

MONITORING AND CONSERVATION OF FINNISH OSPREYS *PANDION HALIAETUS* IN 1971–2005

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Since 1971, authorized voluntary ringers have checked almost all known Finnish nest sites of the Osprey *Pandion haliaetus* annually. Finnish Osprey population remained on the same level through the seventies, increased from 1982 to 1994 by about 3% per year and, since then, has remained "stable". In 2005, of 1541 potential nest sites checked, 926 were occupied, 753 active and 699 successful. Productivity has improved considerably during the last decades and was in 1996–2005: 1.65 large nestlings per occupied territory, 2.04 per active nest and 2.25 per successful nest. The positive trend of Finnish Osprey population can be attributed (1) to decreased persecution during migration and wintering, (2) to decreased impact of environmental toxicants, and (3) to construction of artificial nests to compensate the losses caused by modern forestry. At present, almost 50% of the Finnish Ospreys breed in artificial nests constructed by voluntary ringers.

Key words: Osprey, *Pandion haliaetus*, population trend, productivity, persecution, environmental toxicants, land use, modern forestry, artificial nests.

МОНИТРИНГ И ОХРАНА СКОПЫ (*PANDION HALIAETUS*) В ФИНЛЯНДИИ В 1971–2005 ГГ. П. Саурола. Музей национальной истории Финляндии, Университет Хельсинки, Финляндия.

Начиная с 1971 г. кольцеватели-любители ежегодно проверяют практически все известные гнезда скопы *Pandion haliaetus* на территории Финляндии. Популяция скопы в Финляндии оставалась неизменной в 1970-е гг., затем росла примерно на 3% в год с 1982 г. до 1994 г. и с тех пор остается «стабильной». В 2005 г. из 1541 проверенных потенциальных гнездовых участков 926 были заняты, в 753 были сделаны кладки, и в 699 гнездование было успешным. Продуктивность гнезд значительно выросла за последние десятилетия, составив в 1996–2005 гг. 1,65 подросших птенцов на одну занятую территорию, 2,04 – на гнездо с кладкой и 2,25 – на успешно гнездящуюся пару. Положительную динамику популяции скопы в Финляндии можно объяснить: сокращением прямого преследования в период миграций и зимовки, снижением воздействия экологически токсичных веществ и сооружением искусственных гнездовий для компенсации их утраты в связи с текущей лесохозяйственной деятельностью. На сегодня, почти 50% скоп в Финляндии используют для гнездования искусственные сооружения, построенные кольцевателями-любителями.

Ключевые слова: скопа, *Pandion haliaetus*, динамика популяции, продуктивность, преследование, экологически токсичные вещества, землепользование, современное лесное хозяйство, искусственные гнездовья.

INTRODUCTION

The Osprey *Pandion haliaetus* is a cosmopolitan species, which is distributed all over the world and can be encountered in all continents except in the Antarctica. The Osprey has suffered heavily from several human impacts. Persecution, environmental toxicants, fishery practices and land use have been the main factors, which have reduced both survival and productivity in Osprey populations (e.g. Saurola & Koivu 1987, Poole 1989, Saurola 1997).

In Finland, the Osprey breeds all over the country: from the southern archipelago (60° N) to the northernmost Lapland (70° N). Because the Osprey eats almost exclusively live fish, its distribution is primarily determined by the distribution of favourable fishing waters. For a good nest site the Osprey needs a safe, stable and exposed base to support

the nest. The breeding densities are highest in areas where these two prerequisites are filled. In Finland, the most suitable Osprey habitats are found along the coasts of Gulf of Finland and Gulf of Bothnia, and in the central lake district in southern Finland (Saurola & Koivu 1987).

On the basis of sporadic observations, the Finnish Osprey population decreased in the beginning of the 20th century due to the heavy persecution. During the World War II, the Osprey population slowly recovered, but decreased again from the 1950s to the early 1970s, this time due to both heavy persecution during migration and wintering, especially in Soviet Union and some Mediterranean and African countries, and to detrimental effects of the DDT and other environmental toxicants (Saurola & Koivu 1987, Saurola 1997).

