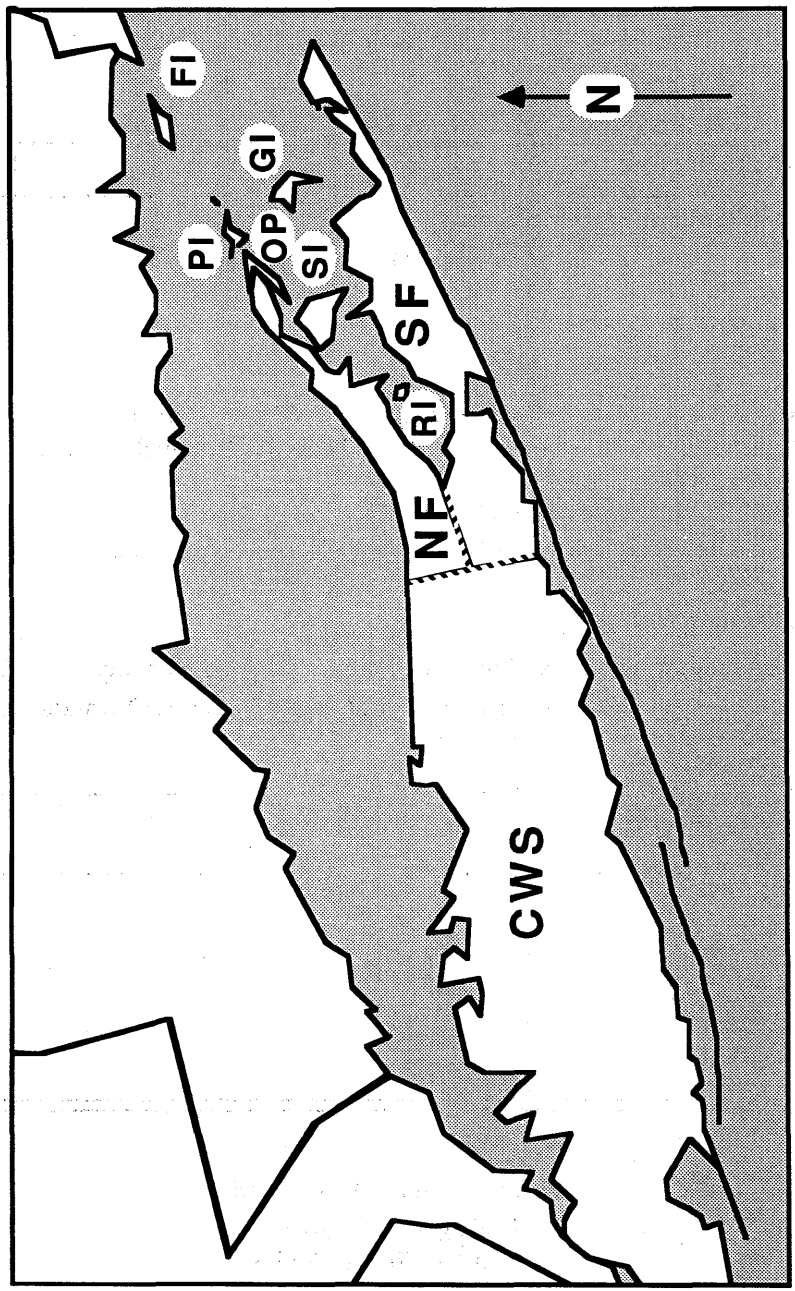

Figure 1. Osprey nesting regions on Long Island, New York. CWS - Central and Western Suffolk; NF - North Fork; SF - South Fork; RI - Robin's Island; SI - Shelter Island; OP - Orient Point; PI - Plum Island; GI

