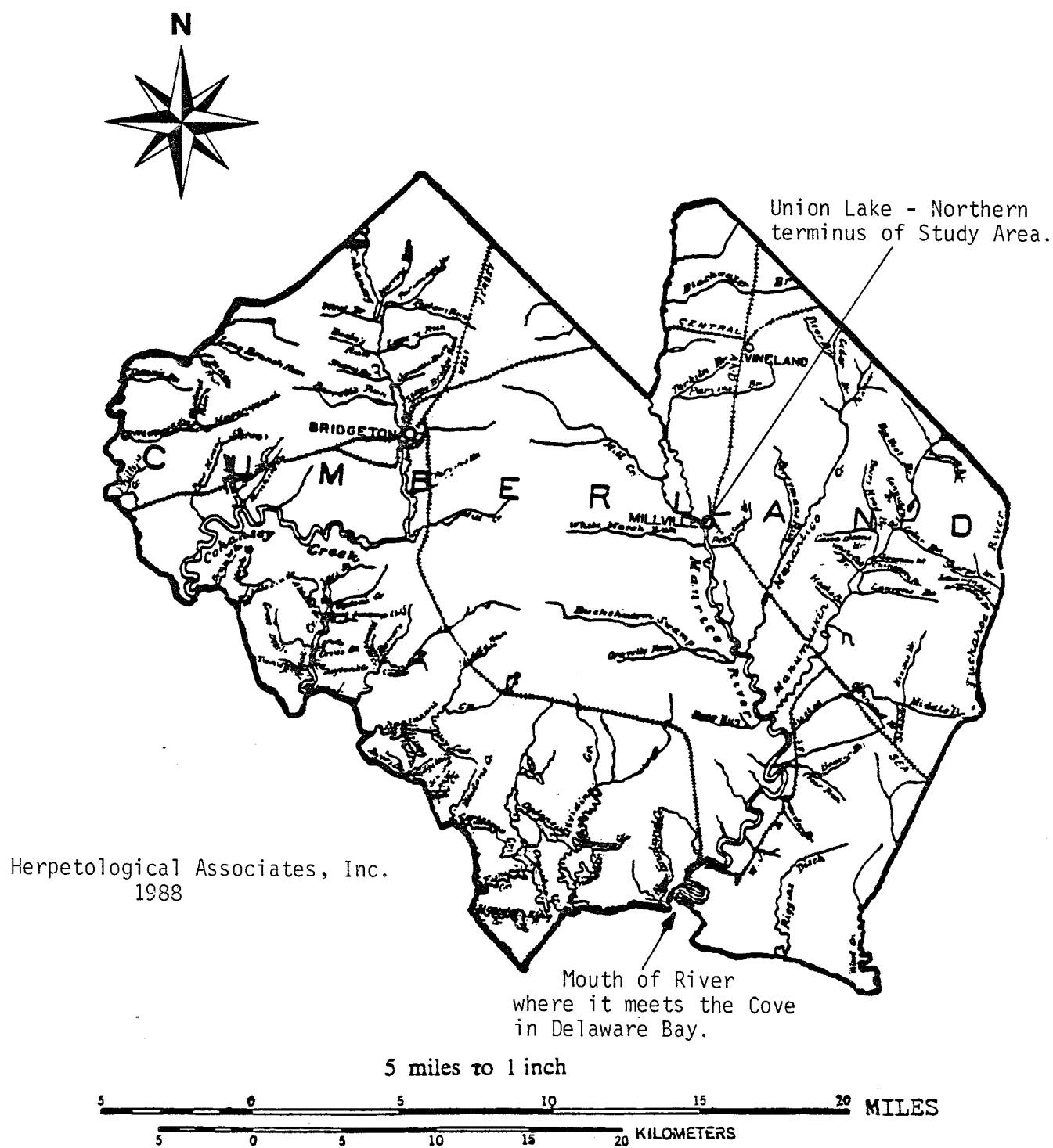


Figure 1. Location of Maurice River Study Area in New Jersey.

Figure 2. Location of the Maurice River Study Area in Cumberland County, New Jersey.



Migrant raptors have been well-studied in New Jersey (Dunne and Sutton, 1986) and elsewhere. While migratory hawks lend themselves to systematic enumeration, 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), yet 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 due to 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 County (Kunkle, 1986) has for 37 years revealed spectacular numbers of raptors along the Delaware Bayshore. As in the case of waterfowl, published data has hinted at major use of the Maurice River by wintering raptors. Up to 35 red-tails 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.

Despite the existence of considerable published data, recent proposals for the industrialization of the rural and pristine Maurice River basin (Frier-Murza, 1987, Whibco, Inc., 1987, Genstar, Inc., 1988) and the potential for such activities to seriously impact upon bird use, have focused attention on the need for systematic data on the avifauna of the Maurice River. 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.



