HACKING: A Method for Releasing Peregrine Falcons and Other Birds of Prey

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INTRODUCTION

Since 1976 The Peregrine Fund has released nearly 2,000 peregrine falcons *(Falco peregrinus)* to the wild in 27 states. The purpose of these releases has been to restore a breeding population of this endangered raptor throughout the falcon's historic range in the United States. Many state and private organizations have expressed continued interest in birds of prey and have made repeated requests for information on techniques of releasing falcons. We originally prepared most of the material in the following pages as a reference for the attendants at our release sites. To that information we have added other details which may be useful to those who are not associated directly with The Peregrine Fund program. We feel that at least some of this information can also be applied to other species. Summarized are the methods of release used by The Peregrine Fund, the philosophies behind these methods, the problems which we have encountered, and the precautionary measures which should be considered when using these methods. These aspects are covered in detail because we have found that details can make the difference between the success and failure of a release.

METHODS OF RELEASE

The Peregrine Fund has used three methods for releasing young falcons: (1) direct-fostering (Burnham, et al., 1978), (2) cross-fostering (Konkel, 1977; Cade and Dague, 1978), and (3) hacking (Cade and Temple, 1977; Sherrod and Cade, 1978; Barclay, 1980).

Direct-fostering consists of placing peregrine chicks into the nest of wild peregrines to augment natural production. Young falcons used in this method are either captive-produced or hatched from eggs that were removed from wild peregrine nests. Eggs laid in the wild often have shells which are too thin to support the weight of an incubating adult, especially when laid on a rocky substrate. Such eggs, however, can be carefully incubated under artificial conditions.

It is desirable to remove wild eggs as soon as possible after laying to decrease the chance of breakage in the nest. If the nest is in a location which might jeopardize the safety of the incubating adults or their young because of water, falling rocks, or exposure to inclement weather, the eggs are simply removed without replacement. This technique will cause the birds to "recycle" and lay a second clutch of eggs, but it should only be conducted early in incubation. Falcons which have incubated longer than 10 to 14 days do not always renest. If renesting is not desirable, "dummy eggs" or young should be substituted when the original eggs are removed from the nest. Dummy eggs are similar in size, appearance, and weight to real peregrine eggs. They are made of a hard yet durable material which is not destroyed when the incubating falcons turn the eggs. J. Craig, Colorado Division of Wildlife, manufactures eggs that are ideal for this purpose.

It is not advisable to try extending the length of time for incubation of dummy eggs much beyond 35 days. If young peregrines are not available to replace the dummy eggs by this time, prairie falcon nestlings can be substituted into the nest and later replaced by peregrines. This second switch should take place before the prairies are old enough to tear their own food (about three-and-one-half weeks of age).

If peregrine chicks are available to substitute directly for the real or dummy eggs, they should be placed in the nest at about three weeks of age. At this age, the young are old enough to be accurately sexed and banded. They can also tolerate the cold if not brooded immediately. If the chicks have been fed by adults in captivity, they will show little resistance to initial approaches by foster parents, but instead usually beg at the sight of the wild adults. This food solicitation seems to deter aggression by adults which have just found large young instead of eggs in their nest. The adults may try to brood these older downies though the youngsters will probably resist such attempts. Even though young falcons may not have been raised by captive adults, they can still be placed into wild nests. The young provide visual and vocal stimuli to the adult which promotes parental behavior, and any resistance on the part of the young is soon overcome by hunger. If the young are much older than four weeks when placed in the nest, the risk of their falling from the nest ledge within the first few days is increased. The young are walking by this age, but are not familiar with the new ledge, especially if sudden danger startles them. No more than three or four similarly aged young should be placed in the eyrie. After the switch, the falcons are left alone except for observing them from a distance to insure that the young are being fed by the adults.

Direct-fostering is probably the most desirable technique of releasing peregrines and of augmenting production in the wild where dramatic eggshell thinning is occurring. Obviously wild peregrines must be present, and intensive observations must be made so that the manipulations occur at the proper time in the reproductive cycle. This method usually involves a great deal of physical work as well as advanced climbing skills.