OSPREY PRODUCTIVITY ON LONG ISLAND 1978-1987: A DECADE OF STABILIZATION

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The Osprey (*Pandion haliaetus*) population of Long Island, New York is part of an isolated, discrete breeding population that ranges from New York City to Boston, Massachusetts (Spitzer 1980). For the first half of this century, it exhibited great success. It was considered to be one of the largest known concentrations of nesting Osprey in the United States, and it was thought to contain the densest known colony in the world on Gardiner's Island (Chapman, 1908). In 1948, with the introduction of DDT, an organochlorine pesticide later found to adversely affect eggshell development, Osprey productivity on Long Island began a period of severe decline (Spitzer and Poole, 1980). The pesticide was ingested by the Osprey through their primary food source, fish. The fish had absorbed the DDT and its toxic metabolites from eating contaminated prey from areas that received runoff from the agricultural lands and wetlands that had been treated with the pesticide. Since the Osprey is at the top of this food web, it became the victim of a phenomenon known as biological magnification (Spitzer and Poole, 1980). Simply stated, each fish absorbed a small amount of the toxin from the prey it consumed and stored the toxin in its tissues. The Osprey consumed many fish, and thereby absorbed and retained large amounts of the toxin. DDT and its metabolites, such as DDE, cause eggshell thinning and ultimately lower hatching rates. Between 1948, when DDT was first used on Long Island, and 1972, when the Environmental Protection Agency banned its use following a successful local lawsuit (Poole and Spitzer, 1983), the Osprey population along the southern New England coast dropped 90 percent (Spitzer and Poole, 1980). This decline was so well correlated with the use of DDT, that Spitzer (1980) called DDT use "an Osprey reproductive failure experiment". In 1969, the declining use of DDT, increased public awareness of such environmental issues, and human intervention in the form of nest pole construction helped to start the recovery of productivity in this Osprey population. The next decade saw a steady recovery, and in 1977 the first population growth was seen (Spitzer and Poole, 1980). That same year, the New York State Department of Environmental Conservation began a regular annual survey of the nesting Osprey of Long Island. We have assembled that data into a summary of the following decade, a decade of population stabilization.

METHODS

Data for this study were collected by New York State Department of Environmental Conservation personnel during the years 1978 to 1987. Aerial and ground techniques both were used in the surveys. Two aerial surveys were done each breeding season, one in mid May and the second in July. The May survey was carried out in a fixed-wing aircraft and consisted of flying over all previously known nest locations, as well as any new locations reported by local observers. This survey was used to find active nests, which were defined as nests with adult Ospreys observed in an incubating posture.

The follow-up survey in July consisted of an aerial survey from a rotary-winged aircraft. All active nests were revisited and young in the nest were counted. This count was used to estimate the number of young fledged. Some young had not yet actually fledged, and others had fledged and were out of the nest, so this count was assumed to produce a good estimator of total fledged young.

Ground site visits were carried out for the first three years of data collection, mostly to highlight and confirm aerial survey results and to obtain detailed knowledge of nest distribution. Four or five visits were made to each site per breeding season to observe progressive nesting activities. These surveys were discontinued in 1980 because of time constraints on personnel and because it was felt that the aerial survey results were sufficiently accurate. The data obtained from 1980 to 1987 were collected from aerial surveys only.

Data were grouped into nine arbitrarily delineated zones on Long Island (Fig. 1). The central and western Suffolk zone covered from the Riverhead town line, west to the end of the island. It was named for Suffolk County because, when the surveys began in 1977, the westernmost active Osprey nest was in central Suffolk County. Since that time, the birds have spread farther west into Nassau County and in 1988, there were reports of a pair possibly residing at Jamaica Bay in Queens County. The South Fork zone consisted of the entire south fork of Long Island from an extension of the Riverhead town line, east to Montauk Point. The North Fork zone covered the whole north fork of the island, from the Riverhead town line east, up to, but not including the marshes at Hallock's Bay. Those marshes made up the Orient Point zone. The Robin's Island, Shelter Island, Gardiner's Island, Plum Island, and Fisher's Island zones included only the land on those respective islands.

