

This survey has provided a data base on 1984-85 population dynamics, ecological use and response to human disturbance on the Hudson River. The results are summarized by species.

Bald Eagles. Our observations revealed eagles along the Hudson year round, but the wintering population is by far the largest and most important. Our best day of observation was February 14, 1985, when seven bald eagles (5 immatures and 2 adults) were in sight at once at Iona Sanctuary and three immatures shortly thereafter at Mt. Beacon twenty miles to the north. Our total population estimate this year was placed at 12. The data also suggests the Hudson is more heavily used by immatures than adults. The vicinity of Iona Island is by far the location that attracts the most eagles. Fish are the most frequently captured food items along the Hudson - White Perch (Morone americana), Herring (clupeidae) and catfish (ictalulidae). Tall (over 35'), open structured deciduous trees with nearly horizontal limbs were by far the most frequently utilized perches. We had no observations of eagles perching on transmission lines or any other man-made structure. Eagles often remain on tree perches on Iona Island and Dunderberg Mountain until dark, certainly roosting for the night. Individual eagles remain for a few weeks at a time until mid-March when the lengthening days or perhaps increasing levels of human disturbance disperse the wintering population.

Ospreys. Our observations have revealed a surprisingly large number of osprey utilizing the Hudson in April and May with a few osprey remaining on the Hudson over the summer. Curiously, we found remarkably few osprey along the Hudson in the fall. We also found that osprey utilize only certain locations along the river. Osprey congregate at the mouths of tributary streams (Moodna and Fishkill Creeks on Cornwall Bay, Wappingers Creek and the Rondout at Esopus) where as many as 15 individuals have been seen at once. Estuarine marshes such as Tivoli and Piermont are also important. Cornwall Bay and Esopus Creek seem to be the most heavily used sites. Goldfish (Carassius auratus), are the ospreys primary prey species in the Hudson.

Peregrine Falcons. As of April 1985, there were four pairs of peregrines on New York City bridges. High bridges are now a preferred nesting site for the new peregrine populations. The bridges spanning the lower and mid-Hudson have been the focus of our attention with peregrines. In January 1985, a wintering peregrine was located on the Tappan Zee Bridge. By late March, this bird began perching around two of the boxes placed up in the bridge's superstructure although by the end of April dispersed, presumably because a mate never appeared. Our inventory of historical cliff eyries along the Hudson revealed only a glimpse of a bird that seemed to be a peregrine. There are three historical cliff eyries that we feel could still attract peregrines; Storm King Mountain, Crows Nest, and the trap rock quarry (Tilcon Corporation) at Haverstraw Bay. There are now about 40 pairs of peregrines nesting or exhibiting nesting behavior in the eastern U.S. Nesting peregrines along the Hudson seems imminent.

PROJECT DESCRIPTION

Objectives

The objective of this survey was to obtain regional information on habitat use, population dynamics and food habits of the bald eagles, osprey, and peregrine falcons that are now utilizing the Hudson River. This information is important to the re-establishment and protection of these raptors and also has direct application to other suburban locations where these birds occur. Specific goals vary with each species as follows:

Bald Eagles

Our primary goal with bald eagles was to locate the natural areas along the Hudson that these birds are utilizing. Other goals included documentation of population size, a determination of the prey species they are exploiting, and observations of their reactions to various forms of human disturbance. Seasonal use of the Hudson as well as any relevant incidental data would also be recorded.

Peregrine Falcons

During this survey, we systematically examined six Hudson River bridges, five historical cliff eyries, and other likely locations for evidence of use by peregrines. Our purpose was to locate courting or nesting pairs to assure protection from human disturbance and to provide nest boxes in situations where appropriate. The purpose of the nest boxes is two fold; 1) to evaluate their usefulness in locating birds since nest boxes are known to attract falcons and 2) to provide nesting pairs with optimum conditions for reproductive success in secure locations.

