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MORTALITY AND FATE OF TRAINED BIRDS OF PREY

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Abstract: From 113 questionnaire returns, the 1st year mortality in captivity of birds of prey taken from the nest and kept by falconers was estimated at 22 percent for 39 peregrines (*Falco peregrinus*), 11 percent for 89 kestrels (*Falco tinnunculus*), 26 percent for 71 goshawks (*Accipiter gentilis*), and 53 percent for 36 sparrowhawks (*Accipiter nisus*). The mortality of 14 trapped immature kestrels and 38 trapped immature goshawks did not differ significantly from this. Between 80 percent and 93 percent of trained falcons and between 50 percent and 67 percent of trained hawks were later lost or released.

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At present almost all the birds of prey trained by falconers are obtained from the wild, though the supply from captive breeding projects may become an important source in the future. In recent years a dispute has arisen concerning the effect of taking such birds from the wild. On the one hand it has been claimed that birds taken for falconry have a restricted life span, and that taking them is detrimental to wild bird of prey populations (König and Schilling 1970). On the other hand it has been suggested that they may survive better than in the wild and eventually, through escape (Brown and Amadon 1968) or deliberate release (Cade 1954), augment the wild breeding stock.

This paper sets out to estimate mortalities for four species of birds of prey commonly flown by falconers in Europe and to provide information relevant to the planning of captive management programs for preserving threatened birds of prey. Data are also presented indicating that a large proportion of birds taken for falconry subsequently become lost by the falconer (i.e., are not recovered after a flight), or are deliberately returned to the wild.

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METHOD

A questionnaire requesting details of species, origin, period in captivity, and eventual fate of individual birds was circulated to members of the British Falconers' Club, who were asked to provide information either on all the birds they had ever trained, or on all within a certain period of time, such as the last 10 years. Questionnaires could be returned anonymously if desired. From 400 questionnaires sent out 113 were later returned completed, mainly from Britain, but a few from other parts of Europe and two from Africa.

Excluded from the analysis were birds found injured or incapacitated in the wild and given to falconers for care and eventual release, or those taken from traps and threatened nests for immediate release elsewhere.

An estimate of 1st-year survival in captivity based on the number of birds remaining in the captive population at the end of the year would be too low, because it would not have included the many birds which survived part of the year in captivity before being lost or released. Data on survival in the wild of birds which have been lost or released are not yet available. Although such data are important for estimating the total effect which taking birds

for falconry may have on wild populations, they are not necessary for an estimate of survival in captivity.

Survival during the 1st year in captivity was therefore estimated on a monthly basis, using the formula

$$S_m = s_m/(s_m + d_m)$$

where S_m is monthly survival, s_m the number of birds remaining in the captive population at the end of the month, and d_m the number dying in captivity during the month.

As well as taking into account the survival in captivity of birds lost or released after less than a year in the captive population, this also enabled the inclusion of birds still in the hands of falconers, after less than a year in captivity, when the survey was conducted. Birds lost, released, or still kept, were included in s_m for each month prior to the month in which their presence in the surveyed captive population ceased to be recorded. They were included neither in s_m nor d_m for that and later months, so no assumptions regarding their subsequent survival were implied.

The number of deaths occurring each month was small, so it was not possible to test for diminished survival at certain times of the year: for example, during the molt, or shortly after capture in the case of trapped hawks. Therefore annual survival $\overline{S}$ was found using the formula below, which does not assume the monthly survivals to be uniform:

$$\ln \overline{S} = \sum_{m=1}^{12} \ln [s_m/(s_m + d_m)].$$

Annual survival was converted to annual mortality $\overline{M}$, since $\overline{M} = 100(1 - \overline{S})$.

So that confidence limits might be attached to this estimate of annual mortality, an approximation for mortality over the year was found using the formula below, which involves the assumption that birds lost, released, or still held, were removed from the surveyed captive population at a uniform rate throughout the year

$$\overline{M'} = D/(E - L/2).$$

$\overline{M'}$ is the annual mortality approximation, D the number of birds dying in the year, E the number present at the start of the year, and L the number lost, released, or still held when the survey was conducted, after less than a year in captivity. This approximation, to which 95 percent confidence limits could be attached using the binomial theorem, was found to agree fairly closely with the estimate based on monthly mortality rates.

RESULTS

Birds kept by falconers may be divided into three categories, according to whether they were obtained as fledglings (eyases in falconry parlance), trapped in juvenal plumage, or trapped when mature. Table 1 gives the mortality during their first year in captivity for four species: peregrine, kestrel, goshawk, and sparrowhawk.

In fledglings the mortality shown was that for their 1st year after leaving the nest, whereas for trapped birds it was for the year starting when they were trapped.

Insufficient data on trapped immature peregrines and sparrowhawks were obtained to warrant calculation of the mortality during their 1st year after being trapped. Very few trapped mature birds were recorded, except in the kestrel, in which only three deaths were reported out of 23 mature individuals.

