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VENTRICULAR FOREIGN BODY IN A BALD EAGLE AND THE COOPERATIVE INTERACTIONS REQUIRED FOR REHABILITATION



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The Exotics Dilemma, Part 4: The Stress of Captivity ... Field Anesthesia of Striped Skunks Using Halothane ... Successful Release of a Wild Wolf Following Treatment of a Leg Injury ... Environmental Education ...

ABOUT THE JOURNAL . . .

THE JOURNAL OF WILDLIFE REHABILITATION is designed to provide useful information to wildlife rehabilitators and others involved in the care and treatment of native wild species, with the ultimate purpose of returning them to the wild. The *Journal* is published by the International Wildlife Rehabilitation Council (IWRC), which invites your comments on this issue. Through this quarterly publication, rehabilitation courses offered in numerous locations, and an annual conference, IWRC works to disseminate information and improve the quality of care provided to wildlife.

ON THE COVER: Ventral-dorsal radiographic view of a common nail within the gastrointestinal tract of a bald eagle. [Photograph: Corrine S. Brown]. BELOW: Halothane can be an effective field anaesthesia for striped skunks. [Photograph: Brian Dinter].



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EDITORIAL

Taking Flight

The other day I spent some time with a very special bald eagle patient just before her release. My thoughts unexpectedly turned to IWRC, and the approaching end of my term as board president. The parallels between my work with this bird and my ten years on IWRC's board of directors have remained with me since.

The eagle's case was a near-impossible task. I had hopes for her recovery that some considered unrealistic. Similarly, the sense of obligation loomed large when I assumed the presidency of IWRC. I had many long days and sleepless nights. My hopes for the organization and for wildlife rehabilitation as a profession seemed lofty. I know many also thought them unrealistic.

Let me tell you a little more about this bald eagle. She was thirteen years old by her U.S. Fish and Wildlife Service leg band. This nesting adult was incubating her chicks one stormy spring day when her life changed in a flash: she was struck by lightning. For days she lay on the ground helpless, sinew and bone exposed to the elements. Her once magnificent body gathered maggots that burrowed deep inside of her.

When the bird arrived at my center, I knew the choices I made on her behalf would determine her future. First I had to choose the right team to ensure the best chance of a full recovery. Which veterinarian would have the expertise, patience, and personality to work on this complicated case? How long should we immobilize each fracture? It had to be just long enough for good callus formation, but not so long as to compromise joint movement or flexibility. Later came the choice of which flight to use. Again, balance was the key: allowing this bird to fly too soon could result in fatal re-injury.

Making choices, building a team, striking a balance and preserving flexibility—all must be pursued boldly. I have tried to do so during my IWRC tenure.

Our rehabilitation team's investment in the injured eagle grew daily. We were focused, dedicated to a common goal. Each person brought his or her special talent to the project. If someone became discouraged, others pushed forward. Creativity abounded. Ideas blossomed. Problems were resolved. Team members began to count on one another for advice and took pride in each other's accomplishments.

This also describes the IWRC board. Like the eagle's rehabilitation team, its members dedicated themselves to a common goal, shared their creative talents selflessly, and strove to respect one another. Without these elements, no team can succeed.

There were periods when I worried whether "lightning eagle" would fly again, and times IWRC has struggled. Life-giving elements were held together with the figurative equivalent of plastic rods, pills, and prayer.

Watching this bird regain her independence was a beautiful process. Each step forward, no matter how small, was cause for celebration and pride in our accomplishments. The ultimate goal was always to have this amazing creature take her leave of us and reclaim her freedom.

As I watched our eagle now restored to her former integrity and magnificence, I remembered with great pride and affection the IWRC members I have watched take flight as well. Many I now proudly count among my closest friends. Like members of the eagle's rehab team, these individuals bring to the profession their own brand of magic. I believe these individuals—with their melding of skills and creative ideas—will be instrumental in the future of this multifaceted profession we call wildlife rehabilitation—a profession still searching for a description of itself.

As "lightning eagle" spread her wide wings to the sky and reclaimed it as her own, my heart begged her future be long, rich, and secure. She has so much potential but still faces threats. Our society must remember it has a responsibility for such magnificence. Even if stewardship is universal among all societies, there may still be rivalry, territorial disputes, and threats from the eagle's own kind.

No one knows how this story will end. All we can do is the best we can. Each of us must remember that if we all don't act in good faith—if the eagle herself doesn't make good choices—there is the chance that her kind may be lost. We must all remain vigilant.

Marge Gibson
IWRC President

Ventricular Foreign Body in a Bald Eagle and the Cooperative Interactions Required for Rehabilitation

by Corrine S. Brown and Joanne Rogers Luebbert

ABSTRACT: An adult bald eagle (*Haliaeetus leucocephalus*) was presented to the Alaska Raptor Center in Sitka, Alaska, USA. Physical examination demonstrated no abnormalities, but routine radiographs revealed a common nail in the upper gastrointestinal tract. This was removed by ventriculotomy. Rehabilitation, including flight conditioning, progressed uneventfully and the bird was released 48 days after initial presentation. Cooperative relationships among individuals, governmental agencies, three rehabilitation centers, and two airlines were instrumental in this rehabilitation effort.

KEYWORDS: Rehabilitation, Raptors, Bald Eagle, *Haliaeetus leucocephalus*, Ventriculotomy, Foreign Body

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Introduction

The Alaska Raptor Center in Sitka, Alaska, USA, is a fully staffed rehabilitation center that admits approximately two hundred avian patients a year. Several rehabilitation centers exist throughout Alaska, and these centers often refer patients to the Alaska Raptor Center because a full-time veterinarian is employed there. Alaska Airlines participates in this cooperative relationship by flying bald eagles at no cost between the rehabilitation centers.

The bald eagle (*Haliaeetus leucocephalus*) is the Alaska Raptor Center's most frequently seen patient. The most common injuries include electrocution and collisions; occasionally gastric foreign bodies are presented. Depending on the size, shape, and location of the object, the foreign body is removed by endoscopy or ventriculotomy.

Ventriculotomy is a surgical procedure in which the coelomic cavity is entered, and an incision is made into the ventriculus to remove the foreign body. It is a serious procedure, both as the bird cannot voluntarily breathe during the surgery, and because there is risk of coelomic contamination with gut contents.

After medical diagnosis and treatment is complete, extensive flight conditioning is necessary for any bald eagle that has been in captivity for more than 10 days, due to rapid loss of muscle condition. Because there is, at present, no flight conditioning complex at the Alaska Raptor Center, a cooperative agreement with the Grounded Eagle Foundation in Condon, Montana, has been established, and bald eagles in need of flight training are sent there. In cooperation with the U.S. Fish and Wildlife Service, bald eagles are then returned to Alaska for release. Again, Alaska Airlines and Horizon Air generously provide transportation for the birds undergoing flight training.

This case demonstrates a unique medical presentation and the importance of effective cooperation among individuals, agencies, and health-care providers in the successful rehabilitation of a bald eagle.

Presentation

An adult bald eagle was found lying on its back on a Prince of Wales Island beach in southeast Alaska. A U.S. Forest Service officer captured the bird and transported it by air to the Ketchikan Indian Corporation Eagle Center, where it was first examined by an experienced rehabilitator. The bird was reluctant to stand and was assessed as suffering from dehydration, but no obvious injuries were identified. The rehabilitator, believing the bird was in a life-threatening situation, immediately forwarded it to the Alaska Raptor Center.

The eagle arrived in Sitka via Alaska Airlines approximately 24 hours after it was found on Prince of Wales Island. Upon presentation, it was standing in the kennel with an unusual posture; it appeared to be attempting to lean forward while keeping its back straight and its feet on the perch. Dehydration was evidenced by a wrinkled cere and feet, and slow, "sticky" movement of the nictitating membrane. A physical examination was performed under isoflurane anesthesia (Table 1). A blood sample was drawn; however, a complete blood count and serum chemistry were not obtained because the bird presented on a Saturday night. Sitka is an isolated Alaskan city and blood samples can only be submitted on weekdays via two-day Federal Express. The packed cell volume was 46%; total protein was 4.6 g/dl.

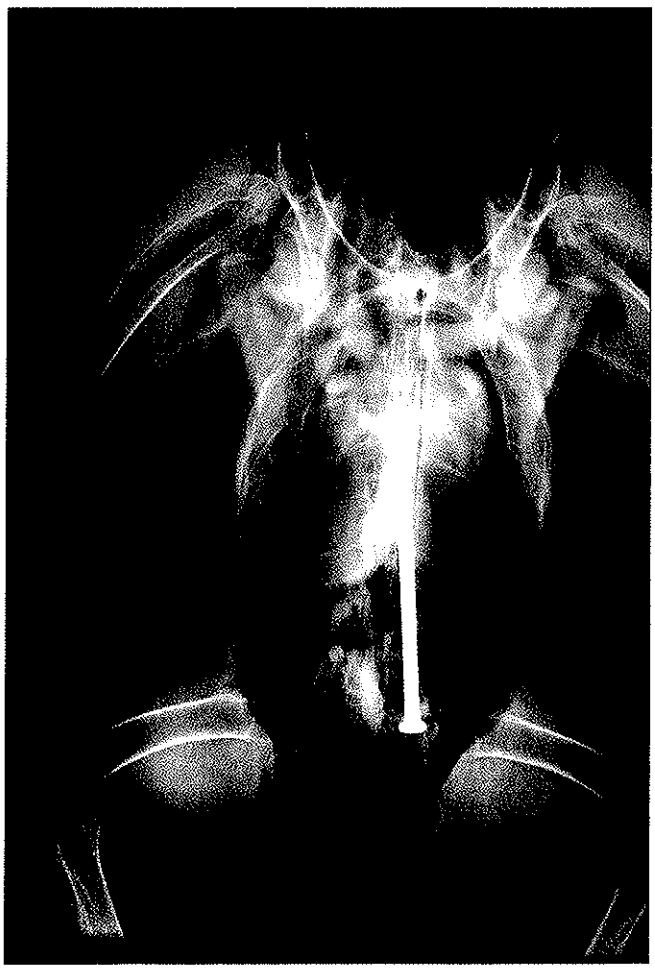
Diagnosis

Based on the physical examination and preliminary blood data, the initial differential diagnoses included concussion, neurological trauma to the spinal cord,

TABLE 1. RESULTS OF INITIAL PHYSICAL EXAMINATION

Body weight	3.63 kg (Normal: 2.8–5.2 kg)
Heartbeat	stable at 140–160 beats per minute
Respiration	stable at 12–16 breaths per minute
Oral cavity	normal; pink mucous membranes
Nares	normal
Eyes	normal; slow, sticky movement of the nictitating membrane
Ears	normal
Neck	normal; nothing was palpated in the crop
Body	thin, with approximately 1 cm of keel palpated; normal abdominal palpation
Wings	normal
Legs and feet	no injuries noted; skin was wrinkled
Feathers	excellent condition

The bird was given 150 ml of Lactated Ringer's Solution subcutaneously. Both ventral-dorsal and lateral body radiographs were taken, and the bird recovered from anesthesia while the radiographs were developed.



CORRINE S. BROWN

Ventral-dorsal radiographic view of a longitudinal metal density (a common nail) within the gastrointestinal tract of a bald eagle.

toxicity (such as lead poisoning), and possibly an atypical crop stasis. Definitive diagnosis was made by examination of the radiographs, which revealed a longitudinal metal-density object within the upper gastrointestinal tract, extending from the distal esophagus to the ventriculus. The object was identified as a 9 cm long common nail, swallowed headfirst.

Treatment

One hour after admittance, the bird was again anesthetized, intubated, and prepared for surgery. A "T"-shaped incision was made midline, with the arms of the "T" approximately 4 cm extending laterally immediately caudal to the distal sternum. The body of the "T" was a 5 cm midline incision extending caudally that allowed access to the coelomic cavity. Because the abdominal air sacs were disrupted, the bird was given assisted ventilation throughout the surgical procedure. The head of the nail was palpated through the ventricular wall and the nail removed through a 4 mm incision in the venticulus. The ventricular incision was closed using a triple layer of 2–0 absorbable suture and an inverting suture pattern. The muscle and skin of the body wall were closed in two layers using 3–0 absorbable suture in a simple interrupted and a Cushing's pattern, respectively. The bird began to breathe on its own within 2 minutes after the incision was closed.

Supportive treatment included 150 ml Lactated Ringer's Solution at the completion of surgery; 2 mg/kg butorphanol tartrate IM SID x 3 days; and 15 mg/kg enrofloxacin IM SID x 3 days followed by 15 mg/kg enrofloxacin PO SID x 7 days. The eagle recovered rapidly from anesthesia and was placed in sternal recumbancy in a kennel for the night, with orders of nothing per os for 48 hours.

The day after surgery the bird was still resting. Its hydration status appeared good, therefore no parenteral fluids were administered, but treatments were given as stated above. Within 1 hour of its return to the kennel, it was standing with a normal posture, and appeared bright, alert, and responsive. The bird continued to improve throughout the next 24 hours.

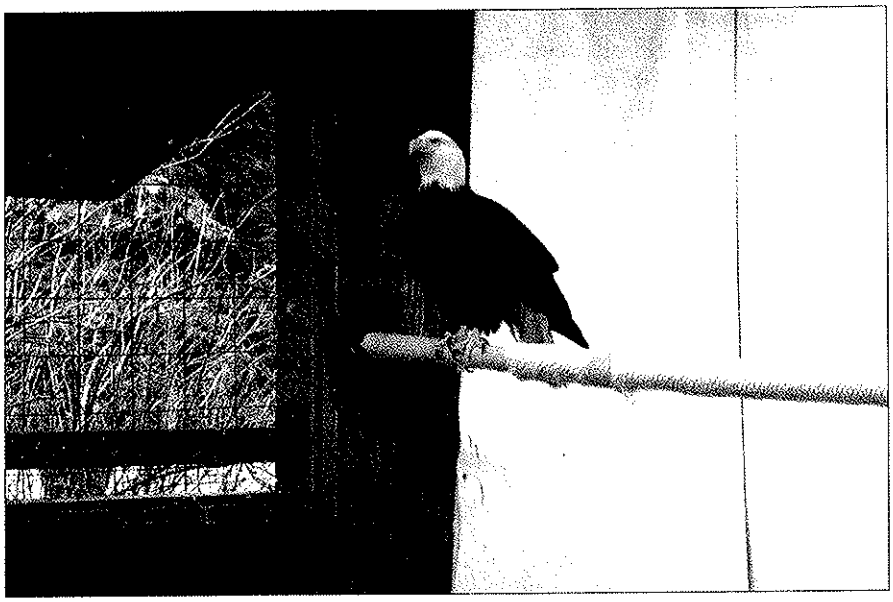
Sixty hours after surgery, 56 gm of slivered, clean salmon was offered to the bird and was immediately consumed. A total of 150 gm of salmon, with oral enrofloxacin, was offered and eaten by the bird within 24 hours.

Progress and Outcome

The bird continued to improve and demonstrated a ravenous appetite for the next 7 days. The diet was slowly increased over that time period, until the bird was consuming 250 gm of salmon BID. The surgical site appeared healed within 10 days after the surgery. After completing the oral antibiotic regime, the bird was transferred to a 9.14 m (30 ft) mews.

In the mews, the bird flew from perch to perch effortlessly. Because of loss of muscle condition during the recovery period, 25 days after presentation to the Alaska Raptor Center, the bird was transferred to the Grounded Eagle Foundation for flight conditioning.

At the Grounded Eagle Foundation, the bird was placed in a 54.86 m (180 ft) "L"-shaped mews and was exercised regularly until it was determined to have returned to good physical condition. A bird is considered in good physical condition when it can fly continuously several times back and forth in the mew without showing signs of physical stress. In this case, the bird was reconditioned in 23 days; returned to Sitka, Alaska; and immediately released to the wild. The entire rehabilitation process took 48 days.



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Bald eagle, "Spike," undergoing initial flight conditioning in a 9.14 m (30 ft) mews at the Alaska Raptor Center in Sitka, Alaska.

Discussion

I. Medical and rehabilitation management

This case illustrates the necessity of a complete diagnostic work-up rather than symptomatic treatment and observation. Especially in remote locations, the timely transportation of wildlife to rehabilitation facilities is critical. Had the bird been kenneled for observation in Ketchikan, it would have been at great risk of perforation and possibly death.

The surgery was uncomplicated; however, anesthesia required special attention to the monitoring of heart rate and respiration since the bird could not breathe spontaneously after the coelum was entered. Removal of the nail required the bird's head be elevated in order for gravity to carry the nail past the caudal edge of the sternum. This allowed the nail to be grasped by the surgeon. Care was essential to avoid perforation of the ventriculus. The foreign body proved to be a nontoxic, vinyl-coated common nail. Ingestion of a galvanized or iron nail might have caused zinc toxicity.

Withholding food and water for 48 hours after surgery was important to allow the ventriculus time to begin healing without interference from food ingestion and/or peristaltic activity. Once the bird had recovered from surgery and was eating regularly, it was ready for flight conditioning.

II. Cooperation between agencies

This case provides an example of the importance of cooperative relationships among rehabilitation centers, state and federal agencies, and local airlines. It also shows the importance of an experienced rehabilitator in making the initial assessment to forward a bird for medical diagnosis and treatment. The U.S. Forest Service acted immediately in forwarding the debilitated eagle to the Ketchikan facility, where its initial rehabilitator recognized the life-threatening situation, even though a diagnosis was not apparent. Had the rehabilitator not acted quickly, the bird's condition would have worsened and possibly proven fatal.

Flight conditioning was judged to be necessary; thus, the bird was sent to the Grounded Eagle Foundation. This effort required extensive coordination between facilities and the airlines. Return of the eagle to Sitka required additional coordination of flights and personnel, as well as timing to coincide with the peak of a herring run, when food was easily obtainable.

Because of this comprehensive cooperative effort, "Spike" the bald eagle flies free again.

