# MONITORING "COMMON" BIRDS OF PREY IN FINLAND IN 1982–2005

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In 1982, the *Raptor Grid,* a nation-wide programme for monitoring both diurnal and nocturnal "common" birds of prey was started by the Finnish Ringing Centre. Voluntary ringers were asked to select a 10 x 10 km study plot and find annually all active nests or at least locate occupied territories of birds of prey from their study plot (annual total has averaged 120). Since 1986, additional information has been collected with the *Raptor Questionnaire*. After that, more than 40,000 potential nest sites of birds of prey have been checked annually. During 1982–2005, most of the Finnish populations of birds of prey remained on the same general level, although the annual fluctuations of vole specialists have been extensive. In the Honey Buzzard *Pernis apivorus*, Goshawk *Accipiter gentilis*, Common Buzzard *Buteo buteo* and Eagle Owl *Bubo bubo* the population trend has been negative during several years. In contrast, the populations of Kestrel *Falco tinnunculus* and Pygmy Owl *Glaucidium passerinum* have increased steeply due to extensive nest box projects. International cooperation is needed to monitor nomadic species.

*Key words:* Birds of prey, monitoring, population changes, productivity, survival, ringers.

**МОНИТРИНГ «ОБЫЧНЫХ» ВИДОВ ХИЩНЫХ ПТИЦ В ФИНЛЯНДИИ В 1982-2005 гг. П. Саурола.** Музей национальной истории Фнляндии, Университет Хельсинки, Финляндия.

В 1982 г. Финский центр кольцевания птиц запустил общенациональную программу мониторинга как дневных, так и ночных «обычных» хищных птиц «*Сеть мониторинга пернатых хищников*» (*Raptor Grid*). Кольцевателей-добровольцев попросили выбрать участок 10x10 км и ежегодно выявлять все гнезда с кладками или, по крайней мере, занятые территории хищных птиц на этих участках (общая цифра за год составила, в среднем, 120). Начиная с 1986 г. дополнительная информация собирается при помощи *Анкет по хищным птицам*. С тех пор ежегодно проверяется более 40 тыс. потенциальных гнездовых участков хищных птиц. В 1982–2005 гг. большинство популяций хищных птиц в Финляндии оставались, в целом, на одном и том же уровне, хотя состояние численности видов, специализирующихся в своем питании на полевках, значительно варьировало по годам. Динамика популяций осоеда *Pernis apivorus*, тетеревятника *Accipiter gentilis*, канюка *Buteo buteo* и филина *Bubo bubo* в течение нескольких лет была отрицательной. Популяции пустельги *Falco tinnunculus* и воробьиного сычика *Glaucidium passerinum*, напротив, резко выросли благодаря реализации масштабных проектов по установке искусственных гнездовий. Для мониторинга кочующих видов необходимо развивать международное сотрудничество.

*Ключевые слова:* хищные птицы, мониторинг, популяционные изменения, продуктивность, выживание, кольцеватели.

## INTRODUCTION

Efficient monitoring is a vital part of nature conservation in a rapidly changing world. Reliable information on present population status, including size, productivity, survival and dispersal and their annual fluctuations, is necessary to predict long-term trends and to formulate sound management measures. The Northern Spotted Owl *Strix occidentalis caurina* is an example of a bird of prey species which has been monitored really professionally, thanks to the basis of remarkable funding by the government (see e.g. Forsman *et al*. 1996). Unfortunately, in most countries respective funding is only a dream, and the actual resources are insufficient to conduct the necessary fieldwork.

In Finland, both the Christmas Bird Count and the Breeding Bird Survey programmes (e.g., Koskimies & Väisänen 1991) have produced valuable data for monitoring common land birds. However, these programmes do not produce relevant data for monitoring birds of prey. Up to the early 1980s, the only monitoring programmes for birds of prey were on the White-tailed Sea Eagle *Haliaetus albicilla*, Peregrine *Falco peregrinus*, Golden Eagle *Aquila chrysaetos*, and Osprey *Pandion haliaetus* (Saurola 1985). Separate reports on the status of these species and the Gyrfalcon *Falco rusticolus* in Finland are presented elsewhere in this volume.

The quality of Finnish amateur ornithologists (ca. 10,000) including, especially, the bird ringers (686 licenses in 2005) is very high. During the last 20 years, ringing of both diurnal and nocturnal birds of prey has had, for several reasons, a high priority (Saurola 1987a). Hence, more than a half of the Finnish ringers have been interested in research and conservation of birds of prey.

In 1982, the Finnish Ringing Centre, with some support for administration from the Ministry of The Environment, started a monitoring project called the *Raptor Grid* to monitor diurnal and nocturnal birds of prey (Saurola 1986, 1997). Since 1986, additional information on breeding performance has been collected with the *Raptor Questionnaire* (Saurola 1997).

This contribution will describe these monitoring techniques based on voluntary work and present some examples of the results on selected species.

## MATERIAL AND METHODS

### Population changes

The *Raptor Grid* programme is completely based on voluntary fieldwork by raptor ringers. When the project started in 1982, ringers were asked (1) to establish a study group consisting of both ringers and other bird-watchers, (2) to select a 10 x 10 km study plot, based on "even-ten-kilometers" of the Finnish National Grid, and (3) to try each year to find all the active nests or at least the occupied territories of the diurnal and nocturnal birds of prey in their study plot (Saurola 1986). The annual routine for each study plot includes: (1) listening for territorial hoots of owls, (2) watching aerial display of buzzards and hawks, (3) searching for nests, (4) listening for fledged broods, and (5) reporting the results in September to the Ringing Centre. In addition, the total number of hours of effort used has to be recorded. For relatively good coverage of all raptor species, about 300–500 person-hours/study plot/breeding season is needed in southern Finland (mixture of boreal forest, agricultural land and lakes). The number of *Raptor Grid* study plots surveyed has averaged 120 per year.

Data from the *Raptor Grid* has been used for estimating changes in population size. While an effort has been made to retain the same set of study plots over time, in practice, some plots have become inactive and new ones have emerged, primarily because of changes in volunteers involved in the fieldwork. Thus, analyses have to control for this potential variation in effort among plots. To do this, for each year, population indices have been calculated through pair wise comparisons of mean numbers in that year to those in a reference year for plots that were active in both years. For this analysis, 1997 was chosen as a reference year because it was a good year with many active plots and large data. Two measures of abundance were examined: all occupied territories and active nests (figs. 1 and 2).

