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The Restoration of Ospreys *Pandion haliaetus* to Breeding Status in Pennsylvania by Hacking (1980-1986)

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INTRODUCTION

The use of agrochemicals and habitat alteration caused the serious decline in Osprey (*Pandion haliaetus carolinensis*) breeding activity in Pennsylvania in the 1950s and 60s. Never known to have been an abundant inland breeder, it had begun to decline before the turn of this century (Spitzer & Poole 1983).

In late 1979 researchers at East Stroudsburg University developed a hacking programme as a means of restoring Ospreys to breeding status in north-eastern Pennsylvania. They were familiar with Peregrine Falcon (*Falco peregrinus*) and Bald Eagle (*Haliaeetus leucocephalus*) hacking programmes conducted a few years earlier (Cade & Temple 1977; E. Milburn & T. J. Cade, pers. comm.) but no literature was available concerning Osprey hacking. Initial hacking was done in the summer of 1980 and results were reported at the Raptor Research Meeting in Duluth, Minnesota, in the fall of that year (Schaadt & Rymon 1983).

STUDY AREA AND METHODS

The study area is located in the Pocono Mountains of north-eastern Pennsylvania which encompasses the broad east-west Appalachian Plateau. Its geological history shows repeated glaciation, much erosion and the formation of a ridge and valley province which has been heavily dissected by several large rivers and their tributaries. In addition to these, many glacial lakes and man-made impoundments are found throughout. Vegetation cover is mixed deciduous-coniferous forests of oak (*Quercus* spp.), maple (*Acer* spp.), beech (*Fragus* spp.), elm (*Ulmus* spp.), birch (*Betula* spp.), pine (*Pinus* spp.), hemlock (*Tsuga* spp.) and spruce (*Picea* spp.). The understory is mixed *Kalmia latifolia, Rhododendron* sp., *Vaccinium* spp. and *Cornus* spp.

A very adequate fish population is found in larger lakes and reservoirs in and around the hacking areas. These range from 300 to 500 ha and are surrounded by tree-lined shores up to 30km long. The most common prey species found were suckers (*Castostomus* spp.), carp (*Cyprinus carpio*), catfish (*Ictalurus* spp.) and various members of the family *Centrarcidae* (Rymon & Katzmire 1986).

Local electrical and telephone utility companies provided services to construct 10 hacking towers at four locations over a 25km radius. Each tower was built on four 8-m utility poles sunk to a depth of 1.5m and spaced 2m apart in a square pattern. A 2m x 2m platform was built between the poles 7m above the ground and two 3-m planks were placed below the nest structures. These planks extended beyond the poles and provided support for an adjacent observation blind constructed of preassembled panels. The nest compartment was supported by 5 x 10cm 2-m long planks, nailed to the platform base. An artificial stick nest was arranged in each nest chamber and lined with dried grass.

The nest platforms were enclosed with preassembled sides and roof panels to prevent prefledging and predator attacks. The sides consisted of 4cm wide vertical wooden slats spaced 6 to 8cm apart. A 2 x 2cm mesh wire was used to cover the top panel and a 1 x 1m piece of plywood was placed over it to shelter the nestlings from sun and rain. The front panel was fitted with strap hinges and rope pulleys so that it could be lowered to a horizontal position for fledging. Complete details of hacking methods are described by Schaadt (1981), Schaadt & Rymon (1983) and Sherrod *et al.* (1982).

Hacking

The first year of hacking (1980) began as a trial with six donor nestlings translocated from the Chesapeake Bay area and placed on hacking towers in the Pocono Mountain region. They were hand-reared and carefully observed throughout nest dependency and after fledging at approximately 8 weeks of age. Most of the donor birds in that and succeeding years were 6 wks old when obtained but some were as young as 4 wks and a few as old as 7 wks. Student interns and graduate assistants served as hack site attendants and fed the nestlings pieces of fish previously caught and stored in freezers. The fish were cut into finger-sized strips, placed on the end of a split green stick and offered to the young through a hole in the blind. All observations were made through a two-way mirror to prevent association between attendants and the food supply. At 7 wks the nestlings were able to stand on their toes and grasp large chunks of fish, thus reducing the effort by attendants. Multiple B vitamin supplements were added to all frozen fish to prevent thiamine (vitamin B1) deficiencies.

Banding and feather dyeing

All donor chicks were banded with U.S. Fish and Wildlife Service –8 lock-on aluminium bands and coloured plastic leg bands. The coloured bands were wrap-around alphanumerics 2cm in width with 1cm x 0.5cm engraved letters and numbers. These could be read at a distance of 0.5km with a Questar 1300mm spotting scope, In 1985 25 donor nestlings were also marked with blotches of red and yellow feather dyes on the underside of secondaries and primaries. The yellow dye chosen was a supersaturated solution of picric acid (phenol, 2,4,6-trinitro-) and Kodak Rhodamine B (tretraethylrhodamine). Colour combinations were unique for each bird and proved to be highly visible at distances of over 1km in flight. The dyes remained visible throughout August but had faded by early September, thus making the young less conspicuous and perhaps less vulnerable.

Sexing

Probable sexes were determined morphologically by size and appearance of pectoral feather patterns (Prevost 1983). This method, however, was not considered reliable enough for a post-fledging study conducted in 1985 and a Wolffe laproscope was employed to verify morphological techniques. Sample (N = 16) birds were examined by laproscopy and probable sexes proved to be 100% correct with a 60% male/40% female ratio (Fortman 1985).