Cross-fostering consists of essentially the same process as direct-fostering, but peregrine chicks are substituted for the young in the nest of other raptors, preferably congenerics such as prairie falcons. It is desirable to conduct this switch when the peregrines are about three weeks old since more pronounced differences between the young of the two species may occur after that time. We recommend placing two young in the eyrie.

We have encountered several problems during cross-fostering experiments with prairie falcons. The lizards, snakes, insects, and small mammals that some adult prairie falcons fed to young peregrines appeared to account for the improper weight gain in the substituted nestlings. Several prairie falcon nests have suffered massive infestations of Mexican bedbugs (*Ociacus* spp.) and other invertebrates (e.g. black flies, *Simulium* spp.). These parasites either forced the young from the nest prematurely or resulted in direct mortality. Prairie falcons often choose nest sites that are more vulnerable to predators than most peregrine eyries in the Rockies. We have lost young peregrines in prairie falcon nests to great horned owls (*Bubo virginianus*), golden eagles (*Aquila chrysaetos*), and coyotes (*Canis*

latrans). To alleviate some problems encountered with cross-foster attempts we recommend selection of sites that have the following attributes: historic peregrine territory, large cliff, large peregrine-like ledge, and a bird-eating diet determined the previous year. With prairie falcon eyries having a history of good productivity as well as the above attributes, we have experienced good fledging success and three known released birds are known to be breeding.

Hacking is a process that has been used by falconers since ages past to allow natural, physical conditioning of eyasses or young birds of prey taken from the nest before they can fly. The falconer places the young raptors on a building such as a shed, barn, or other conspicuous structure and provides them with food which is usually tied down to a board. The birds develop naturally and begin flying, but they return daily to the site for food which the falconer supplies. The birds eventually begin making their own kills and spend more and more time away from the hack site. At this point the falconer retraps the raptors and tames them to be trained for sport.

We have adapted this technique for use in the release of peregrines into the wild state, and we have enjoyed considerable success. Numerous pairs of wild, adult peregrines are now nesting in areas from which they had been completely extirpated. Other hacked falcons have paired with wild birds and are breeding independently. We feel that this is the best method of releasing large numbers of peregrines. The details of hacking comprise the main subject matter of this booklet.

The Release of Adults is still in an experimental phase. We are testing both the release of pairs of adults at potential eyrie sites and the release of single adults as mates for lone, wild peregrines that are occupying traditional eyries. The latter process has already proved successful and involves caging a single bird at a site for later release. The barred cage is an approximate one and one-half meter (about five feet) or larger cube with an enclosed area for protection from the wind.

We play courtship vocalizations toward the wild adult over a loud speaker and place food for the bird on the outside of the cage in order to simulate food transfers. After about ten days or depending on the behavior of the birds, the caged falcon is released or tethered to an outside perch, especially if it is a female. The release of females is probably a simpler task than vice versa since males will court them and bring food to them thus enhancing the probability of survival for the female. The release of males on the other hand is more complicated since a wild female will "expect" her prospective mate to feed her, and she may be very aggressive in her "demands." In both situations it may be necessary to supplement the food supply of the birds for a few weeks after release.

SELECTION AND DISTRIBUTION OF RELEASE SITES WITH EMPHASIS ON HACKING

General Plan

The general pattern of distribution for release sites should be of prime consideration in any release program well before the first birds are liberated. In the overall scheme political boundaries must be considered,

but if the project is destined for success, the influence of these boundaries should be minimized in favor of cooperation and sound biological planning. The release of peregrines at a given location is a large investment in falcons, time, and money. An initial release at a given site commits the program to continue hacking birds at that location for several years. This is necessary in order to maximize the likelihood per number of birds released that pairs will eventually become established. In other words, serious thought should be given when choosing the location for every hack site. Because of the need for long term stability of nest sites, National Parks, National Forests, Bureau of Land Management property, and National Wildlife Refuges with the necessary ecological requirements are highly desirable among potential locations for the release of peregrines.