### Productivity

In 1982, a Raptor Nest Card was introduced, and ringers were asked to fill a nest card for birds of prey nests found during the breeding season. The relatively poor response prompted the use of a special summary questionnaire. Since 1986, all bird ringers *must* report a summary of all nests and territories of all birds of prey they have detected during each year with a simple *Raptor Questionnaire*. The *Raptor Questionnaire* summarizes the total numbers of (1) potential nest sites checked (cf. table 1), (2) active nests and occupied territories found (cf. table 2), and (3) nests of different clutch and brood sizes (cf. table 2) verified by ringers. All these data have been collected within the "territories" of 25 local ornithological societies in different parts of the country (cf. figs. 3, 4 and 5).

Further, the ringer has to give information on the amount of field work done by comparing the present and previous seasons according to following scale: the amount of field work on the species was (1) much more than, (2) a little more than, (3) the same as, (4) a little less than, and (5) much less than in the previous season.

The main purpose of the *Raptor Questionnaire* is to collect data on the annual productivity. In addition, this data, although it cannot be precisely standardized from year to year, may be used with care to detect fluctuations and trends in population sizes, especially when the *Raptor Grid* data are too scanty (figs 3, 4 and 5).

Feedback articles reporting the results of *Raptor Grid* and *Raptor Questionnaire*-programmes have been published every year after the breeding season (e.g., Honkala & Saurola 2006).

**Table 1.** The numbers of potential nest sites of birds of prey checked in Finland in 2005.

| | |
|---|---|
| Natural stick-nests of hawks and buzzards | 3 982 |
| Nests built by *Corvidae sp*. or by *Sciurus vulgaris* | 1 849 |
| Artificial nests for hawks and buzzards | 1 553 |
| Artificial nests for falcons | 5 494 |
| Nest boxes for the Ural Owl *Strix uralensis* | 4 293 |
| Nest boxes for the Tawny Owl *Strix aluco* | 4 133 |
| Nest boxes for Tengmalm's Owl *Aegolius funereus* | 8 399 |
| Nest boxes for the Pygmy Owl *Glaucidium passerinum* | 5 849 |
| Large natural cavities | 2 180 |
| Small natural cavities | 2 924 |

***Table 2.*** Total numbers of active nests (= eggs were laid) of "common" birds of prey reported by Finnish ringers during 1986–2005 and the mean of annual means of productivity (large young per active nest) during the same period.

| Species | | Number | Productivity |
|---|---|---|---|
| Honey Buzzard | *Pernis apivorus* | 1571 | 1.39 |
| Marsh Harrier | *Circus aeruginosus* | 1551 | 2.90 |
| Hen Harrier | *Circus cyaneus* | 276 | 3.38 |
| Goshawk | *Accipiter gentiles* | 14398 | 2.44 |
| Sparrowhawk | *Accipiter nisus* | 5 076 | 3.68 |
| Common Buzzard | *Buteo buteo* | 7192 | 1.89 |
| Rough-legged Buzzard | *Buteo lagopus* | 946 | 1.59 |
| Kestrel | *Falco tinnunculus* | 15091 | 4.16 |
| Merlin | *Falco columbarius* | 439 | 3.22 |
| Hobby | *Falco subbuteo* | 1449 | 2.20 |
| Eagle Owl | *Bubo bubo* | 5383 | 1.60 |
| Hawk Owl | *Surnia ulula* | 235 | 3.63 |
| Pygmy Owl | *Glaucidium passerinum* | 4620 | 4.98 |
| Tawny Owl | *Strix aluco* | 7216 | 2.73 |
| Ural Owl | *Strix uralensis* | 12615 | 2.14 |
| Great Grey Owl | *Strix nebulosa* | 541 | 1.94 |
| Long-eared Owl | *Asio otus* | 1220 | 2.70 |
| Short-eared Owl | *Asio flammeus* | 689 | 3.41 |
| Tengmalm's Owl | *Aegolius funereus* | 13827 | 3.00 |

**Survival and dispersal**

For a ringer, encounters (i.e. both recaptures of live birds and recoveries of birds found dead) are the "prize" for the valuable voluntary work described above. Ringing is also a basis for monitoring survival and dispersal. In principle, it is fairly simple and straightforward to estimate changes in apparent adult survival from representative long-term capture-recapture data sets (see e.g., Forsman et al. 1996, Francis & Saurola 2004). Finnish ringers have been encouraged not only to ring nestlings but also to capture and recapture the adult birds at the nest as well (Saurola 1987a, Saurola & Francis 2004). For four owl species and the Kestrel breeding in nest boxes, the data on adults, especially on females, captured at the nest is fairly extensive, but for open-nesting species almost totally missing (cf. table 3).

**RESULTS**

**Population changes**

The average annual number of study plots included in *Raptor Grid* programme has been about 120. For the diurnal species of birds of prey, these data have been quite representative for monitoring the population changes of the Honey Buzzard *Pernis apivorus*, Goshawk *Accipiter gentilis*, Sparrowhawk *Accipiter nisus*, Common Buzzard *Buteo buteo*, Rough-legged Buzzard *Buteo lagopus*, Kestrel *Falco tinnunculus* and Hobby *Falco subbuteo* (fig. 1), and for the nocturnal ones, of the Eagle Owl *Bubo bubo*, Pygmy Owl *Glaucidium passerinum*, Tawny Owl *Strix aluco*, Ural Owl *Strix uralensis*, Long-eared Owl *Asio otus* and Tengmalm's Owl *Aegolius funereus* (fig. 2).

The population indices indicate significant negative trends in the Honey Buzzard ($p<0.001$), Goshawk ($p<0.01$), Common Buzzard ($p<0.001$) and Eagle Owl ($p<0.01$). The cause of the recent negative trend of the Finnish Eagle Owl population is quite evident: the decrease of the number of open refuse dumps with high numbers of rats, from about one thousand to one hundred during the last 15 years (see Valkama & Saurola 2005). In contrast, at the moment the causes of the negative trends of the three other species can only be speculated.

The population indices show significant positive trends in the Kestrel ($p<0.001$) and Pygmy Owl ($p<0.001$). Both of these species have benefited greatly from extensive nest box programmes during the last two decades. Nevertheless, the recovery of the Finnish Kestrel population is real and not an artifact (caused by the fact that a breeding attempt is more probably found and reported from an artificial than from a natural nest).

