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Goshawk predation and population dynamics in Sweden

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Goshawk Predation on Pigeons and Pheasants

The goshawk (*Accipiter gentilis*) is a controversial species. Goshawk predation on poultry and game leads to persecution by farmers and hunters. Other people feel that goshawks should be protected as completely as other birds of prey, and a few even oppose its use in falconry. In England, where no goshawks bred for more than a century, its re-establishment in the 1960s aroused interest in the possibility that it might help to reduce agricultural damage by woodpigeons (*Columba palumbus*).

This possibility was studied by radio-tracking goshawks released in Oxfordshire. Individual hawks could be followed to record the number of pigeons that they killed, and their disturbance of pigeons on vulnerable brassica crops. Although each hawk killed one pigeon every four days, the pigeon density was so high that their breeding numbers could not have been reduced by more than about 12 %, and their disturbance at brassica fields was no greater than that of passing humans (KENWARD 1978a, 1979). The impact of the predation was further reduced by the selection of pigeons which were in poor condition. This selection increased when hawks chased after departing flocks of pigeons (KENWARD 1978b).

Radio-tracking was used in the same way to study predation by wild goshawks on pheasants (*Phasianus colchicus*) in Sweden. Goshawks, especially those in their first year, tended to gather at pheasant release sites, with no evidence of territorial displacement by older hawks. The hawks killed 4-5 % of the released pheasants per month, and killed 56 % of wild hen pheasants during winter at another study area. Unfortunately, these losses were not mitigated by selection of birds in poor condition, probably because pheasants were killed without a prolonged chase. Instead, there was selection of hen pheasants, especially during snowcover (KENWARD 1977, KENWARD, MARCSTRÖM and KARLBOM 1981).

By combining data from five Swedish areas and two in Germany (ZIESEMER 1983) it could be shown that pheasants are a prefered prey for goshawks, with no tendency to switch to other prey at low pheasant density (KENWARD 1986). Further work in excellent pheasant habitats on Gotland has shown that, if the local abundance of goshawks was increased by a high availability of rabbits (*Oryctolagus cunniculus*), the hawks could reduce the number of pheasants below the level which could be replaced by breeding, and thus caused a sustained population reduction. Similar population reduction of ruffed grouse (*Bonasa umbellus*) has been recorded during goshawk irruptions in North America (KEITH & RUSCH, 1988). These population reductions depended, at least in part, on mammal predation which reduced breeding success, and mammal predation alone can reduce bird populations: predator-removal experiments in northern Sweden showed that predation by foxes (*Vulpes vulpes*) and martens (*Martes martes*) on breeding tetraonids was depressing the adult populations (MARCSTRÖM, KENWARD & ENGREN, 1988).

Goshawk Population Dynamics

The development of reliable radio-tags, which could be tail-mounted without adverse effect on the hawks (KENWARD 1978c), made it possible to study goshawk population dynamics throughout the year. To see whether biased ring recovery was responsible for the 60-65 % first year mortality estimated for Fennoscandian hawks (HÖGLUND 1964, HAUKIOJA & HAUKIOJA 1970), 30-50 juveniles hawks and 20-30 adults were radio-tagged in each of five years on Gotland, a 3,100 square kilometer island in the Baltic. Although 30 % of the hawks were killed by man (a lower proportion than in contemporary ring recoveries), the population remained at about 5 pairs per 100 square kilometers, with an adult mortality of about 20 % and no breeding by first year hawks. The juvenile mortality was lower than in the earlier studies, at about 34 % for females and 51 % for males. This difference in mortality resulted in a 67 % excess of females among the adult hawks, such that only 25 % laid eggs in the second year and only 53 % each year thereafter.

Goshawks seem able to compensate for increased mortality by breeding at an earlier age. ZIESEMER (1983) estimated that 21 % of goshawks in Schleswig-Holstein bred in their first year, and up to 35 % of study populations in Bavaria were breeding in juvenile plumage (LINK 1986). If the data on breeding age from Schleswig-Holstein are fed into the population model for Gotland, the goshawk population would increase by 27 % per annum. Alternatively, it would sustain an equivalent loss of young birds without reduction in the breeding population.

