# A SIX YEAR STUDY OF WINTERING EAGLE POPULATIONS AND WINTERING EAGLE HABITAT IN SOUTHERN NEW JERSEY

With notes on the status of Bald Eagle nesting populations and recommendations for eagle management and Critical Habitat Designation and Aquisition

CLAY C. SUTTON
PATRICIA TAYLOR SUTTON

## INTRODUCTION

Virtually little has been recorded, either historically or in recent years, as to the true numbers of eagles wintering in New Jersey. Substantial data on migratory eagle numbers are available (Table 1), and it is quite evident that fewer birds are coming from northern nesting areas to winter in our state. While scattered data does exist as to New Jersey's eagle populations, there is a historical problem in separating wintering from resident birds (a problem in field ornithology still existing at present).

In 1937 Bald Eagles could be seen regularly throughout the fall and winter,[1] and in 1952 an eagle could be seen on almost any trip along the Delaware Bay Shore.[2] Some records clearly show us that wintering eagles were historically much more numerous. While Julian K. Potter's record of 16 immature Bald Eagles feeding on the Delaware River marshes at Fort Mott, Salem County on August 1, 1936[3] would represent a "post-breeding," early fall maxima, we do have a record from the 1960's of 12 eagles (sp.) at the Tuckahoe River/Corbin City area following a lengthy freeze-up in late winter.[4] A January, 1962, survey for the entire state yielded 20 adults and 7 immatures, and a 1963 follow-up showed 15 adults and 2 immatures, figures which include both resident and wintering individuals.[5] Good comparative data can be obtained from the Christmas Bird Counts (Table 2) and these clearly show that wintering eagles are far less numerous today than in the 1940-1950's. The recorded Christmas Bird Count maxima for the Bald Eagle was 12 in Cape May County in 1952, with the possibility of some duplication involved. Five year averages for the counts are shown in Table 3. While such averages might be comparatively corrected for corresponding effort and conceivable duplication, which was not done here, we nonetheless can generally see that coverage of the established count circles produced far more eagles in the late 1930's, 1940's and 1950's than even much more intensive coverage can produce today.

TABLE 1

AUTUMN MIGRATORY EAGLES RECORDED AT
CAPE MAY POINT, NEW JERSEY, 1931-1979

| Year | Days Obs. | Bald Eagles | Golden Eagles | Total Eagles |
|---|---|---|---|---|
| 1931 | 30 | 40 | NR | 40 |
| 1932 | 45 | 10 | NR | 10 |
| 1935 | 84 | 60: (24a, 36i) | NR | 60 |
| 1936 | 87 | 59 | NR | 59 |
| 1937 | 69 | 165 | NR | 165 |
| 1965 | 86 | 6 | 0 | 6 |
| 1970 | 83 | 5 | 5 | 10 |
| 1976 | 90 | 12 (14: 1a, 13i) | 13 (16: 1a, 15i) | 30 |
| 1977 | 90 | 18 (18i) | 9 (11i) | 29 |
| 1978 | 90 | 10 (14: 1a, 13i) | 5 (5i) | 19 |
| 1979 | 117 | 13 (14i) | 16 (19: 1a, 18i) | 33 |

NR = not recorded, no record.

1976-1979: 1st figure indicates official total by Cape May Bird Observatory Hawk Watch at Lighthouse, Cape May Point. 2nd figure indicates known actual total birds involved, including those seen by other observers, Alfred Nicholson or Clay Sutton.

5 year average, Autumn Migrant Eagles at Cape May Point, 1931-1936: 67 Bald Eagles.

4 year average, Autumn Migrant Eagles at Cape May Point, 1976-1979 (using known totals):
15 Bald Eagles + 13 Golden Eagles = 28 total eagles
(this figure is probably most comparable to the 1931-1937 total since Golden Eagles were largely unexpected and were, no doubt, recorded as Bald Eagles)

*Source*

1931-1970—Choate, E.A., "Hawk Watch Results 1965 & 1970."

1976-1979—Dunne, P.J., "Official Results of Cape May Bird Observatory Autumn Hawk Watch, Cape May Point, New Jersey."

"personal field notes"—Clay Sutton, Jr.

TABLE 2

BALD EAGLES RECORDED ON CHRISTMAS BIRD COUNTS,
CAPE MAY AND CUMBERLAND COUNTIES, AND BARNEGAT, 1930-1979

| Year | Cape May | Cumberland | Barnegat | Year | Cape May | Cumberland | Barnegat |
|---|---|---|---|---|---|---|---|
| 1930 | 3 | NC | 1 | 1956 | 7 | 2 | 2 |
| 1931 | 4 | NC | 4 | 1957 | 3 | 4 | 0 |
| 1932 | 2 | NC | 3 | 1958 | 3 | 5 | 2 |
| 1933 | 4 | NC | 0 | 1959 | 0 | 5 | 0 |
| 1934 | 4 | NC | 1 | 1960 | 1 | 3 | 1 |
| 1935 | 7 | NC | 4 | 1961 | 1 | 3a | 0 |
| 1936 | 6 | NC | 5 | 1962 | 1 | 5 (4a, 1i) | 0 |
| 1937 | 6 | NC | 1 | 1963 | 0 | 1a | 0 |
| 1938 | 7 | NC | 0 | 1964 | 0 | 1a | 1i |
| 1939 | 10 | NC | 2 | 1965 | 0 | 2a | 0 |
| 1940 | 8 | NC | 1 | 1966 | 1 | 1a | 0 |
| 1941 | 9 | NC | NC | 1967 | 0 | 2a | 0 |
| 1942 | 4 | NC | NC | 1968 | 1 | 3a | 0 |
| 1943 | 6 | NC | NC | 1969 | 0 | 1a | 2 |
| 1944 | 6 | NC | NC | 1970 | 0 | 3 (1a, 2i) | 0 |
| 1945 | 7 | NC | 2 | 1971 | 0 | 1a | 0 |
| 1946 | 8 | NC | 0 | 1972 | 0 | 1a | 0 |
| 1947 | 11 | NC | NC | 1973 | 0 | 1a | 0 |
| 1948 | 10 | NC | NC | 1974 | 0 | 1a | 0 |
| 1949 | 10 | NC | 2 | 1975 | 0 | 1a | 0 |
| 1950 | 3 | 0 | 1 | 1976 | 0 | 2a | 0 |
| 1951 | 7 | 1 | 2 | 1977 | 0 | 2a | 0 |
| 1952 | 12 | 1 | 9 | 1978 | 0 | 2a | 0 |
| 1953 | 9 | 4 | 1 | 1979 | 1i | 8 (1a, 7i) | 0 |
| 1954 | 5 | 3 | 1 | | | | |
| 1955 | 7 | 1 | 2 | | | | |

*NOTE*: Unfortunately, historical Christmas Bird Count data does not record adult versus immature numbers/ratios. Such information would be invaluable for studying both the historical productivity and the possible relationships/ratios of resident and wintering eagles.

*Sources*:

*Cassinia*, 1969: "40 Years of Christmas Bird Counts in Cape May County (1927-1966), by Ernest A. Choate and J. D'Arcy Northwood.

Published totals 1967-1979: Keith Seager, compiler of Cape May County Christmas Bird Count.

Published totals 1950-1979: Donald Kunkle, compiler of Cumberland County Christmas Bird Count.

Published totals 1925-1979: Tim Vogel, compiler of Barnegat Christmas Bird Count.

NC = No Count

However, even comparative Christmas Bird Count data can not give us a picture of the historical wintering eagle numbers in South Jersey if only because such counts were done in three specific limited areas (each with a 7½ mile radius) from fixed points.

While perhaps a leap in logic, we can probably assume, however, that current wintering populations might occur in roughly the same proportion to historical wintering numbers as current migratory numbers relate to the historical migratory numbers.

This projection, included as Appendix A, while perhaps unscientific, presents an interesting picture and at least a historical basis for discussion of the current status of the wintering eagle population in South Jersey.

The purpose of this study is not to compare present eagle populations to historic ones, a point which would seem useless because of exhausting documentation as to the Bald Eagle's decline resulting from both the use of pesticides and habitat destruction. There is, however, just cause to adequately

TABLE 3

5 YEAR AVERAGE OF EAGLES RECORDED ON CHRISTMAS BIRD COUNTS, CAPE MAY AND CUMBERLAND COUNTIES, AND BARNEGAT, 1930-1979

| Year | Cape May Co. | Cumberland Co. | Barnegat |
|---|---|---|---|
| 1930-1934 | 3.4 | NC | 1.8 |
| 1935-1939 | 7.2 | NC | 2.4 |
| 1940-1944 | 6.6 | NC | NC |
| 1945-1949 | 9.2 | NC | NC |
| 1950-1954 | 9.2 | 1.8 | 2.8 |
| 1955-1959 | 4.0 | 3.4 | 1.2 |
| 1960-1964 | .6 | 2.6 | .4 |
| 1965-1969 | .4 | 1.8 | .4 |
| 1970-1974 | .0 | 1.4 | .0 |
| 1975-1979 | .2 | 3.0 | .0 |

NC = No Count

*NOTE*: Fewer participants and therefore less total coverage during 1930-1934 probably affected totals recorded.

*Sources*:

*Cassinia*, 1969: "40 Years of Christmas Bird Counts in Cape May County (1927-1966), by Ernest A. Choate and J. D'Arcy Northwood.

Published totals 1967-1979: Keith Seager, compiler of Cape May County Christmas Bird Count.

Published totals 1950-1979: Donald Kunkle, compiler of Cumberland County Christmas Bird Count.

Published totals 1925-1979: Tim Vogel, compiler of Barnegat Christmas Bird Count.

document current population levels and trends for two basic reasons. We need base-line data by which to compare future populations and, very basically, the habitat being heavily used by New Jersey's remaining eagles, be they resident or wintering birds, urgently needs protection in the strongest form possible if we are indeed to have eagles in our future in New Jersey—a state whose natural areas are disappearing at a rate which planners can not even adequately document due to the rapidity of the change.

## Techniques

In this study, southern New Jersey is defined as that area which includes the Mullica River drainage basin complex south to Cape May and west to, and including, the Cohansey River complex.

Specific and separate records were kept on each major river system within this overall area.

A basic assumption was that existing published field records would be inadequate as a basis for a population study, for the following reasons. Most observers do not concentrate primarily on raptors, and by using various sightings from numerous observers there would exist too great a variable regarding actual number of birds present, due to overlapping sightings and counts and possibly undercounting due to cursory coverage of appropriate habitat. Also, few observers make the effort to decipher various, often subtle, plumage differences on a seasonal or even week to week basis. All current compilations of New Jersey Bald Eagle wintering data labor under these difficult censusing problems.

The method, therefore, used to perform this census was repeated visits to the previously described river systems throughout the course of the winter. While no regular "tour" or pattern existed for these visits, each area was visited and censused on the average of at least five times per winter. The river systems with few eagles, however, were visited less often than those with major concentrations of eagles and, while some birds may have escaped detection by this method, it was deemed more important to establish accurate numbers in the more favored areas, an approach with obvious conservation importance. It should be noted that no scientific habitat comparisons should be made between study areas, and that the purpose of the study was simply to ascertain maximum wintering eagle numbers in the South Jersey area.