Ospreys

Our most important goal with this species was to identify the areas along the Hudson being utilized by ospreys and to determine if replica nests in areas of heavy use would elicit courtship behavior. Secondary goals were to evaluate the species composition of their food base and to investigate practical means of quantifying osprey use of the Hudson River.

PROJECT RESULTS

Bald Eagles

Our observations revealed eagles along the Hudson year round, but the wintering population is by far the largest and most important. Summer use of the Hudson by eagles is low. While there are no eagle nests in southern New York, every year since 1980, we have seen or have had confirmed reports of about two eagles each summer. The exposed tidal flats of Cornwall Bay have consistently attracted one or two eagles as have Constitution Marsh and Tivoli Bay. These are the only areas where we have recorded eagles during June, July, and August. Both adults and immatures, in about equal frequency were seen.

During the winter, the lower Hudson sustains many more eagles. Our observations during the winter of 1984-85 were highly productive with an estimated 12 eagles on the Hudson between Cornwall and Peekskill. Our best day of observation was February 14, 1985, when seven bald eagles (5 immatures and 2 adults) were in sight at once at Iona Sanctuary and three immatures shortly thereafter at Mt. Beacon twenty miles to the north. Our total population estimate this year was placed at 12, on the assumption that there were 2 more eagles present but not seen. The data also suggests the Hudson is more heavily used by immatures than adults.

We found the first eagle at Iona Sanctuary on November 20, 1984, a full month earlier than previously recorded. This bird used the area for the better part of a week. This early sighting suggests the Iona Basin may serve as a migrational rest stop for bald eagles. The total number of eagles migrating through southeastern New York however, is relatively low, with hawk watchers recording only 11 bald eagles passing over the Butler Sanctuary (@20 miles east of Hook Mountain) during the fall of 1984. Hawk watchers spent 72 days or 440 hours of observation at this site, one of the most intensively manned sites in the eastern U.S.

The Hudson River wintering populations begins to arrive towards the end of December, seems to increase steadily through January, peaks in early to mid-February, and diminishes through March. By early April, the last eagles are seen only occasionally. The vicinity of Iona Island is by far the location that attracts the most eagles. Constitution Island, just opposite West Point, is the second best location. North of Bannerman's Island in Cornwall Bay, there is usually very little open, ice free water and eagles are only infrequently seen here. Likewise, south of Peekskill Bay, wintering eagles are not often seen, although the river is usually ice free.

Because eagles utilize the stretch of river between Cornwall Bay and Peekskill Bay so heavily, we expended 225 man hours of observation in 1985 to determine why this portion of the Hudson is so important to bald eagles. As expected, several variables are operative here but food and habitat head the list.

1. Availability of Food. Our observations indicate that eagles are found most consistently where the Hudson River is most narrow. Fish are the most frequently captured food items along the Hudson as is the case in all other studies of bald eagles. (The results of our food habit studies are presented on page 9). The physical characteristics of the Hudson River are apparently very important factors affecting wintering eagles. The lower reaches of the Hudson supports more eagles because there is open water. While the ice breakers keep the river open to shipping as far as Albany, the channel is filled with slush, and this must prevent eagles from fishing. Where the Hudson River is narrow, it is deep, the surface currents change direction with the tide and there are conspicuous upwellings. The locations of these upwellings are constant year after year and coincide with repetitious foraging behavior by eagles. Nearly every time an observer was present for a reasonable duration (1-3 hours) eagles were seen foraging and actually catching fish. These upwellings bring live or very fresh fish such as white perch, herring (clupeidae) and catfish (ictalulidae) to the surface of the Hudson River where they are then vulnerable to predation by bald eagles. Since availability of food is nearly always the most important factor affecting wildlife populations, we must conclude from our observations that eagles are coming to the Hudson River for food.
2. Habitat. Our observations further indicate that the quality of bald eagle habitat is good along the Hudson River shoreline from Cornwall Bay south to Peekskill Bay. Tall timber and low levels of human disturbance have long been recognized as the most important components of bald eagle habitat. The land ownership patten along the Hudson here is especially favorable for eagles. There is a vast acreage of State land, two large military reservations, Black Rock Forest, three bird sanctuaries, several private estates, and three islands; all adding up to many thousands of acres of protected land. Forest regeneration along the once denuded shoreline began early on these protected lands so that today tall timber for night roosting and daytime perching is present here.