Goshawk Management

It is no longer adequate to maintain that predators take mainly the injured, diseased or dispersing prey (ERRINGTON 1946), and do not depress prey populations. Although many bird populations are limited by food (LACK 1966, NEWTON 1980), game bird populations can be depressed locally by predators, especially when the birds are secondary prey. It is even possible to build models, based on competence-based variation in predator survival and prey-based variation in predator breeding, where single predators can depress the numbers of their sole prey for long periods (KENWARD & MARCSTRÖM, 1988).

Moreover, even when predators do not depress prey breeding populations, they are still in competition with hunters for the post-breeding population. There may often be ways for hunters to obtain more of the prey themselves without killing predators. For example, intensified farming and forestry, especially where these remove cover or make prey travel further for food, may increase their vulnerability to predators. There is often scope for improving cover at sites where game birds are released or fed in winter. Feed sites can be further improved by ensuring good cover on access routes (hedges, dikes), and lack of trees as perches for hunting hawks (MIKKELSEN 1984). If goshawks are a problem, they can be live-trapped and released elsewhere: few live-trapped birds returned after release more than 30 km away (MARKSTRÖM & KENWARD 1981). Live-trapping with spring nets on killed pheasants is a prefered control method, because it is more selective of hawks that killed pheasants than the use of cage traps baited with live pigeons (KENWARD, KARLBOM & MARCSTRÖM 1983).

Nevertheless, limited killing of predators need not reduce their breeding populations, let alone put species at risk. Logically, goshawk populations can be viewed as a renewable resource, like game birds. On this basis, the 27 % of extra young hawks on Gotland, if hawks there bred as early as in Schleswig-Holstein, estimates the "sustainable yield" of the Gotland population. Another estimate comes from the 15 % per annum increase rate which can be estimated from data provided by THISSEN, MÜSKENS and OPDAM (1981) for the Dutch goshawk population from 1963-1980. These are minimum estimates of the sustainable yield for goshawks, partly because the increase rate of the Dutch population was probably reduced by residual pesticide contamination, partly because some hawks on Gotland were already being killed by man, and partly because the yield estimate for Gotland was based solely on compensation through reduction in breeding age: the estimate did not include the possible increase in productivity per pair if the adult population had been reduced (LINK 1986).

A useful degree of "self-regulation" is built into human predation on goshawks if any killing is confined to juveniles, which are in any case the most common hawks at poultry farms and game release sites. Eighty percent of goshawks caught at such sites in Sweden were in their first year (MARCSTRÖM & KENWARD 1981). Adult hawks tend to remain from year to year in the same home range, whereas juveniles are more mobile and gather in areas with a high availability of prey. Since adult hawks are also the most difficult to trap, a conservative approach is to permit the trapping of hawks around areas with free-range poultry or winter feeding of game. In Sweden, goshawks may be killed at these sites without a licence.

One should certainly seek to prevent a high turnover of adult hawks, as in parts of Bavaria (LINK 1986), which may occur because hawks are often shot on the nest (an easy form of illegal mangagement). Unfortunately, the least desirable methods of removing hawks are often the most easy to use illegally without risk of prosecution. Thus live-trapping is preferable to shooting, since there is less risk to non-target species and goshawks can be released elsewhere (or given to falconers) instead of being killed. The laying of poison baits is unselective and thoroughly undesireable, but it is very hard to detect and prosecute offenders, compared to those who operate cage traps. It is probably no coincidence that in Britain, where it is very rare for a licence to be given to kill a raptor, illegal cage traps are now virtually unknown but there have been many recent incidents of deliberate poisoning (CADBURY 1980).

Conclusions

It seems sensible for protection organisations to work together with responsible hunters to develop conservation legislation which is realistic, and therefore accepted and obeyed. Mutual tolerance between protectionists, hunters and falconers is also worth encouraging as a means of promoting biotope improvements, pollution control and research cooperation. For example, the conservation headlands, which were developed by the British Game Conservancy primarily for game birds (RANDS 1984), are also valuable for plants, butterflies and other wildlife (WILSON 1987, DOVER 1987, TEW 1987). Ultimately, both hunters and raptors depend on good wildlife populations, and there could be no falconry without birds of prey. Falconers developed the captive breeding and release techniques which are the last resort for threatened raptors (CADE & TEMPLE 1977, TEMPLE 1978, SHERROD et al. 1981, JONES & OWADALLY 1985), and reintroduced the goshawk to Britain (MARQUISS 1981, KENWARD, MARQUISS & NEWTON 1981). Protection is an important part of raptor conservation, but only one part, and all possible contributions may be needed in our rapidly changing world.

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