This seemed a reasonable approach, given the limited time available (largely weekends). It is important to note, however, that the observations were by no means random. Two days a week (virtually every weekend) went into this study, and an attempt was made to visit specific areas at a time when the "chances for observation" would be at a maximum. For example, eagles are known to often forage in the direction of the wind. The Mullica River census, therefore, was usually conducted on westerly winds when the birds of this region concentrated in the wetlands feeding areas to the east, and the Cumberland County area was often visited on days of north winds when eagles could be found along the Delaware Bay to the south. While not hard and fast rules, by following such conditions the ornithologist (or the birder) can maximize his chance of sighting raptors present in the vicinity. Besides attempting to stay "downwind" of general roosting areas, an attempt was made to spend "soaring days" (days with good winds and/or lift—when raptors will range far and wide) at sites with a good overview, and to spend days with less auspicious conditions (heavy cloud cover, fog, rain) near known roosting concentration areas.

Both Bald Eagles and Golden Eagles readily lend themselves to the identification of individual birds. In a "small" population sample probably no two individual plumages are exactly alike. Individuals of both species can, therefore, usually be assigned a "year-class," even under field conditions. This method of separating individuals from an overall population on an ongoing basis can even be applied to adults of both species, as size differences and individual fieldmarks or variations can still often be noted. (Adult birds, particularly within the Bald Eagle, are much more problematical than immatures.) The obvious sexual dimorphism of eagles also often greatly helped in the identification of different individuals.

Extensive records were kept for each river system for each winter. These included extensive notes on individual bird's plumage characteristics. Such notes would include size, color, missing feathers, and often a sketch of the bird. In this way it was quite easy to determine if the bird seen in the same area "next week" or even "next month" was the same or a different individual, and in this way the true size of the wintering population could be determined. (Such a technique has been used at the Cape May Point Raptor Count for years, and is inherent in the instructions of the Hawk Migration Association of North America.)

The "one observer" methodology minimized the previously described historical problem of overcounting or undercounting. The sightings of one other observer, Alfred Nicholson of Cape May County, were often used when the plumages he meticulously noted and described differed radically from those of any other birds previously recorded for an individual river system.

The idea of censuring each river system was not a foolproof one since eagles will range for 10-15 linear miles from a roost site in a round trip on a given day and also trade from one area to another on a weekly, monthly, or seasonal basis. Certain sightings, however, attest to the idea that individual birds are usually separable in the field; a specific bird was on numerous occasions seen away from the area from which it was initially counted, and so was not "recounted." For example, a probable fourth-year immature female Bald Eagle with extremely distinctive plumage characteristics was noted at Dennis Creek, the Maurice River, and finally the Tuckahoe River during the course of the winter 1979-1980. The bird was recorded only for Dennis Creek, the area where it spent the most time.

Finally, while such a method is admittedly not "foolproof", sincere effort was made not to recount a bird which was possibly previously associated with a distant area. There was logically little mixing between Pinelands' birds and Delaware Bay Shore eagles, and, therefore, these two areas of greatest concentration were, no doubt, accurately assessed. Also, despite much individual variation in plumages, many Bald and Golden Eagles are quite similar in plumage, and for this reason this survey is probably quite conservative, as "look alikes" would pass for the same bird. This census technique, while as accurate as field

observation can be, no doubt undercounted the wintering birds present due to the factors of some plumage similarity and the aforementioned time constraints.

For the purposes of this study, "winter" is defined as the period from December 15 until March 1, and no sightings were included outside this period. This subjective time span, no doubt, includes a few late fall migrants and particularly some early spring migrants, yet some arbitrary time period was necessary. For far-ranging raptors, such as eagles, the difference between "migration" proper and "wandering" is a difficult one to define. Movement is inherent in their normal behavior, and even though a bird may show a net movement north in February, hopping from one river system to the next over a few week period, it is still "wintering" in these respective areas.

Nonetheless, it should be noted that higher numbers of Golden Eagles were always present in December in the Mullica River area, and that most Delaware Bay Shore Goldens were February birds. It can be suspected that the February Delaware Bay birds were moving north, yet we have not ascertained where the December Pinelands birds go, and much more study will be necessary. However, two Bald Eagles present at Dennis Creek in late November were still present in early January. Realistically, eagle "wandering" varies from winter to winter in response to conditions, both weather and food sources, and prey availability.

Wintering, as defined here, is more our definition of winter than perhaps that of the birds, but there is some justice in this. Regarding man's impact on eagle populations, December through February is the period in which man would have the greatest direct impact on eagles through wood cutting operations and hunting activities. Therefore our "winter" may be a crucial period for these birds in modern New Jersey.

In summary, the desired impact of this study is not only to enumerate the birds present, but also the habitat critical to their present and future well being. The definition of "wintering birds," therefore, takes on a habitat connotation. We define "wintering habitat" as that area upon which an individual eagle is dependent for roosting, resting, or feeding for some part of the winter season. Whether or not the bird spends the entire winter there is immaterial and irrelevant to an itinerant bird like an eagle. If a bird spends any portion of the colder months at a particular resting or feeding area (whether or not the bird's net wandering is north or south) that area is defined as "wintering eagle habitat" and is in some degree important to the bird's welfare.

Whether the area is "critical" or not should depend on the *amount* of eagle use, and that is what this census attempted to discover. Southern New Jersey, both historically and currently, contains valuable feeding and roosting habitat for both resident and northern eagle populations, and in light of current resource management questions, these areas and the number of birds dependent upon them must be defined.

FINDINGS

The compilation of six years data on wintering eagle populations is shown below. Table 4 shows the total numbers present, while Table 5 gives the breakdown for each major drainage basin studied.

The six year "average" is shown as part of Table 5. These figures can be used for rough comparisons with Appendix A, the projected historical wintering population of southern New Jersey.

The value of Tables 4 and 5 is the base line which will exist for future comparisons, and particularly for what these totals indicate regarding critical eagle habitat.

TABLE 4
WINTERING EAGLE POPULATIONS IN MAJOR SOUTH JERSEY RIVER SYSTEMS, 1974-1980

| Area | 1974-1975 | 1975-1976 | 1976-1977 | 1977-1978 | 1978-1979 | 1979-1980 |
|---|---|---|---|---|---|---|
| Cohansey River/ Stow Creek | NS | NS | 0 | 3BE 2a, 1i | 1BE (un) | 2BE (i) |
| Dividing Creek/ Maurice River | 6BE 4a, 2i 1GE (a) | 3BE (a) | 4BE (a) 1GE (sa) | 9BE, 4a, 2sa, 3i | 4BE 2a, 2i | 14BE 3a, 11i |
| Dennis Creek | 0 | 2BE (i) | 2GE 1sa, 1i | 1BE (i) | 3BE (i) | 4BE (i) 2GE (sa) |
| Tuckahoe River/ Egg Harbor River | 1BE (i) | 0 | 1GE (i) | 0 | 0 | 2BE 1a, 1i 1GE (i) |
| Mullica River/ Pinelands Complex | 3BE 2a, 1i 1GE (sa) | 4BE 2a, 2i 5GE 2sa, 3i | 4BE 2a, 2i 4GE 1a, 3i | 6BE 3a, 3i 5GE 2a, 1sa, 2i | 4BE 2a, 2i 4GE 1a, 3sa | 8BE 4a, 1sa, 3i 4GE 1sa, 3i |
| Total Bald Eagles | 10 6a, 4i | 9 5a, 4i | 8 6a, 2i | 19 9a, 2sa, 8i | 12 4a, 7i, 1un | 30 8a, 1sa, 21i |
| Total Golden Eagles | 2 1a, 1sa | 5 2sa, 3i | 8 1a, 2sa, 5i | 5 2a, 1sa, 2i | 4 1a, 3sa | 7 3sa, 4i |
| Total Eagles | 12 | 14 | 16 | 24 | 16 | 37 |

NS = Not Surveyed
6 year average for all areas combined Bald Eagles = 14.7
6 year average for all areas combined Golden Eagles = 5.1
6 year average for all areas combined total eagles (eagles sp.) = 19.8

DISCUSSION

While it is easily seen that wintering eagle numbers in southern New Jersey are no where near projected historical figures, it is clear that winter eagle populations today are considerably higher than available literature indicates, and that the eagle is more numerous than many field observers realize.

Little banding data is available to indicate the source of our wintering eagles; however, we may theorize that they have their origin in New England and eastern Canada. While early coastal and ridge Bald Eagle migrants (August and early September) are usually thought to be southern populations returning south following post-breeding wandering far to the north of their home territory, the late season Bald Eagles no doubt still come from areas far to the north which have not historically been as affected by DDT as the eastern United States populations.

TABLE 5

WINTERING EAGLE TOTALS BY DRAINAGE BASIN, 1974-1980

| Cohansey River/Stow Creek | | | |
|---|---|---|---|
| Winter | Bald Eagle | Golden Eagle | Total |
| 1974-1975 | NS | NS | NS |
| 1975-1976 | NS | NS | NS |
| 1976-1977 | 0 | 0 | 0 |
| 1977-1978 | 3 2a, 1i | 0 | 3 |
| 1978-1979 | 1u | 0 | 1 |
| 1979-1980 | 2i | 0 | 2 |
| 6 yr. total (indiv. bird usage) | 6 | 0 | 6 |

4 year average number of eagles present/year = 1.5 (not directly comparable to other 6 year averages)

| Dennis Creek | | |
|---|---|---|
| Bald Eagle | Golden Eagle | Total |
| 0 | 0 | 0 |
| 2i | 0 | 2 |
| 0 | 2 1sa, 1i | 2 |
| 1i | 0 | 1 |
| 3i | 0 | 3 |
| 4i | 2sa | 6 |
| 10 | 4 | 14 |

6 year average number of eagles present/year = 2.33

| Dividing Creek/Maurice River | | | |
|---|---|---|---|
| Winter | Bald Eagle | Golden Eagle | Total |
| 1974-1975 | 6 4a, 2i | 1a | 7 |
| 1975-1976 | 3a | 0 | 3 |
| 1976-1977 | 4a | 1sa | 5 |
| 1977-1978 | 9 4a, 2sa, 3i | 0 | 9 |
| 1978-1979 | 4 2a, 2i | 0 | 4 |
| 1979-1980 | 14 3a, 11i | 0 | 14 |
| 6 year total | 40 | 2 | 42 |

6 year average number of eagles present/year = 7.0

| Mullica River/Pinelands Complex | | |
|---|---|---|
| Bald Eagle | Golden Eagle | Total |
| 3 2a, 1i | 1sa | 4 |
| 4 2a, 2i | 5 2sa, 3i | 9 |
| 4 2a, 2i | 4 1a, 3i | 8 |
| 6 3a, 3i | 5 2a, 1sa, 2i | 11 |
| 4 2a, 2i | 4 1a, 3sa | 8 |
| 8 4a, 1sa, 3i | 4 1sa, 3i | 12 |
| 29 | 23 | 52 |

6 year average number of eagles present/year = 8.66

| Tuckahoe River/Egg Harbor River | | | |
|---|---|---|---|
| Winter | Bald Eagle | Golden Eagle | Total |
| 1974-1975 | 1i | 0 | 1 |
| 1975-1976 | 0 | 0 | 0 |
| 1976-1977 | 0 | 1i | 1 |
| 1977-1978 | 0 | 0 | 0 |
| 1978-1979 | 0 | 0 | 0 |
| 1979-1980 | 2 1a, 1i | 1i | 3 |
| 6 year total | 3 | 2 | 5 |

6 year average number eagles present/year = .83

NS = Not Surveyed
a = adult
sa = subadult
i = immature
u = undetermined

A small Golden Eagle population exists in upstate New York, New England, and eastern Canada,[6] and many fall coastal migrants and wintering birds undoubtedly originate there. It is, however, questionable whether the total "ridge" migratory numbers could originate from so few documented nests, and recent Ferruginous Hawk and Swainson's Hawk sightings during the fall at Cape May Point lead to speculation if indeed many of our coastal Golden Eagles may also have a similar western origin.[7]

Other origins also exist for wintering birds. The "resident" Bald Eagles of southern New Jersey must be included within wintering populations, for they too spend their "winter" in New Jersey (and also often can not be safely separated out during field censusing). These resident birds, however, are part of the contiguous Chesapeake Bay population—a group which would include the Delaware Bay nesting birds in both Delaware and New Jersey.[8] The Chesapeake population is reasonably healthy,[9] and the immatures and particularly sub-adults no doubt wander widely in search of suitable territory. It is therefore quite likely that some South Jersey wintering Bald Eagles have a more southerly origin—from other parts of the contiguous Chesapeake Bay population.

