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Partnerships for Wildlife Restoration: Peregrine Falcons

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Conservation agencies throughout the world are working to protect and restore endangered species of wildlife. Some of the better known restoration programs are those involving species such as the whooping crane (*Grus americana*) and California condor (*Gymnogyps californianus*), but there are also many less publicized efforts in aid of a wide variety of species. Unfortunately, many of these restoration programs, especially those involving species that have reached critically low numbers, prove to be extremely difficult and often unsuccessful (Halliday 1978; Griffith et al. 1989). However, the need for these programs continues to rise under increasing pressure of habitat loss, overexploitation, introduction of exotic species, and environmental pollution.

Effective wildlife restoration programs often require a large commitment of technical and financial support. Formation of partnerships between conservation agencies and interested corporate sponsors is one means of providing this support. Such partnerships have become more common in recent years. In this chapter, we describe how such a partnership was formed to conduct the successful re-introduction of the eastern subspecies of peregrine falcon (*Falco peregrinus anatum*) to the Sudbury area.

Species Description

The peregrine falcon is one of the world's fastest birds, attaining diving speeds of up to 300 km/h, their powerful talons act as bludgeons, knocking their prey out of the sky (Fig. 12.1). There are three recognized subspecies of peregrine falcon in Canada and the United States. The western peregrine falcon (*F. p. pealei*) breeds along the British Columbia coastline and offshore islands, north through to the Aleutians. The Arctic subspecies (*F. p. tundrius*) breeds in areas above the treeline, along the coastlines of Hudson Bay and in northwestern Canada (Godfrey 1966). The eastern subspecies (*F. p. anatum*), although never very common before the use of pesticides, was found in many regions throughout Canada and the United States until it was extirpated from much of its range from the end of World War II to the present.

The decline of peregrine falcons in eastern North America was monitored and recorded by several researchers (Hickey 1942; Cade and Fyfe 1970; Fyfe et al. 1976). The development and large-scale use of the insecticide DDT from 1947 to the late 1960s is thought to be the main cause for the loss of peregrine populations in North America, as well as Europe (Hickey 1969). However, it was not until several years after the introduction of DDT that the deleterious side effects and the prolonged persistence of the metabolite DDE (dichlorodiphenyldichloroethylene) in the environment became known (Ratcliffe 1967; Hickey and Anderson 1968; Cade et al. 1971; Peakall

FIGURE 12.1. Streamlined body with narrow pointed wings and tail allow the peregrine falcon to move swiftly after prey. (Photo by C. Blomme.)

1976). Rachel Carson's book *Silent Spring*, published in 1962, brought this problem to the attention of the general public, an action that many consider instrumental in initiating the "environmental movement."

Thinning and breakage of egg shells, chick and adult death, and aberrant breeding behavior in adults are some of the adverse effects of long-term exposure to DDT and other chlorinated hydrocarbons (Ratcliffe 1970; Cade et al. 1971; Newton and Bogan 1974). Other species have also been affected (Box 12.1). Although DDT was banned in Canada in 1972 and in much of the United States in 1974, its metabolites are still found throughout the environment (Luoma 1991). Unfortunately, DDT is still used in some central and South American countries such as Mexico and is therefore available as a source of contamination for migratory species including peregrines (Fyfe et al. 1991).