In this contribution I will (1) introduce the Finnish Osprey monitoring scheme, *Project Pandion*, (2) demonstrate the population trends during the last 35 years, and (3) discuss the threats and conservation of the Finnish Ospreys.

MATERIAL AND METHODS

Project Pandion

In 1971, the Finnish Ringing Centre started a nationwide monitoring programme, *Project Pandion* (Saurola 1980, 1995). As a start, inquiries about the nest sites of Ospreys were addressed through mass media to the general public all over the country. Then all information gathered on potential nest sites was distributed to the ringers, who wanted to participate in the project on the voluntary basis, i.e. without any compensation of travelling or any other kinds of costs. Each nest site was pointed only to one ringer, who was then responsible for checking the site. This way the potential competition between ringers was avoided and the disturbance at the nest sites was minimized.

The normal annual routine carried out by a ringer at an Osprey nest is the following.

(a) To fill in a form which includes: (1) all observations on the breeding success, (2) coordinates of the site with the accuracy of at least 100 meters (Finnish National Grid), (3) description of the nesting habitat (type and amount of human influence), (4) description of the nest site (e.g. species, status, height and diameter at the base and at the top of the tree), (5) information on prey remains found.

(b) To ring the nestlings and to measure their wing length and body mass.

(c) To collect dead nestlings, unhatched eggs, eggshell fragments and feathers for analysis of environmental contaminants.

(d) To put a fibreglass label on new nesting trees. The label indicates (1) that the nest site is protected year round, (2) that all disturbances (including photography) in the neighbourhood of the nest are prohibited during the breeding season, and (3) that the nest site is known to the *Project Pandion*. Thus, after the very first year, general public have been requested to report only the unlabelled Osprey nests to the Ringing Centre.

Since 1972, the authorized voluntary ringers have checked more than 90% of occupied Osprey territories known by the *Project Pandion* every year. E.g. in 2005, 1541 potential nest sites were checked and 926 occupied territories detected. Of these 753 were active (eggs were laid) and 699 successful (young were produced). By 2005, there were altogether 44,977 records in the Osprey computer file (one record = all information in one year from one nest site, including the unoccupied ones).

Ringing and recoveries

In 1913–2005, 38,950 Ospreys have been ringed in Finland, of these 36,360 (93%) during the *Project*

Pandion. In the last ten years, the annual ringing total has varied from 1200 to 1400 individuals. In contrast to many other species and due to the nationwide *Project Pandion*, Ospreys have been ringed all over the country, from southern coast to Lapland.

Up to the end of 2005, altogether 2977 recoveries and “interesting” recaptures of 2833 different individuals have been reported. I have classified a recapture as “interesting”, if the bird had moved at least 10 km from the location of the previous recapture or if the time elapsed from the previous recapture had been at least three months.

RESULTS

Population trend

According to the “hard” data produced by the *Project Pandion*, the Finnish Osprey population remained more or less on the same level through the 1970s, increased from 1982 to 1994 by about 3% per year, and, since then, has remained more or less “stable” (fig. 1). However, a part of the population “increase”, especially in sparsely inhabited northern Finland, may be only a result of increased survey coverage. The present population estimate is 1200 breeding pairs (Saurola 1997).

Productivity

The productivity of Finnish Ospreys has increased considerably during the three last decades (fig. 2). In the 1970s, the average production of young was: 1.37 large nestlings per occupied territory, 1.81 per active nest, and 2.01 per successful nest. During the last ten years (1996–2005), the corresponding averages were: 1.65, 2.04 and 2.21.

Causes of death

Of the “final” encounters of each individual, 58% were of birds reported dead with additional information on the cause of death. Of these 1529 Ospreys, 40% were killed deliberately by man, 31% died because of various fishing operations, and 14% were hit by overhead wires. Finnish Ospreys have been killed in altogether 58 different countries (see fig. 3). Those on the top of the list are: Italy (74 individuals killed), Ukraine (56), Russia (37), Mali (36) and Nigeria (35).

Survival

Both for science and for conservation, estimates of survival rates are as important as the estimates of productivity. However, it is much more difficult to obtain relevant data on survival than on production of young. The most reliable estimates of age- and time-specific survival rates are based on sufficient number of both (a) ring recoveries of birds found dead, and (b) recaptures/resightings of birds encountered alive (see e.g. Francis & Saurola 2004).