In contrast, the steep "increase" of the Pygmy Owl population has been until 2003 at least partly due to the fact that a part of population has become more "observable" to ringers, because the owls have moved to breed from natural woodpecker cavities to high-quality nest boxes. In the autumn 2003 a large-scale invasion of Pygmy Owls was observed at the Finnish bird observatories (Ojanen 2004). The indices of 2004 and 2005 (fig. 2) show clearly how the Pygmy Owl population crashed dramatically after the invasion and has not yet recovered.

The populations of the rest of the species mentioned above have remained more or less on the same general level during the study period.

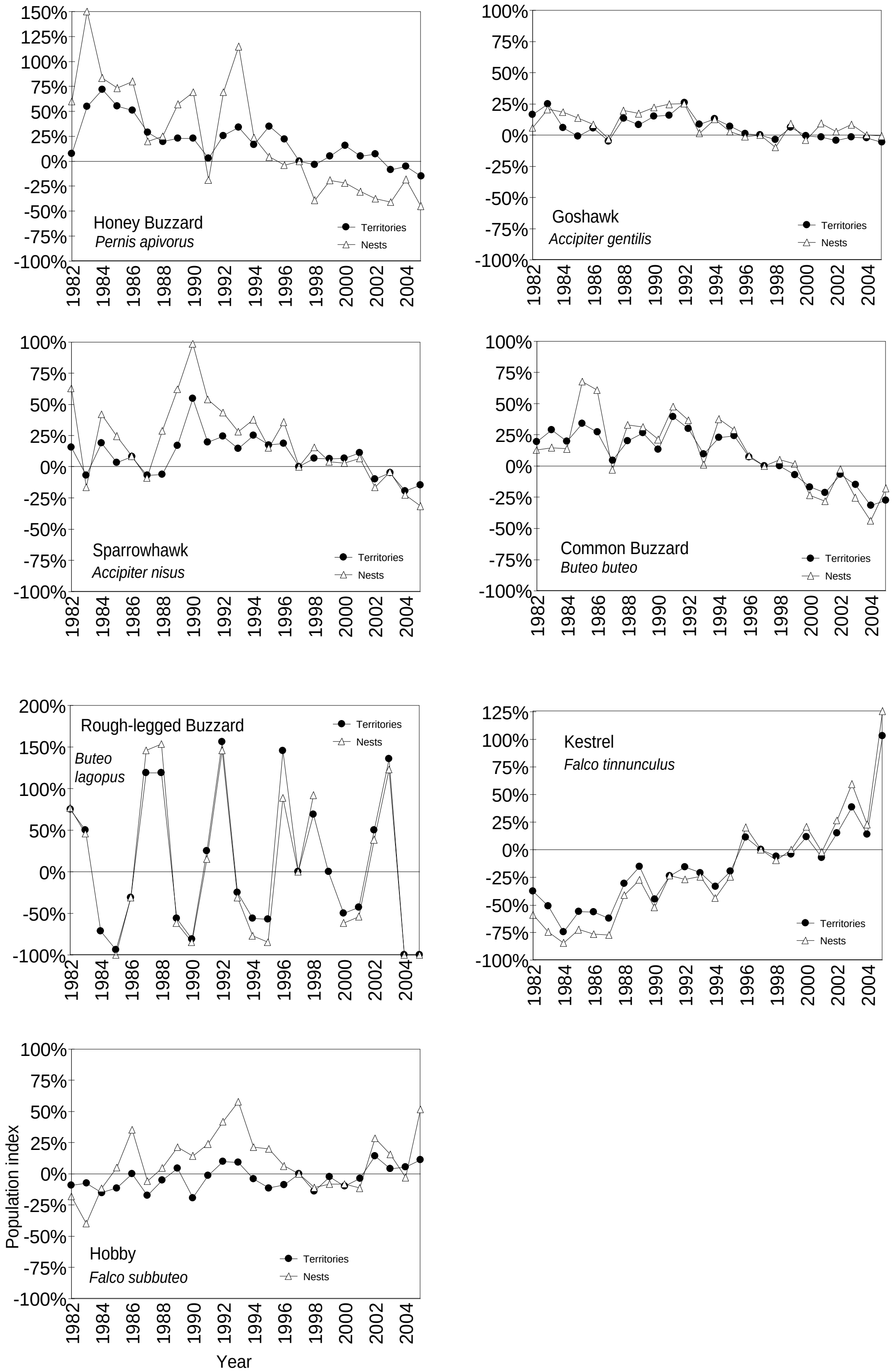


***Figure 1.*** Population indices from 1982 to 2005 of the Honey Buzzard *Pernis apivorus*, Goshawk *Accipiter gentilis*, Sparrowhawk *Accipiter nisus*, Common Buzzard *Buteo buteo*, Rough-legged Buzzard *Buteo lagopus*, Kestrel *Falco tinnunculus* and Hobby *Falco subbuteo* according to the data from *Raptor Grid* 100 km$^2$ study plots. For each species and year, only the plots in which the species was censused also in the reference year 1997, were included. The numbers of territories (dots) and nests found (triangles) were related to the corresponding numbers in the reference year 1997. The index value of the reference year = 0.