ABBREVIATIONS USED IN THIS ARTICLE

IM SID x 3 days	intramuscularly once a day for 3 days
PO SID x 7 days	orally once a day for 7 days
per os	orally, or by mouth
BID	twice a day

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Successful Release of a Wild Wolf, *Canis lupus*, Following Treatment of a Leg Injury

by Richard P. Thiel

ABSTRACT: This paper concerns a case of a wild wolf with a debilitated right front leg, injured in a leghold trap, that survived a minimum of 4.5 years following surgical repair and escape into a wildlife area 50 km from its natal pack territory in Wisconsin, USA.

KEY WORDS: Grey Wolf, *Canis lupus*, Injury, Leghold Trap, Lone Wolf, Rehabilitation, Wisconsin

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Introduction

Two studies have evaluated the types of injury to grey wolves caused by research traps (Keuehn et al. 1986; Shultz et al. 1996, 38–39). Little information is available on the treatment and successful return of injured wolves to the wild (Mech et al. 1984; Schultz et al. 1999). Such information is warranted where wolves are endangered (i.e., the U.S. Endangered Species Act of 1973 imposes a 45-day limit on retaining wild animals in captivity) and in recovery programs where valuable captive wolves are used to establish wild populations. This observation documents the survival of a wild wolf in Wisconsin, USA, treated for a serious trap-related injury.

A 39 kg young adult (>1 year) male wolf (501M) sustained torn ligaments and an elbow dislocation to its right front leg on 21 May 1995 after being captured in a leghold trap in Jackson County, Wisconsin, as part of the state's wolf monitoring program (Wydenven et al. 1995, 147–56). The wolf was taken to a local veterinary clinic, where the diagnosis was confirmed.

Arrangements were made for its transfer to the University of Wisconsin, School of Veterinary Medicine, in Madison, for surgery. That evening the joint dislocation was repaired with artificial ligaments during a 3.5 hour surgical procedure. Humeral cartilage that had been torn off could not be replaced. Wolf 501M was transferred to a holding pen at Sandhill Wildlife Area (SWA), 50 km east of the wolf's natal pack territory, 24 hours after surgery. The wolf escaped on 23 May.

Study Site

The 36 km^2 Sandhill Wildlife Area is surrounded by a 3 m tall, deer-proof woven-wire fence. Sandhill consists of 50% upland forests of oak (*Quercus* spp.) and aspen (*Populus* spp.), and 50% wetlands. Deer (*Odocoileus virginianus*) densities varied from 10.5–11 deer per km^2 between winter 1995–96 and 1997–98, as estimated by hunter harvest registrations, sex-age kill calculations, annual fall trail counts, and biannual helicopter surveys (Creed and Haberland 1980, 83–88, Wisconsin Department of Natural Resources [WDNR], SWA files). Beaver (*Castor canadensis*), cottontail rabbit (*Sylvilagus virginianus*), snowshoe hare (*Lepus americanus*), and raccoon (*Procyon lotor*)—all potential wolf prey—are present on SWA. No other wolves inhabited SWA at the time of 501M's escape.

Methods

Personnel noted whether wolf 501M used its injured limb when tracks were encountered during the first 6 months following its escape. Wolf scats were differentiated from those of coyotes (*Canis latrans*) using the method described by Weaver and Fritts (1979). Wolf scats were teased apart in the field between June 1995 and March 1998, and prey were identified and quantified as percent occurrence to determine diet (Thompson 1952).

During the first summer, car-killed deer were provided *ad libidum* and inspected frequently to estimate the percent utilization, in kg, by the wolf. Weights of summer car-killed deer were estimated using regional age-sex averages: fawns, 18 kg; does, 45 kg; bucks, 57 kg. Age-sex specific weights of winter wolf-killed deer were calculated by assigning age-sex specific mean weights from SWA hunter-harvested deer (W. Hall, unpublished data, WDNR, SWA). Winter consumption rates were determined by following wolf trails in snow to kill sites and estimating percent utilization by wolf 501M and other scavengers. Daily consumption rate was determined by dividing the sum of the calculated weights of deer consumed by the wolf by the number of days wolf trails were followed each winter and the number of

days car-killed deer were available in summer 1995 (Kolenosky 1972).

Alpha pack wolves and recently formed pairs raise-leg urinate (RLU) as a means of displaying dominance and marking their territories (Peters and Mech 1975; Rothman and Mech 1979). Lone wolves that disperse into areas devoid of wolves and appear to have established territories also RLU (Ream et al. 1985; Thiel, unpublished data). Observations of wolf 501M's urination types (RLU vs. squat-leg urination [SQU]) were combined during three winters. The presence of RLUs was interpreted as sign that 501M had established a territory in SWA (Peters and Mech 1975; Rothman and Mech 1979).

Results and Discussion

Wolf trails observed between 2 June and 5 August 1995 indicated the wolf favored its injured limb and used it only when standing, and intermittently while moving. It used its injured limb in each of five trails observed between 21 August and 11 September. Trails followed between mid-September 1995 and 10 March 1999 indicate the wolf consistently favored its right front leg, using it only when chasing deer or moving up or down steep slopes.

Wolf 501M ate a frozen beaver carcass placed inside the kennel on the night of its escape. On 26 and 30 May wolf scats found within SWA contained beaver hair.

On 2 June 1995 wolf tracks were followed to a car-killed deer disposal pit closed eleven months earlier. The wolf exhumed a deer carcass 1 m beneath the soil and ate it. Between 5 June and 6 November 1995, 28 fresh car-killed deer (1114 kg) were placed at the pit site. Wolf 501M consumed an estimated 736 kg from 23 of these deer, or 4.8 kg of meat per day during the 153 day period car-killed deer were provided. In addition, the wolf killed and entirely consumed a 5 kg fawn on 13 June, demonstrating that it was capable of hunting.

Deer were found in 62% of 34 summer wolf scats, 96% of 25 winter scats, and constituted 76% of 501M's year-round diet. Beaver and raccoon were present in 14 of 34 (38%) summer scats, and rabbit remains were found in 1 of 25 (4%) winter scats. Wolf 501M's diet, based on scat analyses, closely resembles the diet of healthy, wild wolves living in Wisconsin (Mandernack 1983; Thompson 1952).

Daily consumption rates of the wolf varied slightly during three winters, ranging from 3.0–4.4 kg/day. These rates are comparable to rates of wild wolves studied in other areas where deer are the major winter food (Fuller 1989; Keith 1983, 66–77; Kolenosky 1972; Mech 1970; Mech 1977, 55–83).

The author assumed that if wolf 501M did not leave SWA, it would establish a territory and RLU. Raised-leg urinations from wolf 501M were originally noted in the first snowfall 6 months following its escape, in December 1995. Eighty-four percent (84%) of wolf 501M's January urinations were RLUs, averaging 1.9 RLUs/km in 51 km of trailing. Wolf 501M's RLU rates dropped markedly in February; 57% were RLUs at 0.4 RLUs/km in 25 km of trailing. A similar decrease in RLUs was noted between January and February from another lone, territorial wolf monitored in northern Wisconsin in 1982 and 1983. (Thiel, unpublished data). This contrasts with RLU activity of alpha pack wolves and newly formed pairs, which increases throughout the February breeding season (Peters and Mech 1975; Rothman and Mech 1979).

Between 4 December 1997 and 9 January 1998 two wolves entered SWA, possibly yearling siblings from a wolf pack residing immediately outside SWA. In 4 days of trailing between 9 and 20 January, wolf 501M and the newly arrived pair were not observed together. In this time the pair made several unsuccessful attempts to dig underneath the SWA perimeter fence. On 20 January, the three wolves were observed traveling together; wolf 501M displaying dominance by RLU-ing. One of the newly arrived wolves displayed estrus blood in her urine on 20 January 1998. A whelping den used in spring 1998 was discovered in SWA on 7 July 1998. No pups evidently survived, and wolf 501M was last observed with another wolf in October 1998. He continued to maintain his territory in SWA through winter 1998–1999.

Under certain circumstances wolves with limb injuries can survive in the wild (Thiel 1993). Although wolf 501M never regained total use of his right front leg, he survived a minimum of 4.5 years after his leg injury (he was alive as of 24 September 1999). Factors that aided this wolf's survival include: (1) surgical repair of the injured limb, (2) car-killed deer supplied for 6 months following escape, and (3) a "release" site devoid of other wolves, where the risk of further injury or death due to interspecific aggression was absent. This debilitated wolf demonstrated that it was a capable hunter, meaning adequately nourished. It settled into a territory, associated with other wolves for greater than 8 months, and maintained its dominance in that time.

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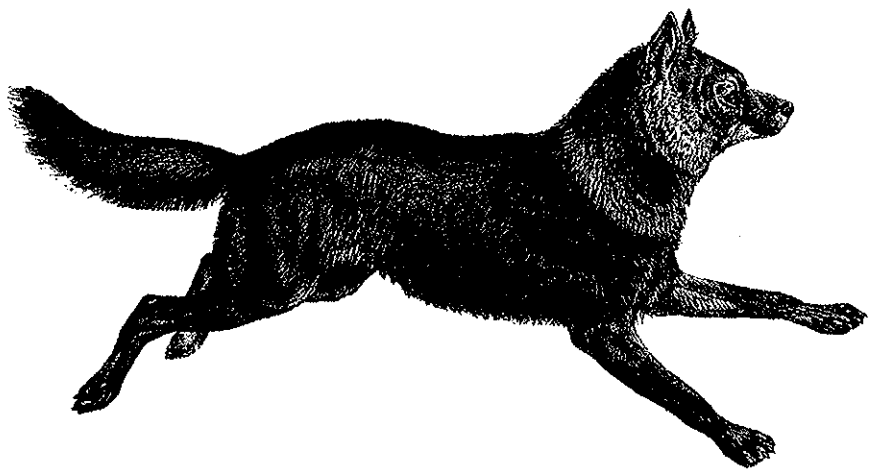
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Field Anesthesia of Striped Skunks, *Mephitis mephitis*, Using Halothane

by Serge Larivière and François Messier

Striped skunks, *Mephitis mephitis*, have been anesthetized using injectable drugs such as sodium pentobarbital (Verts 1960), phencyclidine hydrochloride (Seal et al. 1970), a mixture of tiletamine hydrochloride and zolazepam hydrochloride (Larivière and Messier 1996), or ketamine hydrochloride (Rosatte and Hobson 1983). Most often, injectable anesthetics are administered by means of a pole syringe (Verts 1960) or following physical restraint (Crabb 1941). Solid-sided traps are now commercially available and may be advantageous when working with skunks. Advantages may include reduction of scenting, reduction of stress levels in captured animals, and protection from weather. However, opaque traps do not permit the use of pole syringes (Verts 1960), and commercial traps do not possess a pushing barrier to force animals out of the trap for physical restraint (Crabb 1941). In contrast to injectable drugs, volatile anesthetics permit immobilization without physical contact and can be used to immobilize animals captured in opaque traps.

Propane gas has been used for anesthesia of striped skunks. However, its safety and effectiveness have not been detailed (Rosatte 1987, 599–613), and the high inflammability of this gas makes it potentially dangerous to use. Halothane gas has been used for the field immobilization of mammals such as muskrats (*Ondatra zibethicus*; Blanchette 1989), weasels (*Mustela erminea*; Murphy and Dowding 1994), and American martens (*Martes americana*; Herman et al. 1982). Its advantages include speed of induction and recovery, and ease in anesthesia procedures (Blanchette 1989). The authors tested the effectiveness of halothane gas for the chemical immobilization of striped skunks.



BRIAN DINTER

Exposure to 8 ml of halothane led to complete or acceptable levels of immobilization in seventy of seventy-eight trials. The authors conclude that halothane is an adequate anesthetic for short handling procedures such as eartagging and recaptures.

ABSTRACT: From April to August 1993–95, striped skunks (*Mephitis mephitis*) were captured in south-central Saskatchewan, Canada, and immobilized using halothane. Eighty-one trials were performed on 47 adult skunks (11 males, 36 females) and 7 juveniles (4 males, 3 females). An initial dose of 8 ml (n = 78) provided complete, acceptable, and inadequate anesthesia in fifty-one (66%), nineteen (24%), and eight (10%) trials, respectively. First awakening behavior, stand-up posture, and recovery occurred after a mean (SD) of 52 s (34 s), 71 s (28 s), and 87 s (15 s), respectively. Halothane provided rapid induction and recovery when used on striped skunks.

KEYWORDS: Anesthesia, Halothane, Immobilization, *Mephitis mephitis*, Striped Skunk

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From April to July 1993–95, striped skunks were live trapped in the Thickwood Hills, southcentral Saskatchewan, Canada (52°N, 107°W). Skunks were captured in (1) a mesh-wire live trap (19 x 19 x 51 cm, Tomahawk Live Trap model 204); (2) an opaque-sided plastic trap (23 x 23 x 60 cm, Minnesota Plasti-Catch); or (3) a custom-built wooden live trap (19 x 18 x 71 cm). Traps were baited with canned sardines and checked daily, in the morning.

A wood box (25 x 25 x 53 cm) was made to cover mesh-wire traps to provide a closed environment for anesthesia. Because the edges of the box rested on the ground surrounding the trap during anesthesia, limited air penetrated the handling box and prevented a hypoxic condition. Wooden traps were ventilated through three 1 cm holes in the back, as well as a 0.5 cm space around the trap door. Similarly, ventilation holes in the door of the plastic trap allowed ventilation. All procedures were performed outside to minimize exposure of humans to halothane (Short 1974: 17).

Halothane (8 ml) was applied directly under the door of wooden and plastic traps. For wire traps, halothane was applied to cotton balls and placed inside the handling box. Animals were left undisturbed for 2–4 min, after which their state of immobilization was qualified by their response to mechanical stimuli. State of anesthesia was classified as complete (no reaction to mechanical stimuli and no muscular resistance), acceptable (impaired movements and muscle resistance), or inadequate (no recumbancy, complete awareness, unimpaired movements). Anesthetized skunks were immediately removed from traps for handling. Inadequately anesthetized skunks were left in the trap for an additional 2–4 min, after which their state of anesthesia was reassessed. Failure to detect any sign of anesthesia after the second waiting period led to the second application of 8 ml of halothane.

Handling procedures often began by an injection of Telazol® (Larivière and Messier 1996), or were limited to eartagging, sexing, and weighing. For most recaptures, halothane anesthesia was sufficient. Recovery from halothane was evaluated only for skunks not injected with Telazol®.

Three characteristics of recovery were monitored: first awakening behavior (first nonstimulated head movements), stand-up posture, and complete recovery (unimpaired locomotion, gait normal). Recovery characteristics were calculated from the time of cessation of exposure to halothane. Excitation levels of captured skunks were evaluated before and after application of halothane, and classified as low (limited movement in trap, no scenting) or high (panting, scenting, constant movement in trap).

Eighty-one trials were performed on 11 adult males (mean body mass = 2.60 kg, SD = 0.42 kg), 36 adult females (mean body mass = 2.06 kg, SD = 0.31 kg, n = 33) (Larivière and Messier 1996), and 7 juveniles (4 males, 3 females; mean body mass = 1.00 kg, SD = 0.36 kg, n = 6) in the three different trap types (Table 1). Of these, seventy-one, six, and three trials involved use of a single, double, and triple application of halothane, respectively. One trial required five applications.

Seven of twenty trials in mesh-wire traps resulted in scenting during the covering of the trap, while only three of the 62 skunks captured in opaque traps scented. Similarly, skunks captured in wire traps were excited more often (11/20) than skunks captured in opaque traps (15/61).

Skunks were exposed to halothane between 2–5 min. Initial applications of 8 ml of halothane lead to complete, acceptable, and inadequate immobilization in fifty-one, nineteen, and eight trials, respectively (Table 1). Fifty-eight trials were followed by an injection of Telazol (Larivière and Messier 1996). Other trials (23/81) involved no use of injectable anesthetics. Following halothane anesthesia, skunks exhibited first awakening behavior quickly

TABLE 1. LEVELS OF IMMOBILIZATION OF STRIPED SKUNKS EXPOSED TO A SINGLE DOSE OF 8 ML OF HALOTHANE GAS FOR VARIOUS EXPOSURE TIMES AND TRAP TYPES

		EXPOSURE TIME (MIN)				
Trap type	**Anesthesia**	**2**	**3**	**4**	**5**	**Total**
Homemade wooden box	Complete	11	9	6	2	28
	Acceptable	3	3	7	0	13
	Inadequate	0	0	4	0	4
	Trials	14	12	17	2	45
Minnesota Plasti-catch	Complete	0	2	9	3	14
	Acceptable	0	0	0	1	1
	Inadequate	0	0	0	0	0
	Trials	0	2	9	4	15
Tomahawk wire-mesh	Complete	3	2	2	2	9
	Acceptable	2	0	2	1	5
	Inadequate	1	0	3	0	4
	Trials	6	2	7	3	18
All traps	Complete	14	13	17	7	51
	Acceptable	5	3	9	2	19
	Inadequate	1	0	7	0	8
	Trials	20	16	33	9	78

(mean = 52 s, SD = 34 s, n = 17), whereas stand-up posture and complete recovery occurred after 71 s (n = 14, SD = 28 s) and 87 s (n = 16, SD = 15 s), respectively.

Halothane applications seemed less effective in mesh-wire as compared to opaque traps. Additional stress is imposed on skunks captured in mesh-wire traps through the observation of nearby researchers, and scenting frequently occurs when covering wire-traps. Excited animals can develop life-threatening cardiac arrhythmias under halothane anesthesia (Sawyer 1982, 75), and excitement of skunks captured in wire-traps often appeared high. Therefore, the use of opaque traps is more suitable for handling striped skunks.

Halothane anesthesia on striped skunks was characterized by rapid induction and rapid recovery. This risk of overdose under uncontrolled field application of halothane presumably increases with prolonged exposure. Maintenance of halothane anesthesia over periods exceeding ~5 min requires a small concentration of anesthetic (1.5%; Sawyer 1982, 75) with the use of accurate and bulky delivery systems (Herman et al. 1982). Field conditions may not allow precise anesthesia equipment and procedures to be adopted. Nonetheless, the authors conclude that, regardless of sex or body mass, halothane is an adequate anesthetic for short (~1 min) handling procedures such as eartagging and recaptures.