## **II. Methodological Approach**



## METHODOLOGY:

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. The study area is shown in Figure 3. This study zone is that area of the river system which is surrounded by existing highways although soaring birds were counted if in view on either side of the road delineating the study area. (While the study area does not include the entire drainage basin or its tributaries, it does encompass that area of the river most likely to be affected by proposed industrialization).

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. The sampling points or count stations are also shown in Figure 3. 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 a variety of 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 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) due to sheer 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 was 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.

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### **III. Results of Investigation**



## 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 are shown. 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 pintails were higher than previous data has indicated. Pintails and mallards predominated in the freshwater sections of river and black ducks were concentrated along the lower river.

Finally, the list of other bird species recorded is shown in Table 3. While peak dates and numbers are depicted, these numbers were not the results of systematic survey, only ancillary sightings as an adjunct of the raptor and waterfowl census.

Raptor and waterfowl numbers recorded were highly significant in New Jersey, and reveal habitat use of the Maurice River system to a degree perhaps unequalled 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.

## DISCUSSION - 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 accrued 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 surveyed. 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 dwelling species for which most of the study area no doubt represents peripheral habitat.

The river system is undoubtedly a core area for bald eagle use. In fact, the area receives the heaviest eagle use of anywhere on the coastal plain of New Jersey. Only the Delaware River between the Delaware Water Gap and Dingman's Ferry have more eagles present in winter (Niles, 1985), an area 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 Eagle 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 often used nearby as well. 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, 1989 (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 numerous 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 total 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.



Figure 4. Immature bald eagle (2nd year male) in flight  
Photograph taken on January 10, 1988 near Leesburg (Sampling Station #5), Maurice River Township, Cumberland County, New Jersey.

All photographs by Clay C. Sutton, HA Staff



Figure 5. Adult bald eagle (male) in flight over the Maurice River. Picture taken on February 16, 1988 near Laurel Lake, Cumberland County, New Jersey.



Figure 6. Adult bald eagle (male) descending onto marsh to gather nesting material (Sampling Station #2). Photograph taken on February 16, 1988 on the Maurice River.

Photographs by Clay C. Sutton, HA Staff



Figure 7. Immature bald eagle perched over the river. Photograph taken at Heislerville (Sampling Station #6) on January 5, 1988.



Figure 8. Adult bald eagle (female) resting on the marsh across from the proposed Genstar Barge Port which is known as the "Maurice River Bluffs."

Pictures taken February 16, 1988 by Clay C. Sutton, HA Staff



Figure 9. Same female bald eagle due north of the bluffs, opposite the "grain elevator site" near the proposed Genstar Barge Port.

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 immediate river, the area holds promise for New Jersey's eagle reintroduction program. Eagles were noted feeding on muskrat, fish, and waterfowl. On numerous occasions, eagles were watched "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 the bald eagle finds ideal perching and feeding habitat along the river. (Note: Maps depicting primary feeding and roosting locations noted during this study have been forwarded to the Nongame and Endangered Species Project, NJDEP).

#### 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:

March 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 an unknown number - 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 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. For this study, harriers personified the wild marshes of the Maurice River.

#### 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 were 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 accrue 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 Buckshutum 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. Besides 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 accrued. 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 Stipson'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 petens) 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. A total of 37 were recorded on December 22 and January 24. Red-tails clearly came from miles around to hunt along the river. Total numbers involved are unknown;

a distinctive individual (either leucistic or a partial "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. On 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 due to the harsh 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 (undetermined), and an adult on February 24. The adult was believed to be from the Heislerville Wildlife Management Area artificial 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 yet spectacular and regular raptor of 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. For its small size, (14 miles in length) the Maurice clearly shows the greatest known wintering raptor densities and use 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 AND OTHER BIRDS ALONG THE MAURICE RIVER:

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 least 16 pairs of great horned owls were located within "earshot" of the study area, and probably many more than this use the river valley. 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 screech owls were located - no doubt the true number is many times higher. Two 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 Buckshutum 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. Probable 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 (probable) 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, yet to an undetermined degree at this time.

Table 3 has listed other species recorded along the Maurice during the study period. One hundred and thirty-four (134) species of birds were noted along with the dates of peak abundance. Autumn migrants and wintering birds are both shown. A species total of 134 is a respectable diversity for any section of the New Jersey coast in winter (For a list of regional breeding species, see Sutton and Dowdell, 1987).

The great cormorant seen on February 5 represents only Cumberland County's second record ever. Particularly significant was its location - 11 miles up the river, beyond the Laurel Lake area, in freshwater.