An interesting related topic to consider is whether a good recorded migration number will dictate high wintering eagle numbers (or perhaps even the opposite, as birds pass us to the south). While we assume that some relation exists between migration numbers and wintering numbers (and this was in fact the basis for the projected historical wintering population found in Appendix A), and the record 33 eagles (total) at Cape May Point was followed by the record incursion of wintering birds, we do not yet have enough data to make any true scientific comparison. (In fact, some birds recorded as migrants at Cape May may be subsequently recorded as wintering birds farther up the county or state, due to the nature of the flights at Cape May in which many raptors return north after reaching the watery tip of the Cape.)

### The Cohansey River Area

This eagle-use area would be defined as that area lying south of Route 49, from the vicinity of Canton and Mad Horse Creek Fish and Wildlife Management Area, east to Fairton and Sayre's Neck. It would include the drainages of Stow Creek and the Cohansey River area, and the adjacent wetlands south to the Delaware Bay. One or two eagles were noted each winter, usually perched on the edge of the marshes near the mouth of the river. This basin was not visited in 1974-75, and only cursorily in 1975-76, perhaps skewing the data. Roosting areas were not discovered. Two adults present during the winter of 1977-78 were seen copulating, which led to speculation as to possible breeding; however, subsequent failure to relocate the birds possibly indicates that they were the Bombay Hook/Woodland Beach birds from the Delaware breeding site just five miles across the Delaware Bay.

### The Cumberland County/Maurice River Area

One of the two remaining major strongholds of the Bald Eagle in New Jersey, this study area would include all the area south of Route 49, from Cedarville in the west to Manumuskin in the east and south to Heislerville. Within this area would be the Maurice River drainage basin, and the wooded swamps on both sides of the river, including the documented eagle-use areas of the Manumuskin and upper Maurice River drainages.

Studied extensively were the Dividing Creek area and the virgin hardwood swamps to the north—an important natural resource for New Jersey's wildlife—eagles and otherwise.

This study area receives the most intensive "eagle-use" in the state, if only because the prime habitat here is much smaller than that of the Mullica River use-area. Eagles were seen on virtually every visit to this site, yet always Bald Eagles. Golden Eagles were noted only twice in Cumberland County: one on the 1976 Cumberland County Christmas Bird Count and one in January 1976 at Thompson's Beach. (One seen in the interior swamps on March 9, 1974, was outside this census period.) An area historically well-known for Bald Eagle usage, the extensive Delaware Bay wetlands appear to be perfect habitat for these birds, yet somehow relatively unattractive to the Golden Eagle. The wooded swamps here, comparatively untouched, represent an important historical[10] and crucial current roosting area. Also, the only "known" nesting areas in New Jersey are found here and need maximum protection.

The maxima for this river system occurred on the day of the 1979 Christmas Bird Count when 7 immature and 1 adult Bald Eagle were seen by Alfred Nicholson, Daniel O'Conner, and these authors. Other birds were also known to be present, but unseen (see Table 5). Four birds soaring together were noted twice (an unexpected sight in modern New Jersey), and 5 immature Bald Eagles were sitting together peacefully in the same tree at a communal roost deep within the swamp (like a page from history—a bit of "Old Cape May" that we never expected to witness).

### Dennis Creek Area

The vast acreage which surrounds the Dennis Creek complex, this region stretches from Delmont on the west, and east and south to Reed's Beach in Cape May County. Included are Belleplain State Forest and the wooded headwaters and adjacent wetlands of West Creek, East Creek, and Dennis Creek. Two or three eagles were present here during most of the last six winters, often during the early spring movement in February, pausing for 2-3 weeks at a time in this optimal habitat. Attracted by the vast flocks of Snow Geese present, both Bald and Golden Eagles would hunt on the wetlands, perch on the wetlands' edges, and retire to the wooded swamps of the Belleplain State Forest area to roost. Maxima was 4 immature Bald Eagles during the early winter of 1979-1980. (The Dennis Creek area is also an important holding

area/staging area for the famous Cape May raptor flights in autumn, with eagles often seen there in September/October/November.)

### Tuckahoe River/Great Egg Harbor River Area

While not a maximum eagle-use area, one or two birds were present almost every winter, usually attracted to the vast river delta wetlands complex and the impoundment areas near Tuckahoe and Corbin City. It was here that the previously mentioned historical Bald Eagle winter maxima occurred—12 birds seen by Joe Jacobs in the 1960's. Roosting occurs in the swamps near the river's headwaters, often at or near hidden overgrown cranberry bogs. Individual birds have been noted trading between here, (a "central" area) and the nearby Dennis Creek area along the wooded Cedar Swamp Creek corridor, and probably to the Pinelands/Mullica River complex to the north as well.

### The Mullica River Complex

This is actually a slightly deceiving "title" for a vast, somewhat ill-defined river system which includes not only the Mullica River and adjacent coastal wetlands, but also all the tributaries of the Mullica and their headwaters.

This region would, therefore, include most of the classic "Pine Barrens" areas surrounding the Wading and Oswego Rivers. The importance of this large and complex Pinelands region to wintering eagles can not be gainsaid. While little historical data is available here, this study none-the-less shows that the largest percentage of New Jersey's eagles can be found here.

The observed maxima for Bald Eagles occurred on February 2, 1980, when a progression of eagles (4 adults, 1 subadult, and 1 immature) were viewed in rapid succession as they returned from the wetlands to their roosts about 4 p.m. The maxima for the less gregarious Golden Eagle has been 3 birds seen together on at least four occasions—all over the common hunting grounds: the coastal wetlands. Published reports that "one or two eagles wintered at Brigantine NWR" are somewhat myopic since during only one winter was "roosting" seen to occur on the refuge. The normal behavior pattern for these eagles, both Bald and Golden, is to use the coastal wetlands for hunting. (Brigantine NWR, in particular, with its impoundments and associated waterfowl concentrations acts as a giant "bird-feeder", attracting the large predators.) Roosting, however, was always within the vastness of the inner Pinelands, often near the headwaters of the Mullica's various tributary rivers. The extensive blueberry and cranberry bogs of the Pinelands are the true eagle-use areas, where eagles roost in the evening and then soar extensively during the day. On non-feeding days (eagles usually only feed every two or three days) much of the day was often spent soaring over the bogs and rivers. During days of northwest gales eagles would "ride" the gales downwind to favored wetland feeding areas. Significant is the fact that on at least two occasions individual birds were noted "feeding" near Leed's Point in the morning and then going to roost along the Oswego River over 15 miles away—a daily round trip of over 30 miles. Another

incident dramatically illustrating the vast range of these birds was the aforementioned adult Golden seen at Thompson's Beach in January and then recorded at Leed's Point (approximately 40 miles away) two weeks later (by another observer). The full-adult plumage and distinctive marking of four missing secondaries in the right wing make it likely that it was the same bird.

Little has been published regarding the behavior of wintering coastal eagles, either for New Jersey or elsewhere, and this study discovered many different prey species, hunting techniques, and eagle interactions. These records will be recorded in a subsequent article, yet one notable event should be recorded here. During the winter of 1977-1978, a pair of Golden Eagles wintered along the Lower Mullica (the aforementioned "roosting" near Leed's Point on the Brigantine NWR). This pair (a full adult male and an advanced, subadult, large and magnificent female) was an obvious mated pair, and numerous courtship flights, mutual "preening" and even stick and nesting material carrying displays were noted over the two months the birds were present. And indeed the "territory" they had established west of Leed's Point was vigorously defended, particularly against Bald Eagles, as other eagles were driven off. Such behavior led to personal speculation whether the pair was prospecting for a nest site, seemingly unlikely in New Jersey, yet occurring during a winter when "prospecting" Golden Eagles were present at Pymatuning Lake, Pennsylvania, and Dutchess County, New York.[11] The birds finally disappeared in March, probably to their northern home. Golden Eagles seem to be recovering from persecution and possible pesticide poisoning,[12] and we may see range extensions in the eastern population within the near future. If true, the Pine Barrens may be sought by these birds, since presently immatures often linger in this ideal habitat into late May.

As was the case with the Cohansey River area, the northern Pine Barrens area, north of the Mullica River complex, were not covered due to the travel distances involved. While not technically "South Jersey," the Manahawkin Barnegat area often held additional coastal eagles. These birds, using the northeastern Pine Barrens, were probably not those recorded in the Mullica River area, and this area requires future study.

In summary, the Pine Barrens with its vast wilderness acreage, river systems, and adjacent wetlands remain one of New Jersey's prime eagle-use areas. This study area shows the highest six year average for wintering eagles (sp.). The area remains a major stronghold for the Bald Eagle with numerous wintering birds and some possible residents. The average number of Golden Eagles present makes the Pinelands the principle known Golden Eagle wintering area in the east . . . Nowhere else have such numbers been recorded from a single area this size. Finally, observations during the winter of 1979-1980 yielded preliminary data that many Golden Eagles are present in the inner and northern pines, and that probably more are present than coastal "hunting birds" sightings would indicate. If true, the actual Golden Eagle numbers in the

Pinelands may be double that of the recorded totals, again pointing to the problem of inseparable similar plumages leading to undercounting.

### Limitations of the Study

Previously mentioned limitations include the problem of probable undercounting because of similar plumages, the fact that the Cohansey area was not covered with a weight equal to the other areas, and that the central and northern Pinelands (north of the Mullica River complex) were not covered.

Another related factor is that each successive year in the study was based on the learnings of the previous years. When the study was begun in December, 1974, little was known of eagle numbers, eagle habitat, or habits. As more was learned of principle eagle-use areas, a greater likelihood existed of encountering eagles. Therefore, the lower numbers for the first and, perhaps, the second year of the survey may be lower than the true numbers of birds present. However, since Alfred Nicholson was a principle observer in this study, and these authors based much of their initial search on Nicholson's many years of experience with New Jersey's eagles, it is doubtful that many birds were missed, even in the initial stages of the study. In short, Alfred Nicholson's many hours afield as a cooperator in the study helped to discover most if not all of the eagles present.