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Product Citations

Minnesota Plasti-Catch
Mitlyng Development
Minnesota
USA

Tomahawk Live Trap Co.
(Model 204)
Tomahawk, WI
USA

Halothane
M.T.C. Pharmaceutics
Cambridge, Ontario
Canada

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The Exotics Dilemma: A Case Study in Progress

PART 4: THE STRESS OF CAPTIVITY

by Astrid MacLeod and Philip Dragoumis

ABSTRACT: This case study examines the psychological aspects of wildlife in captivity and examines stress and depression as seen in a "pet" raccoon in Greece. Stress, depression, stereoptypies, and unnatural behaviors in captive animals are examined, as well as environmental enrichment, interaction, and foraging enrichment as means to mitigate these problems.

KEYWORDS: Captive Wildlife, Wildlife Pets, Raccoon, *Procyon lotor*, Behavior, Stress, Depression, Stereotypies, Enrichment, Foraging Enrichment, Exercise, Isolation, Conspecifics, Interaction

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The Case So Far...

In Part 1 of this case study, Miko, a captive-born raccoon (Procyon lotor)*, was admitted to the Hellenic Wildlife Hospital (HWH). The patient, his condition and background, natural history, and the trade in exotic species were discussed. In Part 2 the raccoon's diet was analyzed to determine the severity of his nutritional deficiencies, and a diet was devised to correct them. Part 3 addressed diseases and parasites of the raccoon.*

Stress is a physiological and psychological response to real or perceived threat. An animal can be stressed by climatic changes, fear, lack of food or water, lack of conspecifics, injuries, pathogens, and other factors. Wildlife held in captivity face many stressors, from the acute trauma of capture to the chronic tension of living in a strange and unnatural situation. Lack of choice, room for movement, environmental enrichment, and social stimulation can, and does, have very real consequences.



PHILIP DRAGOUMIS

The HWH Patient

When Miko was admitted to the wildlife hospital, he was ill and obese, and exhibited many signs of chronic stress. He had been kept in a small enclosure for 4 years, with an unvaried and unhealthy diet, little opportunity for movement, and very little social interaction.

The animal was in significant physical discomfort, resulting from severe constipation, dehydration, and malnutrition. The medical aspects of his care were immediately addressed, but there were few improvements in his behavior, in spite of the enriched environment created for him based on the suggestions of the North American care support team. The outdoor enclosure measured 4 m x 4 m x 4 m (13 ft x 13 ft x 13 ft) and held a pool, swing, toys, logs for climbing, areas for hiding, and a bed of fresh pine needles. For several weeks the animal cowered in his bedding, hiding his face behind his front paws.

The raccoon would not eat on his own, thus a routine for hand-feeding was established. A primary caregiver was chosen to feed, clean, and interact with the animal in an effort to reduce any stress that might be caused by a constant stream of new people. Over the course of a few weeks, the raccoon gradually began to accept and show some interest in his caregiver. Over a period of three months, as the animal began to regain his health and self-feed, he began to forage, catch fish, and explore his new environment.

Captive Stress and Behavior

Behavioral abnormalities have long been noted in zoo populations. Here, many animals present behaviors defined as stereotypy (or stereotypies)—activities that have no apparent function, are of invariant pattern, and are repeated regularly. In polar bears (*Ursus maritimus*), these behaviors include pacing, facial tics, and huffing or coughing (Poulsen et al. 1996). The bears' inability to cope with the captive environment and social stress leads not only to behavioral disturbances including stereotyped walking, swimming, paw sucking, or scratching, but to infanticide and skin lesions (Dollinger et al. 1996).

With captive giant pandas (*Ailuropoda melanoleuca*), this behavior became a problem in a captive breeding facility when the male pandas showed little interest as females came into estrus. Instead, the animals spent hours performing repetitive behaviors such as pirouetting and paw sucking (Knight 2000). Primates, elephants, and numerous other species have all displayed abnormal behaviors as a result of captivity stress.

Isolation and Social Interaction

Rats that are housed individually, without the benefit of interaction with conspecifics, show markedly different behaviors than rats living in groups. Rats that had been isolated for 30 days after weaning showed an anxiety-like behavioral profile, with decreases in cerebrocortical, hippocampal, and plasma concentrations of pregnenolone, progesterone, allopregnanolone, and allotetrahydrodeoxycorticosterone. Group-housed rats did not show these decreases, nor was there an increase in corticosterone concentration in plasma, as occurred in isolated rats (Serra et al. 2000).

Early social isolation can lead to problems that include inadequate or inappropriate sexual behavior in some animals. Fear of conspecifics probably interferes with social relationships, as seen in gibbons (Hylobates) that had been separated from their mothers at an early age. If the gibbons were introduced to conspecifics that were younger than 3 years old (and with no more than a 2 year age difference) within their first 19 months of life, sexual proficiency was not a problem, even with animals that had been raised by humans (Mootnick and Nadler 1997).

The golden-mantled ground squirrel (*Spermophilus lateralis*), a species believed to be nonsocial, was considered as a candidate for isolation housing research. Pregnant squirrels were wild-caught and gave birth in a laboratory. When the young squirrels reached the age when they would have dispersed in the wild to live alone (55–62 days), they were housed in individual environments. The young squirrels exhibited many signs of isolation stress, including stereotypical pacing. Results indicated that the golden-mantled ground squirrel was not a suitable candidate for housing experiments, and put into question the species' reported nonsociality (Renner and Rosenzweig 1987).

Further studies of captive animals suggest that single animals, isolated from conspecifics, benefit from social enrichment in the form of attention from their caregivers. In 1991 Reese wrote of laboratory animals:

> "An important, and often neglected, source of social enrichment, especially when animals must be isolated from conspecifics, is attention from caretakers and technicians. That many scientists lack detailed information about their animals, especially their behavior, is distressing and reflects a serious disregard for the single most important element of their research."

Studies reveal dramatic changes for the better in the behaviors of single-housed baboons that received simple attention from attending personnel (Choi 1993). Chimpanzees also benefited from relationships with their human caregivers, resulting in a reduction in behavioral disorders and an increase in more normal activities (Baker 1997).

Miko will probably never have the opportunity for social interaction with members of his own species. While the goal of rehabilitators is release to the wild and care is taken not to habituate viable animals, in a situation where a non-releasable animal is kept for its lifetime, interaction and socialization with human caregivers is an important part of husbandry.

Environmental Enrichment

Standards of animal care in zoos have long included veterinary care, sanitation, shelter, and adequate food and water. The varied problems associated with stress in captive animals have resulted in a large body of research that suggests handling, psychological well-being, and environmental enrichment mitigate stress (Kohn 1994). Today zoos, laboratories, rehabilitation and/or captive breeding facilities, and livestock breeding operations, amongst others, recognize the importance of an environment that supports both physiological and psychological well-being.

Wild-caught brown capuchins (*Cebus apella*) that were singly housed were offered various levels of enrichment involving toys and foraging challenges. Significant decreases in abnormal behaviors and increases in normal behaviors were immediately observed as levels of enrichment were increased. The authors concluded that enrichment affected the capuchins' physiological and behavioral responses to stress in a positive way, enhancing well-being (Boinski et al. 1999). Something as simple as nesting material enriched the lives of laboratory mice. Researchers concluded that the psychological and behavioral needs of laboratory animals cannot be met when using standard laboratory caging. Enrichment provided a more structured environment that allowed animals to perform more species-specific behaviors (Van de Weerd et al. 1997). Laboratory rats were offered a number of stimulus objects and preferred objects on which they could chew (Chmiel and Noonan 1996). There are many more examples of the positive affects of enrichment in literature from fields ranging from livestock farming to captive breeding programs.

In 1991, when the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) adopted Title 9 of the Code of Federal Regulations (CFR), Part 3, Subpart D, Specifications for the Humane Handling, Care, Treatment, and Transportation of Nonhuman Primates, it included Section §3.81: "Environment enhancement to promote psychological well-being of nonhuman primates." The 1999 APHIS "Final Report on Environment Enhancement to Promote the Psychological Well-Being of Nonhuman Primates" identified recommendations from North America, Europe, Great Britain, and Australia. They included:

1. Physical, physiological, and behavioral needs must be satisfied.
2. The environment must contain sufficient useable space, complexity, and enrichment.
3. Social housing should be the general rule and individual housing should be the exception.
4. The environment should promote a species-appropriate repertoire of behavior.
5. Primates should not be weaned from their mothers before they reach 6 months of age. Earlier weaning will produce psychological abnormality.

Captive Stress and Physiology

The effects of stress impact greatly upon the physiology of the animal. In experiments with chickens, researchers found that a simple touch resulted in fever and tachycardia (Cababac and Aizawa 2000). Restraint stress and immunological stress result in reduced growth in male mice, while multiple stressors had a cumulative cost to growing mice (Laugero and Moberg 2000). Researchers studying Gambel's white-crowned sparrows (*Zonotrichin leucophrys*

gambelii) found that captivity appears to have a significant effect on the function of the hypothalamic-pituitary-adrenal (HPA) axis (Romero and Wingfield 1999). Researchers studying major depression in humans also observed dysfunction of the HPA axis (Plotsky, Owens, and Nemeroff 1998).

Raccoons in Rehabilitation

Standards for housing and care required under rehabilitation permits vary from place to place. A joint effort between the International Wildlife Rehabilitation Council and the National Wildlife Rehabilitators Association resulted in a document titled "Minimum Standards for Wildlife Rehabilitation" (3rd edition 2000). It is hoped that these standards will be widely adopted to ensure that minimum requirements for shelter, food, water, basic care, and health are met. Enrichment is not a policy as yet, but an informal survey by the authors shows that some wildlife rehabilitation centers and rehabilitators have a good understanding of the importance of an environment and diet as natural as possible, offering wildlife opportunity to forage, bathe, exercise, socialize, and play.

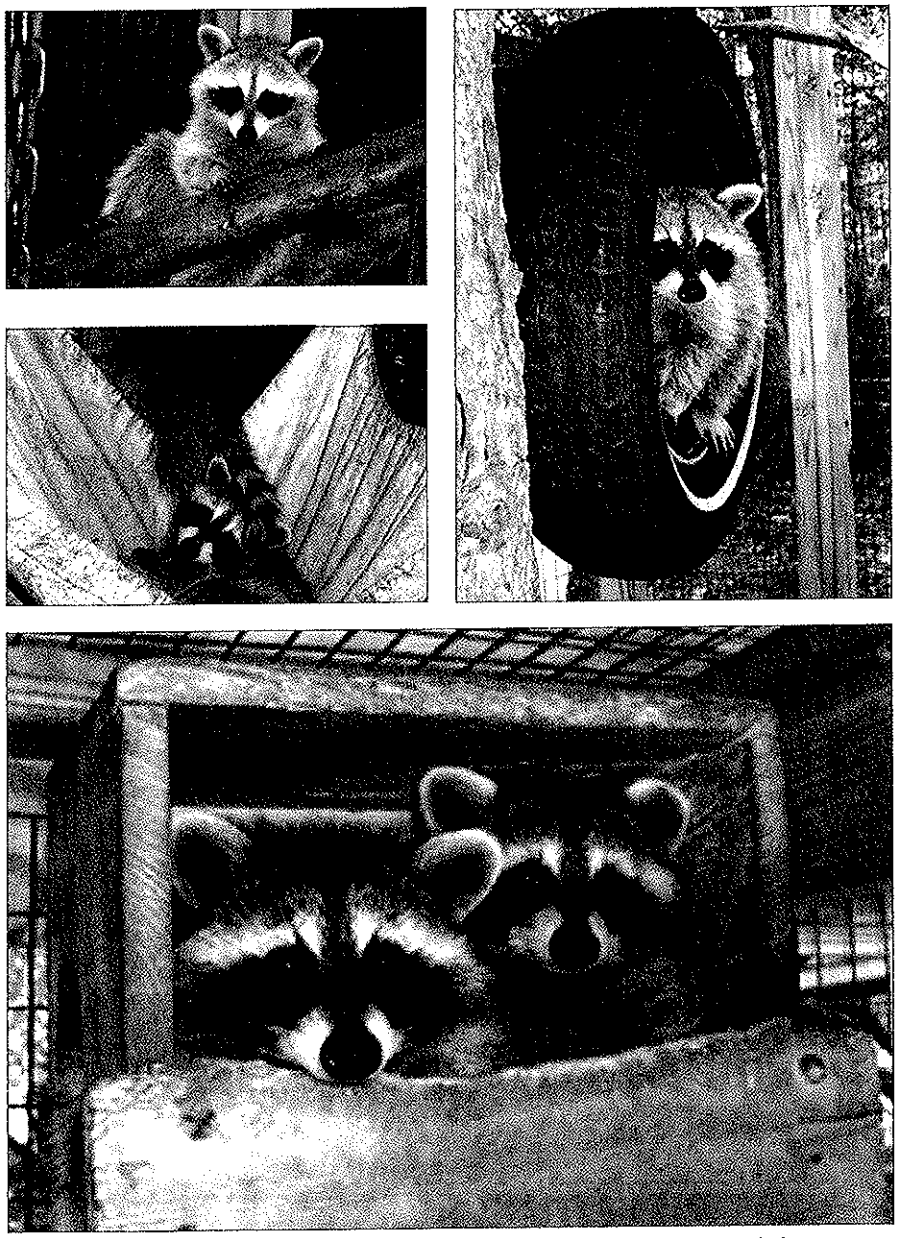
The raccoon is an intelligent and curious animal. In experiments that involved learning and memory, raccoons scored just below primates, on par with cats and higher than rats. A puzzle, on the first attempt, was solved in 17 minutes. The puzzle was solved in 4 minutes on the second attempt, and on subsequent tries, only seconds were required. In tactile discrimination tests, raccoons learned to associate different balls with a food reward. Months later, the correct ball was automatically chosen (MacLintock 1981, 15–16).

In the raccoon's somatic sensory cortex, large areas of nerve cells collect, compute, and store information gathered by the millions of receptors on the underside of each of the animal's sensitive fingers. These bits of data combine in the higher brain areas, leaving what is referred to as an impression. Over thousands of years of evolution, increasingly larger areas of the brain have been forced to store this tactile information, and this area now involves up to 64% of the somatic sensory cortex.

There is good reason to assume that raccoons can construct a "picture" of their surroundings by using their hands, and that picture may be as detailed as a picture that is viewed through human eyes. This may explain the raccoon's tendency to appear "absent" as it turns its head, either storing or retrieving information as it forages with its deft forepaws (Hohmann 1999).

In the wild, raccoons spend much time climbing, fishing, hunting, and foraging for food. Family groups (mothers and kits) often den together through their first winter, although males usually den alone. While 4 or 5 raccoons in a den are the norm, communal dens of 23 raccoons have been reported (Environment Canada 2000). Raccoons, especially juveniles, have need of conspecifics, and when possible, should be raised and housed in groups during rehabilitation.

Enrichment begins at intake, when neonates are offered bedding, warmth, the comfort of conspecifics, and toys. Most rehabilitators interviewed described weaning diets that included variety and as many natural foods as possible. These rehabilitators offered outdoor enclosures equipped with logs for climbing;



PHOTOS: PAT ISAACS

An enriched environment helps ensure both the psychological and the physiological well-being of the captive animal. Logs for climbing, tire swings, nesting boxes, and hammocks provide opportunities for play, exercise, physical and mental challenge, rest, and socialization.

hammocks; tire swings; platforms; nesting boxes; pools for fishing, bathing, and play; and a variety of toys.

The intelligent and curious raccoon, kept in substandard housing without benefit of conspecifics and interaction, opportunity to exercise or bathe, and without the normal challenges of foraging and exploration, will grow increasingly stressed and depressed. Eventually, as evidenced by Miko, psychological and physiological abnormalities arise that ultimately threaten the overall health of the animal.

Miko Today

The story of Miko did not begin the day he was admitted to the Hellenic Wildlife Hospital. It began when his progenitors were captured from the wild and smuggled to Europe, where they were allowed to breed—and where their offspring were sold as pets. It began because there was a socially acceptable commercial opportunity, ways to get around laws, and loopholes in a system that, even today, does not practice consistent enforcement and stringent application of law. Ultimately, this story could only begin because there was a market, and a buyer, for an unusual pet.

The most basic reason for this animal's dilemma results from a mindset that puts human pleasure, entertainment, and desire for the unusual before the animal's well-being and right to a natural life. Public education plays an important part in changing these attitudes and reducing the commercial demand. As keeping wild animals as pets becomes socially unacceptable, peer pressure becomes an effective tool to address the problems that loopholes in laws allow. Until the people of the world frown upon wild animals kept as pets and world governments agree on a unified approach to the problem of trade in exotic species, loopholes will remain, and until human beings understand the harm that is done to both the individual animal and the ecosystem as a whole, the loopholes will continue to be used.

This animal serves as an example of what occurs to the individual as a result of the trade in exotic species. His owners were ignorant of his needs and they made no effort to learn. Rather, the novelty of their exotic pet soon wore off, and they allowed him to languish in inadequate housing, with an inadequate diet, until his condition grew so serious that they could no longer ignore it.