A recent literature search reveals many important historic uncommon bird records for the Maurice River for the fall, winter and spring seasons. Fifty snipe were together at Heislerville on February 8, 1975. Two adult male ruffs were along the Mauricetown causeway on April 15, 1976, and one reeve was there on May 1, 1983. A Eurasian spotted redshank was at Heislerville on March 27, 1977. An unbelievably "early" pectoral sandpiper was with snipe on the upper river on January 11, 1981. An adult black-headed gull in breeding plumage was found on March 17, 1981. Iceland gulls, glaucous gulls, and lesser black-backed gulls have all been noted around the oyster-packing houses at Bivalve and Shellpile over the years. A Lapland longspur was seen on the salt hay farms near the river mouth on March 9, 1980, and two white-winged crossbills were recorded on January 2, 1982 near Laurel Lake. All records are from "Records of New Jersey Birds" (Kane, 1976 to 1983), "American Birds" (Cutler, 1975 to 1983), or the author's unpublished field notes.

For its diversity of habitat and resultant variety and abundance of bird species, the Maurice River is one of New Jersey's top birding areas.

## DISCUSSION - 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 pintail abound. By simply taking the highest counts for each species and adding them together, it is seen 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. Turnover rate is completely unknown at this time -yet considerably more birds are using the Maurice River marshes than peak numbers of this study allow.

While raptor numbers varied due to 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 duck, mallard and pintail numbers were accrued 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 exactly comparable, as the above factors always influenced counts. In addition, two observers regularly allowed for more exacting waterfowl counts. Nonetheless, expected 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. In essence, 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 number 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, but many others were no doubt present. 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 with 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 New Jersey (reflecting early spring migration and population build-up) 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 fairly 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



Figure 10. Aggregations of black duck, mallards and green-winged teal, across the river from the proposed Genstar Barge Port. Picture taken due north from the "Maurice River Bluffs" on November 16, 1987.

Photographs by Clay C. Sutton, HA Staff



Figure 11. The same species of ducks feeding and resting on the marsh across from the proposed "barge port" on the Maurice River (Sampling Station # One).

waterfowl flew out into 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. Oddly, mallard numbers seem to fluctuate independently of black and pintail numbers; mallards outnumbered black ducks during the hunting season. Numerous black duck 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.

#### 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 to be found here during this survey. 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 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.



Figure 12. Aggregations of pintails, black ducks and mallards, across the Maurice River (northeast) from the proposed Genstar Barge Port. Picture taken on February 24, 1988 at Sampling Station #1 by HA Staff member Clay C. Sutton. See Tables one, two and three for a full listing of all the birds observed on the Maurice River and adjacent uplands during this investigation.

Source: Herpetological Associates, Inc., 1988

American Widgeon:

Widgeon 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 widgeon. Over 100 were present there during the winters from 1972 through 1975. A drake Eurasian widgeon 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 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 Manantico Rivers, doubtless held several thousand more ducks, HA data (Sutton and Dowdell, 1987). While survey numbers are not exactly comparable due 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 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.



TABLE 1 - MAURICE RIVER RAPTOR SURVEY:  
FALL, WINTER, SPRING 1987-1988

	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	1A		2A 5-1SA 2i	1A	1A	4-2A 2i	2A		A 3-SA u	2A 3-1SA
Northern Harrier	19	11	29 (2m)	29 (1m)	30 (1m)	29	24	12	30	24 (1m)
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				1D			1L 3-1D 1U	1L	1L	1D

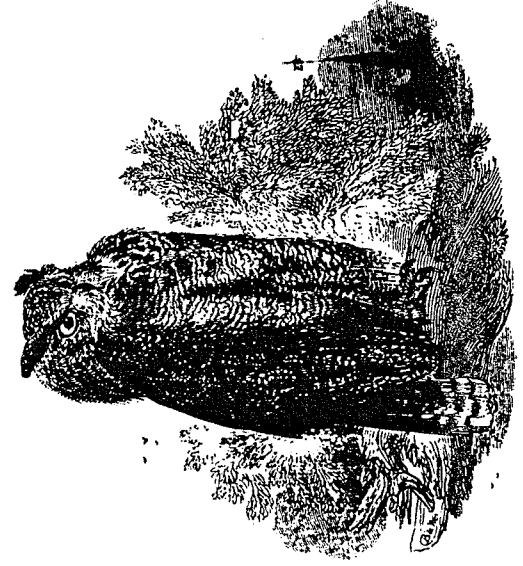
TABLE 1 - (CONTINUED)