North American Peregrine Recovery Program

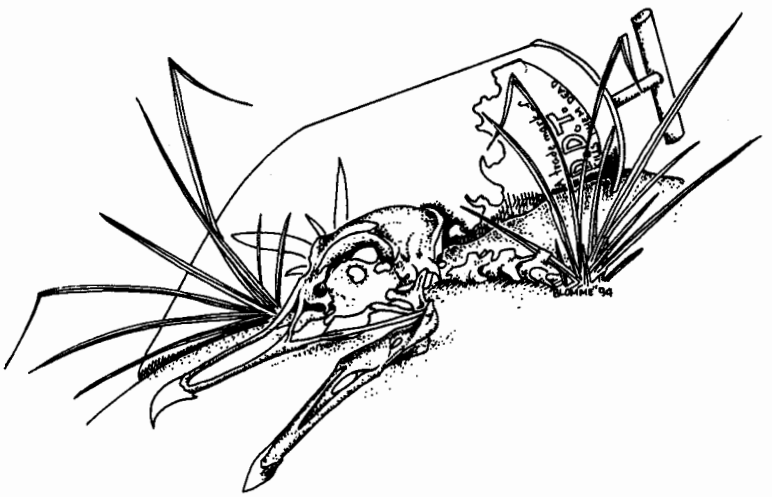
Once it was recognized that the eastern subspecies *anatum* was extirpated from much of eastern North America, researchers in Canada (Fyfe 1976, 1988) and the United States (Cade et al. 1988) initiated breeding programs and tested a number of techniques for re-introduction. The Canadian government, through the Canadian Wildlife Service, has been the main contributor to the re-introduction program in Canada (Erickson et al. 1988). For example, the service established a program at Camp Wainwright in Alberta where captive surrogate parents are used to successfully rear chicks for shipment to release sites throughout Canada.

Although the captive breeding and release program has provided large numbers of birds for re-introduction, the program has been criticized by some researchers. For example, the difficulty in locating released birds and confirming that they are successfully reproducing is to some a sign that the program is not working (Cade et al. 1988; Kiff 1988; Nisbet 1988). To date, more than 400 birds have been released in Ontario, and only seven active nest sites have been identified.

Project Peregrine Sudbury

The decision to re-introduce peregrine falcons to the Sudbury area was made for a variety of reasons. First, the return of this native species to the area had been a dream of many local biologists and naturalists since peregrine releases began in North America. Two release

Box 12.1.



The peregrine falcon has received much public attention and support since the effects of organochlorines were first suspected. However, it is not the only species that suffered severe population declines as a result of these chemicals. The osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*) became endangered, whereas the herring gull (*Larus argentatus*), double-crested cormorant (*Phalacrocorax auritus*), and several other fish-eating birds were affected at various locations.

Herring gulls nest on islands and shorelines throughout the Great Lakes area. They usually lay three eggs in a clutch and average one to two offspring from the colony per season. In 1969, the colony on Scotch Bonnet Island in Lake Ontario revealed an alarming young/adult ratio of 1:8 instead of the expected 1:2 ratio. Further studies showed that herring gulls were accumulating high concentrations of organochlorines such as DDT (DDE), dieldrin, PCB (polychlorinated biphenyls), and dioxin in its tissues. These compounds resulted in behavioral and reproductive problems, causing low recruitment of young.

Since the discovery at Scotch Bonnet Island, the herring gull has become a very important part of the biomonitoring program for the Great Lakes. Egg samples from several herring gull colonies now provide an annual measure of the presence of organochoride compounds. Most contaminants have shown a marked decrease since the early 1970s. Dieldrin has shown only a gradual decrease, and localized populations of gulls in highly industrialized areas of Lake Erie and Lake Ontario still show physical and reproductive problems associated with chemical contaminants. The biomonitoring of contaminants in colonial birds such as the herring gull has therefore become an essential source of information about the condition of the environment in which we live.

efforts had been made previously in northern Ontario, but neither was near the Sudbury area. Second, the steady improvement in the diversity of plant and animal life in the industrially damaged area was thought adequate to support a population of peregrines. A total of 266 species of birds are known to occur in the area (Whitelaw 1989), with several being suitable prey. Third, Falconbridge Limited, one of the mining companies originally responsible

FIGURE 12.2. Large hack boxes located on the east end of the student residence at Laurentian University overlook the city of Sudbury. Large painted numbers on the sides aided volunteers in describing locations of their observations. (Photo by K.P. Morrison.)

for some of the environmental degradation, considered the project an ideal opportunity to illustrate their commitment to improving and restoring industrially damaged ecosystems. The fact that the species of interest was a falcon, the corporate logo of the company, made support for this particular program especially appropriate. Finally, the project was a chance for local government agencies to show that multiagency partnerships could be used to participate effectively in natural resources management and restoration efforts.