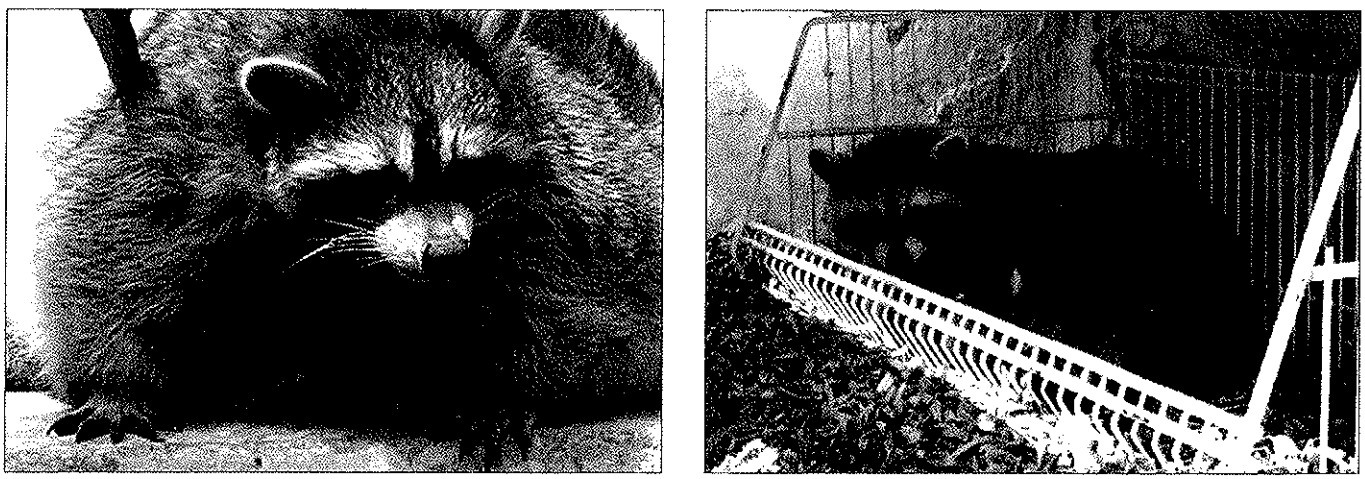
Miko's physical condition had to become life threatening before it stimulated action, and when their veterinarian could not help them, the owners turned to HWH, and unburdened themselves of what they had, in effect, created. Four years in a cramped enclosure with little opportunity for exercise and play, combined with an inadequate diet, resulted in a morbidly obese animal whose heart and digestive system were seriously affected.

His owners had never considered the possibility that the animal might harbor diseases and parasites that could affect his condition and that could impact other animals, domestic or wild. The possibility that he required interaction, interest, stimulation, and affection were overlooked. As a result, the raccoon was stressed and afraid, and exhibited all the signs of serious depression.

Philip Dragoumis, Dr. Kostas Demetriades, and the staff of HWH saw and chronicled the effects of captivity on Miko and began the painstaking work of bring him back to a state of physical and emotional health.

There is little similarity between the animal that was admitted to HWH on 1 April 2000 and Miko today. A balanced diet; an outdoor enclosure with natural light; and opportunity for exercise, foraging, and socialization have had dramatic effect. There has been a steady drop in weight from the initial intake weight of 15 kg. Exercise and play have toned his muscles, and the rolls of fat that once prevented him from grooming or scratching have disappeared. A diet with adequate protein, sunlight, and opportunity for bathing have improved his pelage and overall appearance. His curiosity and playfulness indicate that he has gained a higher level of well-being, both physiological and psychological. While a life in captivity, without conspecifics and no chance for release to the wild, is far from the ideal, every effort has been made to provide a high quality of life for this former pet. He will live out his days at the Hellenic Wildlife Hospital, where he will continue to receive the care he requires.

The practice of removing wild animals from their natural habitats for the exotic pet trade must continue to be discouraged. These animals have specific physiological and psychological needs



PHOTOS: PHILIP DRAGOUMIS

Miko arrived at the Hellenic Wildlife Hospital stressed and fearful, a morbidly obese animal with a seriously compromised heart and digestive system. Eight months later, Miko was a much healthier raccoon.

that are difficult to meet, even by trained professionals. More stringent laws, public education programs, and public awareness may help to end this practice.

We hope that the story of Miko will serve as a moral tale to those who are considering keeping "wild" pets. This is only one of thousands of such creatures taken from their place in the web of life to serve the unthinking desires of humankind.

Acknowledgments

The authors would like to thank the team of people who were instrumental in bringing this animal back to a state of well-being, and those who assisted with various aspects of this case study.

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Miko. May what he has lost serve to bring knowledge.

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How We Raised Money in a Hurry

by Mary Humphries

ABSTRACT: When confronted with a formidable fund-raising challenge, it is wise to consult the experts, craft a feasible plan, and—perhaps most important—trust your instincts. This article details how a development director inexperienced in major-donor fund raising successfully raised $1.5 million for a critical project in just five months.

KEY WORDS: Fund Raising, Middle-Income Donor, House Party, Phone Solicitation, Direct-Mail Solicitation

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Introduction

I recently discovered that, when confronted with a formidable fund-raising challenge, it is wise to consult the experts, craft a feasible plan, and—perhaps most important—trust your instincts. With virtually no experience in securing gifts from major donors, and with the help of many talented and resourceful people, I was able to lead our group in raising $1.5 million from middle-income donors, most of it in just five months. This article focuses on how we accomplished that feat—what worked, what didn't—and the important lessons that we learned.

The Campaign and Its Goals

For eight years, Northwest Ecosystem Alliance (NWEA) worked tirelessly to save 25,000 acres of priceless boreal forestlands in north-central Washington's Loomis State Forest—critical habitat for one of the last remaining healthy populations of lynx in the lower forty-eight states. During that time, we succeeded in getting the U.S. Fish and Wildlife Service to add the lynx to the list of federally protected endangered species. But other campaigns were less successful. Although our science experts spent countless hours in the field studying and documenting the Loomis's ecological values, we were left fighting several bills in the state legislature to mandate logging in the area. And we engaged in four separate and expensive lawsuits to protect the forest, without success.

Then, in April of 1998, when we'd run out of options to save the Loomis wildlands and Washington's lynx, the state's Department of Natural Resources (DNR) unexpectedly offered a deal: they would stop logging the Loomis wildlands we sought to protect—all 25,000 acres—if NWEA and our partners raised the $13.1 million needed to compensate the state's Common School Construction Trust Fund for the market value of the standing commercial timber and the land. The beneficiaries of the trust fund are Washington's schoolchildren, who increasingly need new schools to accommodate their ever-growing numbers.

The deadline for raising the funds was set at 1 July 1999. But before we could know how much money we had to raise, a professional appraisal of the land and timber had to be conducted. That was completed in mid-November, giving us only eight months within which to raise virtually all of the funds—a daunting task for a regional conservation group with a membership of roughly three thousand people, a budget of $650,000 and an untested donor base.

In December, as our coalition developed a plan, I was given responsibility for developing and implementing the grassroots component of the campaign, with a goal of $650,000, or 5 percent of the total funds needed. While this was a relatively insignificant proportion of the $13.1 million price tag, it nevertheless seemed to me a staggering figure. I realized immediately that we were going to have to contact hundreds of people to meet this target, since the range of gifts I would be securing was between $100 and $10,000 with, I hoped, a handful of gifts exceeding that amount to make up for any shortfall. I also knew that I needed some help in putting together a fund-raising plan that would work. I spent two days consulting with experts in the field and, after much number-crunching, we came up with an aggressive but achievable plan composed of four components:

1. House parties
2. Major donor visits
3. Phone solicitations
4. Membership recruitment letters and other mail appeals highlighting the campaign

How We Raised the Money

I had one advantage going into this campaign: we had gotten an early start on grassroots fund raising, as we had to pay the DNR $95,000 by 7 July 1998 in order to defer three timber sales that would have sliced the very heart out of the Loomis wildlands we sought to protect. To raise that money, we conducted our first-ever major gifts campaign in May and June of 1998. Exceeding our goal, we raised $113,000, which swelled to $170,000 later in the year with the response to a December appeal letter to our membership. With this head start, I still had $480,000 to raise between 1 January and 1 July 1999. Here's a closer look at each component of the plan.

1. House Parties

After identifying fifteen initial house party hosts, including members of NWEA's board, we planned to host four parties a week for twenty weeks and raise approximately $1,000 per house party, for a total of $80,000. We also hoped to recruit two additional house party hosts at each event. I hired a full-time house party coordinator whose sole responsibility was to identify hosts, convince them to host a party, work with them throughout the preparty phase, give a slide show presentation at each party, and ask for campaign gifts. Much of my time at the outset was spent preparing the supporting materials needed to ensure the success of these house parties, including standard invitations, an outline of tasks to accomplish for each of the four weeks prior to the party, an agenda for the party itself, introductory remarks, and text for "the ask." We also spent many hours role playing the actual presentation and "the ask" with our house party hosts.

2. Major Donor Visits

We counted 610 prospective major donors. Assuming that we would reach 65 percent on the phone and that 50 percent of those would agree to a visit, we calculated that we had 200 donors to visit. Knowing I could not alone undertake the task of visiting all these people, I hired a full-time major gifts coordinator, along with a part-time gifts solicitor. Among the three of us, we determined that it would be possible to visit all 200 donors. Our goal was to secure an average gift of $500 from 200 individuals, for a total of $100,000.

I drafted a schedule that set forth which weeks letters would be sent to donors, which weeks follow-up phone calls for visits would be made, and which weeks visits would be scheduled so that we could get through all 200 individuals as efficiently and systematically as possible. This schedule worked well until the final four weeks of the campaign, when we realized the number had increased from 200 to at least 250 because of referrals, and we would not be able to visit all who agreed to do so. We opted to simply solicit the remaining gifts by phone.

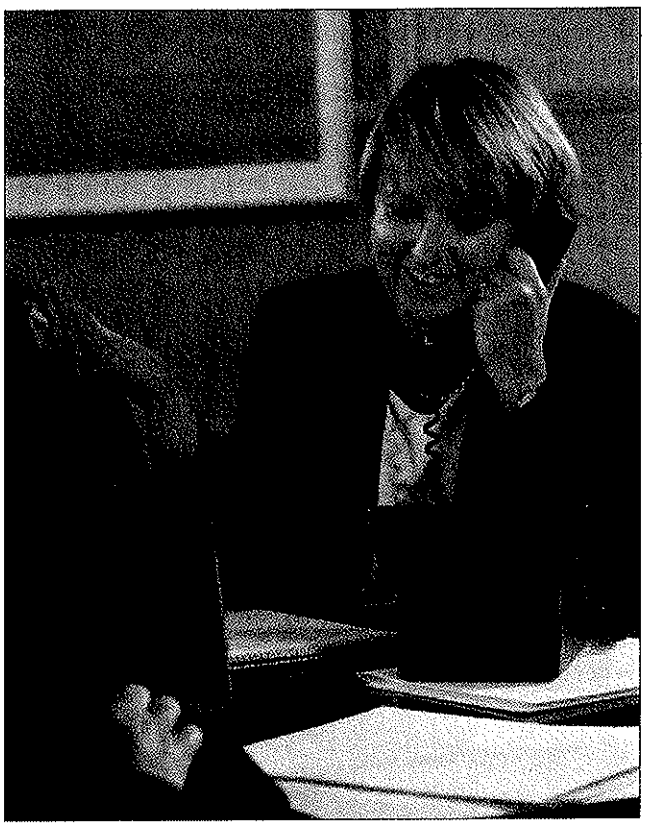
3. Direct Mail Membership Recruitment and Appeal Letters

I calculated that it was possible to raise $100,000 through direct-mail appeals if we stuck to a rigid schedule of four mailings, one per month for the months of February through May. The plan was to mail 250,000 pieces to members and subscribers of like-minded organizations and publications, with an anticipated return rate of 1 percent (2500 responses) and an average gift of $40. I worked with a direct-mail consultant to implement this component of the campaign.

4. Phone Solicitation of Members

After reviewing the number of donors in our database and factoring in the number that we would continue to recruit through direct mail, I calculated that we could reach 2604 people by phone and generate an average gift of $38 per contact, for total funds of $98,952. I hired two part-time phone solicitors and drafted a three-month schedule that would enable them to get all of their calls made.

In summary then, the plan would raise the needed $480,000 in a five-month period and require four full-time staff, one part-time staff person, and the assistance of two consultants—one for direct-mail appeals, the other for ongoing campaign oversight. I estimated the cost of the plan at $151,250. Staff salaries for a five-month period along with consulting fees would come to $51,250, while the recruitment mail-



By the final weeks of the campaign, significant referrals had increased the number of potential donors from 200 to 250. With limited time, the decision was made to solicit gifts by phone rather than personal visit.

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ings alone would cost $100,000. Thus, to net $650,000, we would have to raise about $800,000.

I cannot overemphasize how much the success of the plan depended on the initial preparation of all of the supporting materials: the gift range chart; packets for major donor visits; an outline of what needed to be covered during major donor visits; scripts for telephone conversations with donors, including responses to objections; pledge forms; answers to commonly asked questions; and so forth. Extensive role playing was also extraordinarily beneficial. As the campaign progressed, I found that doing our homework up front, sticking to our goals and schedules, and checking in with one another on how we were all doing, were crucial to our fund-raising success.

In the end, we raised not $800,000 but $1.5 million through dedication, sheer hard work, and ingenuity. It also certainly helped that during the latter part of the campaign we received excellent media coverage in several news stories and editorials, with contact information included. This attention was due in large measure to the fact that the firm helping us secure gifts of $10,000 to $1,000,000 suggested we hire professional media consultants to help with promoting the campaign. We paid $38,712 in fees and incidental expenses to the media consultants, but the income generated from publicity and news coverage was at least five times that amount and likely more. Clearly this was a wise investment of funds.

The Results

The outcomes for my segment of the campaign taught us a lot. Here is what we achieved and what we learned.

- We hosted fewer house parties than expected but secured many more gifts because the hosts were willing to invest considerable time and effort in making sure the events were successful. In fact, the final house party featured a band, fine food and beverages, dancing, singing, and an amazingly heartfelt pitch for gifts from the host. *Expected income:* $80,000; *actual funds from house parties:* $122,951.
- The donor visits also exceeded our most optimistic expectations. The average gift, at $1100, was more than twice the $500 we had projected and represented in many cases a tenfold increase in the donor's previous largest gift. Moreover, some donors we visited made second gifts after just three or four months. *Expected income:* $100,000; *actual funds raised from major donor visits:* $521,739.
- Phone solicitations did not work well for us for two reasons: first, our members made it clear they did not want to be approached for gifts over the phone, and second, the training we did for the phone solicitors was insufficient. *Expected income:* $98,952; *actual funds raised from phone solicitations:* $5,500.
- While the return rate for recruitment mailings hovered somewhere between 0.8 percent and 1 percent, the average gifts were well above our expectations, ranging from $65 to $140, with a single gift of $50,000. *Expected income from mail appeals:* $100,000; *total funds raised from recruitment mailings, special appeal letters to members, and campaign updates with gift forms:* $686,392.

Aside from these results of our four-part program, we learned a number of other things:

- **Word-of-mouth pays off.** Total funds raised from miscellaneous sources (website, member referrals, publicity and media): $194,335.
- **People were willing to make "stretch gifts"** —giving more than we had anticipated—because they could choose from the alternatives of pledges over time, gifts of stock, gifts on credit card, and matching corporate gifts.
- **It is very helpful to have a key person overseeing the whole plan.** Much of my time was spent providing prospects for donor visits; making sure that data were entered accurately; revising support materials; writing thank-you notes; keeping track of how each component of the campaign was performing and adjusting our goals accordingly; training and role playing with staff; and so forth. Staying on top of this administrative function clearly paid off.
- **It takes money to make money.** In the nonprofit world, we tend to want to cut down on expenses wherever possible. This can sometimes be to our own detriment. We learned that spending the money to hire media consultants and extra staff or to mail 250,000 appeals meant that we were able to raise far more money than we anticipated.
- **Perhaps most important, we discovered that most of the money we raised**—about 70 percent—came from households with incomes of $60,000 or less.

In conclusion, I found that the key ingredients to a successful fund-raising campaign are several: preparation and planning; self-confidence and a fundamental belief that the organization's work is important and necessary; excellent communication and social skills. I would also add three more personal observations: (1) trust your instincts when logic fails you and be flexible—plans often need to be altered as the campaign's objectives and interim deadlines are met; (2) accept that you will make mistakes—some large, some small—and that your message will not resonate with all of the people all of the time; (3) accept that you are also capable of great things and that many people will find your passion infectious and your message compelling.

Acknowledgments

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Choosing Instructional Materials for Environmental Education

by David L. Haury and Linda A. Milbourne

ABSTRACT: The overwhelming majority of American adults support environmental education being taught in schools (National Environmental Education and Training Foundation 1997), but teachers wanting to include environmental education in their classrooms face several formidable challenges: instructional materials are widely scattered and are of variable quality; the conceptual foundation for environmental education spans several academic disciplines; until recently there have been no broadly endorsed standards for curricular content; and state requirements for environmental education are highly variable and generally sketchy. These challenges, however, afford a unique opportunity for informed teachers and schools; they have enormous latitude in deciding what is to be taught and how it is to be taught.

KEYWORDS: Environmental Education, Materials, Resources

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Finding Instructional Materials

The first challenge in selecting instructional materials is finding them. In addition to familiar publishing houses, many corporations, professional associations, advocacy groups, and government agencies produce environmental education materials. Suggestions on where to look for instructional materials are offered in a guide for bringing environmental education into the classroom (Bones 1994). Suggested places to look include:

- **Local resources,** including County Cooperative Extension Services; nature centers, parks, and museums; local libraries; government offices; institutions of higher education; local chapters of professional organizations; and local utility companies.
- **State and regional resources,** including state departments of natural resources; regional Environmental Protection Agency offices; and state department of education offices for environmental or energy education.
- **Environmental education offices of federal agencies,** including the Department of Education, Environmental Protection Agency, Department of Energy, Department of Agriculture, Department of the Interior, Department of Health and Human Services, National Science Foundation, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and Tennessee Valley Authority.
- **Nonprofit organizations,** including the Sierra Club, the National Wildlife Federation, and the Friends of the Earth.
- **Clearinghouses and resource centers,** including the ERIC Clearinghouse for Science, Mathematics, and Environmental Education; Renew America Environmental Success Index; and Pembina Institute for Appropriate Development.
- **Print Resources,** including *The Environmental Education Collection: A Review of Resources for Educators* (Vols. 1–3, North American Association for Environmental Education [NAAEE] 1997 and 1998), *The Environmental Education Teacher Resource Handbook: A Practical Guide for Teaching K–12 Environmental Education* (Wilke 1993), and *A Guide to Curriculum Planning in Environmental Education* (Engleson and Yockers 1994).
- **Online information,** including EELink, EcoNet, National Library for the Environment, EPA Environmental Education Center, Environmental Education Internet Sites, Exploring the Environment, Sharing Environmental Education Knowledge (SEEK), and the Environmental Organizations Web Directory.