Originally we thought that our release sites would be located at old, historic eyries. Accordingly, we set up one or two sites in each of several states in cooperation with the state and federal wildlife departments and land managing agencies. Our idea was that by limiting releases to these six or seven states the peregrines would wander enough to eventually encounter one another, pair, and breed. This wandering and pairing has occurred to a certain extent. At the same time, however, many peregrines have returned to breed at release sites or as lone individuals which stayed throughout the breeding season waiting for a mate.

Whether trying to establish a new population of falcons or attempting to augment the production of young in an ailing population, we now feel that breeding pairs can be obtained much sooner, especially in a localized area, by release efforts that saturate small regions with as many immature birds as possible. Because the mortality rate of peregrines during the first year of life ranges between 55 percent (Shor, 1970) and 80 percent (Mebs, 1960) and because they must be at least two years old to breed, several seasons of releases are usually required for success. Barclay (1980) has shown that during releases in the eastern United States, between two and eight peregrines must be hacked for every subadult or adult falcon that returns. It is an uphill battle, but the saturation process must be continued until pairs are eventually formed.

Critical Requirements for Hack Sites and for Nesting Peregrines

Releasing young peregrines from a given location is undertaken with the intention that falcons will return to breed at the site of release or somewhere nearby. The hack site, then, is really a potential nest site or eyrie.

When envisioning a classic peregrine eyrie, one usually conjures up the image of a falcon screaming in defiance from a ledge somewhere on the face of a remote cliff. Ironically, a quick review of nesting records indicates that this cosmopolitan falcon is actually quite adaptable in its choice of nest sites. Aside from breeding on cliffs, the peregrine has been observed to nest directly on the ground, especially in some of the areas of flat terrain found in Europe and Asia. Old stick nests of other birds (Dall and Bannister, 1869; Thomasson, 1947; White and Roseneau, 1970; Campbell et al., 1977; White, Jones, and Devine, 1978) or cavities in trees (Goss, 1878; Ridgeway, 1895; Ganier, 1931; White, Jones, and Devine, 1978) have also served as nest sites for this species. Even man-made structures such as an abandoned oil derrick, bridges, castles, churches, and

skyscrapers in the middle of some of the world's largest cities including New York, Montreal, and Philadelphia have served as nest sites for the peregrine falcon (Craighead and Craighead, 1939; Bond, 1946; Groskin, 1952; Hall, 1955; Hickey and Anderson, 1969; Mebs, 1969; see also Barclay, 1980, for further discussion).

The flexibility with which the peregrine adjusts to different nesting situations has allowed us to successfully hack falcons at three types of sites: natural cliffs, towers, and urban locations. Whether for the successful release of young peregrines or for nesting by returning adults, there seem to be four critical requirements. These are isolation from too much disturbance, security from other predators, protection from the elements, and an adequate food supply. There are no hard and fast rules that satisfy these requirements, however, and each category should be examined independently.

Isolation. Isolation from too much disturbance is important, but it does not necessarily indicate that no human activity should take place within 100 kilometers (about 60 miles) of a peregrine eyrie or hack site. For example, a peregrine nesting on the thirty-third floor of a skyscraper in Baltimore is effectively isolated from the human activity below her as is the falcon nesting on the ground in Finland surrounded by marshy bog, or a falcon nesting on a cliff 200 meters (about 650 feet) above a river used by kayakers. Conversely, a cliff that is only 20 meters high (about 65 feet) and which stands in a picnic ground is not isolated enough for either a nest site or release site. The frequency of disturbance plays an important role in the degree of isolation required by peregrines. A cliff face which is scaled in the spring and summer by rock climbers on almost a daily basis or even on weekends is not suitable for peregrine management. The occasional passing of a car on a nearby dirt road or a hiker on a trail, however, is not enough to cause any problem for either breeding falcons or hacked falcons. Another prime consideration is the seasonality of disturbances. No major operations such as logging or seismic testing, for example, should take place in the immediate vicinity of the peregrines during the spring and summer months (March to August). Conversely, during the fall and winter there should be no problem with this type of work. In fact, assuming that there is enough other suitable habitat in the area to support prey species, logging in particular can be beneficial since it produces open habitat over which the falcons can effectively hunt. One final point to consider with regard to critical disturbance is the time in the breeding cycle or hacking operation at which the disturbance is initiated. If something that is deemed a major, continuing disturbance within a kilometer (about one-half mile) of the eyrie or hack station cannot be avoided during the spring and summer, it is preferable that the disturbance begin before the breeding season or before the young are released. In this manner returning adults or hacked young can become habituated to the problem from the onset of their presence at the site. If the disturbance is initiated during a critical period in the nesting cycle (egg laying, incubation, or the first week after hatching) or the hacking operation (the first week after release), it can produce disastrous results.