	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	<sup>2A</sup> 3-1SA	1i	<sup>2A</sup> 3-1i	<sup>2A</sup> 4-1SA 1i	4-2A 2i	6-3A 3i	3-1A 2i	1i	3-1A 2i	2-1A 1i	2-1A 1i
Northern Harrier	22 (1m)	27 (2m)	32 (im)	23 (im)	26	21 (2m)	12 (1m)	15	12 (1m)	14 (1m)	13 (1m)
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	1D	2-1L 1D	1L	2-1L 1D					1L		1L

TABLE 1 - (CONTINUED)

	10/6	10/16	10/27	11/4	11/9	11/16	11/24	12/7	12/14	12/22
Golden Eagle					1i			1i		
American Kestrel	9	2	4	2	3	3	6	2	2	3
Merlin	1		1		1					
Peregrine	1		1							1

Wind Direction	SE	E	SE	SW	S	E	SW	NW	NW	SW
Wind Speed	10-15	0-5	0-15	5-10	15-0	10-15	0-5	10-15	10-15	0-5
Tide	H	L-F	F-H	H-E	H	L-F	F-H	H	L-F	H-E
No. of Observers	1	2	1	1	2	2	1	1	1	2



Great Horned Owl

TABLE 1 - (CONTINUED)

	1/1	1/9	1/10	1/24	2/5	2/16	2/24	3/5	3/15	3/21	3/31
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Golden Eagle

American Kestrel	3	4	1	5	2		2	2	3	2	1
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Merlin

Peregrine							1				
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Wind Direction	SW	NW	NW	SE	NW	NW	NW	N	NW	NW	NE
Wind Speed	0-5	5-10	10-15	10-20	10-20	20-30	10-20	10-15	15-25	10-20	0-5
Tide	H-E	F	F	F-H	H-E	E	L-F	F-H	E	H-E	E
No. of Observers	1	2	2	2	2	2	1	2	2	1	1

KEY:

Eagles are listed as: A - adult, SA - subadult, i = immature, u = undetermined  
Northern Harrier entries are followed by: (the number of adult males).  
Rough-legged Hawk entries show: D = dark morph, L = light morph, U = undetermined

Tides are shown as: F = flood, H = high, E = ebb, L = low

NOTE: Black vultures also recorded on 3/7 (1) and 3/13 (2).

N. Goshawk also recorded on 1/16.

Red-shouldered hawks also recorded on 1/16 and 1/20.

Rough-legged hawks also recorded on 10/25 and 12/10.

Golden eagle also recorded on 11/10 and 1/11.

Merlin also recorded on 2/12.

Peregrine also recorded on 2/1.

[illegible]

TABLE 2 - (CONTINUED)

	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
Pintail	90	37	200	580	2050	2540	2372	3170	2002	2
Blue-winged Teal								3	2	23
Shoveler						1		6	3	2
Gadwall	2	2	2				5	60	27	4
American Widgeon			3	4			38	25		1
Canvasback						5				
Ring-neck	1						7	1	1	

TABLE 2 - (CONTINUED)

	10/6	10/16	10/27	11/4	11/9	11/16	11/24	12/7	12/14	12/22
Greater Scaup										18
Lesser Scaup										
Oldsquaw						1		1		
Black Scoter										
Goldeneye			8							20
Bufflehead			4	3	50	12		7		20
Hooded Merganser					5					
Common Merganser										
Red-breasted Merganser								3		20
Ruddy Duck			10	10						
TOTALS:	1429	455	380	1839	1505	2854	2616	1474	1955	738

TABLE 2 - (CONTINUED)

	1/1	1/9	1/24	2/5	2/16	2/24	3/5	3/15	3/21	3/31
Greater Scaup	10				12				4	8
Lesser Scaup					2	22	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-breasted Merganser	1		24		4	22	3	25	15	10
Ruddy Duck										
TOTALS:	3832	3084	8685	4428	14505	14766	11206	10392	11218	3546

NOTE: Weather conditions and tide stage are listed in Table 1.



TABLE 3 - SPECIES AND PEAK NUMBERS OF BIRDS RECORDED  
ON THE MAURICE RIVER OCTOBER 1987 TO APRIL 1988

SPECIES	PEAK NO.	DATE
Great Cormorant	1.	02/05
Double-crested Cormorant	100	10/06
Great Blue Heron	22	02/24
Great Egret	20	10/06
Snowy Egret	50	10/06
Little Blue Heron	1	10/06
Black-crowned Night Heron	12	01/27
Wild Turkey	2	12/21
Ring-necked Pheasant	1	11/24 & 2/24
Ruffed Grouse	1	02/24
Northern Bobwhite	15	01/28
Clapper Rail	2	11/04
Virginia Rail	1	01/01
Sora	1	10/06
American Coot	1	01/10
Black-bellied Plover	50	11/04
Killdeer	10	03/15
Greater Yellowlegs	500	11/04
Lesser Yellowlegs	50	11/04
Solitary Sandpiper	1	10/16
Spotted Sandpiper	1	11/04 & 12/7
Western Sandpiper	10	11/16