Daytime or diurnal perching behavior of bald eagles is relatively easy to observe. Tall (over 35'), open structured deciduous trees with nearly horizontal limbs were by far the most frequently utilized perches. Medium sized (20'-35'), open structured white pines or pitch pines were occasionally utilized by eagles.

On one occasion an eagle was seen perching on a rock pinnical in the old stone quarry at Iona Island. We had no observations of eagles perching on transmission lines or any other man-made structure. Bald eagles are known to be very wary and selective of their perches. Open, parkland habitat where tall trees stand out above a grassland or recent logging site is especially attractive to bald eagles. This may be yet another reason Iona Island attracts eagles.

Night time or nocturnal roosting by eagles is more difficult to study. We consistently found eagles flying low over the channel of river (foraging) in the first twilight of dawn. Our dawn observations indicated that the eagles were roosting nearby. Our late afternoon observations revealed eagles remaining on tree perches on Iona Island and Dunderberg Mountain until dark, certainly roosting for the night. We also observed eagles flying into the tall timber on the east bank of the river opposite Iona Island in the afternoon, apparently remaining for the night. Since most of these observations were done with telescopes at a range of nearly a mile, we could not keep the eagles in view until total darkness but we feel confident the birds remained in the immediate vicinity to roost for the night. In many cases, these roosts were very close to the railroad. The only form of human disturbance that caused eagles to leave their perches was an approaching pedestrian or hiker. Since Iona Island was designated an eagle sanctuary and closed to visitors December 1 to April 1, human disturbance here has been greatly reduced.

Individual recognition was frequently possible when observing the eagles on their perches or on floating ice pans as they fed or bathed. One sub adult with a patch of unmolted brown feathers of juvenile plumage was especially easy to identify. Through individual recognition and the ratio of adults to juveniles, we had at least an indication of turnover in this population. In general the eagles seem to stay on the Hudson for 1 to 3 weeks. They are definitely not all "commuting" to the Hudson from elsewhere or just casually drifting through.

From all of these observations we feel that the eagles are attracted to the Hudson because of the availability of food, and the quality of the habitat. With adequate perches, night roosts and tolerable levels of human disturbance, individual eagles remain for a few weeks at a time until mid-March when the lengthening days or perhaps increasing levels of human disturbance disperse the wintering population.

Ospreys

Our observations, research, and interviews have revealed no Osprey nesting along the Hudson River at present or in the recent past. While there is a substantial population of nesting osprey on Long Island and in the Adirondacks, we were able to obtain only records of osprey attempting to nest along the Hudson. Our observations have revealed a surprisingly large number of osprey utilizing the Hudson in April and May with a few osprey remaining on the Hudson over the summer. Curiously, we found remarkably few osprey along the Hudson in the fall.

We now have several hundred sighting of osprey utilizing the Hudson. All field observations by museum staff have been recorded in a bound journal with entries in standardized format to facilitate statistical analysis. Volunteer were furnished standardized forms. From these entries, we tabulated parameters such as hours of observation, osprey seen perched, flying, hunting, capture attempts, species captured, etc.

In general, we have found that osprey utilize only certain locations along the river and these locations are used differently in spring, summer, and fall. From mid-April through May the river supports a large number of migrating osprey. An accurate estimate of spring migrants is impossible. We might say that hundreds but not thousands of osprey utilize the Hudson in their spring migration to their vast Canadian nesting grounds. The key to understanding how many osprey utilize the Hudson during their spring migration is understanding the vastness of the Canadian wetlands.