The data were also summed into a category for the whole region. We chose to use this category for our summary for several reasons. First, it allowed a broad overview of the whole Long Island population as a unit,

which we felt would offer more valuable information than a view of arbitrarily delineated zones. Second, it allowed us to avoid the fluctuations in the individual zone data caused by movement of the birds from one zone to another. Ospreys generally return to nest in an area at or near their previous nesting site, or near the nest in which they were born (Ames and Mersereau, 1964; Henny and Wight, 1969; Spitzer, 1980). Due to habitat and space limitations, and perhaps even nest destruction, some would be forced to move such that they would cross the zone boundaries, which have little meaning to the birds. This movement would affect an increase in productivity for one zone and decrease it in another, causing fluctuations of the data in those zones. The net effect on the productivity of the whole region, however, is nothing. We have assumed that most relocation of Ospreys has occurred within the region of Long Island and its outlying islands. Therefore, a study of that region as a whole would be the best indicator of productivity trends there.

Productivity trends were determined for the whole region and for individual zones by running simple linear regressions of the productivity figures over the ten year period in question. Regression equations were calculated on an IBM PC microcomputer using a MINITAB version 5.1.1 statistics software package. Significance tests were run at a 95 percent confidence level using t-values calculated by MINITAB.

We used the variable of young fledged per active nest as a measure of productivity, because it has been traditionally used in the literature (Ames and Mersereau, 1964; Henny and Wight, 1969; Peterson, 1969; Henny and Ogden, 1970; Henny, 1972; Henny, *et al*, 1977; Spitzer, 1980; Spitzer and Poole, 1980) and because it is considered a statistically viable indicator of productivity status (Bernstein, *pers. comm.*). Bernstein (*pers. comm.*) is presently researching other variables for use as statistically valid indicators of productivity.

RESULTS

Our first impression of the data plots for the whole region was that productivity had leveled off and was stabilizing. The regression and subsequent significance test supported this view. A regression over the ten year period showed that there was no significant trend in the data, but the slope of the regression line (m=0.02218) indicated a slight increasing tendency. The only significant outliers were an extremely high productivity in 1981 (1.41 young per active nest), and an extremely low productivity in 1982 (0.73 young per active nest). All other points fell within the 95 percent confidence range. Regressions were also run for the first five years, and the second five years, but the data still

yielded no significant trends. The slope of the regression line for the first five years (m=-0.00600) indicated a slight decreasing tendency, and the slope of the regression line for the second five years (m=0.02900) indicated a slight increasing tendency.

Regressions of the data grouped into individual zones yielded similar insignificant results. The only significant trend that was found was in the Central and Western Suffolk zone. The slope of the regression line for this zone (m=0.09127) indicated a significant increase in young fledged per active nest there. None of the other zones demonstrated significant trends, but it was interesting to note their tendencies. The South Fork (m=0.01030), North Fork (m=0.01636), Orient Point (m=0.02012) and Gardiner's Island (m=0.05000) zones all showed increasing tendencies of various degrees. The Robin's Island (m=-0.06630), Shelter Island (m=-0.00788), Plum Island (m=-0.07642), and Fisher's Island (m=-0.00800) zones all showed decreasing tendencies of various degrees. A point of interest here is that all of the areas which display decreasing tendencies are small islands extending from the east end of Long Island. Gardiner's Island, however, differs from these in that it does not display a decreasing tendency.

DISCUSSION

The general leveling off trend observed in the data may be explained by the fact that the Osprey may have reached a sufficient productivity level to maintain their population. This assumes that environmental factors are limiting their further growth in some way, and that the population is a self-sustaining one. Henny and Wight (1969) calculated that 1.22 to 1.30 young needed to be produced per active nest in order to maintain a stable population of Osprey in New York and New Jersey. These figures were considered to be reliable enough to be applied to other east coast populations as well (Henny and Ogden, 1970). The mean productivity value for the Long Island Osprey population over the ten year period of 1978 to 1987 was 1.104 young per active nest. Assuming mortality rates declined after Henny and Wight's study due to the ban of DDT, and that their calculated values for maintaining the population would therefore be slightly lower, it seems reasonable to suggest that the productivity on Long Island is at a level which would maintain the population at its present status. Poole (1980), however, estimated that a productivity rate of 0.79 young per active nest needed to be produced in order to maintain the population along the Atlantic coast between New York City and Boston. If this figure is considered more accurate, due to its more recent calculation, the mean productivity rate suggests the population is actually expanding.

