

RAPTOR REHABILITATION AND CONSERVATION IN MINNESOTA*

by

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Minnesota contains many areas of good raptor breeding habitat. The open agricultural lands, hardwood forests, coniferous forests, wetlands and combinations of these habitats provide the diversity and productivity necessary to support many species of hawks, owls, and falcons as well as the Bald Eagle and the Osprey. Additionally, the fall and spring migrations funnel thousands of birds through the state each year, and many overwinter. The encroachment of suburban sprawl upon these habitats and exhaustive year-long recreational use of nearly all the state results in numerous human-raptor encounters. This is particularly true in the greater Minneapolis-St. Paul area which lies near the junction of several habitat types.

The dense human population interacting with the raptor population has resulted in many birds being shot, illegally trapped, and taken from nests. Game farms and commercial hunting clubs with their concentration of game species, attract raptors. Shooting and pole trapping have caused the injury or death of many birds. People seeking hawks and owls for pets may take all the birds from a nest and then, with little knowledge of, or experience in caring for, raptors, end up with undernourished, ill, or injured birds. Diseased or injured raptors are often discovered by people hiking, hunting or driving. As a result of these factors a need has existed for a program involving the conservation and rehabilitation of raptors in Minnesota.

In 1971 Fuller began conducting a radio-telemetry study of various aspects of raptor ecology in Minnesota. In order to test the effects of a new transmitter design on the behavior of hawks and owls, injured birds were sought at a local zoo and state game farm. It was readily apparent that there were several sources of injured raptors but that most birds would need professional veterinary care.

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Dr. Duke, of the University of Minnesota College of Veterinary Medicine, who is conducting gastro-intestinal research on owls, volunteered his help. He also contacted Redig, a veterinary student and falconer, who was eager to apply his professional skill to raptors. It was soon decided to establish a comprehensive program of raptor rehabilitation and conservation.

Initially the effort was all made with the authors' own time and financing. Soon, however, the faculty and staff of several departments were donating time and expertise. This work was a new experience for most, but people have been most cooperative in helping with problems. With this assistance much specialized work, such as radiology and orthopedics, has been accomplished. Financial assistance for various aspects of the program has also been contributed by the Raptor Research Foundation, the Frank M. Chapman Memorial Fund, Duluth Audubon Society, Hawk Ridge Nature Reserve, the Minnesota and St. Paul Humane Societies, a National Institutes of Health Training Grant, the Minnesota Ornithological Union, and other individuals and organizations.

The cooperation of Dr. John B. Moyle and other employees of the Minnesota Department of Natural Resources and Dr. C. A. Swanson, William Halstead and members of the Bureau of Sport Fisheries and Wildlife have greatly contributed to the success of the program. Additionally, members of the various bird clubs in the state, the local humane society, zoo, managers of hunting clubs and several falconers have helped to locate birds and submit them to us. Newspapers, television and radio stations throughout the state have carried requests that residents having injured raptors contact us. These organizations and the news media have also helped spread information regarding the raptors' place in the ecology of the environment, and the laws pertaining to their protection. Cooperation of this nature has been paramount in establishing the program.

To date, these efforts have given results that encourage the continuation of the work. Many people still harbor the misconception that all hawks and owls are poultry killers. Response to newspaper articles and other media has indicated that the public is interested in, and receptive to, information about raptors. Talks to local nature groups, such as the Isaac Walton League, and bird clubs, gave these interested people more specific knowledge about hawks and owls and they in turn pass it on to others. The education of the general public with regard to the raptors' place in the environment may be one of the most important factors in conserving raptor populations.

Professional ornithologists, falconers, educators and state officials have joined in an effort to strengthen the state protection afforded to raptors, and to insure that falconry can continue and contribute to management and conservation efforts. Falconers in the state have been encouraged to organize and cooperate in every way possible. With the present concern for the environment and the esthetic values more and more people are finding in nature, education about raptors can go a long way toward preserving these birds.