Very few data were available from this study for the 2nd and subsequent years. In fledgling peregrines, in their 2nd year 2 died and 6 survived, and in the 3rd, 1 and 3 respectively. Five fledgling goshawks

Table 1. Mortality of birds of prey during their 1st year in the hands of falconers.

Species	Origin	No.	Mortality estimate $\bar{M}$ (%)	Mortality approximation $\bar{M}'$ (%)	Approx. 95% CL for M'
Peregrine (*Falco peregrinus*)	Fledgling	39	22.0	(18.2)	3.1–33.3%
Kestrel (*Falco tinnunculus*)	Fledgling	89	11.1	(13.9)	4.8–23.0%
Goshawk (*Accipiter gentilis*)	Fledgling	71	25.7	(25.2)	13.9–36.5%
Sparrowhawk (*Accipiter nisus*)	Fledgling	36	52.8	(48.2)	28.5–67.9%
Kestrel	Trapped immature	14	41.7	(ND)[a]	(ND)[a]
Goshawk	Trapped immature	38	33.8	(46.5)	24.1%–48.9%

[a] Too few trapped kestrels remained a year in captivity to justify calculation of the mortality approximation and confidence limits for them.

died in their 2nd year and 20 survived, while figures of 5 and 7, 1 and 4 respectively were obtained for the 3rd and 4th years. Since they ignore birds which left the population other than by death, which tends to overestimate the mortality, these figures suggest that the mortality of captive birds in their 2nd and subsequent years was of the same order as that in their 1st.

Tables 2 and 3 provide data on the fate of birds of prey which came into the hands of falconers as fledglings and as trapped birds. In addition to the four species in Table 1, figures for merlins (*Falco columbarius*) are included in both tables, and for lanner falcons (*Falco biarmicus*) in Table 3. Although sample sizes are small, results are expressed in percentages to facilitate comparisons.

For each species, the proportion of released to lost birds, and of both these categories to birds which died in captivity, is similar in the two tables. The last column of each table shows that, in general, fewer falcons died in captivity (7–22 percent) than hawks (33–50 percent).

Table 2. Fate of birds of prey obtained by falconers from the nest.

Species	No.	First year			Subsequent years			Total	
		Lost (%)	Released (%)	Died (%)	Lost (%)	Released (%)	Died (%)	Lost + Released (%)	Died (%)
Peregrine (*Falco peregrinus*)	35	49	17	14	11		9	78	22
Merlin (*Falco columbarius*)	14	29	29	13	29			87	13
Kestrel (*Falco tinnunculus*)	85	18	56	9	8	8	1	90	10
Goshawk (*Accipiter gentilis*)	53	25	4	28	11	10	22	50	50
Sparrowhawk (*Accipiter nisus*)	33	30	24	39	3		4	57	43

Table 3. Fate of immature and mature birds of prey obtained by falconers from trapping.

Species	No.	Total		
		Lost (%)	Released (%)	Died (%)
Peregrine (*Falco peregrinus*)	11	73	18	9
Merlin (*Falco columbarius*)	15	53	40	7
Kestrel (*Falco tinnunculus*)	39	21	59	20
Lanner falcon (*Falco biarmicus*)	39	72	21	7
Goshawk (*Accipiter gentilis*)	42	40	12	48
Sparrowhawk (*Accipiter nisus*)	12	17	50	33

DISCUSSION

The first year mortalities in captivity of all fledglings taken for falconry, except sparrowhawks, appear to be substantially lower than those of wild birds ringed (banded) in the nest. Thirty-nine eyas peregrines had a 1st year mortality of 22 percent. Estimates from band recoveries of wild peregrines in North America (Enderson 1969), and of German and Finnish birds (Mebs 1971), suggest a 1st year mortality of 70 percent, but may have been biased upwards by band loss and preferential recovery of juveniles. Calculations based on fledging success, and the replacement rate necessary to offset adult mortality, suggest that a Massachusetts peregrine population studied by Hagar (1969) may have had a juvenile mortality as low as 55 percent (Shor 1970). The figure of 11 percent for 89 eyas kestrels in their 1st year is much lower than the 60 percent estimated from ringing records of wild British kestrels (Snow 1968), although this figure too may be biased upwards. Taking preferential shooting of juveniles into account, Haukioja and Haukioja (1971) considered an estimate of 63 percent to be most likely for the 1st year mortality of wild Finnish and Swedish goshawks ringed in the nest; this figure is more than double the 26 percent recorded for 71 hawks taken from the nest and trained. The 53 percent 1st-year mortality in 36 eyas sparrowhawks is, however, approaching the 70 percent from ringing recoveries of wild British sparrowhawks by Newton (In press).