### The Status of Bald Eagle Nesting Populations in New Jersey

A discussion of the current status of New Jersey's resident eagles is included within this study of wintering eagles for a number of inherent and obvious reasons.

A.) The remnant population of nesting Bald Eagles in New Jersey is "nonmigratory"—they "winter" here also and must, therefore, be included within winter totals. These resident birds, however, do wander more extensively in early winter, often following available food sources which can be easily capitalized on. In these cases of following an opportunistic food source, both hunting and roosting occur at different sites than those used during the nesting cycle.

Specifically, the Bald Eagles (which nest in "interior" swamps) often move to the nearest river system in winter, an area they do not frequent in fall or summer. Here they capitalize on numerous prey opportunities: waterfowl concentrations attracted to open water during freeze-ups (water kept open by the river's flow), fish and eels killed by freeze-ups in the shallower areas, and also muskrats (more active at this time due to the stress of winter conditions).

During routine observations resident eagles are potentially difficult to conclusively separate from the wintering birds of northern latitudes because of this seasonal movement; they are often seen far from their "home" area in search of the best food sources. Therefore, those "adult resident" Bald Eagles of New Jersey are necessarily included within the wintering numbers shown in Tables 4 and 5.

B.) This study purports to delineate wintering eagle habitat; in no case is the wintering habitat separable from that of resident pairs. While the nest vicinity may be defended by residents during the late winter nesting phase, general eagle-use areas for resident adults and wintering eagles are one and the same. The preferable ideal habitat is quite small in modern New Jersey; wintering and resident eagles alike use the documented superior habitat.

C.) Numerous interactions have been noted between resident and wintering birds, behavior which has major implications regarding the relative distribution of wintering birds. When adult residents defend the nesting area, wandering immatures are forced to relocate in other, less favorable habitat (perhaps the next adjacent habitat). Joe Jacobs observed Cumberland County's resident Bald Eagles dive "repeatedly" on a soaring Golden Eagle, and escort it out of the home swamp.[13] On January 27, 1980, Cumberland County's resident pair, in preparation for nesting, viciously attacked an immature female Bald Eagle which attempted to roost in the vicinity. First literally knocking the bird from the roosting tree, and then diving on it in turn, the adults pursued the "intruder" for over a quarter of a mile until it fled the area.

Prior to this, during the 1979 Cumberland County Christmas Bird Count, 7 immature Bald Eagles were discovered roosting in the resident pair's "home swamp."[14] This caused speculation as to whether the adult pair had disappeared from the area. The subsequent discovery of the adult pair feeding and roosting on the Maurice River, from 5 to 10 miles away, explained the immatures' presence roosting in the historic nesting area. When the residents subsequently returned, the immatures left, one via the dramatic chase described above.

Such an instance documents the overwhelming importance of remaining prime eagle habitat in South Jersey, as wintering eagles "flock" to it whenever it is available for their use. Prime habitat, used by residents and vagrants alike, is inseparable as either specifically wintering or nesting habitat. Nonetheless the presence of an adult nesting pair will, in turn, redistribute wintering eagles to surrounding areas.

TABLE 6
HISTORICAL BALD EAGLE NESTING DENSITY
IN SOUTHERN NEW JERSEY

| Year | Location | No. Active Nests | No. Young Produced |
|---|---|---|---|
| | Salem Co. | 3 | — |
| 1936 | Cumberland Co. | 1 | — |
| | Cape May Co. | 6 | 9* |
| 1936 | Total | 10 | — |

* — 4 nests produced nine young: one, two, three, and three respectively.

*Source*:
Stone, Witmer. 1937. *Bird Studies at Old Cape May,* Vol. I.; D.V.O.C., Philadelphia, Pa.

TABLE 7

COMPILATION OF BREEDING CENSUS DATA OF BALD EAGLES IN NEW JERSEY, 1956-1968

| Year | No. Adults Present | No. Active Nests | No. Young Produced |
|---|---|---|---|
| 1956 | — | unknown | 0 (known) |
| 1957 | — | unknown | 0 (known) |
| 1958 | — | unknown | 0 (known) |
| 1959 | — | 10 | 4 |
| 1960 | — | 8 | 1 |
| 1961 | — | 7 | 1 |
| 1962 | 20 | 6 | 1 |
| 1963 | 15 | 8 | 2 |
| 1964 | — | 6 | 0 |
| 1965 | — | 4 | 0 |
| 1966 | — | 6 | 1 |
| 1967 | — | 3 | 0 |
| 1968 | — | 1 | 0 |

*Source*:

McLaughlin, Frank. 1964. "Status of the Bald Eagle in New Jersey." *New Jersey Nature News*, the New Jersey Audubon Society, Vol. XVIV, No. 2, June, 1964, pages 66-75.

TABLE 8

THE STATUS OF NESTING BALD EAGLES IN NEW JERSEY, 1969-1973

| Year | No. Active Nests | No. Young Fledged |
|---|---|---|
| 1969 | 1 | 0 |
| 1970 | 2 | 0 |
| 1971 | unknown | unknown |
| 1972 | unknown | unknown |
| 1973 | unknown | unknown |

*Source*:

1969-1970: Galli, Joan. "Research and Management of Endangered Wildlife Species in New Jersey (Bald Eagle)," Federal Aid Performance Report. November 7, 1977.

TABLE 9

OBSERVATIONS OF BALD EAGLE NESTING ON THE DELAWARE BAYSHORE OF SOUTHERN NEW JERSEY, 1974-1980

| Year | No. Adults Known Present During Nesting Season | No. Active Nests Observed | No. Young Known Fledged |
|---|---|---|---|
| 1974 | 4 | 2† | 2* |
| 1975 | 4 | 2‡ | 1 |
| 1976 | 3 | 1 | 1 |
| 1977 | 4 | 2 | 0 |
| 1978 | 6 | 2§ | 0 |
| 1979 | 2 | 1 | 0 |
| 1980 | 3 | 1 | 0 |

† — 2nd nest probably abandoned
‡ — 2nd nest failed (fide Joe Jacobs)
§ — 2nd nest attempted, but adult female reportedly shot and killed in early January
* — from one nest (2 young fledged)

*Source*:

Personal observations and field notes: 1974-1980 (previously unpublished) of Clay C. Sutton, Jr. Also, personal observations/communications of Alfred Nicholson.

D.) Finally, numerous observations of nesting activity were made during the study of wintering eagles. It would do the habitat survey a disservice not to include those nesting records, particularly since resident bird records present a year-round perspective of New Jersey's "critical habitat."

A historical perspective on the Bald Eagle nesting population in southern New Jersey is provided in Table 6. The ten nests recorded in *Bird Studies at Old Cape May,* Stone, 1937, were located by Fletcher Street and Turner McMullen who "endeavored to locate all of the eagle nests in southern New Jersey with the object of giving them adequate protection." This figure is undoubtedly quite low because Cumberland County is still known to have historically held at least 7 nesting pair as late as "the early 1950's."[15] The nesting status is known to have held steady until 1948, when Julian K. Potter recorded 4 occupied nests in Gloucester and Salem Counties,[16] and even until 1959 when 10 active nests were still to be found in New Jersey.[17]

The status of the Bald Eagle in New Jersey from 1956 to 1968 is presented in Table 7. A further update is provided from Joe Jacob's notes in Table 8. Finally, known eagle nesting records for 1974-1980, accumulated during the course of this survey, are presented in Table 9.

The nesting eagle population has dwindled from a bare minimum of ten nests, in both 1937 and 1959, to the single known remaining active nest of Cumberland County in 1980. However, given that vast Cumberland County, no doubt, held more nests in 1937 than documented, and then extrapolating the Delaware Bay Shore total to the similarly sized coastal Pine Barrens areas, we could safely project a 1930's resident population to contain approximately 30 or even 40 active nests. Only in this way can we put New Jersey's remaining resident eagles and the critical nature of their required habitat—a habitat both preferred and dictated by many generations before them—in proper perspective.

### The Delaware Bay Shore

The Delaware Bay Shore of Cumberland County and the adjacent hardwood swamps which support it are the last known stronghold of the nesting Bald Eagle in New Jersey. One or two pairs of adult eagles have been resident since the inception of this six year study. While the second pair seemed to disappear following the rumored shooting of an adult eagle in late 1977, at least three different adults were present in both November and January of 1980[18] and all were thought to be resident birds. Sadly, the one active nest located did not fledge young in 1980, possibly due to predators, either natural or human.

A very specific daily and seasonal pattern has been noted for Cumberland's eagles, with specific preferred hunting, roosting and soaring corridors noted. From six years of notes, extremely specific spatial requirements and habitat preferences can be recommended. These observed criteria for the continued welfare of the Bald Eagle in New Jersey are of a confidential nature due to the observed intolerance of these eagles to disruption and human har-

assment, be it well-meaning or otherwise. In modern New Jersey the activity patterns of these eagles are already so dictated by man (as to *available* roosting/perching/hunting/nesting areas) that any increased pressure might be "too much." Therefore the birds must be somewhat protected from even those who merely wish to view and photograph them, and the specific observed preferred habitat must remain confidential. However, these areas, based on these six years' observation, have been reported to the appropriate concerned agencies, such as New Jersey Department of Environmental Protection's Division of Fish, Game and Shellfisheries; the Office of Coastal Zone Management; the New Jersey Pinelands Commission; and the Raptor Information Center of the National Wildlife Federation, by way of maps appended to this study (not included here). These inclusions map and rank critical habitat for both wintering and resident eagles on topographical maps of New Jersey based on the findings of this study.

Only in this way will the benefit of this survey be realized for the conservation of New Jersey's remaining eagles.

### The Pine Barrens

While only one nesting area for the Bald Eagle is currently known in South Jersey (the Delaware Bay Shore of Cumberland County) observations conducted and data uncovered during this study strongly suggest that the Bald Eagle may yet breed within the vast watery complexes of the coastal Pine Barrens region. This is based on a number of factors.

During this study most sightings of adult Bald Eagles were considered to represent resident birds, as opposed to wintering birds from the north. This is another projection which can be based on migratory data (as was the projection of historical wintering numbers). In four years of data gathered during their autumnal hawk watch (Table 1), the Cape May Bird Observatory recorded 54 Bald Eagles. Only two were in the adult plumage, or 3.7% (with one of these birds technically being an advanced subadult with a "banded" tail). While many adults were observed during the counts of the 1930's (40% or 24 of the 60 Bald Eagles sighted in 1935),[19] it must be assumed that a number of these sightings included the 6+ resident pairs in Cape May County at that time, or even some of the Cumberland County/Pinelands resident birds. Witmer Stone mentions how resident birds from nearby nesting areas "wandered" to the Point on proper winds throughout the season.

Therefore, we can assume that the difference between the 40% adult birds in the 1930's and the 3.7% in the 1970's does not necessarily reflect either massive reproduction failure or success of the eagle populations in the northeast (failure has admittedly happened to some degree and is certainly an unknown factor in the figures), but more specifically the more localized removal of southern New Jersey resident birds as a component of the Cape May hawk flights—a removal due to habitat destruction and the affects of pesticides.