Osprey congregate at the mouths of tributary streams (Moodna and Fishkill Creeks on Cornwall Bay, Wappingers Creek and the Rondout at Esopus) where as many as 15 individuals have been seen at once. Estuarine marshes such as Tivoli and Piermont are also important. The zone of clear water and the shallows associated with the mouths of tributaries offer osprey prime foraging conditions and high rates of successful prey capture. Cornwall Bay and Esopus Creek seem to be the most heavily used sites.

From June through August, only a handful of non-breeding osprey remain on the river. These summer osprey spend most of their time perched or loafing, making them very difficult to find. From September through November, large numbers of osprey migrate south along the ridges and uplands of the region where they are tabulated by hawk watchers. For example, one weekend in September 100 ospreys were counted in two days. However, very few osprey are seen on the river, and our observations suggest that some of these may be the same summer residents remaining through mid-October. The stretch of river from Newburgh south to Piermont Marsh appears to be more consistently used by ospreys than the upper reaches from Newburgh north to Tivoli Marsh.

During the spring a special effort was made to observe osprey behavior around replica nests to determine if these birds might be induced to pioneer or reoccupy the Hudson region. Under the World Wildlife Fund aspects of this study, six replica osprey nests were constructed - three on Cornwall Bay, one in Harvard Black Rock Forest, and two in Tivoli Marsh. The Tivoli nests have been in place for one spring, the others two. Nests such as these have been a successful restoration technique with osprey populations along the Atlantic Coast where osprey are already nesting.

This spring's observations of migrating ospreys may have revealed levels of interaction between the birds not seen in the previous two seasons of study. Ospreys exhibited their usual propensity for communal loafing around preferred foraging sites, while head to tail chases, vocalizations, wheeling and displacement activities seem to have been more prevalent than usual. Such parameters, however, are very difficult to quantify.

Recent studies of the populations dynamics of osprey point to a very strong role of tradition in nest site selection. Male osprey, in particular, seem to invariably nest within 30 kilometers of their natal area. This theory seems consistent with our observations of osprey on the Hudson - i.e., many migrants, a few summer residents, always catching fish easily but never nesting. Historical information describing total deforestation of Hudson River shoreline and extremely high levels of human disturbance during the Erie Canal days when the River was covered with sloops, all suggests an early destruction of the osprey's tradition of nesting along the Hudson. Re-establishing this tradition may not be easy.

Peregrine Falcons

The Hudson River peregrine eyries were thoroughly studied by the Herberts during the 1940's and 1950's (Herbert & Herbert 1969). At that time, eight pairs were nesting on cliffs along the River but all disappeared by 1962. As of April 1985, there were four pairs of peregrines on New York City bridges. High bridges are now a preferred nesting site for new peregrine populations. With vast nesting populations of pigeons and enormous numbers of roosting starlings and seagulls, Hudson River bridges seem analogous to maritime bird cliffs. The bridges spanning the lower and mid-Hudson have been the focus of our attention with peregrines. As a result of our publicity to enlist volunteer observers, a wintering peregrine was located on the Tappan Zee Bridge in January 1985. We subsequently, placed three nest boxes on this bridge with the permission of the New York State Thruway Authority. In late March, the falcon began perching and roosting around two of the boxes placed up in the bridge's superstructure although by the end of April dispersed, presumably because a mate never appeared. This peregrine's interest in our nest boxes further strengthens our belief that nest boxes can be helpful in attracting and locating peregrines before they actually nest.

We now have a total of nine nest boxes on the Tappan Zee, Bear Mountain, Newburgh-Beacon and Mid-Hudson Bridges as part of our overall study Project SOAR. These nest boxes provide peregrines with optimal nesting conditions--the gravel substrate necessary for a scrape as well as shelter for the downy chicks. Where peregrines have attempted to nest on bridges without nest boxes, their success rate has been low.