Selecting Instructional Materials

In selecting instructional materials, environmental educators must carefully consider three primary issues: (1) alignment of environmental education topics and content with national standards, state curriculum frameworks, and existing courses of study; (2) professionally accepted criteria for judging the quality of materials; and (3) the needs, interests, and environmental circumstances of local students.

State and National Standards

National standards for curricular content have been developed in several subject areas, and most states are revising or updating state curriculum frameworks to reflect national standards. Schools will be using state frameworks to design or revise courses and programs. When selecting materials for school environmental

education programs, schools should consider any state curriculum frameworks or guidelines having relevance to environmental education.

For national guidelines and standards in environmental education, see *Excellence in Environmental Education—Guidelines for Learning (K–12)* (NAAEE 1998). Two curricular strands in particular have implications for environmental education: "Global Connections" and "People, Places, and Environment." Standards regarding "Personal and Social Perspectives" are particularly relevant to environmental education, and include topics such as human population, natural resources, environmental quality, and environmental changes.

Quality of Materials

To assist educators in judging the quality of instructional materials, the NAAEE has produced a guide, *Environmental Education Materials: Guidelines for Excellence* (1996) that presents six key characteristics of quality materials. Guidelines are presented for each of the key characteristics, along with indicators for evaluating materials. Following is an abbreviated outline of the key characteristics and guidelines, accompanied by examples of materials exhibiting some of the quality indicators for each key characteristic.

1. **Fairness and Accuracy:** Environmental education materials should be fair and accurate in describing environmental problems, issues, and conditions, and in reflecting the diversity of perspectives on them. Example: *A World in Our Backyard: A Wetlands Education and Stewardship Program* (Grades 6–8).
2. **Depth:** Environmental education materials should foster awareness of the natural and built environments; an understanding of environmental concepts, conditions, and issues; and an awareness of the feelings, values, attitudes, and perceptions at the heart of environmental issues, as appropriate for different developmental levels. Example: *Project Learning Tree* (grades PreK–8; American Forest Foundation 1993).
3. **Emphasis on Skills Building:** Environmental education materials should build lifelong skills that enable learners to prevent and address environmental issues. Example: *Energy, Economics & the Environment: Case Studies and Teaching Activities for Middle School* (grades 6–8; Indiana Department of Education 1994).
4. **Action Orientation:** Environmental education materials should promote civic responsibility, encouraging learners to use their knowledge, personal skills, and assessments of environmental issues as a basis for environmental problem solving and action. Example: *Environmental Education in the Schools: Creating a Program that Works* (grades K–Adult; Braus and Wood 1994).
5. **Instructional Soundness:** Environmental education materials should rely on instructional techniques that create an effective learning environment. Example: Global Systems Science Series (Several individually titled guides; grades 9–12; Lawrence Hall of Science 1998).
6. **Usability:** Environmental education materials should be well designed and easy to use. Example: The Cycles for Science Series (curriculum supplements for grades 9–12; Rogers 1996).

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SIMPLE SOLUTION

A Foot-Bath Apparatus

by Janine Perlman

A blue jay (*Cyanocitta cristata*) with what appeared to be an infection in the distal-most joint of toe III, probably resulting from a cut, was presented for care. Following systemic drug treatment prescribed by a veterinarian, the joint was more swollen and inflamed than prior to treatment. Surgical intervention on this delicate toe seemed contraindicated. The remaining option was a hot soak. A foot bath apparatus was developed that would keep the affected area well positioned and the bird relatively calm and dry.

The apparatus uses a 1.89 l (2 qt) plastic mixing bowl as the heat reservoir. Flexible foam (about 2.54 cm [1 in] thick) is wrapped around the bowl as insulation. A florists' foam cube (Oasis) is cut to fit and placed inside the bowl, and a polypropylene centrifuge tube is inserted into the cube with approximately 1 cm (3/8 in) of the tube exposed above the top of the cube. (Any heat-resistant container could be substituted for the tube to accommodate size differences among species.) Bubble-wrap is placed on top of the bowl; a slit or hole provides access to the tube [Figure 1].

Water is added to the bowl until nearly full. Oasis absorbs water and doesn't float, so it remains suspended and easy to position. The soaking tube is then filled to about 60% full, and the entire apparatus is placed in a microwave oven for heating. Microwave times will vary based on individual appliances; it took 5 minutes at high power in a 1000-watt oven to reach the desired temperature, which is uncomfortably hot, but not scalding. The temperature should be *no hotter than 48°C (120° F)*.

Carefully remove the apparatus from the microwave. The soaking solution is added to the tube, followed by cold water, until the tube is almost completely full. Whichever solution is chosen for the soak, the temperature of this liquid is critical; it needs to be quite warm to be effective, but cool enough to be comfortable for a human finger to stay immersed indefinitely. The optimum temperature is approximately 43.3°C (110° F), and *no hotter than 44.4° C (112° F)*. A terrycloth towel provides insulation between the bubble wrap and the bird's body.

If necessary to keep the bird calm, the apparatus may rest inside a five-sided cardboard box—the effect is similar to an ice-fishing shack. The box also may be covered with a cloth to provide almost complete darkness. A hood may be used instead of a box when treating larger nonpasserines.

The affected limb is allowed or encouraged to grasp the distal portion of an index finger, which is then lowered into the tube. The hock can be gently held with the thumb to encourage the submerged foot to stay in place. It is strongly advised that the finger remain in the bath at all times so that the temperature can be monitored. If the bird resists keeping its foot immersed, the soaking solution temperature may be too high. The reservoir, which keeps the soaking solution warm for much longer than needed per treatment, may warm the tube excessively. If this occurs, simply empty some of the contents of the tube and add cold water as needed.

Initially, the blue jay this apparatus was developed for vigorously resisted holding and restraint. The darkness and warmth of this treatment seemed to be soothing, however, and before too long it did not struggle at all during treatment sessions.

The treatment appeared almost immediately effective, and improvement continued until the end of the regimen, when the joint was closer to normal-size than the veterinarian had thought likely, and all visible inflammation was gone. In several subsequent weeks, the joint swelling continued to regress, so that the joint regained essentially normal appearance, though some stiffness may have remained.

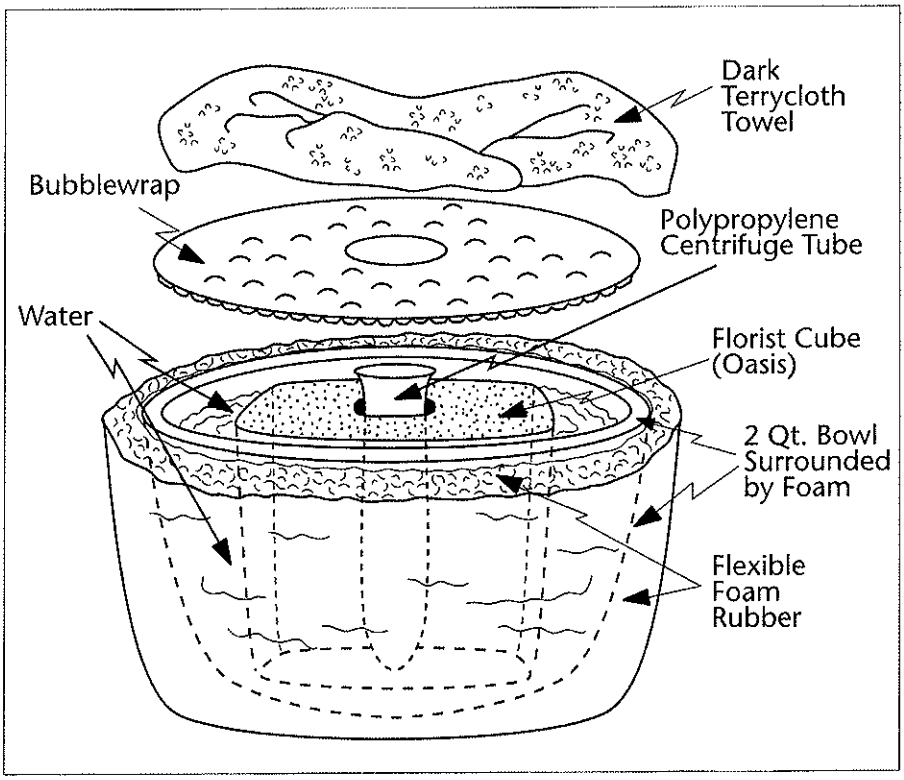


ILLUSTRATION: BARBARA GLEASON

Janine Perlman is an independent rehabilitator who specializes in passerines and hummingbirds.

Barbara Gleason is a freelance scientific illustrator and graphic designer. With her husband, Dan, she coproduced and published Birds! From the Inside Out *(1999). (bgleason@teleport.com)*

Honors awarded in Montreal

Giraffe Award 2000
For Sticking Your Neck Out

Robert Schad

President and CEO — Husky Injection Molding Systems Ltd.

Businessman Robert Schad has been a long-time supporter of wildlife rehabilitation and conservation issues. Unlike many in the corporate world, however, Shad's involvement has not been limited to providing financial support in the form of generous grants to organizations across Canada and the U.S. He has also been willing to become personally involved in specific issues, using his political connections and power to fight for wildlife causes. By "sticking his neck out," Robert Schad has successfully united capitalism and environmentalism.

Significant Achievement Award 2000
For Efforts in Wildlife Conservation

Michael Mesure

Founder—Fatal Light Awareness Program (FLAP)

Michael Mesure's early life was marked by an artistic gift and a love of birds—little did he know how Fate would intertwine these passions. In 1989, Michael went to investigate a story about birds crashing into the brightly lit office buildings of Toronto. He opened the car door and found a bird at his feet—and his life's work. Soon after, The Fatal Light Awareness Program was born. FLAP's development of night lighting reduction programs has saved thousands of migratory birds.

International Award 2000
Wildlife Rehabilitation Support Efforts in Europe

Philip Dragoumis

In 1990, Philip Dragoumis co-founded Hellenic Wildlife Hospital (HWH), the first organization of its kind in Greece. As co-director, Philip is involved in every aspect of the hospital's work, from capture and care to surgery and release. As a member of the IWRC International Committee, he has been instrumental in organizing IWRC's first European Skills Seminar. Within his own community and in neighboring countries, Philip serves as a liaison with government officials and individual citizens, and epitomizes distinguished commitment to wildlife and wildlife rehabilitation.

Spirit Award 2000
Support of IWRC Programs

Debby Farley

Raptor Supervisor—Spring Brook Nature Center

Debby Farley is an educator, naturalist, conservationist, and master falconer who has been involved in wildlife rehabilitation for over 10 years. In the past three years, as the head of the Spring Brook Nature Center Raptor-in-Residence program, Debby has organized three IWRC Basic Skills Seminars, and Advanced Skills Seminars are just around the corner. Debby is also a member of IWRC's Area Representation Committee (ARC). Her experience and enthusiasm are valuable assets for both IWRC and the animals in her care.

For more information on this year's award recipients,
visit the IWRC website at
www.iwrc-online.org

FROM THE LAST ISSUE... CASE XIII

Volunteer Needs

How can wildlife rehabilitation organizations attract and keep the committed volunteers they need?

High Desert Wildlife Rescue board members Susan, Jane, and Sarah were meeting for a year-end analysis and review. As membership chair, Susan was primarily concerned about the lack of volunteers. The organization expended considerable time and energy providing training classes prior to the baby season, with less than satisfactory results.

Over the years, the organization had varied its approach to training in an attempt to accommodate the schedules of potential volunteers. Trainings had ranged from a series of eight weekly classes that addressed the basics of rehabilitation to an intense one-weekend class to a single afternoon consisting solely of instruction for working with baby birds, followed by an apprenticeship with a permitted rehabilitator. Ironically, the mentors didn't have time to invest in the new volunteers who, eventually would have lightened the load for everyone.

Regardless of the format, every year thirty to forty students attended and went on to pass the final exam. By year's end, however, only one or two people could be considered contributing members of the organization.

"Maybe it's because after the spring and summer baby season, we don't have as much for our volunteers to do, so they lose interest," Susan mused.

"People move away," Jane noted. "The demands of a family grow to outweigh the demands of rehabilitation; people develop health problems; some of our best rehabilitators have died." She added wryly, "Hey, some people just decide they want a life!"

Whatever the reasons, the result was clear: a small but dedicated group of individuals found themselves caring for an ever-increasing caseload and all the associated paperwork. To make matters worse, many volunteers had complained about being asked to help with hotline calls, public education, report writing, and fund raising.

The volunteer program clearly wasn't working, but the three women were at a loss as to how to correct it.

QUESTIONS FOR DISCUSSION

1. **Long work hours and lengthy commute times mean that many people must squeeze "leisure" pursuits such as volunteering into the same 24-hour day as the demands of home and family. Who has time to volunteer, and how can rehabilitators find these individuals?**
2. **A wildlife rehabilitation operation's daily tasks include animal care, fund raising, answering phones, handling paperwork, and presenting public education programs. How can rehabilitators attract people with diverse skills and experience to fill these roles?**
3. **The volunteer program of a large rehabilitation center can be quite different from that of a loose-knit coalition of home-based rehabilitators. Are there methods for finding and keeping volunteers that are appropriate only for certain kinds of organizations? Are there methods that will work for all?**
4. **How can a group or organization determine exactly what kind of help is needed?**
5. **Training volunteers involves a significant investment of time and effort. How can trained volunteers be encouraged to stay?**

RESPONSES

I.

Donna DuBreuil
Ottawa-Carleton Wildlife Centre
Ottawa, Canada

We started our program thirteen years ago as a small, loose-knit group of volunteers providing care for mammals. At the time, we naively felt that the core of dedicated volunteers would grow each year, and that no one would fall by the wayside—after all, didn't all normal

Wildlife rehabilitators' interests range far beyond the direct care and handling of wildlife. Standards, ethics, wildlife policy, and community involvement are among the many issues that have a direct impact on the work rehabilitators do every day.

Since these issues benefit from broad public discussion, this section of the *Journal* is designed to offer a forum for wildlife rehabilitators to exchange ideas about challenging issues, which are "up for discussion" by you, our readers. Some of the cases may also be discussed at upcoming IWRC conferences.

The following cases will present either hypothetical situations or real-life problems facing active rehabilitators. Each case is followed with several questions for readers, and responses from people involved in wildlife rehabilitation. To encourage a free exchange of ideas, both attributed and anonymous responses are invited.

Each issue of the *Journal* will publish a synopsis of the original case from the last issue, several responses, and a new case for your consideration. Please see page 27 for this issue's new case and page 26 for details about how to participate.

Space may not be available for all responses submitted, and responses may be edited for space and clarity, but we will include as many responses as possible. We welcome your participation. Only with your help can this forum thrive.

NOTE: The International Wildlife Rehabilitation Council makes no claims as to the accuracy or truth of the following cases, not does it endorse any particular answer or viewpoint.

people want to devote their lives to wildlife rehabilitation?

When our intake reached thirteen hundred mammals, with several hundred of these needing to be kept over the winter each year, we realized that we needed a much more streamlined and business-like—I know this is a bad word to us rehabbers— approach to our task.

Once we also recognized that the majority of volunteers wanted simply to have a hands-on experience with wildlife that likely would be a one-time commitment—not surprising given the amount of work and financial outlay—we changed our recruiting pitch and, just as important, our expectations. Advertising extensively so that we would have a broad choice and screening thoroughly, we sought "caregivers" who would take on a specific aspect of rehabilitation as opposed to "rehabilitators" who would become experts at it all. We now have volunteers who are able to provide temporary care for high-maintenance, formula-fed mammals such as squirrels and raccoons, and we have others who can only do the weaned stage but have properties that are suitable for the large outdoor cage that goes with over-wintering raccoons, or who have suitable property for releasing squirrels and other animals.

Volunteers provide basic animal care. For this, we provide detailed instructions, both in written format and a hands-on training session after the volunteer has been approved for the program and at the time they receive the animals they will foster. All matters pertaining to health issues, questions regarding care, and release protocols are referred to the centre. Veterinary students who serve as field officers provide the screening for potential volunteers and serve as the liaison between volunteers and the centre, as well as the liaison with the veterinarians providing service. These responsibilities are laid out in a written agreement so that volunteers know exactly what is expected of them and what level of support is provided.

There are anywhere from 100 to 125 foster families involved each year, and we find there is an approximate 70 percent annual turnover. The good news is that, knowing what to expect, we use our energies to mount an extensive recruitment effort each year rather than spending time on training people for aspects of the work that neither we nor they want them to take on. Other upsides are that we can deliver a consistent and controlled rehabilitation program; volunteers are fresh, enthusiastic, and committed; and we have a constant source of new release sites so that areas do not become overpopulated.

Volunteers recruited for our in-centre program—we have between forty and fifty people who work 1.5-hour weekly shifts six months of the year—are easier to attract and tend to stay on for a number of years. This provides a more likely base to draw on for people with skills and the willingness to take on tasks other than animal care, such as administration and fund raising.

I recognize that this approach is more suited to centers that have a staff to provide supervision for its centralized style. However, both home-based volunteer networks and centers can benefit from a more realistic attitude as to what we can expect to receive from volunteers. This, in turn, will encourage a more segmented approach to their recruitment and training, saving time and frustration.

RESPONSES

II.