TABLE 3 - (CONTINUED)

SPECIES	PEAK NO.	DATE
Dunlin	1000	11/16
Common Snipe	25	11/4 & 3/5
American Woodcock	2	03/05
Laughing Gull	750	10/06
Bonaparte's Gull	6	02/14
Ring-billed Gull	500	11/04
Herring Gull	2180	02/05
Great Black-backed Gull	240	11/04
Forster's Tern	275	10/06
Rock Dove	150	10/06
Mourning Dove	500	11/04
Belted Kingfisher	20	11/14
Red-bellied Woodpecker	4	
Yellow-bellied Sapsucker	2	10/27 & 11/24
Downy Woodpcker	11	11/24
Hairy Woodpecker	5	11/16
Northern Flicker	230	10/6
Eastern Phoebe	6	10/6
Horned Lark	10	11/16
Tree Swallow	1000	10/06
Blue Jay	1050	10/06
American Crow	200	10/06 & 10/27
Fish Crow	50	10/06 & 3/5
Black-capped Chickadee	1	12/21

TABLE 3 - (CONTINUED)

SPECIES	PEAK NO.	DATE
Carolina Chickadee	55	10/06
Tufted Titmouse	10	02/05
Red-breasted Nuthatch	4	11/04
White-breasted Nuthatch	3	11/24
Brown Creeper	8	11/24
Carolina Wren	12	11/24
Winter Wren	2	01/09
Marsh Wren	4	10/06
Golden-crowned Kinglet	100	11/04 & 12/27
Ruby-crowned Kinglet	12	10/16
Eastern Bluebird	20	10/27 & 11/16
Hermit Thrush	10	11/24
American Robin	1000	11/04 & 3/5
Gray Catbird	8	10/06
Northern Mockingbird	15	10/06
Brown Thrasher	1	03/05
Water Pipit	3	11/04
Cedar Waxwing	30	10/16
European Starling	1000	10/27
Solitary Vireo	2	10/16
Yellow-rumped Warbler	1000	10/27
Palm Warbler	1	10/16
Northern Cardinal	18	01/19

TABLE 3 - (CONTINUED)

SPECIES	PEAK NO.	DATE
Dickcissel	1	10/06
Rufous-sided Towhee	4	10/06 & 11/4
American Tree Sparrow	2	01/10
Field Sparrow	5	11/24
Savannah Sparrow	2	10/16
Fox Sparrow	18	01/09
Song Sparrow	57	01/09
Swamp Sparrow	70	11/04
White-throated Sparrow	177	01/09
Dark-eyed Junco	37	12/07
Bobolink	6	10/06
Red-winged Blackbird	2885	01/09
Eastern Meadowlark	10	11/16
Rusty Blackbird	10	01/01
Boat-tailed Grackle	1000	03/05
Brown-headed Cowbird	88	01/09
Northern Oriole	1	10/16
Purple Finch	5	12/22
House Finch	23	12/07
Pine Siskin	50	11/24
American Goldfinch	60	11/24
Evening Grosbeak	15	11/16
House Sparrow	50	11/16

TOTAL: 134 SPECIES (INCLUDING RAPTORS AND WATERFOWL)

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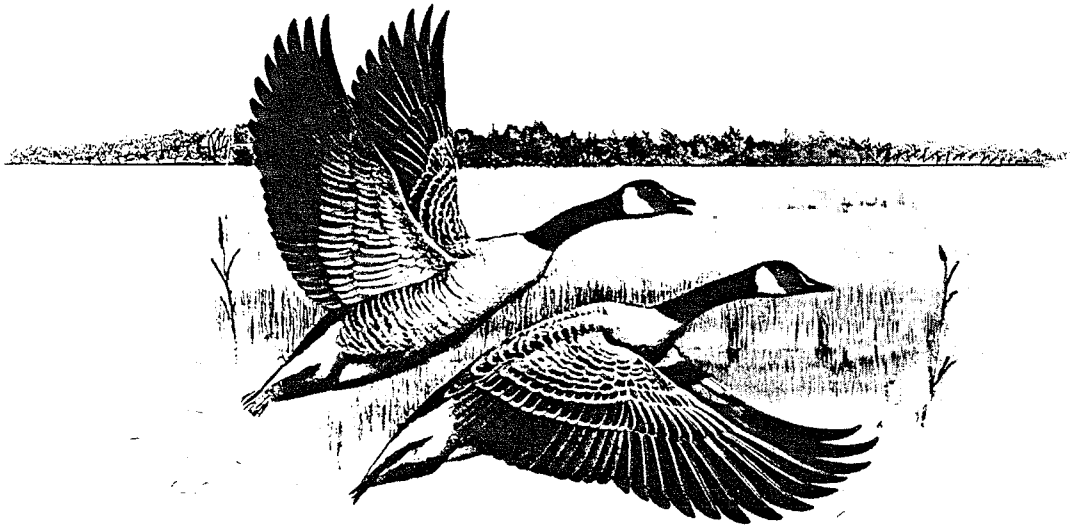
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Whibco Industries