Our inventory efforts focused on the five Hudson River Bridges and eight historical eyries and were conducted between May and July in 1984-1985. Between two and three hours were spent at each site on several occasions, searching for falcons or the streaks of whitewash which typify their presence.

Of the Hudson River crossings from Haverstraw Bay to the Mid-Hudson Bridge only the Tappan Zee has been consistently attracting peregrines. According to American Birds, this was the second winter a peregrine took up residence on this bridge. A falcon had been seen twice this past winter during the course of eagle observations at Iona Sanctuary, and may have been the same bird as that at the Tappan Zee Bridge. In August of 1983, three recently fledged peregrines were reported to Peregrine Fund observers at the Newburgh-Beacon Bridge, and in that same month USDA workers at nearby Stewart Airport (Newburgh) reported two falcons there. No other bridges have so far had any reported peregrine activity or sign around them.

Our inventory of historical cliff eyries along the Hudson revealed only a glimpse of a bird that seemed to be a peregrine. This bird was seen on the cliffs of the Palisades just north of the George Washington Bridge where a peregrine was reported to us by other observers.

Many of the historical cliff eyries along the Hudson now receive such heavy recreational use, it is doubtful they will ever sustain nesting peregrines again. While peregrines seem to tolerate some level of human activity at the base of a nest site, the appearance of humans on top of their nesting cliff, looking down on the peregrines nest site seems to be among the most intolerable forms of disturbance. Today, many historical peregrine cliffs have heavily utilized trails along the most intolerable locations. Furthermore, forest regeneration on these historical nesting cliffs may prevent peregrines from nesting here now that the nesting tradition has been broken. There are, however, three historical cliff eyries that we feel could still attract peregrines; Storm King Mountain and Crows Nest (once alternate nest sites) and also the trap rock quarry (Tilcon Corporation) at Haverstraw Bay.

There are now about 40 pairs of peregrines nesting or exhibiting nesting behavior in the eastern U.S. The Peregrine Fund is experiencing a doubling of this population every two years. From our observations and from the Peregrine Fund's forecast, nesting peregrines along the Hudson seems imminent.

Evaluation of the Food Base

Our goal here was to determine the species composition of the prey base being utilized by ospreys and bald eagles and gain some insight into the availability of these species. Direct observation was a valuable technique for determining the more conspicuous aspects such as are the eagles catching fish or waterfowl? Prey remains were collected beneath feeding perches. Fish remains were identified by Dr. C.L. Smith of the American Museum of Natural History. Mammalian and avian remains were identified by C. Keene and D. Mildner.

Ospreys

Our data base is now the cumulative result of three years of field work. We have many observations of osprey catching fish, many more observations of osprey perched with fish, and about 50 collections of prey remains from beneath their habitual perches. From this we were able to determine that Goldfish (Carassius auratus), Alewives (Alosa pseudoharengus), Bullheads (Ictalurus sp), Carp (Cyprinus carpio), Centrachids (Bass and Sunfish) and Pickerel (Esox sp) are the most important prey species in that order. In April and early May when the alewives run, this species might be taken more frequently than Goldfish, as osprey are seen foraging well upstream on major tributaries known to have alewife runs. At this time of year Goldfish are congregating in the shallows of the Hudson. All things considered though, Goldfish are taken over the entire season that osprey are present and are thus the primary food source.

The significance of Goldfish as a major constituent of the ospreys diet touches on PCB contamination, population fluctuations of Goldfish, furunculosis, as well as historical considerations. Goldfish are, of course, an introduced species so exactly when they became abundant in the Hudson is at least noteworthy. If the Hudson River Goldfish population has been decimated by furunculosis, osprey can still obtain them very easily. We timed a total of 21 hunting flights and the average hunting time per successful flight was 10 minutes. We had no observations of osprey catching eels, a habit thought to be an indication of food stress by Paul Spitzer, an osprey researcher whose opinion is highly regarded. A recent paper on osprey habitat and productivity (Hughes 1982) concludes that benthic-feeding fish are the most easily captured by osprey and that piscivorous ones are most difficult. In this same study, Carp, (closely akin to Goldfish) were found to provide a superior food base for osprey.