Ginnie Silva
Volunteer Coordinator
Rio Grande Nature Center State Park
Albuquerque, New Mexico, USA

There is no simple solution to recruiting and retaining volunteers with desirable skills and dedication. Contact with interested folks can be made through free (public service) advertisements in local newspapers and on radio and TV; on flyers; at education programs; at booths at fairs and festivals; through other nonprofit organizations; through organizations such as R.S.V.P. (a federally funded state program that lists volunteer opportunities at member nonprofit organizations and provides limited reimbursement to participating volunteers for transportation and meals); at universities; and even at high schools. Of course, personal contact with a warm and welcoming person is the ultimate recruiting tool. One should bear in mind, however, that most of these contacts have no real understanding of what they are volunteering for.

Once contact with interested potential volunteers is made, the next hurdle looms. To get someone who wants to care for animals to take on the often-undesirable tasks of office work, answering phones, and so forth, it is necessary to convey the importance to rehabilitation (and ultimately the animals) of support systems and the need for having *all* of the jobs within the organization taken care of. In order to rehabilitate birds, for example, a federal permit must be obtained. Permit requirements include annual reports—which imply the keeping of records. Keeping records involves filing them in retrievable form. Another example of the critical nature of a support system is the phone volunteers. Most organizations are dependent on telephones for education and contact with the public. Telephones require knowledgeable people on one end of the line. New volunteers don't need to have the skills to tube a bird or hydrate a mammal, but they do need good people skills. The people they deal with are frequently in the midst of a human-animal interface crisis, and not at their most rational. In fact, the job of a telephone volunteer is probably the most uniquely stressful job in wildlife rehabilitation.

JOIN THE CONVERSATION

We invite you to read Case XIV, "A Case of Finality," and consider the questions posed at the end. The cases are designed to raise complex issues, leaving plenty of room for varied or even contradictory perspectives. To join the conversation, send your response by 18 January 2001 to Attn: Up for Discussion, IWRC, 4437 Central Place, B-4, Suisun, CA, 94585-1633, USA, or via e-mail to iwrc@inreach.com.

The *Journal* also welcomes suggestions for topics to feature in future issues.

The initial interview is a great place to outline all of your organization's job needs. This task is much simpler if there is a central location, a site where the rehabilitation takes place, where the new volunteer can experience all aspects of a working facility/organization. As a new volunteer makes a connection with others in the group, he or she is more likely to disclose their particular skills and possible willingness to share them. Speed getting the new volunteer trained and practicing their new skills is crucial.

It is critical for the new person to be received well by the organization's "old timers." This often requires extra time in the beginning, but reaps great rewards down the road. Long-time volunteers need to be reminded that, though they may feel crucial to the smooth operation of the group, if they really are indispensable, the long-term work of the group is doomed. The best mark of a good leader and teacher—an effective "core member" of the group—is that if they aren't there, everything runs like clockwork.

The methods for recruiting, training, rewarding, and retaining volunteers in a loose-knit coalition of home-based rehabilitators or a large rehabilitation center should be fairly similar. Each type of organization has advantages and disadvantages. The large center has the advantage of having a "bonding site" for its members. Here, there is a place for volunteers to train and come to spend time performing a variety of jobs at one location, whenever it fits with their schedules. The loose-knit coalition without a permanent rehabilitation center gives its volunteers the opportunity to work at home as their schedules permit. (Unfortunately, however, this often means that the volunteer rehabilitator's life is defined by the animals in their care.)

Keeping volunteers active and enthusiastic is best accomplished by keeping them connected to the organization. Let them know of their importance to the group; keep them informed; offer new challenges and educational opportunities; and always reward achievements and contributions (both big and small). If a volunteer is not happy in one job, offer other opportunities. Letters and little gifts of appreciation, a mention in newsletter articles, and social gatherings (with food!) and parties are great ways to recognize your volunteers' efforts. A few simple words of praise and thanks are often the strongest reward. Whatever the approach used for rewarding volunteer efforts, there is no such thing as too much of a good thing!

NEXT TOPIC... CASE XIV

A Question of Finality

The loosely associated group of wildlife rehabilitators at the local Wildlife Intake Center were saddened over the need to take two young raccoons to the vet to be prepared for rabies "testing." Not only had the animals been brought into the state without a permit, they had been illegally sold to a willing member of the public. The individuals who purchased these particular juveniles had raised them in the family's home for about a week, until one of the animals had bitten a child. They weren't sure which animal had done it. At this point, the "owners" felt the raccoons should be turned over for rehabilitation. To make matters worse, when the animals were brought into the center, the staff member in charge, acting out of concern for the comfort of the cute little guys, had not followed established center protocol.

The protocol for mammals at this central collection point was to put them in a quiet, dark place, then contact a mammal rehabilitator. "*Do Not Touch*" was the rule. Endemic zoonoses in this part of the country included plague, rabies, and hanta virus. Rehabilitators skilled in caring for certain mammalian species were acutely aware of the fatal potential of any of these diseases. They were familiar with preventive measures and some had received the pre-exposure vaccinations for rabies. Others were not vaccinated, preferring to risk exposure to the disease over the risk and cost of taking the pre-exposure vaccine.

Rebecca, the center manager, had hastily instructed George, another staff member and avian rehabilitator, to "make sure the raccoons were hydrated and put them in the dark room." George tried to offer them water, and was promptly bitten by the young male. Now both animals were on their way to be euthanized so their brains could be examined for the inclusions that signify rabies.

Simultaneous to the situation at the center, Josephine, another member of the rehabilitation group, was reading an ad in the local newspaper offering to sell baby "orphaned" raccoons. Knowing that even one case of introduced raccoon rabies in this state—in which raccoon rabies had not yet been reported—could precipitate an extreme public reaction, Jo was concerned about who to contact about this ad. She was afraid that notifying the state wildlife agency might result in immediate sacrifice of the baby raccoons, so she called Rebecca at the center for advice.

QUESTIONS FOR DISCUSSION

1. **What factors should an organization keep in mind when considering whether to require pre-exposure rabies vaccination for those rehabilitators who wish to work with rabies vector species? What are the risks involved in receiving the vaccinations? What are the risks involved in not receiving them? Do the risks of vaccination outweigh the benefits? Who is "at risk"?**
2. **How can wildlife rehabilitators best protect themselves from potentially fatal zoonoses?**
3. **What kinds of public reaction could be precipitated by a human case of raccoon rabies?**
4. **Health departments have strict rabies reporting protocols. How can rehabilitators best assist in the implementation of these protocols?**
5. **Wildlife agencies have laws relating to importation of animals from out of state and the handling of some individual species. How can rehabilitators best help wildlife in the implementation of these laws?**
6. **What would you do if you heard of a rehabilitator accepting raccoons for care in a state where this is prohibited, then transporting them across state lines to be released in another, prohibition-free, jurisdiction?**

COLUMN

Operating Instructions

Training a New Hotline Worker

by Nathalie Karvonen

In previous articles, I've discussed the importance of choosing hotline staff with excellent public relations skills. So now that you've found just the right person to answer your calls, how do you provide them with proper training?

Anyone who works on a wildlife hotline will say an enormous amount of training is needed in order to handle the wide diversity of calls and callers a hotline gets. There are a variety of methods to give the initial training needed to start handling calls. The ideal way to train a new person (since there are not yet any courses available on this subject) is to have them apprentice with a seasoned wildlife hotline "professional." Assuming the trainee is a new person rather than someone familiar with your organization, the sequence of training events should be as follows:

1. Have the trainee "job shadow" all key positions within your organization to give them a good basic understanding of what each person does.
2. Begin the trainee's hotline instruction by having them transcribe messages left on the voice mail system. The trainee and mentor may then discuss how to address each situation.
3. Have the trainee listen to how their mentor then handles the return calls. If your phone does not have a "hands-free" option that will allow the trainee to listen to both sides of the conversation, you may want to consider purchasing a recording device to plug into your phone. This device is inexpensive, and the taped calls can be kept and used for training others in the future. Make sure the trainee understands why all information was given and the techniques used. For example, if advice was repeated two or three times, the trainee needs to know that this was done intentionally to improve listener retention.
4. Once the trainee and their mentor are comfortable with the trainee's level of understanding of at least the most common calls, allow the trainee to begin handling a few simple calls on their own, under their mentor's supervision. Before responding to a question, the trainee should put the caller on hold and then briefly discuss the advice they are about to give with their mentor.
5. The mentor should monitor how the call was handled by listening in or by evaluating the completed call via the recorded tape. The trainee should then call back to give the member of the public additional information or clarify a point if necessary. Most people will be understanding if the trainee explains they are new and that, having discussed the situation with their supervisor, they would like to provide additional information.
6. Once the trainee begins handling calls "solo," make sure there is a back-up person readily available to discuss new or unusual situations the trainee is *certain* to encounter.

If your organization doesn't have experienced hotline staff to serve as mentors, you might want to contact other organizations in your area that provide wildlife hotline services. Ask if they would consider having your trainee apprentice with their hotline staff.

Be prepared for the training period to take a long time. Recently, Toronto Wildlife Center was approached by a local animal control agency about allowing a member of their staff to visit for *one afternoon* to learn how to handle all their calls! I believe this is a dangerous situation, as it allows a person to get just enough training to think they know how to handle calls, when in fact they've only seen the proverbial tip of the iceberg. A good hotline staff person will *never* claim to be finished learning.

In addition to one-on-one training, there are many reference materials that would be handy for hotline staff to have close at hand. Try to gather as many resources as possible; the essential ones are:

- Field guides that cover all native species for your area, including nests, eggs, and nestlings
- Natural history books for your native species
- *Wild Neighbors: The Humane Approach to Living with Wildlife*, published by the Humane Society of the United States
- Detailed maps of the areas your hotline serves
- Lists of volunteer drivers/rescuers (if applicable)
- National and local rehabilitation member directories
- Special contact numbers (e.g., herpetologists, beekeepers, staff at your local zoo and museums, domestic-animal welfare groups, pigeon clubs, and so forth)
- Internet access (but beware: use only sources you trust)

When your hotline staff need to research an unusual situation they should document the information they've learned. That way, if your hotline gets the same question again someone doesn't have to do the research all over. We have developed a Draft Protocols binder where this new information is recorded.

Finally, to make sure your staff continue to learn and gather new information for your organization, it is essential that they interact with other hotline personnel, both within your organization and within the larger rehabilitation community. Try to find the resources to send hotline personnel to conferences whenever possible; IWRC, NWRA, your state/provincial rehabilitation conference, or conferences about related subjects (e.g., zoonoses) are all beneficial. With more training and information, your hotline staff can't help but provide better services to both the public and wildlife!

Nathalie Karvonen is the executive director of Toronto Wildlife Centre. TWC operates a wildlife hotline service available to the public. Last year the hotline received more than 16,000 calls.

COLUMN

Open Minds

What Is Interpretation?

by Kieran Lindsey

If you listen in on discussions about informal education, you're likely to hear the term "environmental interpretation" tossed around. The words may sound impressive, even intimidating, but interpretation is nothing more than an approach to communication. At its most basic level, interpretation is translating the technical language of a natural science into terms and ideas nonscientists can readily understand, and doing so in a way that's entertaining and interesting.

The word "interpretation" is sometimes used to refer only to educational programs in parks and at nature centers. Often these programs are quite formal, despite their occurrence in informal settings. I take a broader view, in part because of the influence of a textbook from my college days, a reference I continue to use titled *Environmental Interpretation—A Practical Guide for People with Big Ideas and Small Budgets*. The author, Sam Ham, believes that parks and recreation sites are not the only places interpretation should be practiced. My own belief is that wildlife rehabilitation settings are great locations for environmental interpretation.

Many informal educators enter their jobs without formal training, and we aren't always sure how we should approach our task. Our only role models may be former school teachers, and so we're likely to use the techniques we were exposed to during a lifetime of classroom learning. There's nothing inherently wrong with this approach—there are some incredibly skilled and innovative teachers—but there are significant differences between classroom teaching and interpretation.

Why does our approach need to be different from that of a classroom teacher? Primarily because we don't have a captive audience. A classroom audience is forced to stay and pay attention if they want to get a good grade or avoid the trauma of a bad grade. Noncaptive audiences aren't worried about grades. They stay and listen because they want to. Captive audiences are motivated by diplomas, certificates, jobs, money, and success. Noncaptive audiences are motivated by interest, self-improvement, fun, the need to pass some time—or possibly even the herd instinct. While visiting a national park, I once overheard a tourist tell her traveling companions, "Let's head over to that amphitheater. There are a bunch of people there; something must be about to happen."

Even though an interpreter may use factual information to illustrate points and clarify meanings, it's the points and meanings she is trying first to communicate, not the facts. This is what distinguishes interpretation from conventional instruction. In the classroom, the teacher's goal often is to communicate facts alone. In interpretation, we present facts only when they help our audience understand and appreciate what we're trying to explain.

There are many ways to make technical information more entertaining. You can start with a smile. In most of the world's cultures, a smiling face indicates pleasure. Your audience takes its cue from you, and people are more receptive to messages when they're relaxed. Other techniques include the following:

- **Use Active Verbs** Verbs are the power in any language. Academic writing stresses passive verbs. Interpretation stresses active verbs. Try "Bats pollinate saguaro cactuses," rather than "Saguaro cactuses are pollinated by bats."
- **Show Cause-and-Effect** People like to know what things cause other things to happen. "When helium balloons deflate and fall into lakes and oceans, they look like something tasty to turtles living in there. The turtles eat the balloons, sicken, and often die."
- **Self-Referencing** By helping someone think about themselves and their experiences as you provide new information, you help them connect the new ideas with something they already care about. For instance, if someone calls to complain about blue jays attacking her children as they leave through the front door, you might explain that the birds are attempting to defend *their* babies, just as the caller is trying to protect her children—and then suggest the kids use the back door for a week or two.
- **Use Metaphors and Similes** Metaphors describe something with words or phrases normally used to describe something very different: "For ten minutes, it *rained* garbage as every tourist on the bus decided to throw what was left of his lunch out the window." Similes compare characteristics of two things: "This tree has spines *like daggers* on every limb."
- **Use Analogies** For example, "Butterfly wings are made of two layers of thin, hard exoskeleton held together with small, hollow rods called nervules. Together, they form a wing that's *similar in design to corrugated cardboard*. The structure is light enough for flight and amazingly strong."

Good interpretation is relevant; it's meaningful and it's personal. When information is meaningful it's because we are able to connect it to something already inside our brains. When something we hear or see doesn't connect with anything we already know, it's meaningless to us. To personalize our message, we must not only find a way to link the information to something the audience knows, but to something they care about. This is especially important with noncaptive audiences because they'll almost always ignore information that seems unimportant, even if they understand it perfectly.

The goal of any conservation education program, formal or informal, is to communicate a message—a message that answers the question "so what?" Environmental interpretation methods help you answer that question in the minds of your audience.

Kieran Lindsey is the former director of the TWRC Wildlife Shelter in Houston, Texas, a wildlife biologist, and president of Natural Assets Consulting. Send your comments and questions to IWRClindsey@aol.com, or to PO Box 1443, Cedar Crest, NM 87008–1443 USA.



Each year the International Wildlife Rehabilitation Council (IWRC) invites wildlife rehabilitators and associated professionals to share their experiences, knowledge, and skills with the wildlife-care community. Our annual conference audience will include veterinarians, rehabilitators, environmental educators, and administrators. All submissions are subject to review by the conference committee.

- Topics of interest include veterinary care, husbandry, case studies, administration, environmental education, and communications.
- Papers, tutorials, workshops, and discussion groups accepted.
- Speakers receive free conference registration.

SUBMISSION DEADLINE:
1 June 2001

International Wildlife Rehabilitation Council

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Contact the IWRC office or visit www.iwrc-online.org for an application form.

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Conservation Classics

The Outermost House
A Year of Life on the Great Beach of Cape Cod
by Henry Beston

Henry Holt, 1992
218 pp; US$13
ISBN: 0-8050-1966-9

Reviewed by Kieran Lindsey.

In 1925 Henry Beston Sheahan built a two-room cottage on fifty acres of leased dune land two miles south of the Eastham Light House Station in Cape Cod, Massachusetts. He then proceeded to invite the world to share in his good fortune.

In September of the following year, Beston vacationed at the beach house, which he nicknamed "the Fo'castle," but found himself loath to return home, so two weeks stretched into a full year of solitude. Beston's journal of experiences and reflections while at the beach filled several notebooks and became the subject of his best-known work.

Who among us has not wished for that single year alone with nature, distanced from the world at large and all its inconvenient conveniences? I guess some things never change. All those years ago, Beston lamented,

> "The world today is sick to its thin blood for lack of elemental things, for fire before the hands, for water welling from the earth, for air, for the dear earth itself underfoot....The longer I stayed, the more eager was I to know this coast and to share its mysterious and elemental life; I found myself free to do so....I had something of a field naturalist's inclination; presently I made up my mind to remain and try living for a year on Eastham Beach."