In the 1970s and 1980s, several methods to catch adult Ospreys at the nest were developed and more than 200 different adults were caught at least once in a local study area in southern Finland.

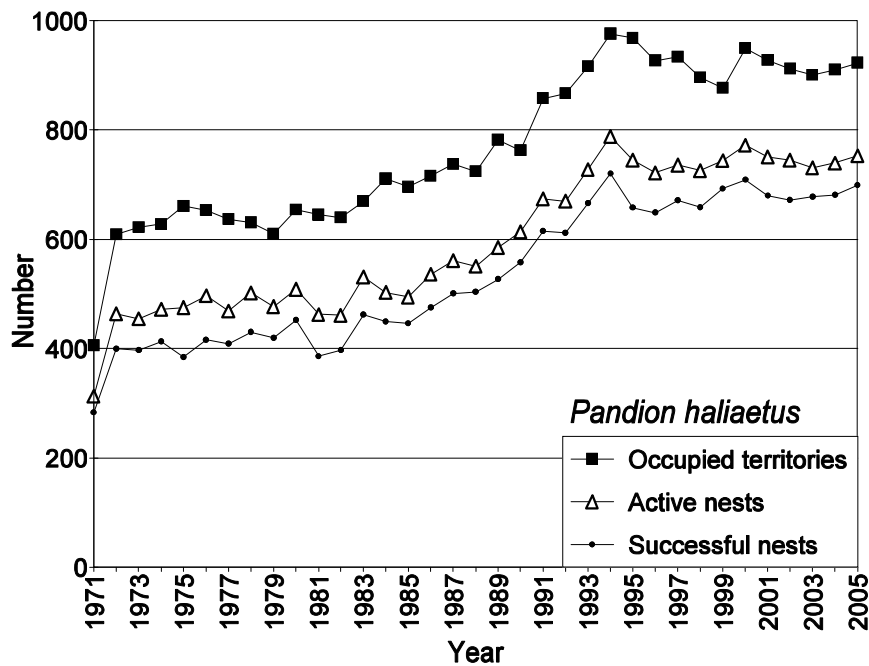


Figure 1. Numbers of occupied, active and successful nests of Finnish Ospreys *Pandion haliaetus* checked in 1971–2005.

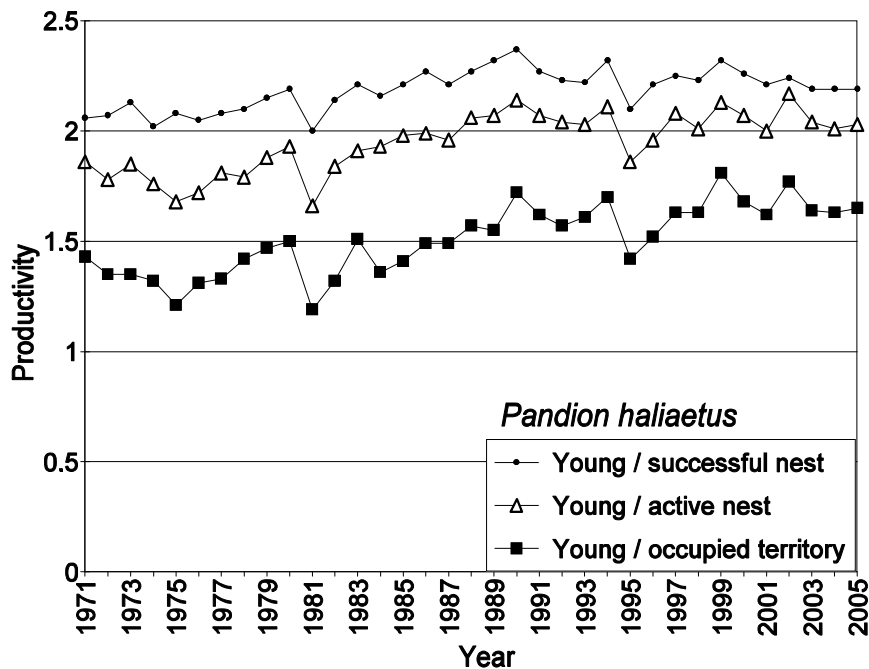


Figure 2. Productivity of the Finnish Ospreys *Pandion haliaetus* in 1971–2005.