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Canada Goose, up to 899 individuals were seen on the Maurice River.

## APPENDIX



Regional Manager - Herpetological Associates, Inc. Southern New Jersey Office

Environmental Program Administrator

(Director, Division of Environmental Health)

Cape May County Health Department

- immediate past position, following a 13 year career in environmental planning with this department
- directed all NJ Department of Environmental Protection and Department of Health programs at County level, including administration, program planning and implementation, policy direction, budgeting and grant procurement.

B.A., Gettysburg College, 1971, Biology

M.A., Glassboro State College, 1973, Environmental Education

Advisory Committee, Cape May Bird Observatory, 1978 to 1986 (Chairman, 1981-1984)

Board of Directors, New Jersey Audubon Society, 1980 to 1986

Chairman, Conservation Committee of New Jersey Audubon Society, 1981 to 1984.

Preserve Stewardship Committee, Cape May Migratory Bird Refuge of The Nature Conservancy, 1981 to present.

Adjunct Faculty, Department of Science and Math, Stockton State College, teaching "Biology of Birds," (an Introduction to Ornithology), 1981 through 1987.

Mid-Atlantic Regional Editor, The Hawk Migration Association of North America, 1984 to present.

Member of the Northeastern Bird Banding Association (Journal of Field Ornithology), a fellow of the Delaware Valley Ornithology Club, and a member of the Cumberland Conservation League.

Chairman, Conservation Committee of the Delaware Valley Ornithology Club, 1986.

Conducted substantial research into the status and distribution of the Bald Eagle, Red-shouldered Hawk, and Barred Owl in New Jersey. Also have extensively studied autumn hawk migration at Cape May, autumn owl migration, spring hawk migration and Delaware Bay spring shorebird populations.

Major conservation research involvements and testimony regarding Cape May habitat protection, the Bear Swamp (Cumberland County), and Smithville (Atlantic County).

45+ articles, notes, papers in 10 publications. Maintain active illustrated slide-lecture series (conservation/natural history/ornithology) and workshop schedule.

Complete resume and references available upon request.

RESUME OF ROBERT T. ZAPPALORTI  
EXECUTIVE DIRECTOR  
HERPETOLOGICAL ASSOCIATES, INC.

1018 Berkeley Avenue, Beachwood, New Jersey 08722

QUALIFICATIONS:

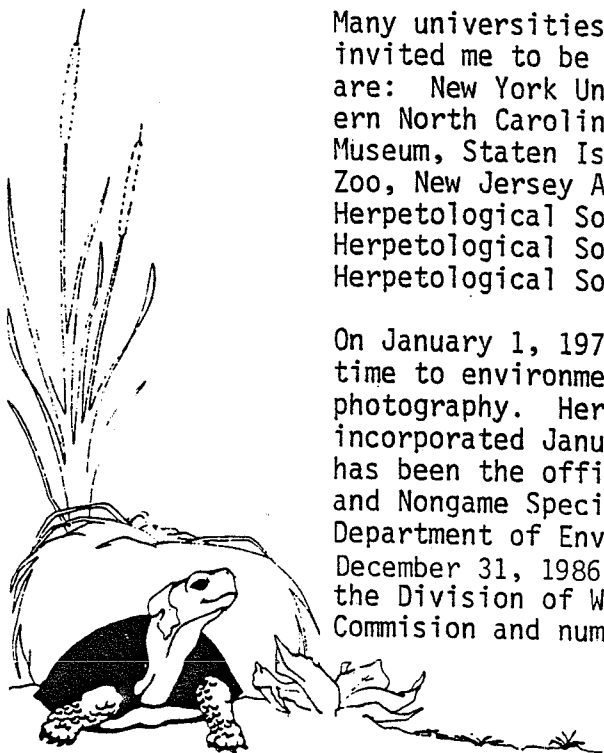
Ten years of in-depth experience in the planning, organization, and implementation of herpetological field investigations for endangered and threatened reptiles and amphibians in New Jersey.... developed management plans....mitigation plans....wildlife photography.....communicative skills....technical writing ability..... hardworking and result-oriented.