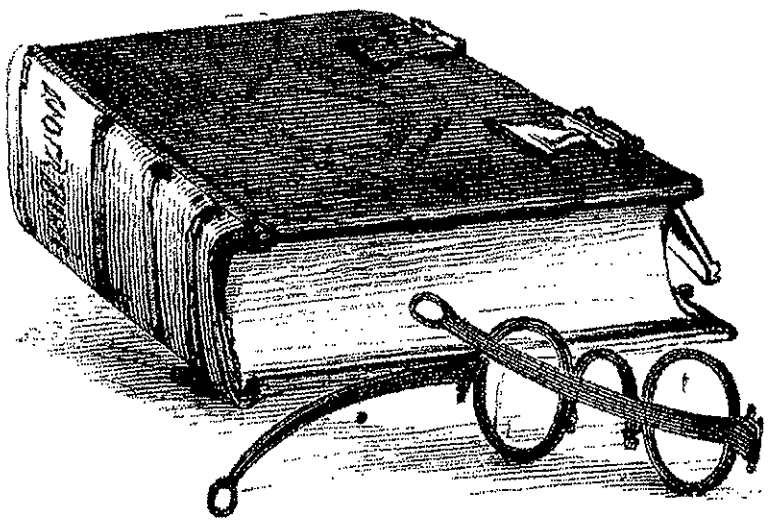
Beston filled the pages of *The Outermost House* with all of these elemental wonders of life—the ceaseless rhythms of wind and sand and ocean, the pageant of stars in the changing seasons, and the migrations of shore and sea birds. Bird flight held a special fascination for Beston, who refused to believe that animals are *machina*, as Descartes long ago insisted. He proposed instead,

> "We need another and a wiser and perhaps a more mystical concept of animals. Remote from universal nature, and living by complicated artifice, man in civilization surveys the creature through the glass of his knowledge and sees thereby a feather magnified and the whole image in distortion. We patronize them for their incompleteness, for their tragic fate of having taken form so far below ourselves. And therein we err, and greatly err. For the animal shall not be measured by the man. In a world older and more complete than ours they move finished and complete, gifted with extensions of the senses we have lost or never attained, living by voices we shall never hear. They are not brethren, they are not underlings; they are other nations, caught with ourselves in the net of life and time, fellow prisoners of the splendor and travail of the earth."

As a mental traveler, transported by the pages of *The Outermost House*, I long ago fell in love with Beston's Cape of 1926. I've never actually been to Cape Cod, and frankly, I'm not sure I would visit if given the chance. I've avoided high school reunions for the same reason; some loves are best kept apart from stark reality. I simply don't want to face the alterations seventy-five years are sure to have wrought.

In 1959 Henry Beston donated the cottage and surrounding dunes to the Massachusetts Audubon Society. Beston's only provision was that "there are to be no changes or building on to the house; I wish it to remain as I had it, to be a refuge and observation station for all good naturalists." The little house stood until February 1978, when a winter storm (known as "the Blizzard of '78") tore the house from the dunes and battered it to bits. One of the few remnants returned by the sea was a plaque designating the Fo'castle a National Literary Landmark, now on display at the Nauset Life Saving Station, owned by the Cape Cod National Seashore.

My annual literary pilgrimage to Beston's "older and more complete" world restores my ability to live and function in these modern times. The Fo'castle may have disappeared from its sandy perch on Eastham Bar, but by simply turning a few pages I am transported to that solitary cottage on a wild and windswept beach filled with the music of surf and migrating armies of birds that I know in my heart no longer exists.



Conservation Classics is intended to provide our readers with suggestions for building a collection of must-have wildlife and ecology reference books.

Fluid Therapy in Small Animal Practice
(2nd Edition)
by Stephen P. DiBartola, DVM, ACVIM

Philadelphia: W. B. Saunders, 2000
624 pp; U.S.$65
ISBN: 0-7216-7739-8

This six-hundred-page veterinary text is a very thorough exploration of all aspects of fluid administration. It is a collaborative work, with many chapters written by doctors with a particular area of expertise. The new edition includes extensive information on use of colloid therapy, blood transfusion medicine, and treatment of shock.

The book starts by reviewing basic applied physiology. The following chapters cover electrolyte disorders, exploring diagnostics and treatment in great detail. The next section reviews the different types of acid-base disorders, diagnostics, and treatment. The book then moves on to technical and hands-on aspects of fluid therapy and then fluid therapy in specific disease states. The last section covers special therapies (i.e., blood transfusions, blood substitutes, parenteral nutrition, and hypertonic fluid therapy).

There is a lot of basic but thorough physiology covered in the early sections. Some of it is relatively slow going and includes a fair number of equations, but the material is clear and well explained. Buried in some of the dry physiology background material is some clinically relevant information. Each chapter does a good job of reviewing and explaining terminology and equations. The electrolyte chapters review the deficiencies, excesses, and pathological states associated with regulation of sodium, chloride, potassium, calcium, phosphorus, and magnesium. Acid-base disorders are covered in great detail.

The chapters on introduction to fluid therapy and technical aspects of fluid therapy offer a lot of good general background and many practical hands-on tips. There is an excellent discussion of route of fluid administration. The chapter also reviews types of catheters (with good photos) and making appropriate choices in which type of catheter to use and where best to place it. There are good discussions of catheter management and all of the potential complications. The book then moves on to reviewing many common disease states and how disease influences choices in fluid therapy. In the later chapters there is a good review of the pathophysiology of shock. The discussions about the use of analgesia, antibiotics, and glucocorticoids in shock states are particularly pertinent to the rehabilitator. The section on blood transfusions and use of colloids gives good practical information on blood collection and cross matching.

This book contains a wealth of useful information. Some of the chapters, such as those introducing and discussing the technical aspects of fluid therapy, would be useful to any advanced rehabilitator. The book also has many chapters of fairly esoteric physiology, with occasional nuggets of clinical significance. It is an excellent reference for veterinarians and veterinary technicians, and would be challenging but useful reading for the advanced rehabilitator with a good background in biology.

Reviewer Janna Wynne, DVM, is a veterinarian in Studio City, California.

Handbook of Veterinary Procedures and Emergency Treatment
(7th Edition)
by S. Bistner, R. Ford, and M. Raffe, editors

Philadelphia: W. B. Saunders, 2000
1022 pp; U.S.$57
ISBN 0-7216-7166-7

This manual of small companion animal medicine was first published in 1969 for practicing veterinarians and veterinary students. The new seventh edition provides an efficient, highly practical resource for today's veterinary practice environment. The accessibility of the information in this book makes it a worthwhile investment for veterinary technicians and other practice staff as well. Advanced wildlife rehabilitators with skills and interest in the treatment of wildlife patients may also benefit from using this manual as a general resource for the care of mammalian species, but its applicability to the treatment and care of nonmammalian wildlife is limited.

The book is surprisingly authoritative for such a small package: nineteen contributing authors; 1022 pages with numerous summary tables and illustrations; major sections covering emergency care, patient evaluation and examination, clinical signs, clinical procedures, and interpretation of laboratory tests; and a section with no less than seventy-three charts and tables on topics ranging from physiologic data to nutritional support to interstate shipping requirements. Wildlife rehabilitators who consider purchasing this handbook must be aware that there is a great deal of extraneous information that will not be of practical use in their work. However, the basics of emergency care, examination, and diagnostic testing are well laid out and would serve well as a foundation for more detailed study of the treatment of species other than the dog and cat.

The overall organization of the book is acceptable, though the section headings and subheadings are not clearly distinguished. Topics are well cross-referenced and indexed. This is important because several times the reader is presented with acronyms that have not been defined but that may be found in the index. Several topics are well covered and would be useful to rehabilitators: ocular emergencies, fractures and musculoskeletal trauma, acute superficial soft tissue injuries (wound management). I was left with only a few concerns, such as the lack of consideration of proper ventilation when treating chemical burns and other toxic dermal exposures (p. 30); the high dosage of dexamethasone sodium phosphate for shock therapy (p. 3, 6–15 mg/kg; the generally recommended range is 2–4 mg/kg for most species); and the incorrect statement that intraosseous infusions are contraindicated in birds (p. 548, true for the large pneumatic bones, but intraosseous infusions can be given very effectively in other locations such as the ulna or tibiotarsus).

The level of detail at which subjects are presented and many of the techniques are described are beyond the training of most wildlife rehabilitators.

However, advanced rehabilitators familiar with basic veterinary emergency procedures, treatment, and patient stabilization stand to gain a valuable medical reference by adding this volume to their libraries.

Reviewer Barry K. Hartup, DVM, PhD, is director of veterinary services at the International Crane Foundation in Baraboo, Wisconsin.

Flight Maps: Adventures with Nature in Modern America

by Jennifer Price

New York: Basic Books, 1999
325 pp; U.S.$24
ISBN: 0-4650-2486-6

Jennifer Price is a historian whose travels through the history and culture of the United States began as a simple question: "What does nature mean to me?" Her essays, published in collections such as *Uncommon Ground: Rethinking the Human Place in Nature*, *The Nature of Nature: New Essays from America's Finest Writers on Nature*, and now *Flight Maps* are the result of her attempt to answer this question.

Price explores nature, not by heading for the wild places "out there," but by wandering through malls and *TV Guides*. As a historian, Price is interested in the ways in which Americans have made—and missed—connections with nature in our everyday lives. In *Flight Maps* she ruminates on everything from the extinction of the passenger pigeon, to the women's bird hat craze of the late 1800s, to pink flamingos, to the popularity of The Nature Company and the use of nature to sell cars.

Flight Maps is a treasure trove of information about our cultural take on nature and the natural world, but I found the first several chapters difficult to wade through. I'm glad I made the effort, though, because the book did get me thinking about the absurdity that is so often present in the Western relationship with nature—and in my relationship with nature as well.

We know the exact day of the extinction of the passenger pigeon. Martha, the last of seven captive birds at the Cincinnati Zoo, died on 1 September 1914. "Missed Connections: The Passenger Pigeon Extinction" provides a concise case study of how quickly a species composed of millions of individuals can slip—or be shoved—down the extinction slide. It offers proof that Adam and Eve's descendants didn't learn much about the consequences of passing the buck with their expulsion from Eden.

The chapter titled "A Brief Natural History of the Plastic Pink Flamingo" was entertaining, but I felt that Price really hit her stride in her fourth chapter, "Looking for Nature at the Mall: A Field Guide to The Nature Company." By the time she took aim at "The Greening of Television in the 1990s," I was cooking dinner with the book in one hand and a spoon in the other.

This clearly is not your typical "nature book." However, it can be argued that *Flight Maps* is by far the better representation of the average American's relationship with nature. By virtue of the work I do, I spend a lot of time thinking about how best to communicate with urban and suburban dwellers about wildlife. This book gave me a new perspective on the average "person on the street," folks for whom wildlife and the wild world are a passing novelty, if that. To be blunt, they are the people wildlife professionals deal with every day.

Reviewed by Kieran Lindsey.

Last Chance to See

by Douglas Adams and Mark Cardwardine

New York: Ballantine Books, 1992
U.S.$11
ISBN: 0-3453-7198-4

Last Chance to See is Douglas Adams's venture into the world of endangered species conservation. Adams is author of the Dirk Gently novels and the well-known Hitchhiker's Trilogy. His rather unusual style may throw some readers at first, but once past this hurdle, this is a good and worthwhile read.

In 1985 Adams was sent by *Observer Colour Magazine* to Madagascar to join zoologist Mark Cardwardine on a search for the aye-aye, a nearly extinct lemur. Cardwardine introduced Adams to the issue of conservation and—out of graciousness or malice, it isn't clear which—in 1988 and 1989 took Adams on a ten-month odyssey through Africa, New Zealand, Asia, and some of Indonesia for a "last chance to see" some rare animals for himself.

Much of the book is less concerned with the animals than with the people Adams and Cardwardine ran into along the way. On the way to look for Komodo dragons, they made a quick stop in Melbourne, Australia, to talk with Dr. Struan Sutherland, an expert on poisonous creatures. (While the dragons themselves aren't venomous, a rather large number of snakes living on the island with them are.) Wherever one runs into people, one also runs into their cultures. Adams shines in his sometimes hilarious, sometimes discouraging, but always believable accounts of his experiences.

Many books about conservation tend to be somewhat depressing. This one generally isn't, although it does have its sobering moments. While in China, for example, a sound recordist traveling with the pair decides to try to get a tape of the world the dolphins, or baiji, live in—namely, the Yangtze River. Because he doesn't have underwater sound equipment with him, the three men have to improvise, spending a fair amount of time trying to buy a condom to wrap the microphone in and having additional trouble because of the language barrier. When they finally manage to make their recording, Adams notes, it "wasn't exactly what I had expected.... Instead of hearing the roar of each individual ship's propeller, what we heard was a sustained shrieking blast of pure white noise, in which nothing could be distinguished at all." This after he has noted that the baiji is half blind and relies primarily on sound for information.

Adams does an impressive job of describing the animals he sees, including some of the more esoteric things about them—for example, the origin of the name "white rhinoceros," given to an animal that isn't actually white, or the true reason for a silverback gorilla's sil-

ver back. He also discusses the factors responsible for their endangerment, such as poaching and the inherent fragility of island ecosystems.

The most intriguing part of the book comes near the end, as Adams muses on the huge subjects of extinction, conservation, and ecology in general, while he rests next to a tree—which just happens to be one of only eight remaining wild bottle palms on the planet.

Cardwardine, an author in his own right, gets his turn with a chapter that explains the two fundamental problems involved in conservation: why it has attracted so much attention in the first place, and why it needs to be done. Cardwardine also updates the reader on the successes of the various conservation efforts he took Adams to visit. This makes for emotionally mixed reading.

Last Chance to See is certainly one of the more interesting books written about the general conservation effort. Its fresh approach documents the problems involved for anyone wanting to know what it is like for conservationists to do the kind of work they do, and does it in a manner that is, perhaps, clearer than most.

Reviewer David Torline is a volunteer and member of the Friends of the Rio Grande Nature Center in Albuquerque, New Mexico.

Backyard Rescue

by Hope Ryden; illustrated by Ted Rand

Beech Tree Paperback, 1997
128 pp; U.S.$4.95
ISBN 0-6881-5496-4

Finally, a book for kids that is actually about wildlife rehabilitation! Besides Suzie Gilbert's beautiful *Hawk Mountain*, I haven't seen anything specifically on the topic. Although this book does give me somewhat mixed feelings because of the way it depicts a state wildlife officer, it is an excellent introduction to just how big a job caring for wildlife can be. The book is written for ages eight and up. Although the language is certainly easy and appropriate for children, it is a delightful read even for adults. The characters are very well drawn and engaging, the dialogue very real.

Backyard Rescue is about two young girls who start rescuing wildlife. The girls have been best friends since they were six. Now ten, one of them finds a screech owl that has been hit by a car; all the flight feathers on one wing are broken. The book does an excellent job in integrating the natural history of the owl and the book's other animals into the story, including having the girls do library and other research on what the animals eat, where they live, and what they might need in order to survive a short time in captivity. The author manages to give these ten year olds more common sense than many adults who find injured birds.

The girls' next patient is a grebe that landed in a snow-covered parking lot. Again, research and calling local bird "experts" helps them discover what is going on, and they wait for the local lake to thaw so they can release the bird. They become very attached to the grebe and experience some of the same concerns we all do. Keeping him as a pet is discussed, but rejected. The school librarian assures them, "Not knowing what lies in store for the bird is truly hard. On the other hand, a bathtub is no place for a wild creature to live out its life. That grebe needs to explore a lake bottom, and hunt for its own food, and find a mate and raise chicks. It won't be able to do any of those interesting things if you don't set it free."

When the girls find a baby red squirrel, a character steps in and points out that cow's milk is not an acceptable formula. The quantity recommended would have drowned him, but at least he got Esbilac! Later he also gets started on a lot of natural foods that the girls spend a fair amount of time gathering.

Throughout the book, the girls show appropriate concern about their animals ending up too tame and ultimately make excellent decisions: flight conditioning for the screech owl before releasing him where he was found; hacking out the young squirrel; finding a wildlife center with other raccoons to socialize their young orphan. Although the girls do not discover until fairly late in the book that keeping wildlife is against the law—and the state wildlife officer is depicted as very unfeeling—some very legitimate points are made in the process. Because the causes of the animals being injured are quite realistic, not all the girls' "patients" survive.

Backyard Rescue is a good book to recommend for elementary school teachers who are inviting you into their classroom!

Reviewer Louise Shimmel is director of Cascades Raptor Center in Eugene, Oregon.

Veterinarian

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PROFILE

EDWARD E. CLARK JR., IWRC'S NEW PRESIDENT

Raised in Flint Hill, Virginia, USA, Edward Clark has been a leader in the field of conservation for more than twenty years. Ed received a BA in history and political science from Bridgewater College and did graduate work in education at James Madison University and the University of Virginia. His dedication to conservation began when he witnessed the devastation left by the clear-cutting of a forest he had visited as a youth. He subsequently became president of the Virginia Wilderness Committee, and led the grassroots effort to protect more than fifty thousand acres in Virginia's two national forests. By 1979 he had become the first executive director of the Conservation Council of Virginia Foundation, and in 1980 he cofounded and became assistant director of the Environmental Task Force in Washington, D.C.

In 1982 Ed and his then-wife—a veterinary technician—joined with a veterinarian and another veterinary technician to work together to provide care for injured wildlife in their community. Working in half of a converted ten-stall horse barn on his home farm and in a spare bedroom in his house, Ed learned the ropes of wildlife rehabilitation. From that small backyard seed, the Shenandoah Valley Wildlife Treatment and Rehabilitation Center was born. The team renovated the building, built caging, and procured surplus equipment. Within five weeks, the center was taking in its first patients, and Ed was kept busy cleaning cages, attending to wildlife patients, and finding the funds to meet rapidly rising expenses.

In 1985 the organization's name was changed to the Wildlife Center of Virginia. The organization was awarded the 1993 National Environmental Achievement Award for Wildlife Conservation, one of the nation's highest awards.

Active in public service, Ed served four years on the Virginia Council on the Environment, the state environmental policy board, and four years as a trustee of the Virginia Outdoors Foundation, one of the nation's largest land conservation trusts. He also serves on many nonprofit boards, including those of the National Wildlife Federation, Philippe Cousteau Foundation, and the President's Council of the Southern Environmental Law Center.

Ed can be currently seen each week on the Animal Planet Network, hosting *Wildlife Emergency*. Among other television appearances, he has hosted two weekly series on Virginia Public Television (PBS); from 1992 to 1998 he hosted *Virginia Outdoors*. He is currently in production on a weekly nature series called *Wednesdays Untamed*.

In 1997 Ed joined the board of directors of IWRC. His extensive experience in non-profit management and organizational development, as well as expertise in environmental policy, resource conservation and wildlife rehabilitation have benefited both the organization and its membership. A popular speaker and presenter at the annual IWRC conferences and abroad, Ed has won the admiration and respect of IWRC's membership and his colleagues on the board of directors. He was nominated for, and accepted, the position of IWRC president in October 2000.