Bald Eagles

Our data for this species is based on two winters field work. From daily observations and from prey remains collected from beneath preferred diurnal perches, we can say that fish are the primary food item for bald eagles wintering on the Hudson. Waterfowl are only occasionally pursued or captured. On one occasion a common merganser (Merqus merganser) was pursued but not captured; the remains of a single mallard (Anas platyrhynchos) were collected under one perch. We have only one observation of an eagle feeding on a deer carcass and one instance of a cottontail rabbit being eaten.

In contrast, we have about 30 observations of eagles catching fish from the river and the remains of fish have been collected for identification. A live feral Goldfish (Carassius auratus) was observed taken on one occasion, and J. Mead of the Bear Mt. Trailside Museum reported an immature eagle feeding on the carcass of a European Carp (Cyprinus carpio) and on that of a striped bass (Morone saxatilis).

Of the fish remains we collected, five were white perch (Morone americana) in the 6"-8" size range, one a large (5-7 lbs.) White Catfish (Ictalurus catus), and two Herring (Clupeidae). We had no observations of eagles feeding on Tomcod (Microgadus tomcod), a species in which cancerous tumors have recently been identified. All of the species we identified occur as common food items in other studies of wintering bald eagles. If White Perch are a primary food item for wintering eagles, the Hudson may have great potential for eagles since White Perch are among the most abundant species in the River.

Response to Human Disturbance

In a heavily populated region such as the lower Hudson Valley, some attention must be directed towards how these endangered and threatened species react to various levels of human disturbance. Birds of prey exhibit more tolerance while hunting and to a lesser extent while loafing at preferred diurnal perches. Night roosting and nesting (breeding) birds are much more susceptible to disturbance.

Our observations of ospreys tend to support these contentions. While on the wing and hunting, ospreys seem unphased by humans. They often hovered and attempted to or took prey within 50' of field observers and fishermen. They likewise seemed unconcerned with people fishing from boats in important foraging areas and during the autumn showed disregard for duck hunters in blinds. Birds with prey would return to preferred perches if not within sight of people. These birds would often flush when approached, and 75-100m seemed to be a critical distance. The same was true for birds at their night roost. But with the extensive and heavily forested shoreline, ospreys were never forced to travel too far to relocate.

The same was not necessarily true for bald eagles. Their preference for tall trees with horizontal branches and open crowns greatly reduces their available perches. This is compounded by the fact that these perches must be near their preferred foraging sites which are limited to narrow, ice free stretches of the River.

Our fixed observations were made $\frac{1}{4}$ mile from the eagle's preferred hunting site at Iona. The birds were unconcerned with our presence. They also exhibited little fear of large ships on the River.

Perched and feeding or loafing birds were readily disturbed by people on foot. Although the Iona Sanctuary is closed during the winter, access to the area is still available through the railroad right of way and this is the greatest source of disturbance. Trains and vehicles travelling the right of way had no effect on the birds at all.

Unless disturbed, eagles would sometimes remain at their diurnal perches to night roost or relocate high up on Dunderberg Mt. during fair weather. Strong winds and bitter cold or intolerable human activity would usually send the birds into the deeper recesses of Harriman Park.

In summary, the most intolerable level of human disturbance we observed was the appearance of a pedestrian or hiker along the shoreline of the Hudson River. This would invariably cause eagles to depart the area. During bitter cold, windy weather, few people are present on the Hudson's shoreline and bald eagles are most frequently seen. This factor may be most important to wintering eagles. Shoreline protection, in terms of habitat and human disturbance, is clearly essential to the sustained existence of bald eagles on the Hudson River.

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