Partnership

The path from talking about a release to actually making one happen requires the efforts of many dedicated individuals, contribution of money, and administrative support. The process began with the involvement of several dynamic and determined individuals who promoted the program as a partnership between government, industry, and academia and capitalized on the heightened interests in environmental restoration in the Sudbury area. However, what began as a partnership between agencies (Ontario Ministry of Natural Resources, Falconbridge Limited, Noranda Inc., Laurentian University, World Wildlife Fund) soon expanded to involve the general public. Several hundred volunteers helped monitor the movement of birds, especially in the few days after releases.

Urban Release—Sudbury (1990–1991)

The release of peregrines into an area can occur by augmentation, cross-fostering, or hacking (Burnham et al. 1978; Sherrod et al. 1981). The first two techniques depend on having established breeding pairs in the region. Therefore, only the hacking technique was available to us.

The roof top of one of the student residences at Laurentian University in Sudbury was chosen for the hack box site (Fig. 12.2) (see Idle 1990) for details of construction). The site overlooked a woodland and nearby lake and met the following criteria: (1) an unobstructed vista to permit peregrines to orient themselves to surrounding landscapes during the hacking phase; (2) protection from vandalism and predation; (3) suitable locations for observers to watch released birds; and (4) adequate natural food supply and habitat for young falcons to hunt.

Birds arrived by air freight from Edmonton each summer. A media presentation at the time of arrival gave members of the press the opportunity to obtain photographs of the young birds (Fig. 12.3). The Sudbury peregrine story was

FIGURE 12.3. Warren Holmes (Vice President and General Manager, Falconbridge Ltd.) and Karen Laws (District Biologist, Ministry of Natural Resources-Sudbury) launch the first year of Project Peregrine. The co-operative venture was the first of its kind in Ontario. (Photo by M. Roche.)

FIGURE 12.4. Peregrine chicks are removed from their shipping boxes and transferred to the hack after the bands are verified. Note the sharp talons and beak used for capturing and tearing prey. (Photo by C. Blomme.)

televised on the Canadian national news in 1990. Media personnel enthusiastically covered the peregrine release projects each summer.

Each bird was examined and its band number recorded before being placed in a hack box (Fig. 12.4). Standard, individually numbered, eight-digit aluminum Canadian Wildlife Service bands had been previously placed on one leg of each bird. On the other leg, a bright red aluminum band individually labeled with ei-

FIGURE 12.5. These 4-week-old chicks have just been placed in the hack box. The interior provides perches, a feeding station, gravel, a hide, and a vista of the surrounding landscape. (Photo by C. Blomme.)

ther two numbers, two letters, or a combination (3E, A2) were present. These bands were used to identify individual birds at a distance using binoculars or a spotting scope. Birds were distributed to the various boxes according to age. The birds' ages at arrival ranged from 29 to 35 days, with an average of 32 days for 1990 and 1991.

Life in the Hack Box

During the 2-week hacking period, the young falcons, called eyasses, were monitored 24 hours a day using concealed windows and remote cameras (Fig. 12.5). Initially, the birds were fed small pieces of quail, but as the falcons grew, whole quail were delivered through feeding tubes. Considerable care was taken to avoid contact between the care givers and the birds to prevent domestication.

Wing flapping behavior increased as development progressed. As release time approached, some birds would cling to the front aluminum bars, flap their wings vigorously, and begin elevating off the floor. Sexual dimorphism was evident, with females being larger than males of equivalent age.

Release Day

Sherrod et al. (1981) recommend that birds should be 42–45 days of age when released. Sudbury's birds were 42–48 days of age on release in 1990 and 41–46 days of age in 1991. Two releases occurred each year, with totals of 15 and 17 birds released in 1990 and 1991, respectively. Each release day depended on weather conditions and the developmental stage of the chicks. Ideal conditions for release were clear days with a light breeze providing slight updrafts to assist with first flights. On the morning of the release, food was placed outside the hack so that birds would initially associate food with the hack site. A water basin with fresh water was placed near the hack boxes for bathing.