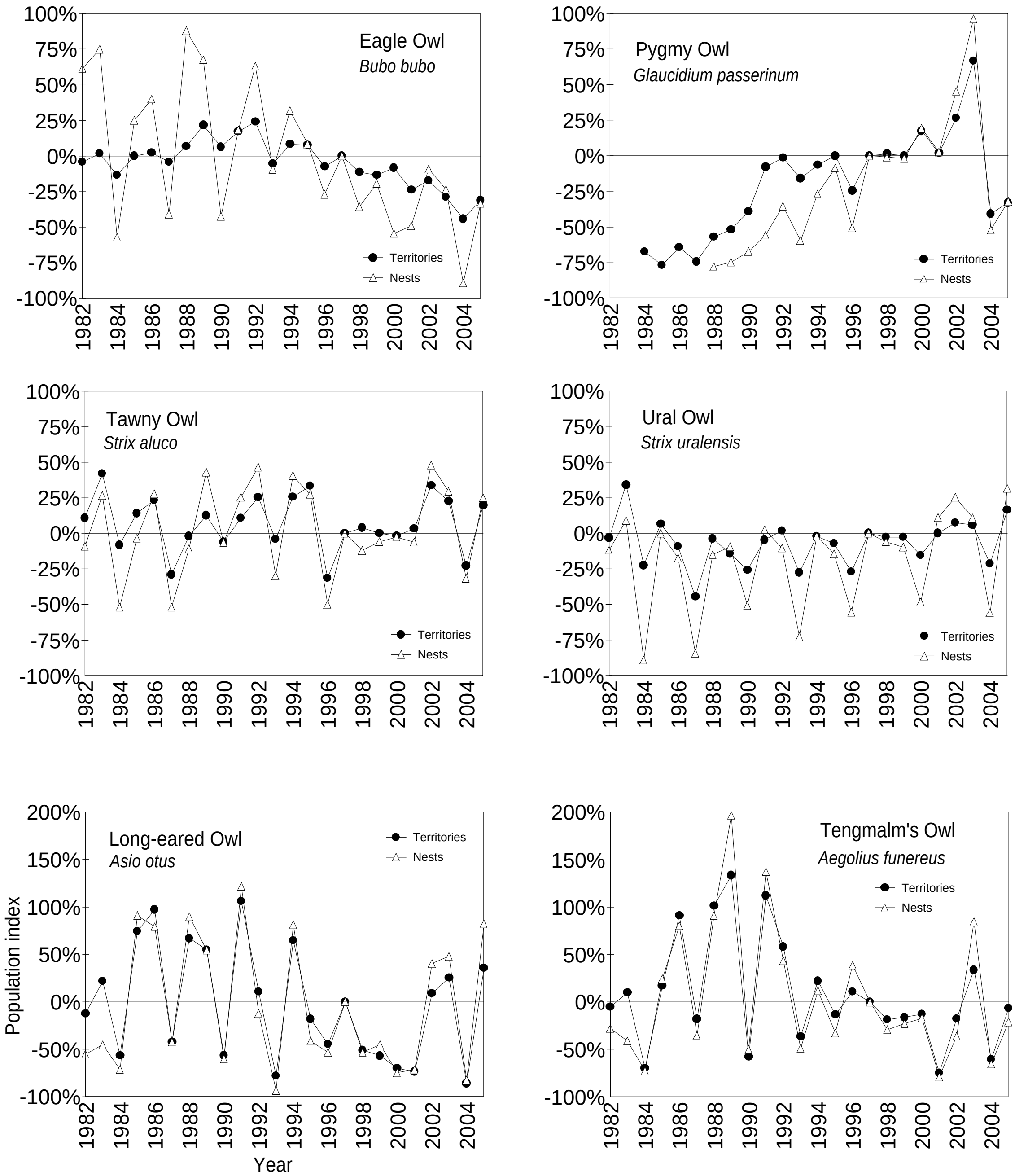


***Figure 2.*** Population indices from 1982 to 2005 of the Eagle Owl *Bubo bubo*, Pygmy Owl *Glaucidium passerinum*, Tawny Owl *Strix aluco*, Ural Owl *Strix uralensis*, Long-eared Owl *Asio otus* and Tengmalm's Owl *Aegolius funereus* according to the data from *Raptor Grid* 100 km$^2$ study plots. For each species and year, only the plots in which the species was censused also in the reference year 1997, were included. The numbers of territories (dots) and nests found (triangles) were related to the corresponding numbers in the reference year 1997. The index value of the reference year = 0.

However, the annual fluctuations of the indices of vole specialists, the Rough-legged Buzzard, Tawny Owl, Ural Owl, Long-eared Owl and Tengmalm's Owl, have been, as expected, very large (figs. 1 and 2).

The amount and distribution of the study plots of the *Raptor Grid* are not appropriate for monitoring the Marsh Harrier *Circus aeruginosus*, although it is clearly a southern species. For the same reason, data from the *Raptor Grid* do not tell anything relevant about the population changes of the more northern species like the Hen Harrier *Circus cyaneus*, Merlin *Falco columbarius*, Hawk Owl *Surnia ulula*, Great Grey Owl *Strix nebulosa* and Short-eared Owl *Asio flammeus*. For these species, information from *Raptor Questionnaires* is of great value (figs. 3, 4 and 5).