However, due to many practical difficulties in trapping adult Ospreys in closed forest habitats and to the low quality of individual colour rings, this activity did not continue effectively enough in the 1990s. Thus, accurate and reliable estimates of survival rates of Finnish Ospreys are not yet available.

The distribution of ring recoveries by age classes indicates, however, as expected, that a remarkable proportion ("40%") of Finnish Ospreys die during the first year of life. The longevity record of the Ospreys ringed in Finland is 26 years, which is, as well, the highest age of the Osprey so far recorded in the world.

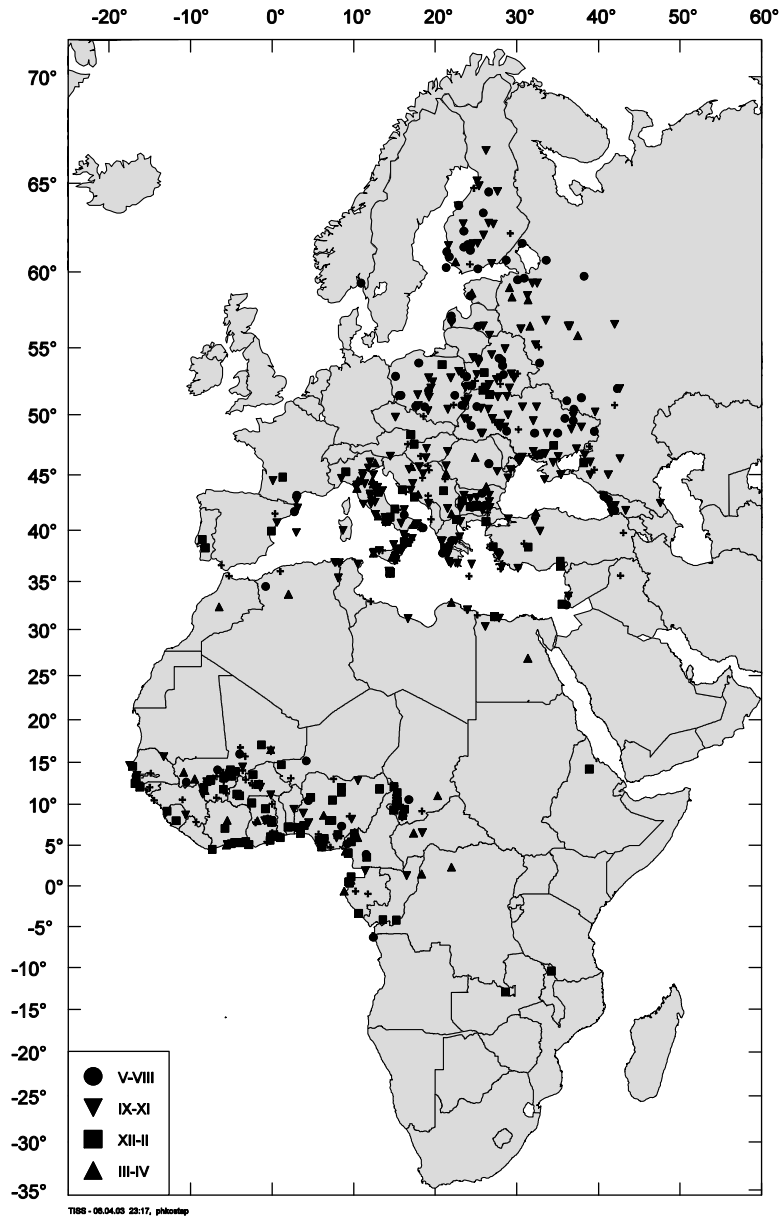


Figure 3. Spatial distribution of encounters of Ospreys *Pandion haliaetus* ringed in Finland and reported as killed by man. Seasons indicated by the following symbols: circle = May–August; triangle, pointing down = September–November; square = December–February; triangle, pointing up = March–April; cross = finding date inaccurate.