This change in the composition of the Cape May flights occurred some time ago, as veteran observer Alfred Nicholson termed the 1976 Cape May

Point adult Bald Eagle only the second he had seen in over 30 years of observation there—the first being an adult which ran the gantlet of gunfire in Nicholson's first trip to Cape May in the late 1930's.

The current theory for the vast proportion of immature Bald Eagles in the coastal flights is a basic one: A vast percentage of *all* raptors at Cape May are immatures—a figure which holds true for all species to varying degrees—but probably averages 80-90% for all hawks seen. The scientific basis for this remains conjecture; however, it is assumed that it is the inexperienced young birds which are characteristically blown to the coast by the northwest winds—both gales and the general prevailing wind drift. Adult birds, having previously faced the arduous coastal flight and Delaware Bay crossing, are theorized to "avoid" this energy-ineffective route on their second flight south—following the ridges for lift, and simply not getting caught again in the dead-end peninsula of Cape May.

Regardless of the cause, the effect is fact. The vast majority of Cape May migrants are immature birds, quite unlike the "ridge" totals which include an expected percentage spread of immature versus adult raptors, including many adult Bald Eagles.

The point of this discussion is to prove theoretically that most, if not all, of New Jersey's wintering adult Bald Eagles are residents. If we assume that the coastal wintering birds have similar geographic origins as our late season migrants, we can assume that probably only about 3.7% of our wintering Bald Eagles are adults. Conversely, if a large percentage of coastal New Jersey's wintering eagles were adults, we could then logically assume that a greater percentage of adult eagles would be sighted by coastal fall hawk watches, which is not the case. (To digress even further, a similar percentage can be proven for Golden Eagles (none of which are resident). Coastal autumn migrants average 11% adults (approximately 4 of 43),[20] as opposed to 16% adults (5 of 31) of the wintering birds recorded by this study.) While Golden Eagle data can not be directly related to Bald Eagle data, the basic concept presented is considered valid—that most "wintering" adult Bald Eagles may be considered residents.

Two final points bear this out: Cumberland County's adult Bald Eagle total has never exceeded known resident numbers, known resident numbers being based on spring and summer counts, and/or nest associations. With Cumberland being the Bald Eagle stronghold, if many migratory adult eagles came in, they would be recognized and recorded. It is, therefore, logical to extrapolate these observations to the Pinelands area and assume that most adult Bald Eagles may well be New Jersey residents, as is the case in Cumberland County.

While such a postulation leaves room for error (in fact for an error of three or four birds—the total adult Bald Eagle Pinelands population) there do exist summer records to back the contention that the Bald Eagle still possibly breeds within the Pinelands.

While no summer observations have been conducted by these authors in the Pinelands, some have been reported to us: a full adult Bald Eagle soaring over Batsto in July[21] and two adult Bald Eagles seen along the Mullica River in June[22] (while these birds could represent southern, post-breeding wanderers to the north, again *all* Cape May coastal plain *spring* migrant Bald Eagles have been immatures).

Finally, considerable note has been made of obvious "mated pairs" of adult eagles in the Pinelands during this survey, and nuptial activities have been watched on numerous occasions in winter (although never copulation, nor nest-building activity).

While much of this evidence of nesting is largely circumstantial, finally, and most convincingly, not all eagle breeding records for the Pine Barrens are "historical," for as late as "1974 or 1975" an active eagle nest was located[23] although breeding success was not ascertained. This confidential record, for an undisclosed area, was by a most competent observer, who further confirms that "a few years before that" three active nests existed in the vastness of the inner Pinelands. (The "1974 or 1975" nest was also known and monitored by Joe Jacobs,[24] but its very existence was never disclosed by him—illustrating this veteran raptor enthusiast's concern for the welfare of the birds and the need for absolute secrecy regarding nesting sites.)

At this point, in the interest of accuracy, we must give due consideration to an "opposing" viewpoint. Recent communications with veteran eagle observer Edward Manners have suggested that the case for current Pinelands' breeding may not be that strong. Manners and Joe Jacobs always believed that winter Pinelands adult eagles were not residents, but instead migrants from the north if only because sightings virtually ceased after March. (This might be explained somewhat logically for even breeding birds since the Bay Shore resident eagles "disappear" from the Maurice River in March also; they retreat to the inner swamps to breed. Similar behavior might explain the March disappearance of Pinelands' birds from the river systems where they had been highly visible.)

However, Ed Manners relates that the Bald Eagle was never a common breeder in the Pinelands, even during the 1940's war years when persecution was little and pesticides had not yet received widespread use. Even at this time there were only "one or two nests" near the mouth of the Mullica River.[25]

Keeping in mind the authors' theory that many wintering adults could conceivably be resident, it must be remembered that it is just that—a theory, which only extensive summer field work in the Pinelands can prove or disprove. Until then Manner's thoughts should be given high regard. In our favor, however, it should be remembered that the vast private bog complexes virtually are never seen by the birder or the ornithologist and the Bald Eagle, being forced out of the rest of New Jersey, could well seek sanctuary in this the last wilderness. Historical nesting records indeed are known for the upper Pinelands river systems[26] and resident eagles may still exist there.

The fact that an active Pinelands' nest is known for recent years is just cause for speculation that nesting still occurs there, particularly in light of both the sightings and the above reasoning of this study, and there is at least some reason to be optimistic. It is thrilling to think that the Barrens are still wild and undeveloped—indeed large enough that an eagle nesting location may remain an undiscovered mystery!

Resident eagle habitat in the Pineland is no doubt similar to that required and used by documented wintering birds, and should be protected as such. Classic wintering eagle habitat still remains in the Pinelands. It should not only be protected and preserved as a refuge and stronghold for winter birds, but also as an area in which the remaining resident eagles can thrive and perhaps even increase, now that chlorinated hydrocarbon levels no longer prevent a possible comeback and reoccupation of former habitat. If nesting does not currently occur it is still a prime area for a future repopulation to occur and should be protected as such. The Bald Eagle historically roamed the Pine Barrens, and does so today both as wanderer and possibly as resident, and so it should always.

CONCLUSIONS:

Six years of field work show that the eagle is still very much a part of South Jersey's avifauna. Recorded totals indicate that the Bald Eagle is more numerous today than any previously published records indicate, or than recent Fish and Game surveys show. Within the study area a six year average of 14.6 Bald Eagles, while far less than the projected historical population shown in Appendix A, is a figure which still shows the Bald Eagle to be a top predator in the wetlands food chain. This six year figure and recorded maxima will stand as a logical base line by which to compare existing wintering eagle populations to future six year intervals.

This study's observed Golden Eagle maxima and yearly averages indicate far more birds than shown in previously published records. Indeed, this study has major implications regarding a reassessment of the status of the Golden Eagle in New Jersey. The most recent published status, "Records are usually on single birds at coastal marshes . . . Rarely reported inland,"[27] is not applicable. Recorded totals show the Pinelands of New Jersey to be the major known published Golden Eagle wintering area in the east. Nowhere else, including the Appalachian Mountains, are such numbers recorded in such a concentrated area. While eastern Golden Eagle populations are far less than western populations, the eastern birds are perhaps even more of a priceless heritage which must be protected, and this proof that New Jersey holds such a large percentage of wintering Goldens holds major ramifications for wildlife management. With the eastern population considered to be "endangered"[28] (by wildlife experts—whether by legislation or not) the argument that the Golden Eagle should not be officially named an endangered species in New Jersey because we are on the periphery of its range, with only a marginal number

of birds, is no longer acceptable. Golden Eagles from throughout the northeastern United States and Canada depend on New Jersey habitat in winter; they must be as vigorously protected here as on their nesting grounds.

The 1979-1980 winter incursion of Bald Eagles leads us to hopeful speculation. Recent published literature indicates that residual pesticide levels are finally declining throughout the northeast,[29] Bald Eagle production is perhaps nearing pre-DDT numbers in the Chesapeake Bay,[30] and also the active nests and production (young/nest) are known to be rising in New England. Once again, after a drought of many years, we perhaps have a substantially larger source for wintering eagles in New Jersey; indeed, the number present in the 1979-1980 winter was thought to be "the largest number present in over 20 years."[31] In fact the 30 Bald Eagles recorded compares quite favorably with the 27 recorded by McLauglin in 1962,[32] a figure which contained many resident adults and many fewer immatures.

Delaware Bay residual pesticides are now rapidly declining;[33] in 1979, the Delaware Bay Bald Eagles at Bombay Hook National Wildlife Refuge raised young for the first time in 10 years.[34] While an individual eagle can probably not "recover" from pesticide induced infertility, recruitment and subsequent replacement of one or both eagles may again result in fertility, as long as there are fertile birds in the population to be recruited.

Hope, therefore, remains for New Jersey's nesting eagles. While only a few pairs still exist, nesting has been annual. In the Delaware Bay nest, monitored for over 20 years, the last young was produced in 1976. Failure in 1977, 1978, and 1979 may well be linked to harassment. Indeed, failure in 1978 is linked to the rumored shooting of one adult eagle. The female did disappear, based on observation, but the male then recruited a new mate. Subsequent nest failure is probably unrelated to pesticides, as it is published that raccoons stole the eggs in both 1979[35] and 1980.[36]

RECOMMENDATIONS:

With pesticides disappearing, hope remains for New Jersey's resident eagles. However, an increased importance must be placed on eagle habitat protection if the resident eagles are ever to become more than a remnant of their former numbers.

Total habitat preservation of documented eagle-use areas is the only way in which the eagle will remain a part of our avifauna. With documented recovery from pesticides occurring and the modern "record" eagle incursion of 1979-1980, it is possible that the eagle may once again grace our skies in appreciable numbers, but this can only occur if the important eagle-use areas are preserved in their entirety immediately. Six years of observations and records of eagle-use support the following specific recommendations. These recommendations are linked to various observed threats.

The key to eagle protection in New Jersey is habitat preservation. Habitat destruction/alteration detrimental to eagles may take many subtle forms. We

are not just faced with the conversion of one type of ecosystem to another. Virtually all eagle-use areas documented in this study can be easily classified as the most wild and least impacted areas within the respective drainage basins. In short, the birds use the areas where there are the fewest people. Man's use of the land takes many forms. Off-road vehicle use and motorcycles have been seen in all study areas. Wood-cutting is currently, and will continue to be. a major factor bringing man to otherwise wild, little-impacted areas of woodland. Both the removal of trees and the presence of man and noise associated with it are a problem and have been witnessed in all major eagle-use areas.

Hunting, generally seasonal, but increased in duration due to considerable observed poaching, exerts a major pressure upon wintering eagle populations. Again the major factor is man's presence in prime eagle habitat. This problem is compounded with New Jersey's burgeoning population, placing many more hunters afield than ever before. Duck hunters scatter over the entire wetlands, often in large numbers, particularly on weekends. Deer hunters spread through the inner swamps where roosting occurs, and deer season, both legal and non-legal, remains a major pressure for eagles. (A deer stand/blind is located virtually beneath the known Delaware Bay nest.) The problem associated with hunting is a seasonal one of numbers of people using the prime eagle habitat for their purposes; a certain amount of disruption occurs. There exists no simple "solution" for this major factor impacting on eagles in modern New Jersey. At Dennis Creek during the 1979-1980 winter, on a Saturday during duck hunting season, two of the four immature Bald Eagles present could literally not find a place to hunt or even perch due to the estimated number of 120+ hunters present on the wetlands from Reed's Beach to West Creek. This is not an isolated instance, as many could attest to the same conditions surrounding Brigantine NWR and the wetlands of the Mullica River complex.