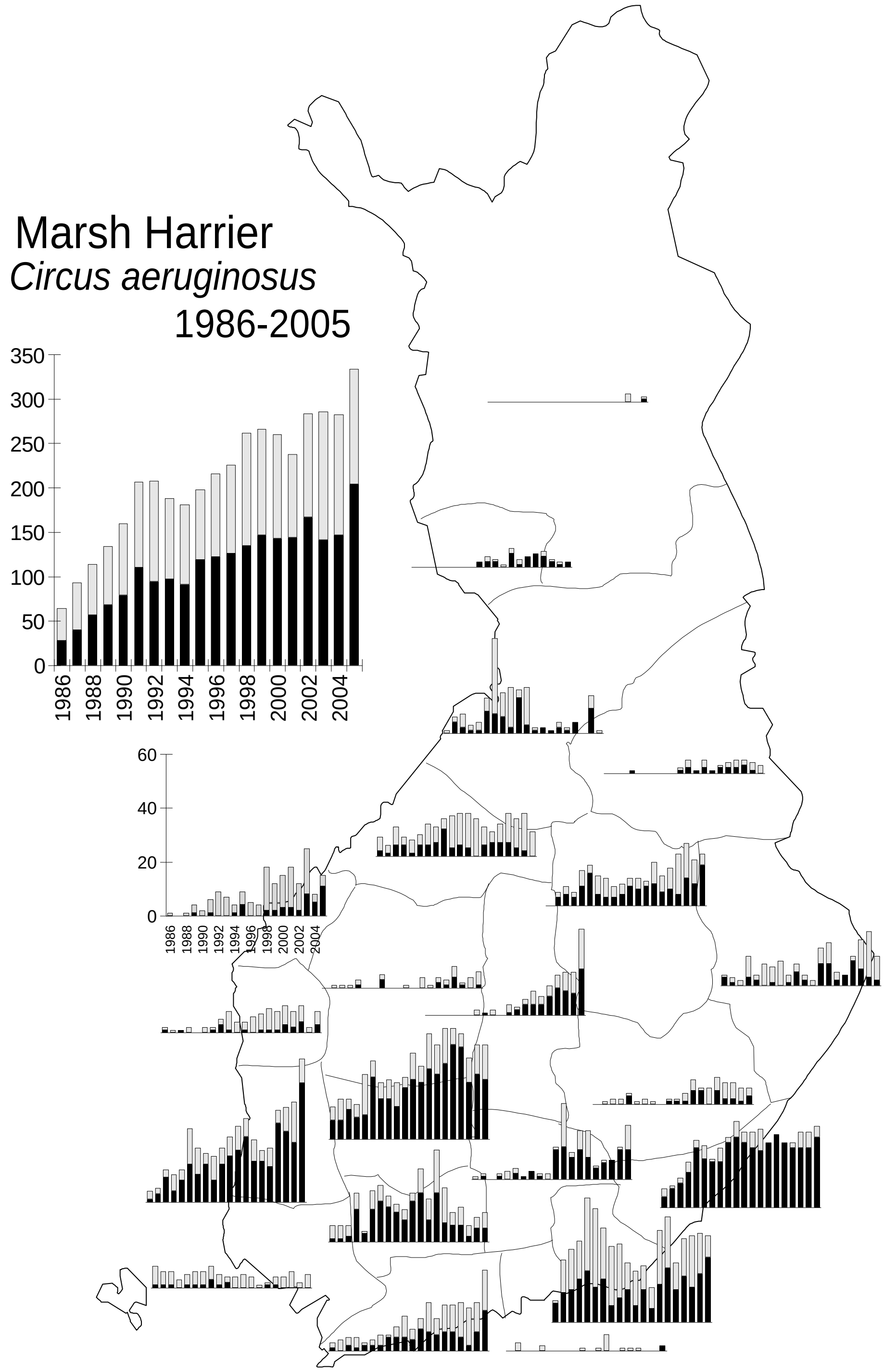


***Figure 3.*** The annual numbers of active nests (black) and occupied territories (grey) of the Marsh Harrier *Circus aeruginosus* reported by the ringers in the areas of local ornithological societies during 1986–2005 according to the *Raptor Questioinnaires*. Note: The scale for all local areas is the same but different for the entire country.

The numbers of occupied territories and active nests of the Marsh Harrier (fig. 3) reported by the ringers have increased during the last two decades. This is due to both the real increase of the population and, in some degree, to the increase in searching effort by the ringers as well.

The Hawk Owl (fig. 4) and Great Grey Owl (fig. 5) are both northern vole specialists, which breed only during the peak years of microtines. Hawk Owls are real nomads, which may change their nesting areas thousands of kilometers as suggested by ring recoveries (Saurola 2002).

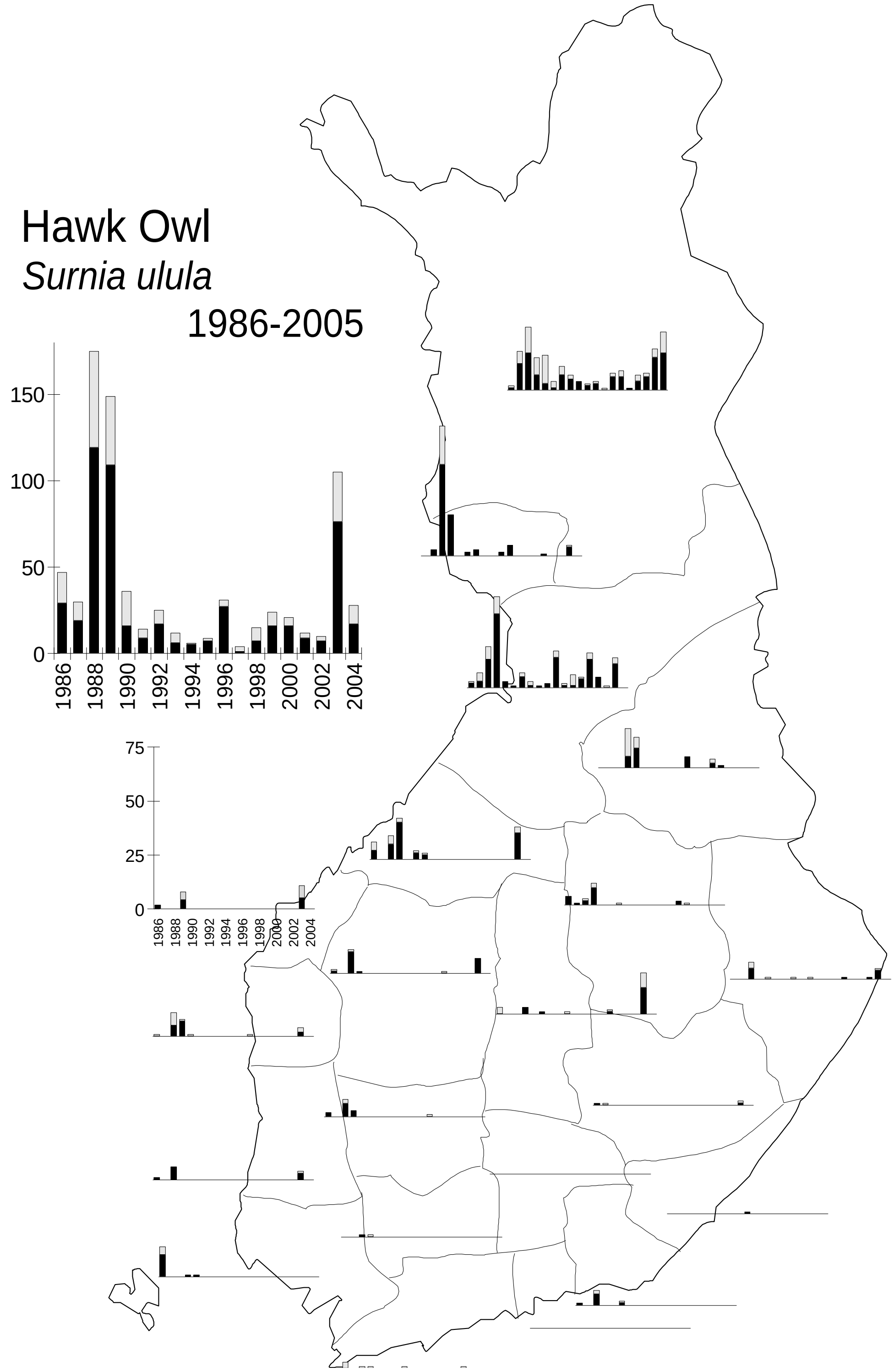


***Figure 4.*** The annual numbers of active nests (black) and occupied territories (grey) of the Hawk Owl *Surnia ulula* reported by the ringers in the areas of local ornithological societies during 1986–2005 according to the *Raptor Questioinnaires*. Note: The scale for all local areas is the same, but different for the entire country.