Dispersal

Altogether 38 male and 34 female Ospreys ringed as nestlings in Finland have been recaptured as breeders at the nest. According to these data, the *natal dispersal distance*, i.e. distance from fledging site to the first breeding site, was significantly shorter in males (median = 27 km, maximum = 433 km) than in females (median = 133 km, maximum = 534 km). In addition, three females and one male ringed as nestlings in Sweden have been recaptured as breeders in Finland, 380–480 km away from their natal sites. When the “random” recoveries of adult birds ringed as nestlings and found

dead by the general public during the breeding season were used for estimating natal dispersal, the distances distributed exactly as could be expected from a mixed data set of both sexes (median = 68 km; $n = 212$).

“Lack of information about dispersal has begun to limit progress on several biological fronts” (Walters 2000). Adequate knowledge of dispersal is of crucial importance in understanding population dynamics, as well as in planning adequate conservation measures, e.g. reintroduction programmes in cases when the local population has become extinct.

Migration and wintering

The very high number of encounters of marked birds gives a good general picture where Finnish Ospreys spend the non-breeding season (figs. 3 and 4). During migration they have been encountered all over Europe from the British Isles to Russia. Further, ring recoveries show that the wintering area of Fin-

nish Ospreys is very wide: from the west coast of West Africa to Arabian Peninsula and from the Mediterranean to the southern coast of South Africa (cf. Saurola 1994). Thus, the changes in the Finnish Osprey population are linked to the environmental and cultural changes in large areas in Europe and Africa.