There is an indication that trapped immature kestrels and goshawks may have a higher mortality in captivity than birds obtained as fledglings, although a *t*-test of the difference between monthly mortalities during the 1st year in captivity was not significant. A higher mortality might be expected in birds obtained by trapping because, while fledglings are probably taken at random from the population, as Perrins (1971) has suggested, trapped birds may be the weaker, (and hence) less wary, or hungrier individuals from a population. Moreover, trapped birds have had longer in the wild to be exposed to infectious diseases which may develop in captivity. On the other hand, some weak individuals may have been eliminated from the wild population prior to trapping.

Tables 2 and 3 show that the proportion of trained birds which became lost, were deliberately released, or died in captivity varied considerably between species. A high proportion of peregrines and lanner falcons was lost, and the proportion released was small. This may reflect the relatively great distance which their style of hunting takes these large falcons from the falconer, because a bird which goes out of sight may not return to the falconer or be found by him. The difficulty of obtaining these species in Britain, and the fact that lanner falcons are not native to the British Isles, probably militated against deliberate release of them. Some birds may also have

been lost prior to the time when they would otherwise have been released.

Conversely, far more kestrels were released than were lost. Kestrels, for which a license may be obtained in Britain without great difficulty, are usually trained by beginners acquiring initial experience in handling birds of prey. They are not often trained to hunt and do not normally fly far from the falconer, which probably explains why comparatively few are lost. Most are eventually released by "hacking-back," whereby food is provided for a bird flying free until it teaches itself to hunt. Merlins, which traditionally were released by British falconers prior to their molt, occupy an intermediate position.

The proportion of goshawks and sparrowhawks which died in captivity is noticeably higher than that of falcons. In sparrowhawks this result probably reflects the high 1st year mortality in a species which, by virtue of its small size and susceptibility to seizures, is considered by falconers to be difficult to keep. Very few goshawks were released, possibly because they too are difficult to obtain in Britain, and the proportion lost was much less than in the large falcons. So although the mortality of fledgling goshawks was half that of sparrowhawks in their 1st year, many remained in the captive population and died there later.

The questionnaire system may have been biased towards recording data from falconers whose birds had below average mortality. It could be argued that those who failed to return a questionnaire might also have been most likely to let their birds die as a result of ignorance or neglect. Many deaths were, however, recorded among captive goshawks and sparrowhawks, giving rise to a high mortality in the latter species. If the results refer to birds kept by those with above average ability, they show what can be achieved by responsible falconers whose birds are kept singly or in small numbers, flown free, and, in most cases, encouraged to hunt their natural prey.

These data do not take into account deaths which may occur after a bird is taken and before it comes into the hands of a falconer. If birds are taken by falconers themselves without the involvement of intermediaries, who may be less competent to handle them, there need be few such deaths. Of 53 goshawks taken by the author from nests in Scandinavia and sent to Britain, only one died in transit and one shortly afterwards. Under these circumstances it seems unlikely that the statement "Bekanntlich haben gefangene Greifvögel eine beschränkte Lebenzeit" (Captured birds of prey are known to have a restricted life-span) (König and Schilling 1970:174) can be upheld in the case of peregrines, kestrels, and goshawks obtained and kept by falconers such as were represented in the questionnaire returns.

Brown and Amadon (1968:148) suggest "It could even be argued that a falconer, taking the whole of a brood of young falcons from the nest, and rearing them thereafter himself, may be giving them a better chance of ultimate survival than they would have in the wild state . . . In many cases hawks kept by falconers are likely to have a higher survival rate (than 1st year birds in the wild). If a falconer rears only two out of four birds that he takes to the adult state, and they subsequently escape from him, he may be the unconscious agent of an actual increment in the population of adult birds in an area."

Although Table 2 shows that the proportion of falconers' birds which get lost or are released after their 1st year is fairly small, because so many leave the captive population during their 1st year, the survival of peregrines, kestrels, and goshawks,

taken as fledglings and kept by falconers, does seem to be higher than in the wild. So the suggestion of Brown and Amadon is not negated by these results, but will only be proved valid if the survival of trained birds after loss or release is such that their expectation of breeding successfully in the wild is higher than those not taken as eyasses. Quantitative data on the survival of lost or released birds of prey must be obtained before the effect on their populations of harvesting fledglings for falconry can be estimated.

Birds which are trapped have already survived for some time in the wild, and might be expected to do so again after being lost or released. Where the trapped birds would otherwise be killed, for food or to preserve game, it might be argued that obtaining them for falconry benefits the wild population, since Table 3 indicates that a high proportion will probably re-enter the wild. However, in cases where, as Haukioja and Haukioja (1971) suggest for Scandinavian goshawks, the original trapping is taking a surplus of juvenile birds from a healthy population, the effect on that population may also be neutral since there are more than enough juveniles to replace the adults which die each year.

Correspondingly, it can be argued that trapping birds specifically for falconry may be detrimental to wild stocks, especially where mature birds are concerned. But the effect is again likely to be neutral where a small proportion of a healthy population is being taken.

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