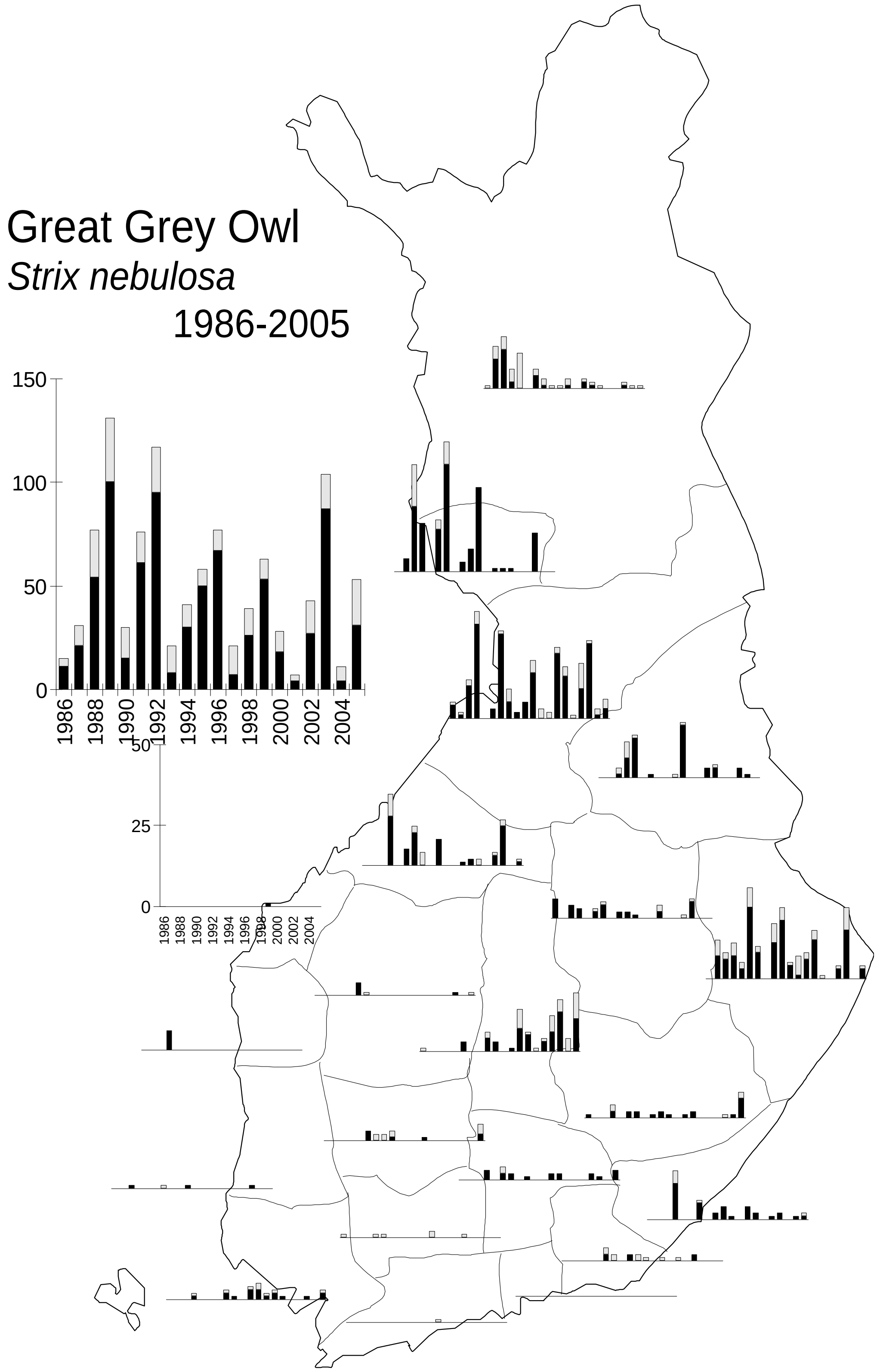


***Figure 5.*** The annual numbers of active nests (black) and occupied territories (grey) of the Great Grey Owl *Strix nebulosa* reported by the ringers in the areas of local ornithological societies during 1986–2005 according to the *Raptor Questioinnaires*. Note: The scale for all local areas is the same, but different for the entire country.

In Fennoscandia, part of the Great Grey Owl population is nomadic, but the other part is resident as shown by Stefansson (1997). Monitoring long-term population trends of such nomadic species must be based on international cooperation.

**Productivity**

According to the data collected with the *Raptor Questionnaire*, the average productivity of all species has been "normal" (table 3). Annual fluctuations in productivity of the vole specialists, e.g. the Ural Owl (fig. 6), have been large, as expected. In the *Raptor Questionnaire* data on productivity only one significant trend has been detected: the annual mean productivity of the Kestrel has improved significantly (p<0.01) from 1986 to 2005 (fig. 7). During this period, the mean proportion of unsuccessful breeding attempts has dropped from about 13% to 6%. This is most probably due to the fact that more pairs monitored by the ringers breed in nest boxes, which are surely safer against predators than the natural sites.

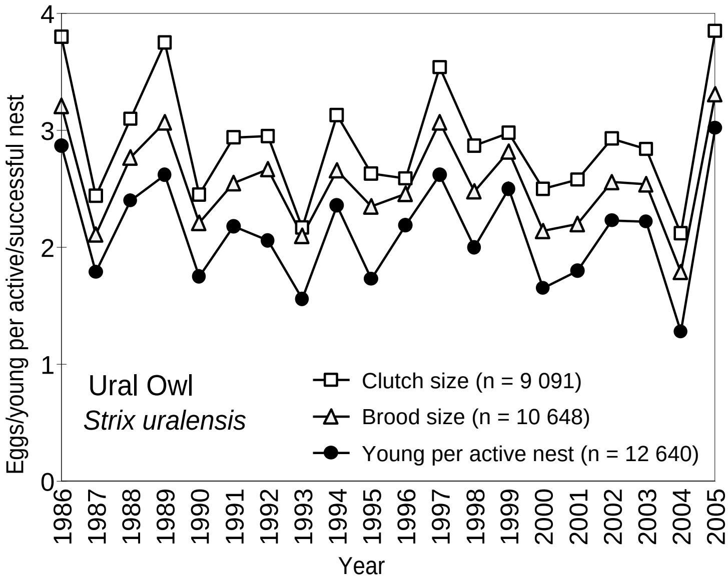


***Figure 6.*** Annual mean clutch size (squares), brood size (= young per successful nest; triangles) and productivity (young per active nest; dots) of the Ural Owl *Strix uralensis* during 1986–2005 according to the *Raptor Questionnaires*. Total amount of data for the entire period given for each category.