FIGURE 12.6. This 49-day-old peregrine falcon perched near an observer during its third day of freedom. The red band on the left leg (band number 08) indicates it is a male from Sudbury's release. (Photo by C. Blomme.)

Observers with portable radios maintained a continuous watch over the birds for the first 5 days after release, a critical period during which the birds attempt their first flights, learn to manoeuver, and land. Many volunteers were needed for these intense observations. In 1990, 70 volunteers and, in 1991, 75 volunteers from a variety of backgrounds and disciplines contributed to this co-operative venture.

Our first release day was July 11, 1990. To the delight of gathered representatives of the partners, television and other media crews, and many interested members of the general public, all eight birds flew on the first day, three of them within the first hour (Fig. 12.6). The second release in 1990 and the two releases in 1991 were equally successful, with most birds flying on the first day. The longest delay was female "HR" (46 days old), who took her first flight 5 days post-release.

Training and experience were obviously essential for the young peregrines to develop their tremendous aerobatic skills. For example, one bird took off and circled the residence, but when it approached for landing on the roof, it pulled up at the last second, crashing into the wall, and fortunately, slid safely to the ground. These types of incidents were noted on several "first" flights and were a constant concern for the observers watching the birds learn to fly and land.

Peregrine visual capabilities are acute. After release, many birds would be flying after dark (Courtin 1991; Hillis 1992). Hunting behavior was noted within the first 5 days of release. Perched birds would peck at and eat insects and spiders, and flying birds would chase monarch butterflies (*Danaus plexippus*), sulphurs (*Colias* sp.), and hornets. As flying skills improved, the young peregrines concentrated more on pursuing birds as prey. American goldfinch (*Carduelis tristis*), starling (*Sturnus vulgaris*), and tree swallow (*Iridoprocne bicolor*) were chased. Even a large great blue heron (*Ardea herodias*) was harassed by the young peregrines. These chases appeared to be precursors to actual capturing of prey at a later age. Confirmed kills were difficult to substan-

tiate or observe. A rock dove (*Columbia livia*) was the first confirmed kill by a peregrine at 16 days after the first release. One peregrine was also observed eating the remains of a sharp-shinned hawk (*Accipiter striatus*).

Long periods of observations by volunteers and project staff resulted in many confirmed sightings of individual birds well after release. In 1990, the last bird observation (band number DU) was recorded on September 12, 6 weeks after release. The average age of the 15 birds at the time they were last observed was 76 days. As many as 11 falcons were seen on August 17, when the youngest and oldest birds would be 67 and 83 days of age, respectively. Birds began their southern movements between August 10 and September 12, 1990. In 1991, the average age of the 17 birds when last confirmed was 77 days. Three birds were seen on September 9.

Wilderness Release—Killarney Provincial Park (1992–1993)

Peregrine falcons reach maturity between 2 and 3 years of age. At this time, a breeding territory would usually be established and defended by a male. If a nest happened to be located close to the hack box site, a territorial male may chase newly released peregrines. Therefore, in the third year of the program the hack boxes were moved to a new site, located at Hawk Ridge (elevation, 310 m) in a wilderness park, approximately 60 km south of Sudbury. Steep cliffs in the park provided potential nesting sites; natural food was plentiful; risk of predation and human interference was low; and access for staff was challenging but possible. Again, more than 70 volunteers from the park campgrounds and Sudbury community offered assistance at the new site.

Many challenging logistical problems had to be overcome at this remote site. Four hack boxes had to be secured to the edge of the cliff with stainless-steel cables (Fig. 12.7), and concealed observation stations had to be established at either end of the ridge to monitor birds during the releases. A base camp was established at the bottom of the cliff for project staff. A helicopter was needed to transport the crates containing the falcon chicks to the site.