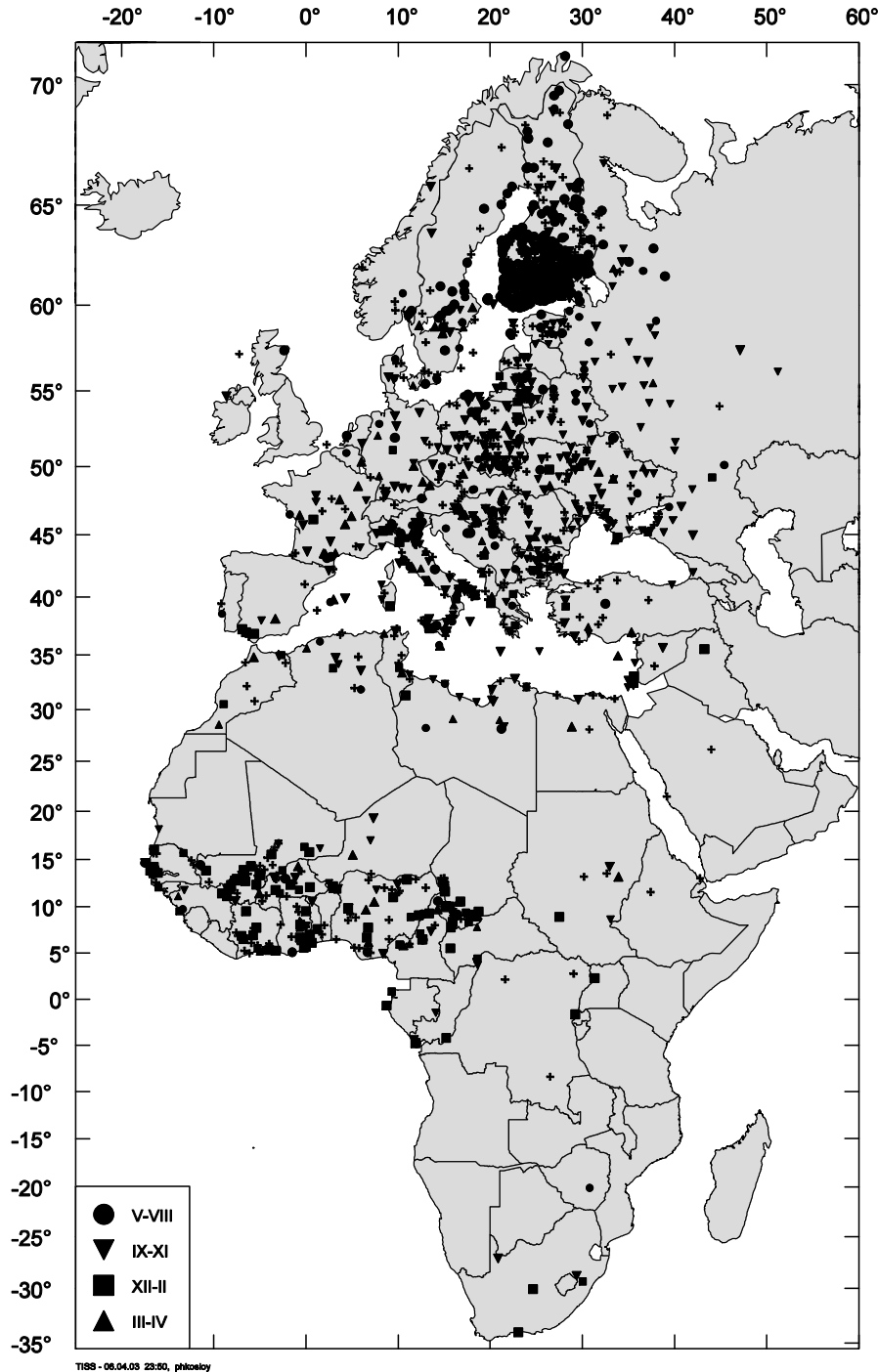


Figure 4. Spatial distribution of encounters of Ospreys *Pandion haliaetus* ringed in Finland. Encounters reported as killed by man excluded (see fig. 3). Seasons indicated by the following symbols: circle = May–August; triangle, pointing down = September–November; square = December–February; triangle, pointing up = March–April; cross = finding date inaccurate.

The picture based on ringing has been recently supplemented with satellite tracking, which has produced, in addition to purely scientific data, important information for conservation as well (see <http://www.fmnh.helsinki.fi/satelliteospreys/>).

Satellite tracking has demonstrated that, in addition to breeding and wintering sites, conservation of good stopover areas along the migration routes seems to be important for the Ospreys as well as for many other migrating species of birds (e.g. Saurola 2005).

DISCUSSION

At present, Finnish, as most of the other European Osprey populations which have been monitored carefully, have been either increasing or have remained on the same general level during the last two decades (Saurola 1997). E.g. in Germany (Schmidt 2001 and Daniel Schmidt pers. comm.) and Scotland (Dennis and Dixon 2001 and Roy Dennis pers. comm.) the growth rate has been about 8% per year. The most encouraging example has been recorded in a state-owned forest area of 25,000 hectares in central France, where the population increased from one pair in 1990 to 18 pairs in 2003, or in other words 27% per year (Thiollay & Wahl 1998, Wahl & Barbraud 2005)! In 1997, Schmidt and Wahl (2001) recaptured in this area one breeding male and two females, which were ringed as nestlings in Germany, more than 900 km from their breeding sites. This indicates that at least part of the rapid increase was due to long distance natal dispersal.

The favourable trends of the European Osprey populations are due to several causes, which will be shortly discussed below.

Persecution

In the beginning of the 19th century, Ospreys were breeding throughout Europe. Due to heavy persecution, which started as early as the 17th century and peaked during the 19th century, local populations decreased rapidly and, in many countries, the species became extinct during the first decades of the 20th century. During the World Wars I and II, killing of birds of prey decreased, but continued again after the wars (see Bijleveld 1974).

In Finland and Sweden, the Osprey has been fully protected since the late 1920s. However, the legal protection was given to the Osprey less than 50 years ago in many other European countries along the migration route of the Finnish Ospreys: e.g. in the former USSR in 1964 and enforced in 1974, and in Italy in 1971 (Saurola 1980).

Because legal protection does not always mean that killing ceases, I have tried to estimate the changes in persecution in Europe and Africa by calculating persecution indices from ring recoveries (Saurola 1980, 1994). This analysis suggested that hunting pressure on the Ospreys really decreased

significantly in the 1970s all over Europe, but it has remained on the same level in Africa during the last decades.

Environmental toxicants

In the late 1940s and 1950s, DDT and other environmental contaminants appeared as a new threat to the future of Ospreys all over the world (e.g. Poole 1989). DDT metabolites caused disturbances in calcium metabolism of females; the egg-shell thickness decreased, eggs broke during incubation, and breeding success decreased. After the ban of the use of DDT in developed countries, concentrations of DDT metabolites in the Osprey eggs have decreased, as indicated e.g. by studies in Sweden (Odsjö & Sondell 2001).