PROFESSIONAL EXPERIENCE:

I was formerly Associate Curator of Herpetology and Education at the famed Staten Island Zoo in New York and was employed at that institution for fourteen years. My training and technical experience were received during my service at the Staten Island Zoo under the direction of the late Carl F. Kauffeld, Director and Curator of Reptiles. On January 1, 1964, I was fortunate enough to be selected, from many applicants, as Reptile Keeper. I served in that position through January 1, 1974, at which time I was promoted to Associate Curator of Herpetology and Education.

Many universities, museums, zoos and herpetological societies have invited me to be guest speaker at various functions. Some of these are: New York University, Trenton State College, University of Western North Carolina, Trenton State Museum, Morris Museum, Staten Island Museum, Staten Island Zoo, Turtle Back Zoo, Philadelphia Zoo, Atlanta Zoo, New Jersey Audubon Society, National Audubon Society, New York Herpetological Society, Connecticut Herpetological Society, Florida Herpetological Society, Georgia Herpetological Society, Philadelphia Herpetological Society and the Ocean County Nature Club.

On January 1, 1978, I left the Staten Island Zoo to devote my full time to environmental consulting, research, writing and wildlife photography. Herpetological Associates was started by me and was incorporated January 13, 1980 in Staten Island, New York. My firm has been the official herpetological consultant to the Endangered and Nongame Species Program, Division of Fish, Game and Wildlife, Department of Environmental Protection (NJDEP) from April 1977 to December 31, 1986. Additionally, my firm has been the consultant for the Division of Water Resources (NJDEP), CAFRA (NJDEP), the Pinelands Commission and numerous environmental consulting firms throughout



## PROFESSIONAL EXPERIENCE:

the Tri-State Area. Herpetological Associates, Inc. has also worked for the Ocean County Planning Board, the Ocean County Utilities Authority and the Ocean County Environmental Agency. We were also commissioned by several builders in Ocean County to conduct various herpetological surveys for endangered and threatened reptiles and amphibians on proposed development sites. We developed management plans and/or mitigation plans which were reviewed by the Endangered and Nongame Species Program (NJDEP), CAFRA (NJDEP) and/or the Pinelands Commission.

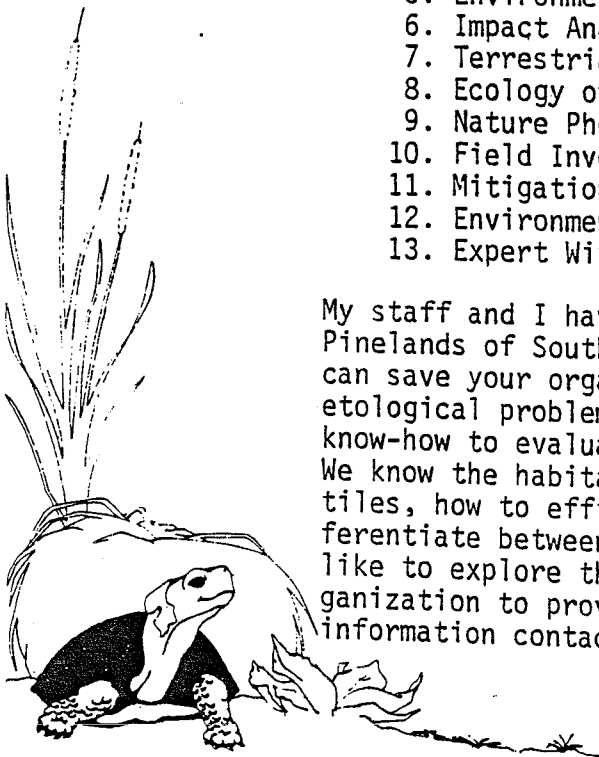
Since about 95% of Herpetological Associates work is carried out in New Jersey, and 75% of it is in the Pinelands, my firm is moving to Ocean County. As of January 13, 1985 Herpetological Associates will be a New Jersey Corporation based in the Toms River area of Ocean County.

While most of our work has been carried out in New Jersey over the last several years, we have also worked in other states. Field work and research were conducted in New York, Connecticut, Pennsylvania, North Carolina, South Carolina, Georgia and Florida.