The birds were fed and monitored daily for 2 weeks after arrival. Black bear (*Ursus americanus*) were common in the area and were a concern due to the presence of dead quail. Misto-van deodorizing chemical was applied on the ground surrounding the hack boxes and proved to be a deterrent to bears approaching the hack sites.

During the releases, volunteers in canoes observed the peregrines from the lake surface at the base of the cliff. Climbing gear and safety equipment were needed for safe approach to the hack boxes to remove frontal barriers. Feeding boards were placed on the roof of two hack boxes, and later, only one feeding station was maintained for the birds of both releases.

Release of the 59 young peregrines at the remote location went smoothly, with no groundings observed. All birds flew within 1 hour of barrier removal. This was noticeably different from the urban releases and was attributed to the older ages of the released birds. Birds were released at between 47 and 52 days of age at Hawk Ridge. The extra hack time was intended to ensure stronger development of young falcons to reduce the chance of groundings and slow fliers, as observed in the urban releases.

Flight development and hunting techniques developed similarly to the urban released birds but were more spectacular to observe over the hills and forests of this wilderness park. Birds dispersed from the area by the third week of August. The average time to dispersal for the urban and wilderness releases was similar at 35 days.

North American Monitoring

Monitoring of the success of this endangered species recovery project would not be possible

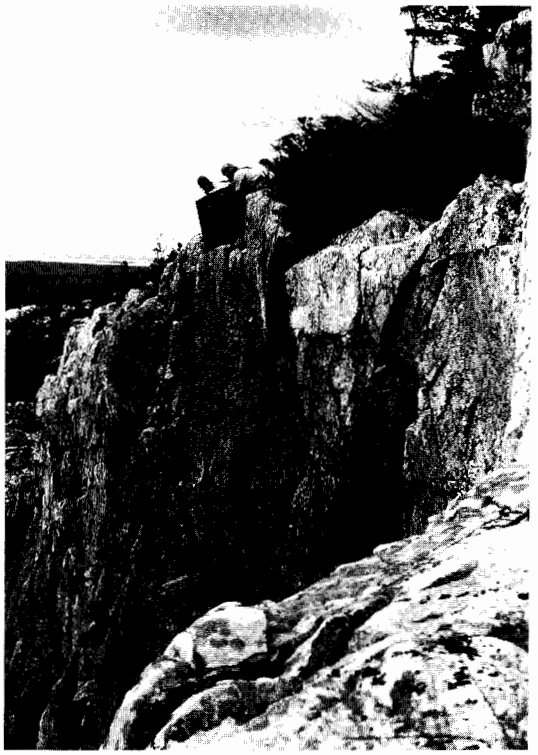


FIGURE 12.7. The location of the hack boxes on Hawk Cliff above George Lake in Killarney Provincial Park was very different from the urban release at Sudbury. The vista revealed little human development. (Photo by C. Blomme.)

without an intricate network of communications across North America. Observations by avid naturalists, conservationists, and other interested people provide reports of band sightings to the U.S. Department of Fish and Wildlife or the Canadian Wildlife Service. In 1990, one of Sudbury's birds, female "DY," was identified and photographed in Terre Haute, Indiana, on September 12, 35 days and 1000 km away from her Sudbury origin. Female Z4, released July 23, 1993, was observed in good condition in Cape May, New Jersey, on September 27.

Since beginning in 1990, our project has released 91 falcons to their historical range (Fig. 12.8). Fifteen sightings have been reported, 6 of which were mortalities. Two birds were shot, one while a person was protecting his pigeons; one bird hit a glass building in Los Angeles, California; one bird was found as a carcass; and two birds were hit by cars while in pursuit of prey. One bird fell into a sewage treatment site and was subsequently rehabilitated and released in Florida. Two males and a female returned to Sudbury 1 year after release. A female released in Sudbury in 1990 was observed with a mate at the Toronto waterfront in October 1993. One of the returning birds has been the subject of a detailed follow-up study that is described in Box 12.2. As of June 1994, there have been no other confirmed sightings of the rest of the birds, but we assume that many are alive.