In Finland, since the start of *Project Pandion*, bird ringers have collected addled Osprey eggs for further analysis of contaminants. The results of the analysis made so far have shown a highly significant decrease in the sDDT (= total DDT) concentrations in the Finnish Osprey eggs: the geometric mean of sDDT decreased from 63.6 (in 1971–1975) to 17.4 ppm/lipid weight (in 1991–1992, Saurola unpubl. data). During the same period, there was no significant change in sPCB level, which was quite low already in the early 1970s (overall geometric mean was 32.8 ppm/lipid weight during 1971–1992).

In 2004, a new project was started to analyse the trends in dioxin and toxic PCB congener concentrations in the addled Osprey eggs collected during 1971–2006 in Finland.

Fishing and fish farms

Ring recovery analysis has indicated that fishing and fish farms have caused many Osprey deaths both intentionally and unintentionally during breeding, migration and wintering. In Finland, the most dangerous time for Ospreys is early spring, when most of the fishing grounds are still covered by ice. At this time many Ospreys have been found drowned in nets in small areas of shallow open water exploited both by Ospreys and by (mainly amateur) fishermen.

At commercial fish farms, Ospreys have been killed both by illegal shooting and by wrongly placed strings or nets set to protect fishes. Nowadays the Finnish fish farms are quite safe for the Ospreys, because the government pays compensation to the owners from damages caused by the Ospreys. E.g. in 2002, according to information from the Ministry of The Environment, altogether 19 fish farms growing mainly Canadian rainbow trout *Oncorhynchus mykiss* claimed that the damage caused by the Ospreys was 102,961 euros in total. Of this sum, 39,032 euros were compensated by the Ministry of The Environment (Matti Osara pers. comm.).

The present system seems to work, but it has been criticized as well. Firstly, it is very questionable to subsidise rainbow trout farming at all, because it pollutes both the inland and Baltic waters. Sec-

only, the estimate of "damage" is based too much on the information from farms. Thirdly, if public money has to be used, then it should be used, instead of annual compensation, to construction of proper protection nets, which will prevent the damages and no compensation is needed in the future.

Land use

At present, land use is one of the main conflicts between the Osprey and man. In many areas Ospreys have been forced to move away from the primary habitats along the shore of the sea or lakes because of tourism, recreation etc. In Finland, only about 15% of occupied nest sites are close to the shoreline. The dream of every Finn is to have a summerhouse and *sauna* by the lake or in the Baltic archipelago. In addition, sailing, canoeing, bathing, angling and other recreational activities concentrate to those areas, which are still free from summerhouses. Hence, there is less and less undisturbed shoreline left for Ospreys. In many cases the historic nest sites have been abandoned, and the Ospreys have been forced to move to the middle of forests, several kilometres from their historic nest sites and fishing grounds.

The Finnish conservation law states clearly that it is forbidden to disturb breeding of any bird species. On the other hand, "every man's right" states that everybody can move freely, without permission from the landowner, everywhere except in the very few areas, such as strict nature reserves and military areas.

Forestry and peat industry

Saurola (1997) has recently discussed the detrimental effects of modern forestry on European Ospreys. Habitat destruction by modern forestry and peat industry is a continuous threat to all birds breeding in forests and peat bogs, although the official guidelines have improved during the last years in many countries. Modern forestry may have four kinds of negative effects on the welfare of the Osprey: (a) cutting of occupied nest trees, (b) cutting of potential alternative nest trees, (c) cutting of trees from the protection zone around the nest, and (d) disturbance from forestry activities in the neighbourhood of the nest during the breeding season.

Because the Osprey is fully protected in all European countries, the occupied nest trees should be protected during the breeding season throughout Europe. In Finland, the nests and nesting trees are fully protected during the non-breeding season as well.

Protection of just the occupied nest tree is not enough, because of the "evolution" of the top of the tree occupied by the Osprey. The Osprey brings every year new sticks to the nest, which grows higher and higher. Finally the nest falls down and most probably breaks some important branches. After this, the quality of the top is lower than it was to serve as a solid base for the nest. Thus, within each territory, a sufficient number of old, flat-

topped nest trees should be saved as alternative nest trees for the future.