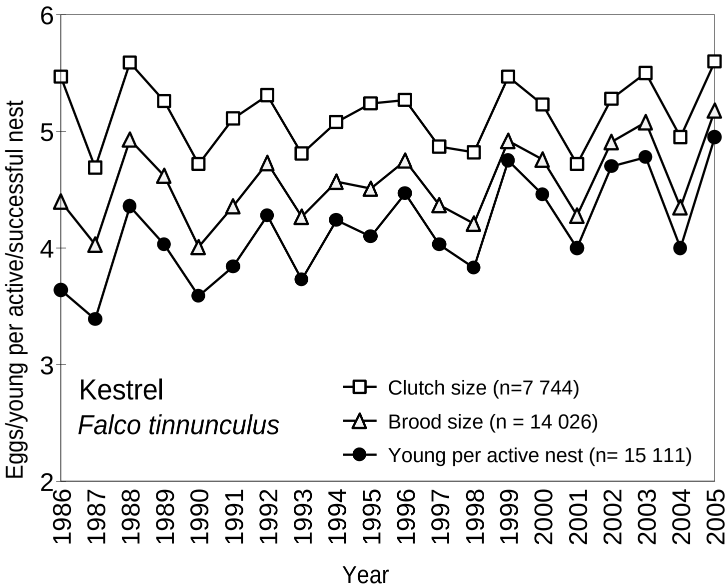


***Figure 7.*** Annual mean clutch size (squares), brood size (= young per successful nest; triangles) and productivity (young per active nest; dots) of the Kestrel *Falco tinnunculus* during 1986–2005 according to the *Raptor Questionnaires*. Total amount of data for the entire period given for each category. The mean productivity (dots) has improved significantly during the study period. $y = 0.048x + 0.013$; $R^2 = 0.41$; $p < 0.01$.

**Table 3.** Total numbers of all species of birds of prey ringed in Finland during 1913–2005, and total numbers of "interesting" encounters (see text) according to Valkama & Haapala (2006).

| Species | | Ringed | Encountered |
|---|---|---|---|
| Honey Buzzard | *Pernis apivorus* | 3786 | 171 |
| Black Kite | *Milvus migrans* | 56 | 2 |
| White-tailed Eagle | *Haliaetus albicilla* | 2202 | 5689 |
| Marsh Harrier | *Circus aeruginosus* | 6518 | 225 |
| Hen Harrier | *Circus cyaneus* | 1884 | 75 |
| Pallid Harrier | *Circus macrourus* | 3 | 0 |
| Montagu's Harrier | *Circus pygarcus* | 48 | 0 |
| Goshawk | *Accipiter gentilis* | 53723 | 8616 |
| Sparrowhawk | *Accipiter nisus* | 45420 | 3615 |
| Common Buzzard | *Buteo buteo* | 22531 | 1093 |
| Rough-legged Buzzard | *Buteo lagopus* | 3626 | 153 |
| Lesser Spotted Eagle | *Aquila pomarina* | 1 | 0 |
| Greater Spotted Eagle | *Aquila clanga* | 5 | 1 |
| Golden Eagle | *Aquila chrysaetos* | 2379 | 1048 |
| Osprey | *Pandion haliaetus* | 38950 | 2905 |
| Kestrel | *Falco tinnunculus* | 79378 | 4028 |
| Red-footed Falcon | *Falco vespertinus* | 10 | 2 |
| Merlin | *Falco columbarius* | 2613 | 140 |
| Hobby | *Falco subbuteo* | 4305 | 82 |
| Gyrfalcon | *Falco rusticolus* | 298 | 10 |
| Peregrine | *Falco peregrinus* | 3467 | 250 |
| Barn Owl | *Tyto alba* | 1 | 1 |
| Eagle Owl | *Bubo bubo* | 14063 | 3094 |
| Snowy Owl | *Nyctea scandiaca* | 66 | 8 |
| Hawk Owl | *Surnia ulula* | 2864 | 51 |
| Pygmy Owl | *Glaucidium passerinum* | 29284 | 1937 |
| Little Owl | *Athene noctua* | 1 | 1 |
| Tawny Owl | *Strix aluco* | 40781 | 10876 |
| Ural Owl | *Strix uralensis* | 41559 | 11417 |
| Great Grey Owl | *Strix nebulosa* | 2356 | 139 |
| Long-eared Owl | *Asio otus* | 12236 | 500 |
| Short-eared Owl | *Asio flammeus* | 6654 | 277 |
| Tengmalm's Owl | *Aegolius funereus* | 107857 | 5545 |

**Survival**

So far the Tawny Owl is the only species, on which an extensive and technically updated survival analysis (White & Burnham 1999), based on combined data of dead and live encounters (Burnham 1993) from the entire country, has been made (Francis and Saurola 2004). Survival rates averaged 33% in the first year, 64% in the second, and 73% in subsequent years of life. About 50% of the dramatic annual variation in survival rates could be explained by the stage of the vole cycle and severity of winter weather. No long-term trend in survival was detected during 1980–1999.

In addition, an analysis based on local recaptures has shown the similar effect of the three-year vole cycle on the adult survival of breeding males of the Finnish Tengmalm's Owls (Hakkarainen et al. 2002). Similar analysis cannot be made for the females of Tengmalm's Owl because of long breeding dispersal distances of the females (Korpimäki et al. 1987).

## DISCUSSION

**Raptor grid**

*Incomplete Coverage*. This sampling method is, in principle, very simple, but in practice for some species very laborious, when the study plot is as large as 100 $km^2$. Hence, the variation in search effort and success is high between the study plots. Because the main aim of this project is to produce annual population indices for detecting long-term trends, variation between study plots is not critical, providing that effort from year to year within each study plot remains the same.

*Turnover of Study Plots*. In principle, the set of study plots and the search effort in each study plot should be the same from year to year. In practice, because the work is voluntary, some study plots become inactive and new ones emerge. However, the use of an appropriate statistical procedure in the data analysis, may reduce this potential bias.

Here (figs. 1 and 2) all years were compared pairwise with the reference year 1997, which was in general a good year with much data and fairly close to the middle of the study period. This very simple method is relatively unbiased. However, quite a large amount of data from study plots, which were not active in 1997 was not used, and, in the future, more sophisticated analytical methods, e.g. programme TRIM (Pannekoek & v. Strien 2004) will be used.

*Semi-random Selection of Study Plots*. Because the *Raptor Grid* 10 x 10 km study plots have not been selected randomly, they may be better areas for birds of prey than other potential study plots nearby, and, hence, the changes detected may not represent the changes in the entire population. Although the ringers may freely select their study plots, the boundaries ("even-ten-kilometer" lines) of the plots are randomly pre-determined by the National Grid. For this reason, the quality differences between such large plots and other potential plots nearby are small.