NEWS BRIEFS

House Finch Study

As part of ongoing ecological studies of conjunctivitis in house finches (an eye disease caused by the bacterium *Mycoplasma gallisepticum*; see www.birds.cornell.edu/hofi), a research team is conducting health evaluations of several house finch populations around the United States. Headed by Dr. André Dhondt, professor of ornithology at Cornell University, and Dr. Barry Hartup, director of veterinary services, International Crane Foundation and the University of Wisconsin School of Veterinary Medicine, the researchers hope to establish long-term (up to four or five years) relationships with bird banders who have the potential to capture house finches year-round. (The project has the full support of the United States Geological Survey [USGS] Bird Banding Laboratory.)

The project's goals are to:

1. Determine survival estimates in relation to infection status of house finches from across North America based on capture-recapture data. To this end, participating banders are asked to (a) make a special effort to trap and recapture as many house finches as possible; (b) record exactly where the birds are (re)captured; (c) record eye condition; (d) provide the project with this information. (Software and/or a web interface to collect the banding and recapture data are being developed).
2. Obtain diagnostic samples (cloacal and/or eye swabs and blood samples) from selected color-marked populations with the hope of follow-up of individuals through recapture as well as resighting.

For further information about participating in this effort, contact Véronique Connolly at the Cornell Laboratory of Ornithology (vc42@cornell.edu).

Salmonella Threatens New Zealand Birds

The New Zealand Department of Conservation (DOC) says a Salmonella epidemic among sparrows appears to have jumped the species and could pose a threat to native birds. Thousands of sparrows have been found dead in recent weeks, especially in Otago and Canterbury. The deaths are thought to be linked to a sharp increase in the number of cases of salmonellosis in humans.

DOC's chief technical officer of biosecurity, Geoff Hicks, says dead sparrows have now been found in cities throughout New Zealand and there are

reports of waxeyes (*Zosterops lateralis*) dying. Hicks says samples are being analyzed by the Ministry of Agriculture and Forestry to establish whether the waxeyes are affected by the same organism. He says there is some evidence of other native birds dying.

Canterbury's medical officer of health, Mal Brieseman, says the strain of Salmonella is unusual to New Zealand and he thinks it may have been introduced from overseas. The National Center for Disease Investigation is compiling the laboratory results to determine if the sparrows all died from the same strain of Salmonella. Roger Poland, the animal health information coordinator for the Ministry of Agriculture and Fisheries, says the results of all of the tests need to brought together so the exact strain of Salmonella can be determined.

Infectious Diseases May Hinder Sea Otter Recovery

Recent increases in the frequency and variety of infectious diseases in the southern sea otter (*Enhydra lutris*) may jeopardize the population recovery of this threatened species.

Examination of southern sea otter carcasses by USGS scientists from 1992–98 yielded unexpected results. The frequency and variety of infectious diseases found were unusual for wildlife species; more than 40% of the animals died from parasitic, fungal, or bacterial infections.

The southern sea otter, a California coastal species, was listed as threatened by the U.S. Fish and Wildlife Service in 1977. Although this population has increased since then, the rate of recovery has been slower than expected, and recent censuses indicate a substantial population decline. Concern that increased mortality was hindering recovery led to an effort begun in 1992 by the USGS–National Wildlife Health Center to document the causes of death in southern sea otters.

The most frequent infectious diseases identified were peritonitis caused by abnormal migration of acanthocephalan parasites (*Polymorphus spp.*), toxoplasmosis (*Toxoplasma gondii*, a protozoan disease that causes inflammation of the brain), and a variety of systemic or severe bacterial infections.

Toxicologic analyses for two classes of marine contaminants with immunosuppressive properties (butyltins and organochlorine compounds) were performed by scientists at Michigan State University on tissues provided by USGS from a limited number of dead adult sea otters. The tests showed elevated levels of butyltins and geographically localized exposure to polychlorinated biphenyls (PCBs). The significance of these findings with respect to the high incidence of infectious disease in southern sea otter populations is unknown.

USGS continues to participate in monitoring causes of death in southern sea otters and hopes to investigate the significance of these disease and contaminant findings to the southern sea otter population's status and trends as well as to identify means to control disease and environmental contaminant exposure.

Getting the Lead Out

In eleven years, Mark Pokras of Tufts University School of Veterinary Medicine has examined nearly 150 loons in New England that were poisoned by swallowing lead fishing gear. Pokras has won a victory in New Hampshire—the first state to restrict lead tackle. Sinkers, by law, can be no smaller than an ounce and jigs no shorter than an inch. Lead shotgun pellets were banned for U.S. waterfowl hunters in 1991.

The Other Volunteers

Although many of your center's volunteers may work evenings and weekends, there may be others in your community willing to donate their professional skills during the week. Could your organization benefit from the services of a veterinarian, a graphic designer, or a plumber? In some cases these volunteers may call your shelter to offer their services, but you don't need to wait for them to come knocking on your door. Visit the local chamber of commerce and attend regional professional conventions to meet some of the business people eager to get involved in the community. Contact local universities to find out if professors might be willing to challenge their students with special projects. After graduation, budding professionals just entering a field are often looking for experience to add to their resumes, so place an ad in the newspaper requesting a volunteer to donate specific consulting services. Or place a call to some of the several groups founded for the sole purpose of connecting professionals (often retired) with volunteer opportunities:

Accountants for the Public Interest
202/347-1668

American Association of Retired Persons
202/434-2277

National Executive Service Corps
212/529-6660

Points of Light Foundation
202/223-9186

Recycled Computers

Many cities and larger metropolitan areas have computer recycling organizations that donate (or provide heavily discounted) computer equipment, software, and advice to nonprofit organizations. Visit the PEP National Directory of Computer Recycling Programs at www.microweb.com/pepsite/Recycle/recycle_index.html to find a computer organization in your state.

Conference to Address Wildlife Health and Management

From 2–6 July 2001 a conference will be presented by the Australian Association of Veterinary Conservation Biologists, World Association of Wildlife Veterinarians, Wildlife Society of the New Zealand Veterinary Association, and the Wildlife Diseases Association Australasian Section. The event will be held at Taronga Zoo, Sydney. For further information contact Dr. Larry Vogelnest, Taronga Zoo, PO Box 20, Mosman NSW 2088, Australia; lvogelnest@zoo.nsw.gov.au; fax 612/ 997-84516.

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HERPETILE SPECIES

Movement of Captive-Released Orinoco Crocodiles (*Crocodylus intermedius*) in the Capanaparo River, Venezuela

Maria del C. Muñoz and John Thorbjarnarson

J. Herpetology. 2000. 34(3).

To test the feasibility of using captive-reared Orinoco crocodiles to restock depleted wild populations, the authors used radio-telemetry to monitor 8 crocodiles (103.3–139.3 cm total length) released in the Capanaparo River in southwestern Venezuela. Crocodiles were located every 1–2 days from April 1991–March 1992 to determine movement patterns, survival, and growth. The crocodiles moved considerably in the first month following release; the maximum distance moved was 11.6 km upstream by 1 crocodile 4 months after release. Later, however, crocodiles later became more sedentary; by the end of the study the maximum distance from the point of release was less than 8 km. Six of the crocodiles moved upstream while 2 moved up to 3.3 km downstream. Crocodiles remained principally along the main course of the river in areas with mixed shallow and deep water habitats and abundant sand beaches. As the river rose during the wet season, crocodiles remained in the same areas, but moved into shallow-water areas among flooded riparian vegetation. The mean growth rate of released crocodiles (0.079 cm TL/day) was similar to that of smaller wild-born juvenile crocodiles. The authors conclude that a carefully designed program of releases of captive-reared crocodiles can be an effective conservation tool to speed the recovery of depleted populations of Orinoco crocodiles.

AVIAN SPECIES

Nine Years after the *Exxon Valdez* Oil Spill: Effects on Marine Bird Populations in Prince William Sound, Alaska

David B. Irons et. al.

Condor. 2000. 102(4).

The authors compared post–*Exxon Valdez* oil spill densities of marine birds in Prince William Sound from 1989–91, 1993, 1996, and 1998 to prespill densities from 1984–1985. Postspill densities of several species of marine birds were lower than expected in the oiled area of Prince William Sound when compared to densities in the unoiled area. These negative effects continued through 1998 for five taxa: cormorants, goldeneyes, mergansers, pigeon guillemot (*Cepphus columba*), and murres. Black oystercatchers (*Haematopus bachmani*) and harlequin ducks (*Histrionicus histrionicus*) exhibited negative effects in 1990 and 1991. Loons showed a weak negative effect in 1993. Black-legged kittiwakes (*Rissa tridactyla*) showed relative decreases in 1989, 1996, and 1998 that may have been caused by shifts in foraging distribution rather than declines in populations. Glaucous-winged gulls (*Larus glaucescens*) showed positive effects in most postspill years. Murrelets and terns showed relative increases in 1993, 1996, and 1998. Generally, taxa that dive for their food were negatively affected; taxa that feed at the surface were not. Effects for some taxa were dependent upon the spatial scale at which they were analyzed. Movements of birds and the mosaic pattern of oiling reduced the authors' ability to detect oil spill effects, therefore, results may be conservative. Several marine bird species were negatively affected at the population level and have not yet recovered to prespill levels. This may be related to persistent oil remaining in the environment and reduced forage fish abundance.

MAMMALIAN SPECIES

Butorphanol and Azaperone as a Safe Alternative for Repeated Chemical Restraint in Captive White Rhinoceros (*Ceratotherium simum*)

Robin W. Radcliffe, Shannon T. Ferrel, and Sara E. Childs

J. Zoo and Wildlife Med. 2000. 31(2).

Anesthesia in the white rhinoceros (*Ceratotherium simum*) has routinely involved potent narcotic anesthetic agents such as etorphine or carfentanil, with their associated adverse side effects. In captive rhinoceroses conditioned to routine handling, a combination of butorphanol and azaperone at mean (± SD) doses of 69.3 ± 18.0 mg and 103.1 ± 20.9 mg, respectively, was used to produce levels of neuroleptanalgesia ranging from light "standing" sedation to deeper planes of anesthesia producing sternal and lateral recumbency. This combination was used for repeated (minimum repeat frequency of 3 days between events) anesthetic episodes (n = 26) in 2 animals, with the remaining episode performed in a white rhinoceros with chronic renal disease. The action of butorphanol was satisfactorily reversed with naltrexone (125 mg i.v. and 125 mg IM). Results (mean ± SD) include sternal recumbency achieved in 14.1 ± 8.1 min after IM dosing, standing, and ambulation occurred in 1.7 ± 0.6 min after reversal, heart rate was 62.0 ± 10.1 beats/min, respiratory rate was 14.7 ± 5.6 breaths/min, and percentage of oxygen saturation of hemoglobin (Spo_2) was 89.2 ± 3.0%. Without supplementation, the total elapsed time ranged from 44.9–103.0 min; elapsed times up to 214.3 min were achieved with supplementation (mean time to supplementation was 28.0 ± 13.9 min after initial dosing). Butorphanol and azaperone produced adequate muscle relaxation and apparently adequate analgesia for minor surgical interferences. Respiratory rates and Spo_2 measurements were improved compared with reports of using more potent opioids in this species.

Serologic Survey of Selected Viral Agents in Recently Captured Wild North American River Otters (*Lontra canadensis*)

Kevin R. Kimber, George V. Kollias, and Edward J. Dubovi

J. Zoo and Wildlife Med. 2000. 31(2).

Blood samples were collected from 64 wild North American river otters (*Lontra* [*Lutra*] *canadensis*) from northern and eastern New York state and analyzed for serologic evidence of exposure to selected viral agents during a 1995–96 translocation program. No clinical signs of disease nor lesions suggestive of prior viral exposure were seen. Titers were detected for antibodies against canine distemper virus, canine herpesvirus-1, and canine parvovirus-2 but not for antibodies against canine adenovirus-1, canine coronavirus, canine parainfluenza virus, rabies virus, feline herpesvirus-1, feline calicivirus, or feline coronavirus. This is the first report of titers for antibodies against canine herpesvirus-1 in North

American river otters, and it suggests a low prevalence of antibody titers against most canine viruses in otter populations in northern and eastern New York. Confounding variables in this study could include exposure to domestic dogs associated with the project, prolonged time spent in captivity, and concurrent bacterial or parasitic infection. Stress-associated humoral immune suppression could have altered serologic profiles, especially in otters exposed to dogs after trapping but before venipuncture.

WILDLIFE SOLUTIONS

Evaluating Immunocontraception for Managing Suburban White-Tailed Deer in Irondequoit, New York

Brent A. Rudolph, William F. Porter, and H. Brian Underwood
J. Wildlife Mgmt. 2000. 64(2).

Immunocontraception is frequently proposed as an alternative to lethal removal of females for deer management. However, little information is available for evaluating the potential of applying immunocontraceptives to free-ranging populations. The authors sought estimate effort required to apply porcine zona pellucida (PZP) to individual deer and assess the utility of using immunocontraception to control growth of deer populations. The study was conducted in a 43 km^2 suburban community with about 400 deer. Effort per deer was measured as time required to capture and mark deer, and then to apply booster immunocontraceptive treatments by remote injection. Estimates of numbers of females to treat to control population growth were based on the generalized sustained-yield (SY) model adapted for contraception of females. The SY curve was calibrated using data on deer abundance acquired from aerial population surveys and nutritional condition of females removed by a concurrent culling program. Effort was influenced by four factors: deer population density, approachability of individual deer, access to private and public land, and efficacy of the contraceptive treatment. Effort and deer density were inversely related. Cumulative effort for treatment increased exponentially because some deer were more difficult to approach than others. Potential of using immunocontraception at low population densities (<25% ecological carrying capacity) is limited by the interaction of the proportion of breeding-age females in the population and treatment efficacy, as well as encounter rates. Immunocontraception has the best potential for holding suburban deer populations between 30–70% of ecological carrying capacity, but is likely to be useful only in localized populations when the number of females to be treated is small (e.g., 200 deer).

NUTRITION

Foods of Arctic Foxes (*Alopex lagopus*) during Winter and Spring in Western Alaska

R. Michael Anthony, Neil L. Barten, and Pamela E. Seiser
J. Mammalogy. 2000. 81(3).

During 1986–91, carcasses of 619 arctic foxes (*Alopex lagopus*) collected from local trappers and at biological field camps on the Yukon-Kuskokwim Delta in western Alaska from November through May were analyzed to determine gastrointestinal contents, age, sex, and body condition. Prey in declining order of importance were small mammals (95% tundra voles, *Microtus oeconomus*), birds, marine mammals, and fishes. Foxes with small mammal remains in their stomachs were captured farther from the Bering Sea coast than those without small-mammal remains (2.8 km); foxes consuming remains of marine mammals were closer to the coast (1.9 km) than others (4.9 km). Although eggshells had a poor likelihood of occurrence in stomachs, they were found in all months and years. In 1986 and 1987 foxes consumed fewer small mammals than in other years. Mean ages of foxes captured in 1986 (3.7 years) and 1987 (3.2) were greater than in all other years (1.5). Capture of adults was more common as winter progressed. Indexes of subcutaneous fat decreased annually in April–May and were highest in 1991, when occurrence of carrion of marine mammals was highest.

PARASITOLOGY

Prevalence of *Sarcocystis* Species Sporocysts in Wild-Caught Opossums (*Didelphis virginiana*)

J. P. Dubey
J. Parasitology. 2000. 86(4).

Sarcocystis sporocysts were found in intestinal scrapings from 24 (54.5%) of 44 opossums (*Didelphis virginiana*). The number of sporocysts varied from a few (<10,000) to 245 million. Sporocysts from 23 of 24 opossums were fed to captive budgerigars (*Melopsittacus undulatas*), and the inocula from 21 opossums were infective, indicating the presence of *Sarcocystis falcatula*. Sporocysts from 24 opossums were fed to gamma-interferon-knockout (KO) or nude mice; inocula from 14 opossums were infective to mice. *Sarcocystis neurona* was detected in tissues of KO mice by specific staining with anti–*S. neurona* antibodies, and the parasite was cultured in vitro from the brains of KO mice fed sporocysts from 8 opossums. *Sarcocystis speeri* was identified by specific staining with anti–*S. speeri* antibodies in tissues of KO mice fed inocula from 8 opossums; 3 opossums had mixed *S. neurona* and *S. speeri* infections. Thus, the prevalences of sporocysts of different species of *Sarcocystis* in opossums were: *S. falcatula* 21 of 44 (47.7%), *S. neurona* 8 of 44 (18.1%), and *S. speeri* 8 of 44 (18.1%) opossums. *Sarcocystis neurona* alone was found in 1 opossum, and *S. speeri* alone was found in 1 opossum. Mixed *Sarcocystis* infections were present in 21 opossums.

Sarcocystis campestris from Naturally Infected 13-Lined Ground Squirrels, *Spermophilus tridecemlineatus tridecemlineatus*, from Nebraska

David S. Lindsay, Richard D. McKown, and J. P. Dubey
J. Parasitology. 2000. 86(5).

Grossly visible sarcocysts were seen in the skeletal muscles of 1 of 12 13-lined ground squirrels, *Spermophilus tridecemlineatus tridecemlineatus*, collected in Nebraska. The tissue cyst wall was up to 5.0 mm thick and contained spikelike projections. Transmission electron microscopy of tissue cysts revealed they were similar to *Sarcocystis campestris* (Cawthorn, Wobeser, and Gajadhar 1983), previously known only from experimental infections in Richardson's ground squirrel *Spermophilus richardsonii*. Prominent electron-dense bodies were observed lining the microfilaments present in the spikelike projections of the sarcocyst wall. This is the first report of *S. campestris* in a natural intermediate host and the first report of this parasite outside of Saskatoon, Canada.

TAIL END

by Astrid MacLeod



PHOTO: BOBCAT (*Lynx rufus*) ©1997 THE LEARNING COMPANY, INC.

Dances with Bobcat

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