Predators. Breeding adults usually pick nest sites that are not accessible to mammalian predators, and the parents are extremely aggressive toward any avian predators in the area. Falcons that are hacked and there-

fore without defense by natural parents, however, are very susceptible to predation. We have found that small cliffs at lower altitudes surrounded by mixed deciduous-coniferous forests and pasturelands are likely to be visited by great horned owls and that young peregrines may be killed in the night even two weeks after they have been flying. On the contrary, falcons fledging from cliffs at higher elevations and surrounded almost completely by coniferous forests have suffered no predation from owls. These nocturnal predators are nearly always present in woods that are adjacent to marshes and wetlands, and hack towers should always be placed at least one and one-half kilometers (about a mile) away from forests.

Golden eagles are a constant threat at many of the hack sites which are located on cliffs; ideally, a hack site should not be located within 16 kilometers (10 miles) of a nesting pair of eagles, but, again, this depends on the local topography. Goshawks (*Accipiter gentilis*) and red-tailed hawks (*Buteo jamaicensis*) will also attack and kill young peregrines. Although all of the avian predators mentioned may make an easy meal of a young falcon, this is especially true of the hawks that are nesting near the hack site. Ospreys (*Pandion haliaetus*) are normally rather unaggressive, but if they are raising young in the vicinity of a hack tower, certain individuals will pursue nearby peregrines with deadly determination. Hack towers should be placed no closer than 500 meters (about 550 yards) to an active osprey nest. In many of the instances where our hacked falcons were killed by owls, the falcon was not eaten. It appeared that the falcons may have been killed on a competitive basis since anything that is prey for the falcon in the daylight hours is prey for the owl at night.

Mammalian predators can also be a threat to young falcons. Raccoons *(Procyon lotor)* and ring tails *(Bassariscus astutus)* are especially troublesome, and at higher elevations martins *(Martes americana)* are potential problems. These mammals will not hesitate to attack and kill a peregrine if they can catch it. They are probably attracted to the hack box by the odor of decaying food remains. We have found that porcupines *(Erethizon dorsutum)* and members of the marmot family *(Marmota sp.)* will chew on hack boxes, presumably attracted to the glue in the wood. Not only can porcupines destroy a box over the winter, but in a single night they can chew a large enough hole to allow other mammalian predators an entrance to the hack box. During the off-season we have covered the sides and back of the box with one-fourth to one-half inch hardware cloth to protect it. The fronts are also left in the boxes at locations where mammals may try to eat them.

Foxes (*Vulpes* and *Uroncyon* spp.) and coyotes will also kill fledglings, and they are especially dangerous during the first two to three days of flight when the falcons may end up on the ground.

The best strategy to use against other predators is simply to avoid them. Sometimes, however, this is impossible at cliff sites. Before any measures are taken to control predators, it is necessary to have the proper permits from both state and federal authorities. We have already mentioned that the more heavily wooded, higher elevations are usually free of owls. J. Barclay has worked out an effective method of trapping great horned owls at night with a mist net, a tame owl tethered below the net, and a loud speaker which plays the recorded hooting of a courting owl. The problem with this method of management is that there seems to be