Relocation of nuisance hawks and owls has been instituted at two private hunting clubs, and one state game farm. In the past steel pole traps or guns were used to eliminate raptors, but at these three concentration areas for prey species,

the use of a Swedish Goshawk trap proved to be effective in keeping predation down to levels similar to those obtained by the former methods. Two of these areas set and maintained a trap throughout the fall; the third allowed a falconer to trap on weekends. A total of five Red-tailed Hawks, one Cooper's Hawk, 10 Goshawks, two Broad-winged Hawks, two Red-shouldered Hawks and 12 Great Horned Owls were trapped. Dr. H. Meng (1971) provides additional data from a similar project in New York, where the Swedish Goshawk trap was as effective as pole trapping. The Swedish Goshawk trap and the verbalail are suited to the needs of these hunting clubs and game farms because they are effective, but need only be checked periodically. Other devices, such as the bal chatri trap and bow-net, require more continuous attention, but can also be used effectively. Once trapped, the raptors were released in suitable habitats away from game concentrations, on nature areas, or in the case of fall migrants, some distance south of the capture site.

We are seeking the assistance of state and federal officials to encourage a switch to humane methods of live-trapping. The pole trap is indiscriminate and exists as a potential danger to all raptors. If a pole-trapped bird does not die in the trap it usually sustains injury. Of 17 pole-trapped Great Horned Owls we have received, only four had injuries minor enough to allow them to be released immediately, four were eventually released, nine were permanently disabled or died as a result of their injuries. Hopefully, future legislation will dissuade users of this technique. However, manpower for proper enforcement of laws is seldom adequate. Therefore, the introduction of alternative successful trapping techniques may prove more valuable in saving birds from the gun and pole trap. Falconers, federal bird banders and conservation workers might be encouraged to help trap and relocate raptors. In states where regulations permit, a falconer could obtain a bird, formerly destined to be shot, through such cooperative efforts.

In the past year and a half we have received over 120 injured and diseased raptors from throughout the state. Unfortunately, in the early stages of the project we received birds only after people had tried to care for the birds themselves. These cases were usually beyond help because of advanced stages of disease, shock, malnutrition, or dehydration. As knowledge of our work spread, cases were received soon enough for our treatments to be effective. A total of 90 birds were treated from January 1972 to March 1973 for a variety of illnesses and injuries (Table 1). Thirty of these birds were able to be released again. In addition to receiving many of the common species, representatives of several species such as the Bald and Golden Eagles, Peregrine Falcon, and Gyrfalcon that are uncommon in many parts of the country were also treated (Table 1). Our most frequent patients were Great Horned Owls that were injured by pole traps (Table 1).

The regimens of therapy applied to these birds are in general the same that would be applied to any injured and debilitated animal. Inasmuch as the majority of the birds received had injuries to the extremities, the following discussion

Table 1. Summary of raptor injuries—January 1972 to March 1973.

Species/Injury	Projectile	Pole Trap	Accident	Malnutrition	Disease	Total
Red-tail	8	2	1		2	13
Kestrel				5		5
Red-shoulder	1					1
Broadwing	4			1		5
Rough-leg	1					1
Marsh Hawk	2					2
Sharp-shinned			1			1
Goshawk	5	2	1	1	9	18
Peregrine			1			1
Gyr Falcon			1			1
Bald Eagle	2	2	1			5
Golden Eagle	1					1
Screech Owl	1					1
Barred Owl	3	1	1			5
Long-eared Owl	1		1			2
Snowy Owl	2		2			4
Great Horned Owl	6	17	1			24
Total	37	24	11	7	11	90*

*Raptors treated prior to 1972, and those that died before treatment, or were dead on arrival are not included in this total.

will be confined to a description of the management of these. Our first concern was to stop blood loss. This was best done by locating the source of the bleeding and applying pressure with the fingers until bleeding ceased. Then, the rest of the body was palpated for other injuries such as lacerations or fractures. A swab was usually passed down the esophagus into the stomach to determine if there was hemorrhage in the upper gastrointestinal tract. The debris was cleaned from open wounds, dead tissue was removed, and wounds were packed with antibiotics. At this time we also formulated some notion of the nutritional status of the bird. Broken wings or legs were bound against the body to prevent further injury while the bird was brought through the process of being nutritionally and metabolically stabilized. Only after this stabilization has occurred should one consider subjecting the bird to the stress of surgery to reduce fractures.

To bring about this nutritional stabilization the bird was fed a good high protein diet for several days. Most birds are dehydrated by the time they are received and treatment for this will also have to be considered. In the case of the bird that was dehydrated or could not or would not eat solid food, a slurry consist-

ing of boiled Coke or lactated Ringer's solution, raw eggs, vitamin supplements and finely chopped meat was fed via stomach tube. After a couple of days, light meat such as the breast of pheasant was introduced into the diet, with roughage being given at a later time.