Eagles are still shot at in New Jersey as well as the rest of the nation. In 1977-1978 it was rumored that one or more eagles were shot in Cumberland County.[37] In February, 1977, at Goshen Landing in Cape May County these authors watched a duck poacher fire a volley of about 15 shots with a .22 caliber rifle at a soaring Golden Eagle. He thankfully missed, if only because of the range, but undoubtedly some do not.

Personal encounters have revealed that muskrat trappers "hate" eagles (and hawks) for stealing their catch from the traps. This occurs, no doubt, to some extent as an immature Bald Eagle soaring over West Creek, Cape May County in February of 1979, had a muskrat trap (or perhaps a fox trap) dangling from one foot.

The major threat to New Jersey eagles, however, remains the habitat loss, the resultant housing encroachment, and the people-use of the land which inevitably follows. This report will not attempt to analyze this all-too-well known progression, but only illustrate a prime example. As this is written, a 7000 unit subdivision is planned for the Pinelands areas of Galloway Town-

ship virtually on the border of Brigantine National Wildlife Refuge.[38] Much of this acreage is documented prime eagle roosting and hunting habitat.

While this is a glaring example of the problems facing eagle protection in New Jersey today, it is happening throughout the state on a much smaller scale which might be likened to cancer. In Cape May County, the creeping suburbanization resulting from the casino-related housing boom threatens to wipe out eagle-use along the Tuckahoe River and Dennis Creek forever. Even if eagle areas were set aside today, the population associated with this growth and their recreational interests become a major factor placing people in areas where historically only eagles soared.

As this is written planned expansion of the sand-mining industry threatens the climax hardwood swamp that is the Delaware Bay Bald Eagle's home. Such threats are not imagined, but real, as the strip-mining operation has encroached to possibly the very limit of the eagles' spatial requirements and tolerance. This expansion of the sand-mining industry threatens both critical eagle nesting and wintering habitat alike as these strip mines eliminate eagle-use areas forever, with the very sand needed for the glass industry underlying the crucial lowland swamps. Since the "developed" areas logically can not be stripped, the wilderness is the target—all to provide nonreturnable bottles for the exploding population of New Jersey and the northeast.

Bald Eagle management in modern New Jersey must take two thrusts. Critical eagle habitat must be recognized and preserved by whatever means necessary, but preferably by legislation. Outright purchase is not always necessary; if for instance a cranberry grower in the Pinelands has coexisted with eagles for decades, there is no reason he should not continue to do so. If for instance the Office of Coastal Zone Management, through the regulation process, can guide the sand-mining industry into non-eagle-use areas, thereby preserving optimal habitat, this may be acceptable. However, purchase of crucial habitat is the best historically documented route to eagle protection.

The second thrust in eagle management must be the recognition of land-use threats to raptors, as well as the threatening activities of man due to New Jersey's growing masses.

The threats of wood-cutting and various recreational interests must be identified when they directly impact on documented critical eagle habitat and/or historic eagle behavior patterns. While perhaps a hard matter to control due to the many complexities, an attempt must be made. Discussion and planning must ensue. The possibility of declaring certain areas "off-limits" to the public should be explored, just as the United States Fish and Wildlife Service has "closed" eagle nesting areas in the Chesapeake Bay area. Indeed, in certain Fish and Wildlife Management Areas and areas within the Wharton State Forest, for example, simple road closure might have major implications. Within the Pine Barrens these authors once witnessed a pair of eagles flush three times in a row due to vehicular traffic on a sand road—all within a one-hour period. Also a dirt road, highly travelled by off-road motorcyclists, passes within

500 yards of the single remaining active nest—no doubt a mental if not physical disruption to the nesting eagles. Road closure in critical eagle-use areas must absolutely be considered as a method to relieve recreational impact on eagles, particularly in nesting and roosting areas.

Regarding nesting eagle population management, the philosophies espoused by the Cumberland Conservation League are timely, valid, and should be followed. This set of observations and recommendations is here included as *Appendix B*. It should be remembered that as pressured as New Jersey's eagles now are, they are no doubt less able to accept undue harassment or possible "over-management" than the healthy and much less impacted Chesapeake population might. With pressures as great as they are, for instance, any one nest "visit" or overflight may be "too much"—the final straw in a life which no doubt contains daily disturbances or pressures from the many various sources previously mentioned. Indeed, Julian Potter's and Frank McLaughlin's project slogan, later clearly believed in by Joe Jacobs, of "observe, not disturb," must be "adhered to religiously"[39] in our time as well.

With the future of the eagle in New Jersey dependent upon large, contiguous tracts of land which can be used for the purpose of roosting, hunting, perching, and nesting, the observations of six years are here recorded as maps delineating observed critical eagle habitat in New Jersey. These maps, existing as an addendum to this study, are by nature confidential and will not be directly attached to those copies which will be distributed to the general public for the obvious reasons of "one more pressure" discussed above. These maps, depicting critical areas, important areas, and marginal eagle-use lands, will go directly to concerned state agencies such as the New Jersey Pinelands Commission, the Office of Coastal Zone Management (New Jersey Department of Environmental Protection), New Jersey Fish, Game, and Shellfish (New Jersey Department of Environmental Protection), and it is strongly recommended that they be used in the land-use planning processes which are the mandate of these state agencies. Also, the United States Fish and Wildlife Service and the National Wildlife Federation Raptor Information Center will receive these maps, which will hopefully be used during their review and comment process concerning proposed projects for these areas.

Finally, concerned public conservation groups, such as the Nature Conservancy, the Philadelphia Conservationists, the New Jersey Conservation Foundation, the Delaware Valley Ornithological Club, and the New Jersey Audubon Society will receive these recommendations.

By this method, the true value of these six years of eagle records will hopefully be derived by concerned groups, both public and private, each doing their part to preserve these documented critical eagle habitat areas.

Final recommendations are that this study be continued. An ongoing project is the only way to monitor the ever-changing status of the eagle in New Jersey, so that each six year segment may be compared to those before it. This

report must exist as a base line for the 1970's, but the only way for a scientific base line to be of value is to continually compare its findings to the current condition.

Also, the Cohansey River area, the Tuckahoe River region, and the upper Maurice River area, while not comparatively the most crucial eagle-use areas, must all be further studied simply because less time was spent there than in areas theoretically holding more eagles. The central Pinelands, a major holding area for wintering and possibly nesting eagles, must also be looked at much more closely, as data surfacing only in the final years of this six year segment indicate possibly greater numbers of eagles here than were documented or imagined. Finally, the possible nesting status of the Bald Eagle in the Pinelands must be resolved as soon as possible for the obvious habitat preservation implications.

It is fervently wished that the prepared maps now be taken into account by concerned citizens and agencies, so that they may realize their potential for eagle habitat protection . . . Only in this way can we protect one of New Jersey's most priceless natural heritages—the Bald Eagle.

While specific site records for both the Delaware Bay Shore and the Pinelands must remain confidential for the aforementioned obvious reasons, the interested naturalist or birder none-the-less has an excellent chance of seeing the Bald and Golden Eagle in New Jersey. The Brigantine National Wildlife Refuge and the surrounding wetlands of the Mullica River east of the Garden State Parkway remain the best published sites in New Jersey to view eagles at any time from October through April. On almost any day (weather permitting) of this period, eagles may be seen (by one who specifically watches for raptors) from such vantage points as the refuge dikes, the Leed's Point and Mott's Creek Roads, and the Chestnut Neck area. This is particularly true, as previously mentioned, on days of northwest winds when the birds are carried from the interior Pinelands to the coastal areas for feeding. The importance of this coastal basin, and of the buffer zone which backs it up, can not be overemphasized, yet the proposal of a 7,000 unit + subdivision in this area inevitably means that change will come—as it has so many times before for New Jersey's eagles.

However, this time, not much change is left in the birds; only so much adaption is possible in a shrinking world in which not only extinction, but also extirpation, is forever.

"arrogant, unwilling to give ground,
the . . . . eagle seems almost to disdain
the civilization that is sweeping
it away . . . ."

Peter Mathiessen [40]

## APPENDIX A

### A Projected (Theoretical) Historical Wintering Eagle Population in Southern New Jersey

(based on a comparison of known current migratory records to known historical migratory numbers, and the extrapolation of this figure [ratio] to known current wintering numbers)

| Historical Migratory Average 1931-1937: 67 eagles (sp.) | | Historical Wintering Average 1931-1937: (unknown) |
|---|---|---|
| Current Migratory Average 1976-1979: 28 eagles (sp.) | = | Current Wintering Average 1974-1980: 20 eagles (sp.) |
| $\frac{67}{28}$ | = | $\frac{x}{20}$ |
| $28x$ | = | 1340 |
| $x$ | = | 1340/28 |
| $x$ | = | 47.85 or 48 eagles (sp.) |

| Historical Migratory Maxima 1931-1937: 165 eagles (sp.) | | Historical Wintering Maxima 1931-1937: (unknown) |
|---|---|---|
| Current Migratory Maxima 1976-1979: 33 eagles (sp.) | = | Current Wintering Maxima 1974-1980: 37 eagles (sp.) |
| $\frac{165}{33}$ | = | $\frac{x}{37}$ |
| $33x$ | = | 6105 |
| $x$ | = | 6105/33 |
| $x$ | = | 185 eagles (sp.) |

*NOTE*:

The historical wintering eagle (sp.) average for southern New Jersey would, therefore, be approximately 48 (@ 50) birds per winter.

The historical wintering eagle (sp.) maxima for southern New Jersey would, therefore, be approximately 185 birds per winter.

However, a problem then exists in separating Bald Eagles from Golden Eagles, as historical hawk counts neither expected nor recorded Golden Eagles in the East (i.e.: their presence was not realized, and all eagles were therefore recorded as Bald Eagles).

The current ratio of wintering Bald Eagles to wintering Golden Eagles is:

$$\frac{\text{88 total BE recorded 1974-1980}}{\text{31 total GE recorded 1974-1980}}$$

or

$$\frac{2.84 \text{ BE}}{1 \text{ GE}} \quad \text{approximately} \quad \frac{3 \text{ BE}}{1 \text{ GE}}$$

However, we can not assume that the ratio was the same historically since no such severe decline in population has been documented for the Golden Eagle. We can probably, therefore, project that the historical wintering (and migratory) coastal Golden Eagle population was roughly the same as today (or, perhaps, even a few more Golden's exist today — as they exploit the niche of the vanished Bald Eagle in much the way the Goshawk is filling the declining Cooper's Hawk's former range and niche in the northeast).

Therefore, to arrive at a valid historical wintering Bald Eagle population we can simply subtract the current Golden Eagle figures:

48 Historical Eagle (sp.) Wintering Average (projected)
— 5 Current Golden Eagle Wintering Average
---
43 Probable Historical Bald Eagle Wintering Population Average for Southern New Jersey

*and*:

185 Historical Eagle (sp.) Wintering Maxima (projected)
— 8 Current Golden Eagle Wintering Maxima
---
177 Probable Historical Bald Eagle Wintering Population Maxima for Southern New Jersey

While this spread (43 average vs. 177 maxima) is wider than the compared current average and maxima (14.7 vs. 30 Bald Eagle wintering population — observed) this might be expected. The figure of 165 maxima historical BE migration (1937) is much higher than the figures for 1936 or 1937, and either indicates a phenomenal migration year or, perhaps, that the observer recorded many more "local" eagles (10 nests present in Cape May County alone in 1937) than the previous year's observers.