Even if all trees around the nest tree are removed, the Osprey most probably don't abandon the site, although the probability of breeding failure increases for several reasons: (a) a solitary tree is much more exposed to damage caused by storms, (b) the disturbance zone of many activities (forestry, sports, recreation) is wider in open clear-cuts than in closed forests, and (c) a nest in a solitary tree is more vulnerable to predators, especially to the Eagle Owl *Bubo bubo*.

Inappropriate timing of forestry work in the neighbourhood of the nest has caused several breeding failures in Finland. Construction of logging roads, digging of forest ditches, harvesting, improving of young stands and planting seedlings are all activities which should be forbidden in the neighbourhood of the nest during courtship, incubation and brooding periods.

Guidelines for forestry

Metsähallitus (the former Finnish Forest and Park Service) published in 1994 new guidelines for forestry in state-owned land. According to these guidelines at the nest site of the Osprey

- a) the nest tree is protected all year under the Nature Conservation Act,
- b) protective tree stand (density 200 stems/ha) must be left around the nest for a radius of 50 metres,
- c) bog surrounding the nest tree must be left in natural state,
- d) all forestry activities must be avoided close to the nest during 15 April–31 July,
- e) old Scotch Pines *Pinus silvestris* and, in addition, saw timber trees must be left in clumps for future development into ideal new nest sites,
- f) paths and hiking routes must not be established within 500 metres from the nest.

These guidelines for state-owned and private lands would be sufficient for the protection of Finnish Ospreys. In practice, however, the guidelines are on private lands only recommendations and therefore not necessarily followed by the foresters.

Artificial nests

Construction of artificial nests has been the only direct measure to compensate for the effects of modern commercial forestry. In Finland, the first artificial nests were constructed in 1965. Now, four decades later, in practice a half (47–49%) of the Finnish Ospreys breed in artificial nests constructed by voluntary bird ringers to compensate the high-quality natural nest sites destroyed by one-track forestry. In my own intensive study area in southern Finland, the percentage of artificial nests has been more than 90% already for two decades. I have estimated that the population in that area would be less than 50% of the present level without artificial nests. In such areas the Ospreys are, unfortunately, "prisoners of artificial nests".

Construction of artificial nests has been an effective tool in conservation of Ospreys. However, protection of natural nest trees and their surroundings should always be the primary goal. Construction of artificial nests should be used only as the very last and temporary measure to save or reintroduce local populations, but never as an excuse to destroy natural breeding habitats.

Finnish Osprey Foundation

The Ministry of The Environment and the regional Environment Centres have the official responsibility for all nature conservation in Finland. In addition, a non-governmental organization, *The Finnish Osprey Foundation*, was founded, on the basis of the money produced by a book on the Osprey (Saurola & Koivu 1987), in 1990 to promote especially the conservation of the Osprey by collecting money from private companies and general public. The foundation has constructed an *Osprey Centre*, where ordinary people can get information on the conservation and research on the Osprey and, as well, make personal observations and photographs of fishing Ospreys from a close distance, without disturbing them.

CONCLUDING REMARKS

(1) During the last decade, local Osprey populations in northern and central Europe have been stable or recovering from the effects of persecution and environmental toxicants. These two threats are not anymore major problems in Europe, but they still may be problems for European Ospreys wintering in Africa.

(2) In contrast, habitat destruction caused by modern forestry, peat industry, tourism and recreation is still an important negative factor for the Osprey in many areas. More clear and strict official guidelines and positive recommendations are needed to protect traditional and new nesting habitats of the Osprey all over Europe.

(3) Construction of artificial nests has been an effective tool in conservation of Ospreys. However, it should be used only as the very last measure to save a local population and never as an excuse to destroy natural habitats and nest sites.

(4) All conservation must be based on reliable ecological information. Continuous and systematic population monitoring and ringing are both vital elements in conservation. In Finland, the role of well-trained *amateur* ringers, i.e. lovers of their passion, birds, has been crucial for conservation of Finnish Ospreys.

Acknowledgements. This contribution is mainly based on the *Project Pandion*, a landmark of raptor conservation erected by Finnish bird ringers.

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