When surgery was indicated for the repair of injuries, we began with radiographs to determine the extent of injuries. A technique consisting of 43 KVP, 300 MA, for 1/20 sec at 40 inches (100 cm) from the table top proved to be satisfactory for the extremities for a bird the size of a Red-tail. A ventral-dorsal shot was usually made, occasionally followed by a lateral view. No anesthesia or sedation was required although the bird often was restrained with masking tape.

For treatments requiring anesthesia we relied almost entirely on ketamine (Ketaset, Parke-Davis) given at a rate of 20-40 mg/lb (44-88 mg/kg). This produced sufficient anesthetization for completion of most procedures. Once anesthetized, the bird could be intubated and put on metofane or halothane and nitrous oxide anesthesia for longer procedures. A Bald Eagle was held in the surgical plane of anesthesia for five hours this way. By using acepromazine (Acepromazine, Ayerst Labs., New York, New York) in combination with ketamine, the dosage of ketamine could be reduced by about 30 percent and a much smoother recovery was produced, i.e. when the anesthetic wore off the birds stood up with little involuntary flapping of the wings or thrashing of the legs. This combination has been used only in a Broad-winged and two Red-tailed Hawks and needs further evaluation. We observed a considerable variation in dose/response with ketamine.

Most fractures involving the extremities were stabilized with intramedullary pinning. Pins were usually left in five to six weeks, but this is dependent on the degree of healing and should be monitored radiographically. Wings were brailled for the first two to three weeks and legs could be further stabilized with a modified Schroeder-Thomas splint. Brailing was usually sufficient for fractures of the digits and radius. Stainless steel pins were obtained very cheaply by purchasing stock material from an industrial jobber. The pins then cost about 20 cents instead of the usual \$4.00-5.00.

Other than failure to heal due to vascular impairment, there were few complications involved with the surgical corrections of fractures. Infection of the bone was seldom seen. Occasionally an unusually large inflammatory reaction occurred which tended to create a post-surgical arthritis and ankylosis of nearby joints. We believe that this can be controlled to some extent by the local injection of Depro-Medrol (Upjohn), a long acting steroid, once callous formation is well under way.

Many raptors have been saved but left permanently disabled. Our efforts with these individuals have been to place them where they will be most useful. For instance, the North Woods Audubon Center has an excellent educational and exhibition program which gives many people the chance to see these raptors and learn about them. Also, some school systems and nature centers have personnel qualified to care for and speak about raptors. Other hawks, owls, and

falcons have been used in research on physiology, telemetry, diseases, chromosome studies, blood analysis and anatomy studies. Still others have been turned over to captive breeding projects. These permanently injured birds are used to the fullest extent, but they still represent a problem inherent in the medical aspects of rehabilitation.

In addition to the treatment of injuries, much of our effort was involved with the study of and treatment of aspergillosis in Goshawks. Our data came from two sources: a field survey done on wild birds trapped at Hawk Ridge Nature Reserve, Duluth, Minnesota, during an extensive immigration of Goshawks during the fall of 1972, and from clinical cases seen in birds captured by falconers and those injured birds found by people throughout Minnesota.

Table 2 lists the results of the field survey. A total of 49 Goshawks were trapped in bow nets on two different days, October 8 and October 17, 1972, and their tracheas were swabbed. These swabs, cultured on Sabarouds agar, showed that 26 birds had cultures positive for *Aspergillus fumigatus* and 23 were negative. The significance of these results is difficult to assess. For example, in eight captive Goshawks with clinical signs of aspergillosis, five cultured positive for *A. fumigatus*, and three died from the disease; three cultured negative, yet two of these died of aspergillosis anyway (Table 3). Our conclusion is that more than 50% of the population we sampled carried the aspergillus organism and that, as a result, these birds may or may not at some time become ill.

The clinical signs associated with aspergillosis (Table 3) usually began to appear three to four weeks after the Goshawks were shot or captured. This supports the often mentioned hypothesis that the development of this disease is triggered by some stress factor. It is possible that the three to four week period was sufficient time for pulmonary infection to occur and to bring about the clinical signs of aspergillosis. The excreta of infected birds were watery in nine

Table 2. Incidence of aspergillosis in wild Goshawks.