However, because relatively few of New Jersey's *total* resident eagles were recorded at this migration point, and because a healthy nesting population existed along the Delaware Bayshore and within the Pinelands, it is theorized that the total birds present in winter (both former migrants and residents) would be considerably higher than the projected average based on migratory figures, and the true winter Bald Eagle norm may well have been closer to the 177 maxima figure than the 43 average figure (given that some 20-30 pair were "resident" [nesting] in southern New Jersey in the 1930's).

While perhaps a relatively unscientific projection, Table 4 gives us a theoretical picture of wintering eagle populations in southern New Jersey — a phenomenon for which no published recorded figures exist.

This pre-DDT and pre-habitat destruction figure, be it ever so theoretical, is necessary to put today's remnant populations in a proper perspective.

## APPENDIX B

## A POSITION PAPER ON BALD EAGLE MANAGEMENT IN NEW JERSEY

BACKGROUND:

The rearing of young Bald Eagles can be separated into three stages, each of which lasts approximately five weeks:

(1) Incubation stage. Both parents assist in incubating the newly laid clutch of eggs over a five week period, though interrupted incubation may require a somewhat longer time. The young hatch at intervals of a few days.

(2) Down stage. Following hatching the young eaglet is completely covered with long, silky, thick down ranging in color from white to light gray. After three weeks this down is replaced by short, wooly, thick down of a dark gray color. Brooding by both parents may continue until the young are four weeks old.

(3) Juvenal stage. About five to six weeks after hatching, scattered feathers begin to appear on the body and wings of the eaglet. At the age of seven or eight weeks the eaglet is fairly well feathered with only a little down remaining, and the flight feathers are half grown. By the time it is ten to twelve weeks old, the eaglet is ready to leave the nest.

According to the late Frank McLaughlin, breeding Bald Eagles in New Jersey normally lay a complete clutch of eggs by February 14. Hatching of the eggs could be expected to occur five weeks later on about March 20.

In one case reported by Witmer Stone, however, an eaglet estimated to be about two days old was found in a nest in Cape May County that also contained two eggs on April 19. Incubation of the newly hatched eaglet would presumably have begun about March 13, almost a month later than the February 14 date advanced by McLaughlin as typical for New Jersey. A variable seasonal nesting span is indicated.

Adult eagles may continue to incubate an infertile egg well beyond the five week incubation period. In 1962 Joseph Jacobs collected from two nests on May 5 eggs which were known through monitoring to have been incubated at least nine weeks, three days and twelve weeks respectively. Analysis revealed the presence of DDT in the eggs.

SPECIFIC NOTES ON THE DELAWARE BAY BALD EAGLE NEST:

A. Distance of nest from the nearest known observation points: 0.65 miles.

Distance of nest from nearby, somewhat heavily travelled unpaved road: 0.33 miles.

B. Altitude of nest and observation points:

The nest is in an 80 foot tall tree about 10 feet from the top of the tree. The base of the tree is approximately 15 feet above sea level. The nest is therefore about 85 feet above sea level.

C. Description of the nest tree:

The nest tree is an 80 foot tall pitch pine *Pinus rigida* Mill. It has been used for nesting by eagles continuously since the late 1950's according to Donald Kunkle of Newport. The circumference of the tree at 4½ feet above the ground was measured at 7 feet, 6 inches on December 26, 1976.

The nest tree is much taller than other trees in its immediate vicinity, and it offers a clear view in all directions. The nest is located about 10 feet below the crown of the tree in a crotch formed by the upper whorl of branches emanating from the main stem. Although the nest receives some cover from the foliage above it, there is on the whole relatively little foliage; the crown of the tree is open and accessible, with several nearly horizontal branches used for perching by both the adult eagles and their young.

The newly reconstructed nest in 1980 is bowl-shaped. In previous years the nest was two to three times its present size, and had developed an inverted cone shape.

D. Size of the nesting territory:

The boundaries of the nesting territory are not completely known. The nesting pair use perch trees about three miles south-southwest of the nest. These perching trees are known to be adjacent to popular hunting areas.

E. Sensitivity of the eagles to disturbance:

A state highway and an active industrial site are located within one mile of the nest. Airplanes flying at altitudes of about 500 feet do not appear to disturb the eagles, but an adult eagle was seen to crouch in the nest and almost disappear from view at the approach of off-road motorcycles over ½ mile away. During the incubation stage the eagle on the nest will flush when a person approaches to within 0.1 mile of the nest tree on the ground. Even if the intruder retreats immediately, the eagle may not return to the nest for as long as twenty minutes. If the intruder remains, the eagle may fly a short distance from the nest in his direction making a high-pitched twittering sound.

F. Approximate nesting stage dates for 1980:

(1) first date incubation observed: March 16.

(2) projected end of incubation stage: April 20.

(3) projected end of down stage: May 25.

(4) projected end of juvenal stage (eaglets leave nest) : June 29 through July 13.

(5) The nest was not successful in 1980. Failure appeared to have occurred during the incubation stage.

State biologists appear to have begun monitoring of the Delaware Bay eagle nest during the 1978 breeding season. Through their observations the biologists concluded the nesting pair of eagles were infertile. It should be noted, however, that although no young were produced at the nest in 1977 and 1978, eaglets were successfully reared in 1975 and 1976.

One of the nesting pair of eagles—probably the female bird—is believed to have been shot and killed in 1978 following the breeding season's end. The remaining bird took a new mate and the pair produced a clutch of eggs in 1979. Assuming the state biologists were correct in their conclusion of infertility, it is nevertheless possible that the dead eagle was the only sterile partner in 1978, and also possible that its successor was fertile.

Arrangements had been made, however, on the assumption that the nesting pair could produce no young in 1979. The U.S. Fish and Wildlife Service's Patuxent Wildlife Research Center was to supply a two-and-one-half-week-old captive-bred eaglet for transplantation into the nest, at which time the eggs laid by the eagles would be removed for chemical analysis.

State biologists began monitoring the Delaware Bay nest at "the beginning of March" in 1979 according to a newspaper article by Ford Bothwell. The exact date on which incubation was first observed is not known, but if it was underway on March 1 any fertile eggs should have hatched by about April 4.

The biologists observed incubation in process on April 10, and apparently concluded that their suspicions of infertility had been confirmed. The nest was consequently entered on April 11. No eggs could be found, however, apparently as a result of predation; an active raccoon den was discovered at the base of the eagle tree.

QUESTIONS OF THE CUMBERLAND CONSERVATION LEAGUE:

The following questions might be posed in relation to the Bald Eagle management program in New Jersey:

(1) on what grounds did state biologists conclude that the nesting pair in 1978 were infertile? Could nesting failures in 1977 and 1978 have been caused by other factors such as predation, climate conditions, disturbance, etc.?

(2) on what date was incubation first observed in 1979? Did the state biologists allow over five weeks to pass from this date in order to be certain that the eggs were in fact not viable?

(3) are transplants of captive-bred eaglets the most effective way of improving the status of the Bald Eagle in New Jersey? What cost-effective alternative actions might be considered?

(4) aside from transplants, what other eagle management activities are being undertaken in New Jersey? Are efforts underway to monitor nesting or roosting sites on a year-round basis and to protect them from disturbance, to provide protection for eggs and eaglets from predators, to acquire critical eagle habitat, or to monitor pesticide levels in water, sediment, or indicator species in the territory occupied by eagles?

We have reviewed "Pesticide Residues in Estuarine Mollusks, 1977 versus 1972—National Pesticide Monitoring Program" and "Organochlorine Residues in Estuaring Mollusks, 1965-72 —National Pesticide Monitoring Program" regarding current pesticide residues in the Delaware Bay, and offer the following summary.

Oysters were chosen for pesticide monitoring because, through the process of biomagnification, residues of DDT as high as 25 pp*m* accumulate in oyster tissues within 96 hours at a level of environmental contamination of only 1 pp*b*. When the water supply is no longer contaminated organochlorine residues are flushed rapidly from oyster tissues. They consequently reflect ambient water quality, and serve as a tool for measuring pollution levels accurately.

DDT spraying to control mosquitoes was discontinued in 1966, but it was not until 1968-1969 that DDT residues peaked in oyster samples on the New Jersey side of the Bay. Since then there has been a trend towards decreased residue levels. Samples collected in 1977 contained about one-third as much DDT as did samples collected in 1972.

DDE appears to be the major DDT metabolite affecting eggshell thinning. Sampling and analysis of eagle eggs have shown a straight line relationship between the rate of reproduction and the amount of DDE and dieldrin present: the higher the residues, the lower the rate of reproduction. It is therefore logical to assume that reproductive success should increase as the amounts of chlorinated hydrocarbons in the environment decrease. There is already some evidence that this process is underway in Osprey and Bald Eagle populations.

DDT residues in Delaware Bay from 1965-1977 have tended to be two to three times greater than those found in Maine and Maryland. It would make sense for our eagle population to lag behind those states in recovering from pesticide contamination. There is still plenty of food here for eagles, and if we act to preserve their nesting habitat, there is good reason to be optimistic about a comeback.

RECOMMENDATIONS:

Regarding the above questions and comments, the Cumberland Conservation League urges these following actions be taken:

(1) Read and review "Behavioral Responses of Wintering Bald Eagles to Human Activity" by Mark Stalmaster and James Newman (*J. Wildlife Management,* 42 (3) : 506-513) . The

findings should be immediately applied to Bald Eagle management in New Jersey. The intolerance of eagles to gunfire, and the suggested activity restriction zones, should be noted.

(2) All efforts should be taken to allow our remaining Bald Eagles to raise their own young, without disturbance or "overmanagement."

(3) Documented eagle nesting, roosting, and feeding areas should be preserved, in their entirety immediately. Purchase of critical habitat is of utmost importance. Acquisition is the only way in which eagle-use areas might be preserved for future generations of eagles and man.

The Cumberland Conservation League will be glad to work with the Division of Fish and Game to identify and acquire observed critical eagle habitat. Please do not hesitate to contact us. We hope these comments are useful in the establishment of a viable Bald Eagle management plan in New Jersey.

Daniel O'Conner,
President
Cumberland Conservation League

## BIBLIOGRAPHY


Bent, Arthur Cleveland. 1937. *Life Histories of North American Birds of Prey*. Smithsonian Institution, U.S. National Museum Bulletin 167. U.S. Government Printing Office, Washington, D.C. 409 pp. See pages 325-326 and 340-341.

Bothwell, Ford. 1979. "Masked Bandits Rob Eagles' Nest." *Philadelphia Journal*. Philadelphia, Pennsylvania. April 25, 1979. Page 36.

Butler, Philip A. 1973. "Organochlorine Residues in Estuarine Mollusks, 1965-72—National Pesticide Monitoring Program," *Pesticides Monitoring Journal*, Vol. 6, No. 4, March 1973. pp. 298-302.