Benefits of the Partnership

This re-introduction of peregrine falcons could not have been as successful without the partnership approach. The birds were the principal beneficiary of the partnership, but the partners also benefited. For example, there were immediate and tangible benefits for partners such as tax credits and positive publicity for sponsoring industries, as well as less tangible but still very useful information exchange through personal involvement, a benefit that

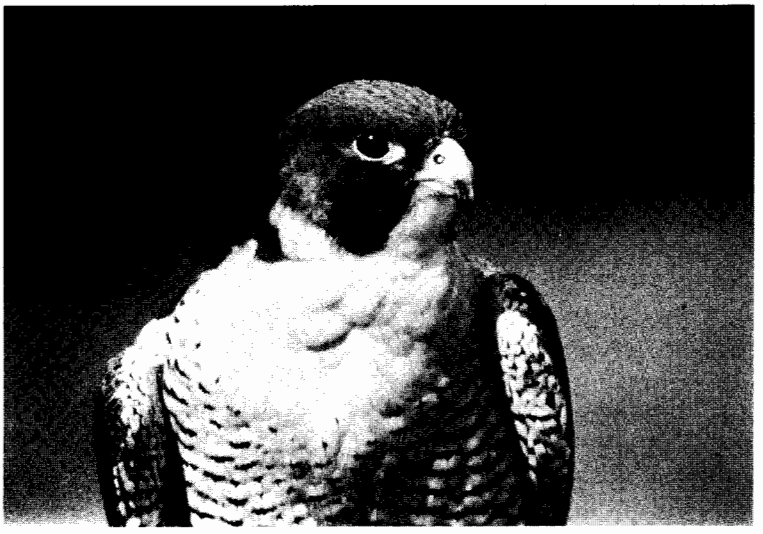


FIGURE 12.8. An adult peregrine falcon looks very different from first- and second-year birds. This male is one of the original breeders from Camp Wainwright, Alberta. Note the prominent black facial crest and the buffy clear chest. (Photo by C. Blomme.)

can greatly assist in future cooperative efforts. The direct exchange of environmental and natural history information, particularly with the volunteers and other members of the general public, was one of the most rewarding parts of this program.

One should not overstate the ease with which such partnerships can be formed or suggest that they will always be successful. Successful partnerships require considerable commitment, flexibility, awareness of the goals and needs of all involved, frequent and extensive communication, humility, and an appreciation of the contributions and sometimes the limitations of each member. No doubt, many partnerships can be expensive, inefficient, and difficult to maintain, but to our knowledge there has been little objective analysis of the factors (e.g., number of partners, level of financial contribution, du-

Box 12.2. Female AD's Story

On May 10, 1991, female AD was observed in Sudbury on top of the building near the site where she was released a year earlier. In September of that year, she was regularly observed in downtown Detroit where she paired and mated with an unidentified subadult male in the spring of 1992. These birds nested and laid three eggs on a ledge beneath a fire escape on the thirty-third floor of an office building. The eggs proved non-viable. Close monitoring by Detroit peregrine biologists resulted in a fostering operation. Two 10-day-old chicks, one male and one female, were exchanged for the eggs. The two eyasses were immediately adopted and reared successfully. After fledging, the fostered young female established residence in downtown Detroit. Her brother was observed flying toward Windsor, Ontario, near the end of summer 1992.

The Detroit peregrine staff have renamed our Sudbury female "Judy" and her mate "Pop." In 1993, Judy and Pop overwintered in downtown Detroit. Mating occurred in mid-March. Four eggs were laid, with two healthy chicks hatching in mid-May. This was the first recorded wild hatching of peregrine falcons in the Detroit, Michigan, area. Both chicks had fledged by the end of August 1993 and were residing in the Detroit area. In 1994, Judy and Pop again produced two healthy chicks.

ration of project, administrative structure) that contribute to success or failure. Given the need for partnership in environmental or ecological restoration, such analysis should be encouraged.

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