*Geographical Distribution of Raptor Grid Study Plots*. The number of resident ringers is very low in northern Finland and, consequently, the data from both the *Raptor Grid* and the *Raptor Questionnaire* is not representative for the northern half of the country. This bias is very difficult to avoid without extra funding for travel costs for visiting ringers from southern Finland.

**Raptor questionnaire**

*Population Changes*. The total amount of annual fieldwork done by ringers in searching for nests is not constant, although most of the ringers have a traditional ringing "territory" where they check the same nest boxes and territories from year to year. So far, the total effort has been increasing: new permits for raptor ringers have been issued, and some of the veteran ringers have increased their effort, e.g., by putting up more nest boxes within their ringing territory. In principle, the data could be corrected for the change in effort (see Material and methods), but this has not yet been done.

*Productivity*. Data from the *Raptor Questionnaire* gives a fairly reliable picture of the annual productivity of Finnish birds of prey. However, a potential bias must be noted. First, a successful nest of an open-nesting species is probably found more often than an unsuccessful one. Thus, the productivity estimates for open-nesting species may be too high. Second, the productivity in nest boxes and other artificial nests constructed for birds of prey may be better than in natural nests and, thus, not represent the productivity of the entire population (see below).

**Natural vs. artificial nests**

Nest box programmes were started as a conservation measure to compensate for the loss of natural cavities by commercial forestry. Later, the use of nest boxes became a research method to find and reach nests much more easily than in natural circumstances. However, some potential biases must be taken into account when analyzing data from nest boxes and other artificial nests.

(1) If only a small part of the total population breeds in artificial nests, and if the number of natural nests becomes an important limiting factor, a decrease of the "natural population" will not be detected if all monitoring data comes from artificial nets.

(2) Properly constructed and placed artificial nests may be better nest sites than natural ones. In virgin forests the number of good natural nest sites is probably large enough that the difference between natural and artificial sites is negligible. In commercial forests, in contrast, nest boxes are, most probably, more productive than the natural sites. Hence, data on productivity from nest box studies do not represent "normal" reproductive success in commercial forests. For example, Ural Owl females may, by scraping the nest bowl deeper and deeper during incubation, push the eggs down through the bottom of a thin stick nest. This cannot happen in a cavity or in a nest box. In addition, young leave a stick nest an an earlier age and are more vulnerable to predators than those in a deep cavity, stump, or nest box.

**Survival**

Monitoring long-term trends and annual fluctuations in adult and juvenile survival is much more complicated but at least as important as monitoring productivity both for "pure" science and for management and conservation. Survival during the first year of life cannot be estimated with the capture-recapture data on breeding adults. On the other hand, estimates based only on recoveries of birds ringed as nestlings and found dead by the general public are unreliable; although some attempts to overcome this problem has been made (Rinne et al. 1990, 1993.). This means that combined data sets including a large number of both ring recoveries of birds found dead and annual recaptures of birds alive, collected systematically during many years and at the same time of the year, usually at the nest, are needed for reliable and useful survival estimates. As an exception from this "rule" see e.g. Saurola et al. (2003).

In Finland, there are quite large data sets of ringings and encounters of several species of both diurnal and nocturnal birds of prey filed in an easily accessible computer database (table 3). However, for nearly all of the species the encounters are almost exclusively recoveries of birds found dead, in spite of the fact that the Finnish Ringing Centre has encouraged ringers to try to catch breeding adults at the nest (Saurola 1987a). In Finland, the best (and at the moment only) data sets of birds of prey for a "comprehensive" survival analysis are those of the Tawny Owl and Ural Owl. In addition to large data sets of recoveries of birds found dead and recaptures of breeding adults, both natal and breeding dispersal distances of these two owl species are short enough for collecting representative capture-recapture data (Saurola 1987b, 2002, Saurola & Francis 2004). The first analysis on the Tawny Owl survival has been made (Francis & Saurola 2004), and a respective analysis on the Ural Owl is under preparation (Saurola in prep.).

**Nomadic species**

There are no resident "Finnish breeding populations" of the Snowy Owl *Nyctea scandiaca*, Hawk Owl and Great Grey Owl. These "populations" are only individuals of a large nomadic population from northern Russia through Finland and Sweden to Norway, and they happen to breed now and then in Finland. The Short-eared Owl belongs to the same group, but the common area of its "Western-Palearctic population" extends much further south. Long-eared Owls breeding in Finland are at least partly nomads as well, but probably on a much smaller scale (perhaps mainly within Finland?). These conclusions are based mostly on "common sense" and not on hard data: there are very few breeding season ring recoveries of dead birds and hardly any recaptures at nests showing the real extent of the breeding and natal dispersal of these species.

It is not possible to monitor nomadic species properly without intensive cooperation over large areas in northern Europe and across national boundaries. At least during the peak years for these species, which are easily detected, extra study plots should be established to estimate their densities, nestlings should be ringed, and the adults ringed/recaptured at nests as extensively as possible in all countries sharing the populations. These proposals are of course impossible to realize all over northern Russia. But for the Nordic countries, and perhaps including northwestern Russia, a joint "Nomadic Owls" programme is perhaps not totally unrealistic if the idea is properly "sold" to volunteers.

## CONCLUDING REMARKS

1. In Finland, good cooperation between professional-level volunteers (bird ringers) and organizations responsible for monitoring bird populations (Ministry of The Environment and Finnish Museum of Natural History) has produced valuable data for monitoring population changes and productivity of common diurnal and nocturnal birds of prey. In fact, for economical reasons, this has been the only way to get such important information.

2. The data available does not yet suggest really alarming negative trends during the last 15 years for most of the resident species of Finnish birds of prey. However, the trends of the Honey Buzzard and Common Buzzard have been negative during many years. An international project for more extensive monitoring and conservation must soon be taken under consideration

3. In many areas in Finland, commercial forests have been heavily harvested, and cavity-nesting owl species suffer from the lack of natural nest sites, i.e. suitable cavities in hollow trees. In those areas, these owl species are dependent on the continuous voluntary work of owl ringers, who try to compensate the losses with appropriate nest boxes.

4. Reliable survival estimates are crucial for estimating the status and future of the population. Representative data sets for survival estimates are available only for the Tawny Owl and Ural Owl in spite of the efforts to encourage the ringers to ring and recapture the breeding adults at the nest.

5. More fieldwork and international cooperation is needed before reliable conclusions on nomadic species are possible.

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