Butler, Philip, Charles Kennedy, and Roy Schutzmann. 1978. "Pesticide Residues in Estuarine Mollusks, 1977 versus 1972—National Pesticide Monitoring Program," *Pesticides Monitoring Journal*, Vol. 12, No. 3, December 1978. pp. 99-101.

McLaughlin, Frank W. 1964. "Status of the Bald Eagle in New Jersey." *New Jersey Nature News*. New Jersey Audubon Society. Vol. 19, No. 2. June, 1964. pp. 66-75.

Snow, Carol. 1973. "Southern Bald Eagle and Northern Bald Eagle." *Habitat Management Series for Endangered Species Report No. 5*. Bureau of Land Management Technical Note 171. U.S. Department of the Interior, Washington, D.C. 58 pp. See pages 21-22.

Stalmaster, Mark V. and Newman, James. 1978. "Behavioral Responses of Wintering Bald Eagles to Human Activity," *Journal of Wildlife Management*, Vol. 42, No. 3. pp. 506-513.

Stone, Witmer. 1937. *Bird Studies at Old Cape May*. Delaware Valley Ornithological Club, Philadelphia, Pennsylvania. 941 pp. See page 291.


---

## FOOTNOTES

1. Witmer Stone. *Bird Studies at Old Cape May*, Vol. 1. (Delaware Valley Ornithological Club, Phila., Pa., 1937).
2. Bennett K. Matlack. "Nesting Eagles in South Jersey," *Naturalist Digest* (Audubon Center of South Jersey), Sept. 1952.
3. Frank W. McLaughlin. "Status of the Bald Eagle in New Jersey," *New Jersey Nature News* (New Jersey Audubon Society), Vol. XVIV, No. 2, June 1964. pp. 66-75.
4. Joseph Jacobs, personal communication to Alfred Nicholson, @ 1970.
5. McLaughlin, loc. cit.
6. Walter R. Spofford. "The Breeding Status of the Golden Eagle in the Appalachians," *American Birds*, Vol. 25, No. 1, Feb. 1971. pp. 3-7.
7. Clay Sutton. "New Jersey's Second and Third Ferruginous Hawks," *Peregrine Observer*, Vol. 3, No. 1, Winter 1980.
8. William S. Clark. 1978. Personal Communication.
9. "Chesapeake Bay Bald Eagle Banding Project—Report 1977," National Wildlife Federation, Raptor Information Center.
10. Alfred Nicholson. 1973 to Present. Personal communication.
11. *American Birds*, Vol. 32, No. 5, September 1978. pp. 984 & 1006.
12. *Hawk Mountain News*, April 1980. (Hawk Mountain Sanctuary Association, Kempton, Pa.)
13. Joe Jacobs. @ 1976. Personal communications.
14. Donald Kunkle. Cumberland County Christmas Bird Count, 1979.

15. Merril Cottrel. May 3, 1980. Personal communications.
16. Julian K. Potter. "Hawks Along the Delaware," *Cassinia,* No. XXXVII, (Delaware Valley Ornithological Club, Phila., Pa.) . pp. 13-16.
17. Frank W. McLaughlin. "With Each Farewell We are Poorer (Status of the Bald Eagle in New Jersey 1959-68)," *New Jersey Nature News,* New Jersey Audubon Society, Dec. 1968. p. 144.
18. "1980 Bald Eagle Survey—Cape May, Cumberland, and Salem Counties," Cape May Bird Observatory (New Jersey Audubon Society) .
19. Robert P. Allen and Roger T. Peterson. "The Hawk Migrations at Cape May Point, New Jersey," *Auk,* Vol. LIII, Oct. 1936. pp. 393-404.
20. Cape May Bird Observatory Official Hawk Watch, 1976-1979.
21. Jon Sutton. August 1978. Personal communication.
22. Peter Dunne. 1980. Personal communications.
23. Gary Paterson. 1976. Personal communications.
24. Ibid.
25. Ed Manners. August 1980. Personal communications.
26. Sid Walker, personal communications to Alfred Nicholson, @ Sept. 1979.
27. Sharon Brady. "An Assessment of the Birdlife of the Pinelands National Reserve/Pinelands Area." January 11, 1980.
28. Walter R. Spofford. "The Breeding Status of the Golden Eagle in the Appalachians." pp. 3-7.
29. Philip Butler, Charles Kennedy, and Roy Schutzmann. "Pesticide Residues in Estuarine Mollusks, 1977 versus 1972—National Pesticide Monitoring Program," *Pesticides Monitoring Journal,* Vol. 12, No. 3, December 1978. pp. 99-101.
30. "Chesapeake Bay Bald Eagle Banding Project—Report 1977," National Wildlife Federation, Raptor Information Center.
31. Alfred Nicholson. Personal communication.
32. Frank W. McLaughlin. "Status of the Bald Eagle in New Jersey." pp. 66-75.
33. Philip A. Butler. "Organochlorine Residues in Estuarine Mollusks, 1965-72—National Pesticide Monitoring Program," *Pesticides Monitoring Journal,* Vol. 6, No. 4, March 1973. pp. 298-302.
34. "Delaware Has 4 Bald Eagles," *Philadelphia Inquirer,* March 30, 1980. p. 4-C.
35. "Masked Bandits Rob Eagles' Nest," *Philadelphia Journal,* April 25, 1979. p. 36.
36. "Raccoon Again Eats Eggs of State's Last 2 Nesting Eagles," *Asbury Park Press,* May 25, 1980. p. A-15.
37. Greg Holjack (New Jersey Fish and Game) . @ Feb. 1978. Personal communication.
38. "Project Menaces Wildlife,'" *The Press* of Atlantic City, April 11, 1980.
39. Frank W. McLaughlin. "Status of the Bald Eagle in New Jersey." pp. 66-75.
40. Peter Mathiessen. *Wildlife in America* (Viking Press: New York: 1964) .

## LITERATURE CITED


Allen, Robert P. and Roger T. Peterson. "The Hawk Migrations at Cape May Point, N.J." *Auk,* Vol. LIII, October 1936, 393-404.

*American Birds,* Vol. 32, No. 5, September 1978. pp. 984 & 1006.

Brady, Sharon. "An Assessment of the Birdlife of the Pinelands National Reserve/Pinelands Area." January 11, 1980. (as submitted to the State of New Jersey Pinelands Commission)

Butler, Philip. "Organochlorine Residues in Estuarine Mollusks, 1965-1972—National Pesticide Monitoring Program." *Pesticides Monitoring Journal,* Vol. 6, No. 4, March 1973, 298-302.

———, Charles Kennedy, and Roy Schutzmann. "Pesticide Residues in Estuarine Mollusks, 1977 versus 1972—National Pesticide Monitoring Program." *Pesticides Monitoring Journal,* Vol. 12, No. 3, December 1978, 99-101.

Choate, Ernest A. "Hawk Watch Results at Cape May Point, 1965 & 1970." *Science Notes,* No. 11, March 9, 1973 (New Jersey State Museum) .

——— and J. D'Arcy Northwood. "40 Years of Christmas Bird Counts in Cape May County (1927-1966)." *Cassinia,* 1969.

Clark, William. Personal communication. 1978.

Cottrel, Merril. Personal communication. May 3, 1980.

"Delaware Has 4 Bald Eagles." *Philadelphia Inquirer,* March 30, 1980. p. 4-C.

Dunne, Peter. "Official Results of Cape May Bird Observatory Autumn Hawk Watch at Cape May Point, 1976-1979."

Galli, Joan. "Research and Management of Endangered Wildlife Species in New Jersey (Bald Eagle)." Federal Aid Performance Report. November 7, 1977.
*Hawk Mountain News.* April 1980. (Hawk Mountain Sanctuary Association, Kempton, Pa.)
Holjack, Greg. (New Jersey Fish and Game) Personal communication. @ February 1978.
Jacobs, Joseph. Personal communication to Alfred Nicholson. @ 1970.
Kunkle, Donald. (compiler) "Cumberland County Christmas Bird Count, 1950-1979."
Manners, Edward. Personal communication. August 1980.
"Masked Bandits Rob Eagles' Nest." *Philadelphia Journal.* April 25, 1979. p. 36.
Mathiessen, Peter. *Wildlife in America.* New York, Viking Press, 1964.
Matlack, Bennett K. "Nesting Eagles in South Jersey." *Naturalist Digest* (Audubon Center of South Jersey), September 1952.
McLaughlin, Frank W. "Status of the Bald Eagle in New Jersey." *New Jersey Nature News* (New Jersey Audubon Society). Vol. XVIV, No. 2, June 1964. pp. 66-75.
———. "With Each Farewell We are Poorer (Status of the Bald Eagle in New Jersey 1959-1968)." *New Jersey Nature News,* December 1968, 144.
National Wildlife Federation (Raptor Information Center). "Chesapeake Bay Bald Eagle Banding Project—Report 1977."
Nicholson, Alfred. Personal communication. 1973 to present.
Paterson, Gary. Personal communication. 1976.
Potter, Julian K. "Hawks Along the Delaware." *Cassinia,* No. XXXVII (Delaware Valley Ornithological Club, Phila., Pa.). 13-16.
"Project Menaces Wildlife." *The Press* of Atlantic City. April 11, 1980.
Seager, Keith. (compiler) "Cape May County Christmas Bird Count, 1967-1979."
Sutton, Clay C. "New Jersey's Second & Third Ferruginous Hawks." *Peregrine Observer,* Vol. 3, No. 1, Winter 1980.
———. Personal Field Notes.
Sutton, Jon. Personal communication. August 1978.
Spofford, Walter R. "The Breeding Status of the Golden Eagle in the Appalachians." *American Birds,* Vol. 25, No. 1, February 1971, 3-7.
Stalmaster, Mark and James Newman. "Behavioral Responses of Wintering Bald Eagles to Human Activity." *Journal of Wildlife Management,* Vol. 42, No. 3, 506-513.
Stone, Witmer. *Bird Studies at Old Cape May,* Vol. 1. Phila., Delaware Valley Ornithological Club, 1937.
Vogel, Tim. (compiler) "Barnegat Christmas Bird Count, 1925-1979."
Walker, Sid. Personal communication to Alfred Nicholson. @ September 1979.

ACKNOWLEDGEMENTS

The authors sincerely wish to thank Mr. Alfred Nicholson for his invaluable help and contributions during the course of this study. Not only were his sightings carefully noted and gratefully shared, but his 30 years of field experience with New Jersey's eagles and his intimate knowledge of their behavior and habitat were the basis on which the study was begun. Without Al Nicholson's background, interest, and stimulation this study would be far less complete. We also gratefully acknowledge his untiring struggle in the conservation movement in southern New Jersey.

Thank you's go to Mr. Don Kunkle for his review of the manuscript, and for the data he so kindly provided.

Also, we commend Mr. Gary Patterson for his example of boundless energy in the protection of the New Jersey Pinelands and for sharing his own Pinelands' eagle sightings and knowledge.

Clay will always remain indebted to the late Joe Jacobs for a memory of pleasant hours afield, his sharing of experiences, and for a model of what can be accomplished in ornithology in one's available extra time. Joe was instrumental in Clay's realization that certain conservation work can indeed be highly enjoyable!

We thank Mr. Ed Manners for his current and historical insights—a perspective that extensive New Jersey eagle banding has given him. We appreciate his shared thoughts and ideas.

R.D. 3, Box 7
Cape May Court House
New Jersey 08210