Release and post fledging

Of the 100+ birds fledged from hacking towers (1980-86), 90% fledged at the estimated age of 8 wks. A few fledged early and had to be recovered and returned to the hacking towers for later release, while a few remained in the towers for a week or so after their age group had fledged. Fledglings usually left the hack towers smoothly on their first flights and perched in trees or man-made structures nearby. Usually within hours or several days they returned to the hack towers to rest or feed on cut-up fish provided by the attendants.

After they began to return regularly to the towers to roost and feed, they also started to show innate fishing behaviour. The time scale for each to become independent of tower feeding was highly variable and ranged between a few days and several weeks post fledging. At no time was any attempt made to "wean" or cut back fish provided for them at the hack towers. During several hacking seasons young would return to the towers to feed on occasion until southward dispersal as late as late September (Schaadt & Rymon 1982).

RESULTS AND DISCUSSION

Releases and returns

During the summers from 1980 to 1986 a total of 111 donor nestlings from the Chesapeake Bay area (Virginia and Maryland) were translocated to four hacking areas in north-eastern Pennsylvania. The original releases (1980-81) were small (N = 10) and no positive identification of those birds has been made. Subsequent releases were larger: 1982 (N = 22), 1983 (N = 28), 1984 (N = 18) 1985 (N = 25) and 1986 (N = 6). Known mortalities were considered to be very low (N = 9) and handling and rearing both went smoothly in all years.

Original expectations for returns were based on banding data which suggest that most young birds spend two winters in Tropical American wintering grounds before returning to their natal sites to nest. After that 50% will breed as 3-year-olds, 30% as 4-year-olds and the remaining 20% will not breed for the first time until they are 5-year-olds. These data also showed that individuals often return to nest within comparatively few km of their natal sites (Spitzer & Poole 1983).

The experience in Pennsylvania has been one of great site-fidelity of returning birds. The first returns came in 1984, when 3 two-year-olds appeared at their respective hacking areas. In 1985, 6 (1982 released) three-year-olds and, in 1986, 23 colour-marked adults returned to the vicinity of the hacking locations.

Nesting

The first sign of nesting was in 1985, when four nests (all built by 1982 released males) were located. One male constructed a nest atop a 15m nest pole erected only two days earlier. He began frequent "fish" or courtship flights and attracted an unbanded migrating female, copulated with her for several days and lost her due to disturbance by industrial construction work nearby. Later that season (1985) he continued courtship behaviour until fledglings from the nearby hacking tower began to perch on his nest pole. His behaviour changed immediately to that of parenting and for the remainder of the summer until fall dispersal he fostered up to nine hacked young. At the peak of feeding he was delivering one fish per 10 min interval.

Nesting success

The first successful courtship and nesting activity was observed in 1986 when the same male mentioned above returned to his nest pole on April 5 and immedately began courting an unbanded female (thought to be the same female he mated with in 1985 because of pectoral pattern). Once again industrial work at the steam electric generating station on the site disturbed the pair. A new nest pole was quickly put in place 0.75km from the original pole on April 8 and the pair started to build there on April 10. On April 13 a second pair of banded four-year-olds was found nesting near another hack site 35 km from the first location. This pair built atop a 6m nest pole erected over the water in January 1986. Fully-lined nest cups were completed by both pairs before April 19 and egg laying began on or about April 26. The first hatching took place on the nest over the water just prior to June 3.

Four additional active nests were located over a 35 km radius during the 1986 season. One was built on another 6m pole over water, one on the superstructure above a dam at a reservoir hack site and two in 15 to 20m white pine (*Pinus strobus*). All nests were completely lined and attended. The furthest nest from any hacking area was near another reservoir 16 km away. The greatest dispersal noted (1986) was a female (thought to be a 1983 release) found nesting on an arm of Lake Champlain, Vermont, 400 km north-east of the nearest hacking (P. Spitzer pers. comm.).

Productivity

In 1986, two active nests produced four chicks, all of which survived through fledging and dispersal towards wintering grounds. One brood (N = 3) was produced by a pair hacked within 200m of their nest site in 1982. The second pair consisted of a four-year-old banded male and an unbanded female. The male was hacked at the site of nesting and also fostered hacked young there in 1985. This pair successfully reared one chick which also dispersed southward in September. The production of four young, through dispersal, by four-year-old hacked Ospreys at two north-eastern Pennsylvania locations is the first completely documented case of hacked Ospreys producing successful young. It is also the first well-documented case of Ospreys nesting in Pennsylvania in many decades.

CONCLUSION

A total of 23 banded hacked Ospreys returned to Pennsylvania in 1986. Six complete fully-lined nests were built in the vicinity of four hacking sites which released birds from 1980-86. Two pairs produced four chicks, all of which dispersed on southward migration in September. The behaviour of the hacked adults appeared to be normal and the prey base of the interior waterways was very adequate. Some territorial conflicts arose at the active nests when other banded adults returned to the same area. Three of the nests built (N = 6) were started late and assumed to have been past the normal egg date for the area. One unsuccessful nest was built by a four-year-old male that copulated with several three-year-old returned females but was unable to form a bond. The same male had returned to the same site since 1984 and also built an unsuccessful nest there in 1985. Two nests were built in white pine snags 10 to 16 km from the nearest hack sites. These nests indicated that nesting dispersal had begun and further radiation can be expected in future years. Of the 10 nests built in 1985-86, seven were built on man-made structures and three in trees.

The results of this seven-year hacking effort have indicated that this is a viable means of reintroducing Ospreys in areas of suitable habitat. The full cycle, from pioneering with a species with no previous record of being hacked to documentation of successful reproduction, is evidence that this method has much potential for widespread implementation.

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