The low productivity figure from 1982 was attributed to prolonged inclement weather during incubation and hatching of the Osprey in that

season (Puleston, unpublished data). Weather data (NOAA, 1982) for Long Island for that breeding season indicate that precipitation in central and western Suffolk County was 7.28 to 8.40 inches (18.5 to 21.3 cm) above the normal. Precipitation on the South Fork at Bridgehampton was 12.09 inches (30.7 cm) above the normal, and on the North Fork at Riverhead was 8.09 inches (20.5 cm) above normal in June, 1982. Most Ospreys are hatched in late May or early June (Chapman, 1908; Brown and Amadon, 1968; Henny and Wight, 1969), and they are most vulnerable to mortality in their first month of life (Henny and Wight, 1969). This inclement weather coincided with the first month of life for most of the Long Island Ospreys, and there is little doubt that it is what caused the severe decline in young fledged per active nest in that year, either through exposure, or perhaps even drowning in the nests. The greatest declines were in the Gardiner's Island, Plum Island, and Fisher's Island zones. These three islands are located off the eastern tip of Long Island in open water, and are probably quite vulnerable to severe weather. Lesser declines were seen in all of the other zones as well.

The high productivity figure in the preceding year is not as easily explained. It is easy to blame bad weather for failure, but one cannot conversely say that good weather necessarily leads to success. Bad weather can be defined easily, but good weather cannot. The peak in productivity could be due to any number of environmental factors including weather, food supply, nesting site availability, or immigration. There were only five more active nests in 1981 than in 1980, and it is unlikely that they could have skewed the data so strongly, so immigration may be ruled out. Of the individual zones, the North Fork zone had the greatest increase in productivity from the previous year. The South Fork, Orient Point, Plum Island, Fisher's Island and Gardiner's Island zones each contributed to the increase to a lesser extent. The Shelter Island and Central and Western Suffolk zones remained constant from the previous year, and the Robin's Island zone decreased in productivity.

The significant increase in productivity seen in the Central and Western Suffolk zone may be accounted for by the increase in the number of productive active nests in the zone during the study period. Between 1978 and 1987, the number of productive nests increased by a factor of ten; more than in any other zone. This may be due to to any of the environmental factors listed above, but in this case, immigration is also a possible cause. During the study period, Ospreys expanded westward on Long Island, which may account for the increase in productivity there.

The decreasing tendencies displayed by the outlying islands, though not significant, are intriguing. It is curious to note that Gardiner's Island is the only outlying island that shows an increasing tendency. This may be due to predation. Gardiner's Island is free from any native or introduced mammalian predators (Puleston 1972), such as Raccoons (*Procyon lotor*), which have been known to prey upon nests on or close to the ground (Ames and Mersereau, 1964). There is also little human disturbance or development on Gardiner's Island (Puleston, 1972), which also may play a role. Further study is required before any solid conclusions may be drawn on this point.

The noise which obscure trends in the data from the individual zones is probably due to movement of birds from one zone to another. This hypothesis is testable through banding and field observation studies. However, due to the Osprey's breeding cycle, such a study would require a minimum of three to four years to track each year's hatchlings. This time constraint, coupled with costs involved, make this sort of project unfeasible for anyone other than State or Federal wildlife research units.

Based on the lack of a significant trend, either increasing or decreasing, in data for the whole Long Island region, I would conclude that the productivity of the Osprey population of Long Island has stabilized, with some natural fluctuation, over the decade of 1978 to 1987. The mean productivity value, when compared to Poole's (1980) estimate for maintenance of the population, suggests that the population is increasing.

SUMMARY

A regression analysis of Osprey productivity data from Long Island, New York shows a level trend with no significant increasing or decreasing trend for the period of 1978 to 1987. There was a significant increase in productivity in Central and Western Suffolk County, possibly due to increased nesting there. There was a significant peak in productivity in 1981, and a significant drop in productivity in 1982 on the whole island region.

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