Herpetological Associates, Inc. specializes in the following areas of environmental consulting:

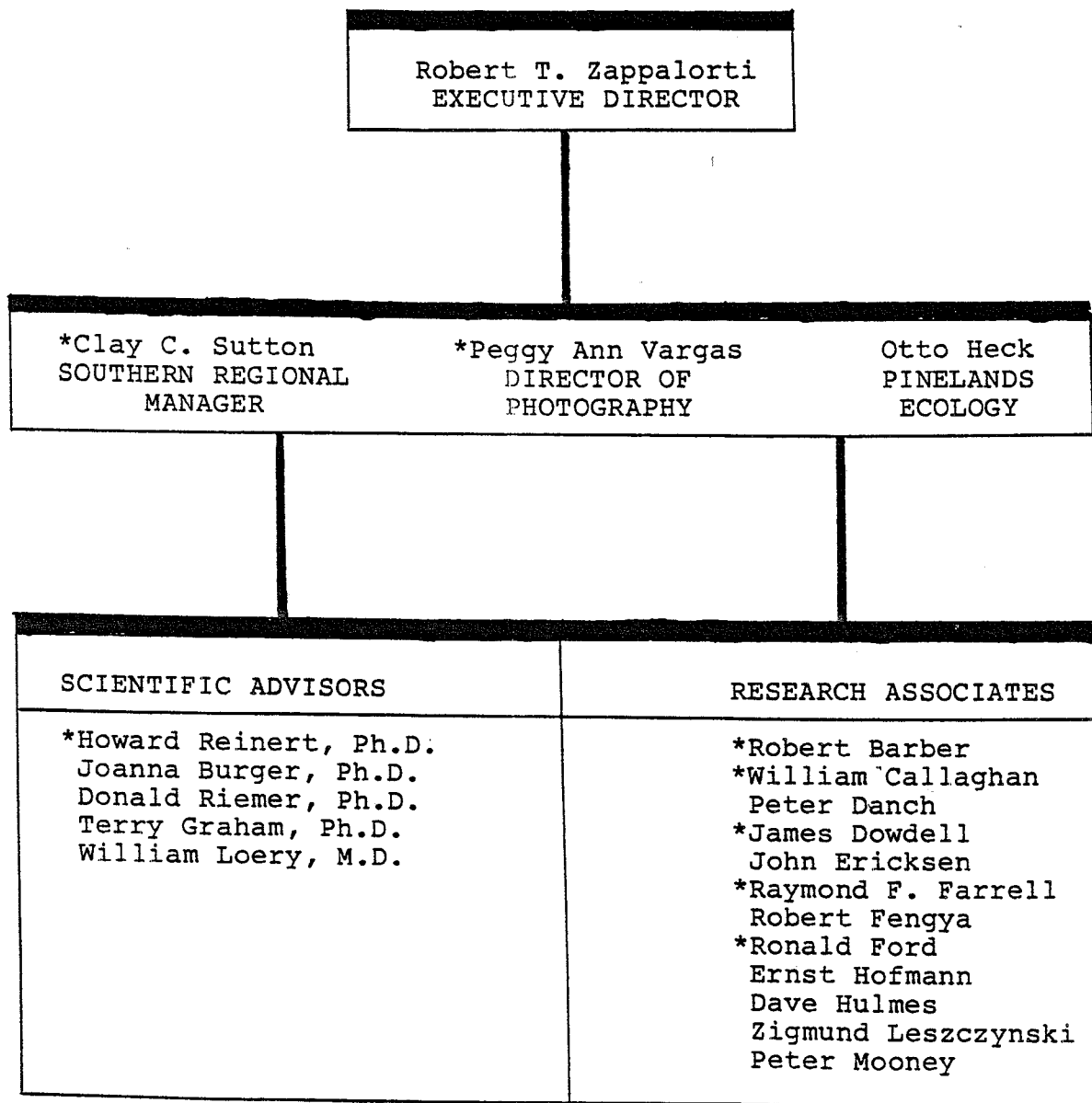
1. Project Management
2. Endangered and Threatened Reptiles
3. Endangered and Threatened Amphibians
4. Habitat Evaluation
5. Environmental Monitoring
6. Impact Analysis and Assessment
7. Terrestrial and Aquatic Ecology of Herptiles
8. Ecology of the Pine Barrens
9. Nature Photography
10. Field Investigations
11. Mitigation and Management Plans
12. Environmental Report Preparation
13. Expert Witness/Public Hearings, etc.

My staff and I have had vast experience (20 years) working in the Pinelands of Southern New Jersey. Herpetological Associates, Inc. can save your organization valuable time and man-hours when herpetological problems arise. We have the knowledge, experience and know-how to evaluate habitat and find specimens for identification. We know the habitat requirements for endangered and threatened herptiles, how to efficiently locate specimens, and the criteria to differentiate between marginal and critical habitat for them. I would like to explore the possibility of working with your company or organization to provide any of the above-mentioned services. For more information contact me at 201 349-5065.



HERPETOLOGICAL ASSOCIATES, INC.

Staff Organization Structure



\* = Key Personnel

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