October 8, 1972.

Incidence	Males			Females			Totals
	Imm.	2 yr.	Adult	Imm.	2 yr.	Adult	
+	1	3	2	2	7	6	21
-	4	2	2	0	2	2	12

October 17, 1972

+	0	2	2	0	1	0	5
-	1	2	2	1	3	2	11

Total 26+, 23-

Table 3. Clinical signs of aspergillosis in Goshawks.

Signs	Number of birds observed.
Culture on Sab-Dex	5/8 +; 3 died
	3/8 -; 2 died
Watery feces	9/12
Excess pale green pigment in feces while engorged	10/12
Weight loss	12/12
Dyspnea	12/12
Anorexia with regurgitation when force fed	12/12
Death	8/12

out of 12 cases; watery to the point where a large puddle up to three feet in diameter would form on the floor within a day. Most of these excreta were infiltrated with a pale green pigment, presumably bile. We have observed that normal birds often excrete bile when hungry, but these birds with aspergillosis had sickly green excreta while there was still ample food in the digestive system. Weight loss in these birds was dramatic. For example, a female Goshawk weighing 2 lbs 11 ozs (1216 g) dropped to 2 lbs 4 ozs (1020 g) in 48 hours. Respiratory difficulty occurred within three days of the first signs. The first sign often was an unusual response to normal activity; later birds began to gasp for air while just sitting quietly on a perch. Shortly thereafter the birds usually stopped eating. Force feeding was effective for one to two days, but then birds began to regurgitate food. Fluids were better retained than solids at this point. Death usually ensued in three to five days after the birds stopped eating. The whole course of the disease has been noted to run from five to eleven days. It should be pointed out that these signs are not specific for aspergillosis, but could be indicative of any debilitation disease. However, if an American Goshawk is showing these signs, we believe that chances are very good that it is indeed afflicted with aspergillosis.

Therapy with Amphotericin B (Fungizone, Squibb and Sons) was instituted for all 12 cases mentioned above (Table 3). It was administered intravenously in the cutaneous ulnar vein at a rate of 0.75 mg/kg and via nebulization with a hand nebulizer. Eight of the birds treated subsequently died while four survived. The latter four were given I.V. injections every other day and nebulization treatment for one hour per day every day. The original diagnosis was confirmed by necropsy among the eight that died. Those that survived were falconer's birds and were not sacrificed to confirm the original diagnosis or to ascertain the degree of remission. Supportive therapy is also an important part of any treatment regimen and in these four cases it consisted of maintaining the fluid, caloric, and acid-base balances of the bird using the slurry described above.

A regimen of prophylaxis was also tried using five captive Goshawks. This consisted of an initial injection of Amphotericin B followed by daily nebulization for one week. The birds were initially swabbed to check for *A. fumigatus* prior to treatment and swabbed again after two weeks. Three were positive prior to treatment and none were positive afterwards (Table 4). It should be noted that the five birds treated here were all trapped much later in winter, i.e. after January 1, and they might represent a resistant segment of the population that had survived the period of stress associated with the fall immigration and readjustment to new habitat.

Table 4. Prophylaxis with aerosol Amphotericin B.

Bird Number	Culture 1*	Culture 2**
1	+	-
2	+	-
3	-	-
4	+	-
5	-	-

*Prior to prophylaxis with Amphotericin B.

**Subsequent to prophylaxis with Amphotericin B.

These initial observations on aspergillosis have raised many questions. To answer some of these, an experiment is now being prepared utilizing Coturnix Quail. The goals of this experiment are: (1) to develop an early diagnosis technique through the use of serum antigen-antibody agglutination reactions; (2) to evaluate regimens of therapy; (3) to evaluate programs of prophylaxis. Basic information obtained from these experiments will then be applied in experimental work that utilizes some of the crippled hawks we have.

In conclusion, the following points can be made concerning rehabilitation:

1. It is of definite value to the individual bird that is returned to the wild.
2. Such a program has sufficient merit to attract public attention, thereby making people aware of the birds and of the problems complicating their survival.
3. It provides basic knowledge and expertise so that rare and endangered species can receive more competent attention.
4. Rehabilitation programs provide a source of birds for research work and educational programs.
5. A program which incorporates careful scientific observations and experimental testing of hypotheses formulated by these observations, can provide much useful information about the biology of raptors and thus contribute to their management and conservation.

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